

Chapter 3:

Affected Environment

CHAPTER 3: AFFECTED ENVIRONMENT

The “Affected Environment” describes existing conditions for those elements of the natural and cultural environments that would be affected by the implementation of the actions considered in this plan/EIS. The natural environment components addressed include wetlands and floodplains; rare, unique, threatened, or endangered species; state-listed and special status species; wildlife and wildlife habitats (with a focus on birds and invertebrate species that could be affected by ORV use or management); soundscapes; visitor use and experience (including night skies); socioeconomic resources; and Seashore management and operations. Impacts for each of these topics are analyzed in “Chapter 4: Environmental Consequences.”

WETLANDS AND FLOODPLAINS

WETLANDS

Wetlands include areas inundated or saturated by surface or groundwater for a sufficient length of time during the growing season to develop and support characteristic soils and vegetation. The NPS classifies wetlands based on the USFWS Classification of Wetlands and Deepwater Habitats of the United States (the Cowardin classification system). Based on this classification system, a wetland must have one or more of the following attributes:

- The habitat at least periodically supports predominantly hydrophytic (wetland) vegetation.
- The substrate is predominantly undrained hydric soil.
- The substrate is nonsoil and saturated with water, or is covered by shallow water at some time during the growing season (Cowardin et al. 1979).

The majority of the undeveloped acreage within the Seashore can be classified as a wetland. The predominant wetland types at the Seashore are marine and estuarine. Marine wetlands occur along the beaches on the oceanside of the Seashore, and estuarine wetlands generally occur along the soundside, adjacent to the many tidal creeks that are prevalent along the islands. Non-wetland or “upland” areas of the Seashore include areas landward of the dune line, areas around NC-12, and other developed areas such as those in and around villages and Seashore facilities.

Marine wetlands at the Seashore are located in the intertidal zone (from extreme high tide to extreme low tide) and in the subtidal zone, which includes areas permanently submerged below coastal waters (Cowardin et al. 1979). Generally, areas of the Seashore’s beaches between the toe of the dune and the extreme low tide water line are considered intertidal marine wetlands. Marine wetlands are found along the entire length of the ocean shoreline and are typical of a sandy beach environment, subject to high wind and wave energy. Estuarine wetlands consist of deepwater and adjacent tidal wetland areas that are often partially enclosed by land but are influenced by marine waters and freshwater runoff from adjacent uplands (Cowardin et al. 1979). Estuarine wetlands at the Seashore typically fall into two classes: emergent or scrub–shrub. Emergent wetlands, also referred to as tidal marshes, are characterized by herbaceous perennial vegetation such as saltmarsh cordgrass (*Spartina alterniflora*), black needlerush (*Juncus roemerianus*), bulrush (*Scirpus* spp.), and cattail (*Typha* spp.) (NCDENR 2008a). Scrub–shrub wetlands are typically dominated by woody vegetation less than 20 feet tall. Typical vegetation species found in these wetlands include wax myrtle (*Myrica cerifera*) and eastern red cedar (*Juniperus virginiana*) (Sutter 1999). Although most wetlands at the Seashore are tidal, there are also some areas of nontidal wetlands, located primarily on Hatteras Island near the village of Buxton and Buxton Woods

Coastal Reserve. These wetland areas include forested and emergent wetlands and are predominantly freshwater swamps and marshes that are not influenced by the tides.

Wetland areas provide substantial environmental and economic benefits to the Seashore and surrounding areas of coastal North Carolina. For example, wetlands trap sediment and pollutants from stormwater runoff and provide a natural filter before this runoff can enter local waterways. Wetlands also store large volumes of water and function like sponges to reduce the likelihood of flooding during storm events. Wetlands also protect the shoreline from erosion and provide excellent habitat for fish and wildlife species, many of which are threatened or endangered (NCDENR 2008b).

FLOODPLAINS

North Carolina's barrier islands have historically been and continue to be affected by coastal forces and flooding events. The barrier islands that comprise the Seashore are flat and narrow and lie adjacent to the shallow and wide Pamlico Sound. The widest part of the Seashore islands is near Cape Point, between Buxton and Frisco (Pendleton et al. 2005). According to Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps, most of the Seashore is within the 100-year floodplain, with the exception of some areas within the 500-year floodplain (Shaded X Zone) located at the Navy tower site on Bodie Island and a larger area near Buxton.

Generally, lands along the ocean beaches and adjacent to the sound (at wide points) are in flood zone "VE," which is the flood insurance rate zone that corresponds to 100-year coastal floodplains that have additional hazards associated with storm waves. Zone "VE" is also referred to as the "Coastal High Hazard Area." The remainder of the Seashore that is located within the 100-year floodplain and not directly adjacent to the ocean or sound lies within the "AE" zone, which is subject to waves less than 3 feet high (NCDCCPS 2008).

Because the Seashore is almost entirely within the 100-year floodplain and is subject to high water table conditions and high wave action, many areas are subject to drainage and flooding problems that often result from storm events. Areas near Buxton Woods and Cape Point Campground have been documented as historically flood-prone and are examples of popular Seashore destinations that experience flooding during times of above-average precipitation events (Martin pers. comm. 2003).

RARE, UNIQUE, THREATENED, OR ENDANGERED SPECIES

This section addresses species present at the Seashore that are listed by the USFWS as either endangered or threatened. In some cases, the species may also be listed by the State of North Carolina. These species include the federally and state-listed piping plover (*Charadrius melodus*); federally and state-listed loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) sea turtles; and federally and state-listed seabeach amaranth (*Amaranthus pumilus*).

Species listed only by the state, and not federally listed as threatened and endangered, are discussed in the "State-Listed and Special Status Species" section of this chapter.

PIPING PLOVER

The piping plover is a small (6 to 7 inches long, weighing 1.5 to 2.2 ounces), highly camouflaged, sand-colored shorebird endemic to North America. The USFWS recognizes three distinct piping plover population segments: (1) the Atlantic Coast (from the Maritime Provinces of Canada to the Outer Banks of North Carolina); (2) the Great Lakes (along Lake Superior and Lake Michigan); and (3) the Great Plains (from southern, prairie Canada to Nebraska).

Wintering populations are found on the Atlantic Coast from North Carolina to Florida, on the Gulf Coast from Florida to Mexico, and in the Caribbean, with the greatest number of wintering birds found in Texas. Fewer than 3,000 breeding pairs of piping plovers were detected in the United States and Canada in 2001, although the most recent breeding census estimated breeding pairs in excess of 3,500 (Elliott-Smith et al. 2009). Piping plovers were common along the Atlantic Coast during much of the 19th century, but nearly disappeared due to excessive hunting for decorative feathers. Following passage of the MBTA in 1918, plover numbers recovered to a 20th century peak in the 1940s.



Piping Plover

Credit: Gene Neiminen / USFWS

Increased development and beach recreation after World War II caused a population decline that led to federal protection for the plover (USFWS 2007b). Habitat loss caused by human development and recreation, and low reproductive rates caused by disturbance and predation, were considered to be the primary causes of the decline (Elliot-Smith and Haig 2004). The Atlantic Coast population was federally listed in 1986 as threatened (FR 1985). At the time of listing, there were approximately 790 Atlantic Coast pairs, and the species was in decline. Therefore, a recovery target of 2,000 pairs was established in the 1996 Revised Recovery Plan for the Atlantic Coast population (USFWS 1996a). Disturbance and predation were intensively managed after the listing, and the Atlantic Coast population rose to 1,890 pairs by 2007 (USFWS 2007c), but was still short of the recovery goal of 2,000 pairs (USFWS 1996a; Hecht pers. comm. 2008).

The population for the Atlantic Coast Southern Region (or Recovery Unit), which comprises the states of Delaware, Maryland, Virginia, and North Carolina, was estimated at 333 pairs in 2007, which was the highest since 1986, but still short of the regional goal of 400 pairs (table 14). North Carolina experienced more than a 50% decline in breeding pairs from 1989 (55 pairs) to 2004 (20 pairs) (USFWS 2004a) for reasons discussed in the “Risk Factors” section later in this chapter; however, the number of breeding pairs was estimated at 64 pairs in 2008, which represents the highest number recorded in North Carolina in the years that complete surveys have been conducted (1989–2008) (NCWRC 2008a). Estimates for the 2009 season indicated a total of 54 pairs in the state (Hecht pers. comm. 2009).

Piping Plover in North Carolina

North Carolina is currently the only state on the Atlantic Coast that hosts piping plovers during all phases of their annual cycle, including the establishment and holding of territories, courtship and copulation, nest scraping and nest building, egg laying and incubation, chick rearing and fledging, and migration and wintering (Cohen et al. in press). Band sightings indicate that plovers from all three North American breeding populations depend on Cape Hatteras during migration and/or the winter. Plovers from the endangered Great Lakes population have been observed in fall and spring migration and during the wintering period (Cohen et al. in press). Early nesting records indicate that plovers were nesting at Pea Island in 1901 and 1902 (Golder 1986). The first published account of breeding piping plovers in North Carolina is from 1960, when a young bird was photographed in early June on Ocracoke Island (Golder 1985).

TABLE 14. SOUTHERN REGION (INCLUDING NORTH CAROLINA) PIPING PLOVER POPULATION TRENDS, NUMBERS OF BREEDING PAIRS

	Delaware	Maryland	Virginia	North Carolina	South Carolina	Southern Region Total
1986	8	17	100	30 ^a	3	158
1987	7	23	100	30 ^b	—	160
1988	3	25	103	40	—	171
1989	3	20	121	55 ^a	—	199
1990	6	14	125	55	1	201
1991	5	17	131	40	1	194
1992	2	24	97	49	—	172
1993	2	19	106	53	1	181
1994	4	32	96	54	—	186
1995	5	44	118	50	—	217
1996	6	61	87	35	0	189
1997	4	60	88	52	—	204
1998	6	56	95	46	—	203
1999	4	58	89	31	—	182
2000	3	60	96	24	—	183
2001	6	60	119	23	0	208
2002	6	60	120	23	—	209
2003	6	59	114	24	—	203
2004 ^c	7	66	152	20	—	245
2005 ^d	8	63	192	37	—	300
2006 ^e	9	64	202	46	—	321
2007 ^f	9	64	199	61	—	333
2008 ^g	10	49	208	64	—	331
2009 ^h	—	—	—	54	—	—

Source of 1986–2001 data is USFWS 2002

Source of 2002–2003 data is USFWS 2004a

^a The recovery team believes that the apparent 1986–1989 increase in the North Carolina population was because of an intensified survey effort.

^b No actual surveys were made in 1987; estimate is that from 1986.

^c USFWS 2004b, Preliminary 2004 Atlantic Coast Piping Plover Abundance and Productivity Estimates (Updated March 2007); Figures are preliminary estimates.

^d USFWS 2005a. Preliminary 2005 Atlantic Coast Piping Plover Abundance and Productivity Estimates.

^e USFWS 2006c. 2006 Atlantic Coast Piping Plover Abundance and Productivity Estimates.

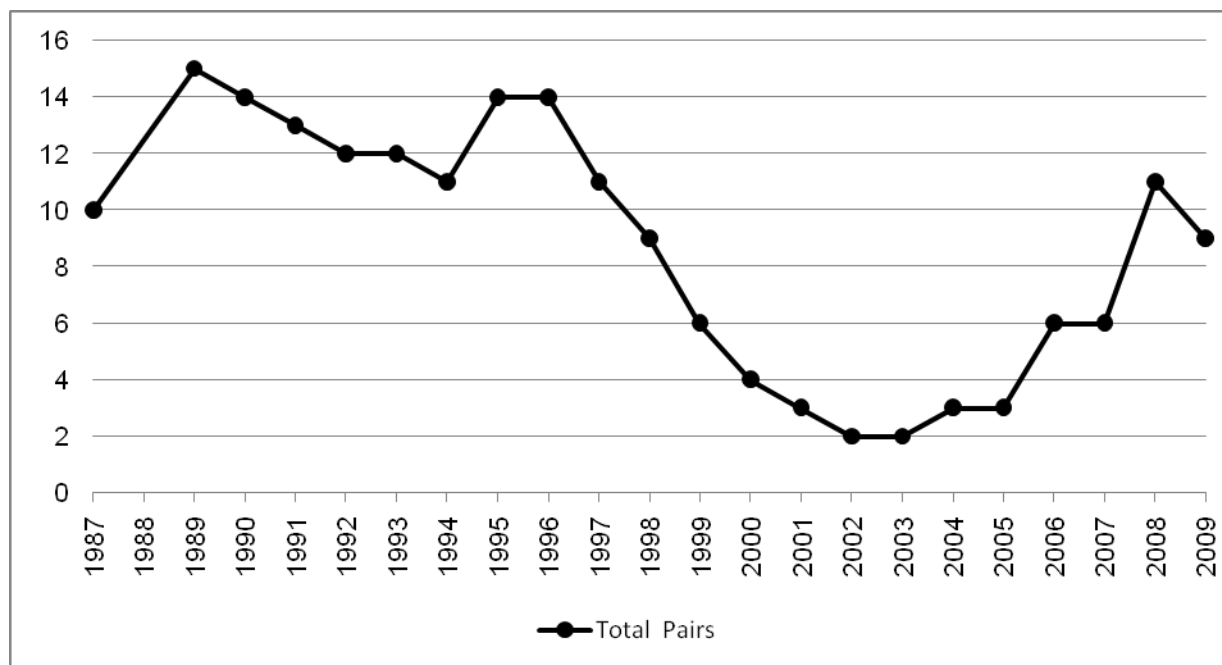
^f USFWS 2007c. 2007 Atlantic Coast Piping Plover Abundance and Productivity Estimates.

^g USFWS 2008c. 2008 Preliminary Atlantic Coast Piping Plover Abundance and Productivity Estimates.

^h Hecht pers. comm. 2009

— = No data available.

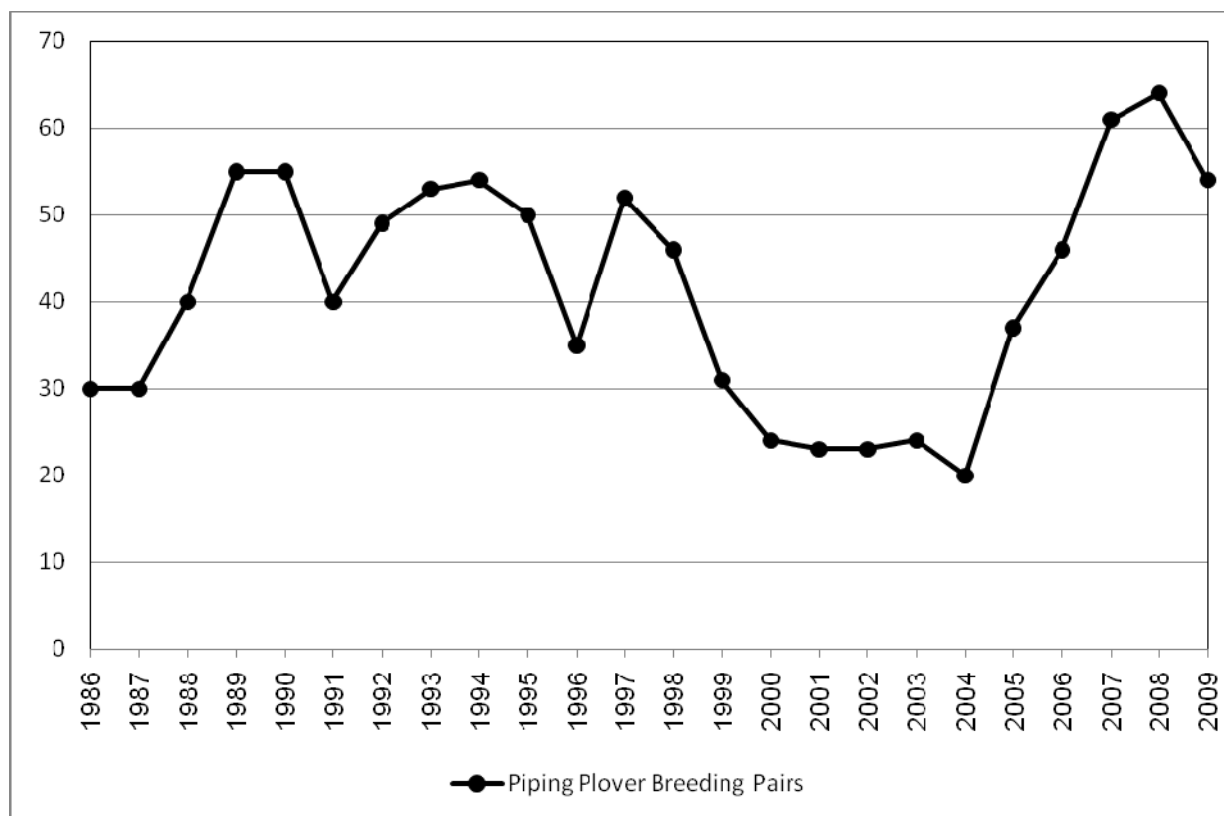
At the Seashore, four nests and one brood were observed in 1984, and five chicks were confirmed to have fledged that year. All four nests were located adjacent to least tern (*Sterna antillarum*) colonies on wide, open, sandy flats (Golder 1985). Nine pairs were counted in 1985 (Golder 1986), and 10 pairs in the summer of 1987 (Cooper 1990). The piping plover population reached a high of 15 pairs at the Seashore in 1989, and subsequently varied between 11 and 14 pairs through 1996, after which a sharp decline began (see figure 3). The population at the Seashore reached a low of two breeding pairs in 2002 and 2003, with only three breeding pairs reported in 2004 and 2005 (NPS 2009b). The population increased to 6 pairs in 2006 and 2007 and to 11 pairs by 2008 (NPS 2009b). The Seashore recorded nine piping plover breeding pairs during the 2009 season (Muiznieks pers. comm. 2009).



Source: NPS 2009b; Muiznieks pers. comm. 2009

FIGURE 3. NUMBERS OF PIPING PLOVER BREEDING PAIRS, CAPE HATTERAS NATIONAL SEASHORE, 1987–2009

NCWRC staff conducted a piping plover breeding census along the coast of North Carolina during the June 1 through June 9, 2008, census window. The census included all suitable habitat on ocean and inlet beaches with the exception of Browns Island, which lies within a military live-fire training range. Sixty pairs and seven individual birds were counted during the census window. The end-of-season best estimate, which includes pairs discovered after the census window, was 64 pairs and 5 individuals, which was a 5% increase from the 2007 estimate of 61 pairs and is the highest number recorded in North Carolina in the years that complete surveys have been conducted (1986–2008; see figure 4). However, the 2009 end of season estimates indicated a total of 54 breeding pairs in the state (Hecht pers. comm. 2009). Statewide, the distribution of piping plovers in 2008 was similar to previous years, with the majority of nesting pairs found at Cape Lookout National Seashore (NCWRC 2008a).



Source: USFWS 2004a, 2004b, 2005a, 2006b, 2007c, 2008c; Hecht pers. comm. 2009
Data reflect total season estimates, which includes birds found after the census window had closed

FIGURE 4. NUMBERS OF PIPING PLOVER BREEDING PAIRS IN NORTH CAROLINA, 1986–2009

Habitat Description

On the Atlantic Coast, piping plovers nest in sand, gravel, or cobble substrates in backshore, dune, interdune blowout, overwash fan, and barrier flat zones of open or sparsely vegetated beaches. Nest sites may have little or no slope (Cairns 1982; Burger 1987), although nesting does occur on lower-elevation dunes (Cairns 1982). On wide beaches, piping plovers nest in the open to maintain a wide field of view, but on narrower beaches nests can be established under clumps of vegetation (Cairns 1982; USFWS 1996a). Where beaches are wide, piping plovers tend to nest far from the tide line to reduce risk of nest overwash, but this can place nests closer to vegetated dunes where the risk of predation is higher (Burger 1987). Piping plovers have also been observed nesting within least tern colonies, which could provide an added defense against predators due to the antipredator behavior of least terns (Burger 1987).



Plover Habitat

Credit: NPS

In the winter and on migration, piping plovers tend to be found in areas with wide beaches and inlet habitats, foraging in moist, substrate habitat that includes both low- and high-wave-energy intertidal zones, mudflats, moist sand flats, ephemeral pools, shores, and brackish ponds (Cohen et al. in press; Elliot-Smith and Haig 2004; Nicholls and Baldassarre 1990; Wilkinson and Spinks 1994). During winter distribution surveys on the Atlantic Coast from 1986 to 1987, piping plovers were almost always found

associated with other species of shorebirds, such as sanderlings (*Calidris alba*), least sandpipers (*C. minutilla*), or western sandpipers (*C. mauri*), in addition to other piping plovers (Nicholls and Baldassarre 1990).

Critical Habitat Designation

All piping plover breeding sites at the Seashore were designated as critical habitat for wintering birds, as defined by the federal ESA (FR 2001) until 2004, when a court decision vacated the designation for Oregon Inlet, Cape Point, Hatteras Inlet, and Ocracoke Island (*Cape Hatteras National Seashore Access Preservation Alliance versus U.S. Dept. of the Interior*, 344 F. Supp. 2d 108 [D.D.C. 2004]). A rule to revise designated critical habitat for the wintering population of the piping plover in North Carolina was proposed in 2006 (71 FR 33703). That proposed rule described four coastal areas (named Units NC-1, NC-2, NC-4, and NC-5), totaling approximately 739 hectares (1,827 acres) entirely within the Seashore, as critical habitat for the wintering population of the piping plover. The USFWS also proposed to add 87 hectares (215 acres) of critical habitat to two previously proposed units. As a result, the proposed revised critical habitat designation for the species now includes four revised critical habitat units totaling approximately 826 hectares (2,042 acres). The final rule for the revised critical habitat designation became effective on November 20, 2008 (73 FR 62816).



Piping Plover Nest Site

Credit: NPS

Critical habitat identifies specific areas that are essential to the conservation of a listed species, or that contain physical and biological features that are essential to the species and that may require special management considerations or protection. Approximately 2,043 acres in Dare and Hyde counties are designated as critical habitat for the wintering population of the piping plover (73 FR 62816).

Section 7 of the ESA requires federal agencies to ensure that actions they authorize, fund, or carry out are not likely to destroy or adversely modify designated critical habitat. Activities that may destroy or adversely modify critical habitat include those that alter the primary constituent elements (PCEs) to an extent that the value of critical habitat for both the survival and recovery of the species is appreciably reduced (65 FR 41793).

The PCEs for the wintering population of the piping plover are the habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support these habitat components. Specifically, the PCEs are

- (1) Intertidal sand beaches (including sand flats) or mud flats (between the mean lower low water line and annual high tide) with no or very sparse emergent vegetation for feeding. In some cases, these flats may be covered or partially covered by a mat of blue-green algae.
- (2) Unvegetated or sparsely vegetated sand, mud, or algal flats above annual high tide for roosting. Such sites may have debris or detritus and may have micro-topographic relief (less than 20 inches (50 centimeters) above substrate surface) offering refuge from high winds and cold weather.
- (3) Surf-cast algae for feeding.

- (4) Sparsely vegetated backbeach, which is the beach area above mean high tide seaward of the dune line, or in cases where no dunes exist, seaward of a delineating feature such as a vegetation line, structure, or road. Backbeach is used by plovers for roosting and refuge during storms.
- (5) Spits, especially sand, running into water for foraging and roosting.
- (6) Salterns, or bare sand flats in the center of mangrove ecosystems that are found above mean high water and are only irregularly flushed with sea water.
- (7) Unvegetated washover areas with little or no topographic relief for feeding and roosting. Washover areas are formed and maintained by the action of hurricanes, storm surges, or other extreme wave actions.
- (8) Natural conditions of sparse vegetation and little or no topographic relief mimicked in artificial habitat types (e.g., dredge spoil sites).

Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries as of November 20, 2008 (50 CR 17.95 b (1)(2)).

Of the 2,043 acres of designated critical habitat in Dare and Hyde counties, approximately 1,827 acres are located within the boundaries of the Seashore and are located at Bodie Island Spit, Cape Point, Hatteras Inlet Spit, Ocracoke Inlet Spit, and South Point (73 FR 62816).

The four units of designated critical habitat that include acreage within the Seashore are described below:

NC-1: This unit extends from the southern portion of Bodie Island through Oregon Inlet to the northern portion of Pea Island. It begins at ramp 4 near the Oregon Inlet Fishing Center on Bodie Island and extends approximately 7.6 kilometers (4.7 miles) south to the intersection of NC-12 and Salt Flats Wildlife Trail on Pea Island. The unit is bounded by the Atlantic Ocean on the east and Pamlico Sound on the west and includes lands from the MLLW (mean lower low water) on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by piping plovers and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. Any emergent sandbars south and west of Oregon Inlet, including Green Island and lands owned by the State of North Carolina are included.

NC-2: This unit is entirely within the Seashore and encompasses Cape Point. The unit extends south approximately 4.5 kilometers (2.8 miles) from the ocean groin near the old location of the Cape Hatteras Lighthouse to the point of Cape Hatteras, and then extends west 7.6 km (4.7 miles) along South Beach to the edge of ramp 49 near the Frisco Campground. The unit includes lands from the MLLW on the Atlantic Ocean to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur).

NC-4: This unit extends from the western end of Hatteras Island to the eastern end of Ocracoke Island. The unit extends approximately 7.6 kilometers (4.7 miles) southwest from the first beach access point at the edge of ramp 55 at the end of NC-12 near the Graveyard of the Atlantic Museum on the western end of Hatteras Island to the edge of the beach access at the ocean-side parking lot (approximately 0.1 mile south of ramp 59) on NC-12, approximately 1.25 kilometers (0.78 miles) southwest of the ferry terminal on the northeastern end of Ocracoke Island. The unit

includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. All emergent sandbars within Hatteras Inlet between Hatteras Island and Ocracoke Island, including lands owned by the State of North Carolina are included.

NC-5: This unit is entirely within the Seashore and includes the western portion of Ocracoke Island beginning at the beach access point at the edge of ramp 72, extending west approximately 3.4 kilometers (2.1 miles) to South Point and then back east on the Pamlico Sound side to a point where stable, densely-vegetated dune habitat meets the water. This unit includes lands from the MLLW on the Atlantic Ocean shoreline to the line of stable, densely-vegetated dune habitat (which is not used by the piping plover and where PCEs do not occur) and from the MLLW on the Pamlico Sound side to the line of stable, densely vegetated habitat, or (where a line of stable, densely vegetated dune habitat does not exist) lands from MLLW on the Atlantic Ocean shoreline to the MLLW on the Pamlico Sound side. All emergent sandbars within Ocracoke Inlet are also included.

Diet

Piping plovers feed primarily on freshwater, marine, terrestrial, and benthic invertebrates (Elliot-Smith and Haig 2004) such as marine worms, fly larvae, beetles, crustaceans, or mollusks (USFWS 1996a). Adults forage both day and night (Staine and Burger 1994), but young chicks are brooded during the night and therefore feed by day (Wolcott and Wolcott 1999). During territory establishment, foraging adults exhibit a preference for a moist substrate habitat that particularly includes mudflats, sand flats, ephemeral pools, and shores of brackish ponds and excludes the high-wave-energy intertidal zone (Cohen et al. in press). Broods forage primarily on damp sand flats or moist substrate habitat, where the abundance of prey is much higher than in other habitats (Kuklinski et al. 1996).



Piping Plovers Foraging along Shoreline

Credit: Gene Nieminen / USFWS

Chicks with access to moist substrate habitat survived better than chicks without such access in Virginia (Loefering and Fraser 1995) and Rhode Island (Goldin and Regosin 1998). A study in New York in 1992 and 1993 found that piping plover broods had higher foraging rates in areas with ephemeral pools and tidal flats, which suggested that these habitats were superior. This study also documented higher incidences of arthropods in the moist substrate habitat, which could explain the increased plover numbers and survival rates in these habitat types. Management implications of this study include conserving a variety of foraging habitat (Elias et al. 2000). Burger (1994) found that when broods had access to a diversity of foraging habitat zones, the impact of human disturbance was reduced because chicks had opportunities to escape disturbances and still forage.

Breeding Biology

On the Atlantic Coast, breeding territory establishment and courtship generally begin in late March, the first nests are initiated in late April, and the brood-rearing period extends from late May to mid-August

(Cohen 2005). On beaches with more birds in the northern end of the Atlantic Coast breeding range, most pairs establish breeding territory within a day or two of the birds' arrival in early spring, whereas pairs on sites with fewer birds can take several days or weeks longer to become established (Elliot-Smith and Haig 2004).

Piping plovers are primarily monogamous during the breeding season but often change mates between seasons. The nest is built by the male and consists of a shallow scrape in sandy substrate that may or may not be lined with pebbles and shell fragments.



Piping Plover Chicks

Credit: Mary Hake / NPS – Cape Cod National Seashore

The normal clutch size is four (USFWS 2007b), and the average duration for egg laying is six days (Elliot-Smith and Haig 2004). Replacement of lost or destroyed eggs has not been reported. If one or more eggs are lost, the pair continues to incubate the remaining eggs.

Incubation is shared by males and females and typically commences the day of clutch completion, but sometimes occurs when the next-to-last egg is laid (Elliott-Smith and Haig 2004).

The length of incubation ranges from 25 to 29 days, and a pair will re-nest multiple times if successive clutches are destroyed, but re-nesting after the chicks hatch is rare (Elliott-Smith and Haig 2004). Chicks leave the nest scrape within a few hours of hatching, except when a

nest hatches at night, and they never return (Wolcott and Wolcott 1999). Broods may move hundreds of meters away from the nest site during the first week after hatching (USFWS 1996a). Chicks are vulnerable soon after hatching, and survival rates are lower if the brood is forced to move. Members of a breeding pair share brood-rearing duties, though some females desert broods within 5 to 17 days (Elliott-Smith and Haig 2004). Although chicks follow adults to a foraging habitat, chicks forage for themselves. Fledging time ranges from 25 to 35 days (USFWS 1996a), and most adults and young depart the breeding grounds between mid-July and early September (Cohen et al. in press).

Breeding Chronology and Performance at Cape Hatteras National Seashore

Locally breeding piping plovers arrive at the Seashore in mid-March, begin courting and pairing in April, and begin to scrape and/or build nests by the third week of April. Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point Ocracoke (South Point) all contain potential nesting habitat. Nesting has occurred in all but one of these areas in the last 10 years. Although there has not been a breeding pair on the north end of Ocracoke Island since 1996, resource management staff members continue to monitor this area for potential plover activity. Under the Interim Strategy, Seashore personnel would generally begin monitoring for piping plover arrival and prenesting behavior in late March and early April. Monitoring and surveys of these sites were conducted a minimum of three times per week. However, the 2008 consent decree required staff to begin monitoring these sites on March 15, and monitor every two days from March 15 to April 15, and daily from April 16 to July 15. Bodie Island Spit had to be monitored daily from March 15 to July 15. All known nests are protected by predator exclosures, which have been in use at the Seashore since 1994. Once nests are located, they are briefly approached once a week to inspect the exclosure, count eggs, and search for predator tracks. Morning and evening observations begin when clutches are expected to hatch. Monitors observe from a distance for evidence of hatching or chicks. After hatching, in areas not open to ORV use, the broods are monitored a few hours in the morning and a few hours in the afternoon until the chicks have fledged or

are lost. Seashore personnel document brood status, behavior, individual bird and/or brood movements, human disturbance, predator interactions, and other significant environmental events.

Table 15 shows the numbers of breeding pairs of piping plovers at the six known nesting sites from 1987 to 2009. Table 16 provides data on piping plover hatching and fledging success at the Seashore from 1992 through 2009. The 11 nesting pairs identified in 2008 marks an 83% increase from the 6 pairs identified in 2007 (NCWRC 2008a).

TABLE 15. NUMBERS OF PIPING PLOVER BREEDING PAIRS BY SITE, CAPE HATTERAS NATIONAL SEASHORE, 1987–2009

Year	Bodie Island Spit	Cape Point	South Beach	Hatteras Inlet Spit	North Ocracoke Spit	South Point	Total Pairs
1987	0	4	0	4	1	1	10
1989	—	—	—	—	—	—	15
1990	0	8	0	4	2	0	14
1991	0	5	0	3	5	0	13
1992	0	4	0	4	4	0	12
1993	0	5	1	3	3	0	12
1994	0	5	1	3	2	0	11
1995	0	6	1	4	2	1	14
1996	1	5	1	5	1	1	14
1997	1	4	1	3	0	2	11
1998	0	4	1	3	0	1	9
1999	0	3	1	1	0	1	6
2000	0	2	0	2	0	0	4
2001	1	1	0	1	0	0	3
2002	1	0	0	1	0	0	2
2003	0	0	0	1	0	1	2
2004	1	0	0	1	0	1	3
2005	0	0	1	1	0	1	3
2006	1	2	1	1	0	1	6
2007	1	4	0	0	0	1	6
2008	1	5	1	0	0	4	11
2009	0	5	0	0	0	4	9
Total (% of total pairs)	8 (4.6 ^a)	72 (41.1 ^a)	10 (5.7 ^a)	45 (25.7 ^a)	20 (11.4 ^a)	20 (11.4 ^a)	190 (100)

Source: NPS 2009b

^a Total number of pairs was 190, but locations were not available in 1989. Therefore, percentages from the specific sites are based on the 175 nests that were recorded at one of the six specific nesting areas.

— = No data available.

TABLE 16. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT CAPE HATTERAS NATIONAL SEASHORE, 1992–2009

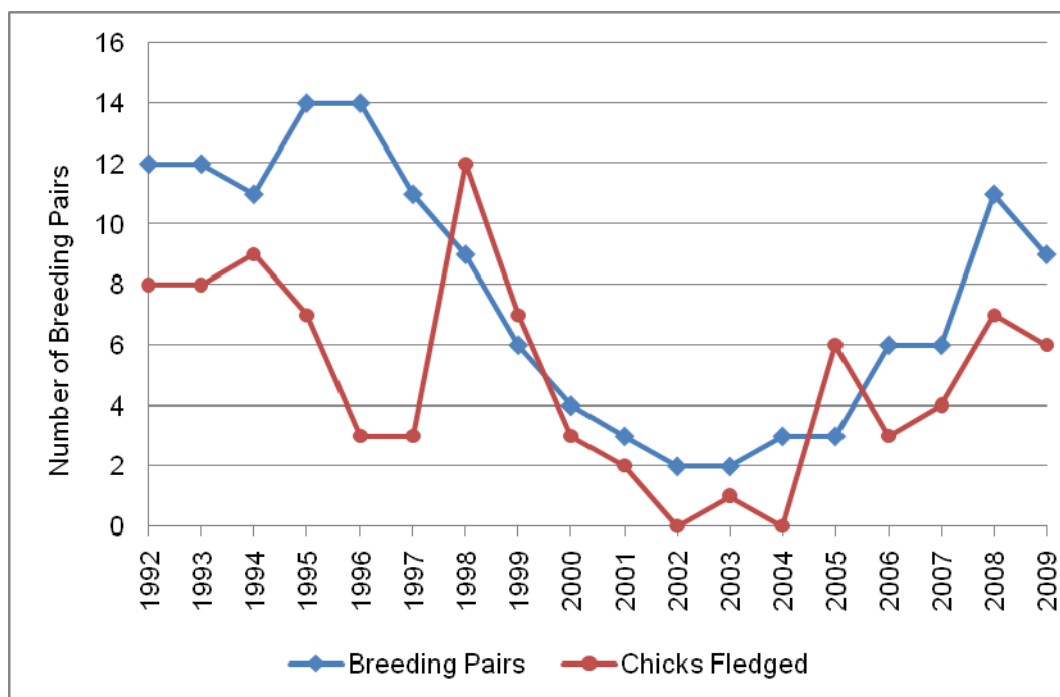
Year	# Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate ^b
				#	%	#	% ^a	#	%	
1992	12	14	49 ^c	8	57.1	17	34.7	8	47.1	0.67
1993	12	21	69	9	42.9	27	39.1	8	29.6	0.67
1994	11	18	65 ^d	10	55.6	32 ^e	49.2	9	28.1	0.82
1995	14	19	63	13	68.4	30	47.6	7	23.3	0.50
1996	14	16	56 ^f	10	62.5	30	53.6	3	10.0	0.21
1997	11	16	47 ^f	10	62.5	32	68.1	3	9.4	0.27
1998	9	8	31	6	75.0	20	64.5	12	60.0	1.33
1999	6	6	23	3	50.0	11	47.8	7	63.6	1.17
2000	4	6	23	3	50.0	10	43.5	3	30.0	0.75
2001	3	3	10	1	33.3	3	30.0	2	66.7	0.67
2002	2	3	8	1	33.3	1	12.5	0	0.0	0.00
2003	2	2	5 ^f	2	100.0	5 ^f	100.0	1	20.0	0.50
2004	3	2	6	1	50.0	4	66.7	0	0.0	0.00
2005	3	2	8	2	100.0	8	100.0	6	75.0	2.00
2006	6	4	15	3	75.0	9	60.0	3	33.3	0.50
2007	6	10 ^g	29	6	60.0	17	58.6	4	23.5	0.67
2008	11	13	43	8	61.5	22	51.2	7	31.8	0.64
2009	9	9	34	6	66.7	22	64.7	6	27.3	0.67
Average Fledge Rate at Cape Hatteras National Seashore = 0.64										

Source: NPS 2009b; Muiznieks pers. comm. 2009

^a Percentage of all known eggs.^b Fledge rate is defined as the number of fledged chicks per breeding pair (number of total pairs).^c Assumes three eggs from a brood whose nest was not found.^d Assumes two eggs from a brood whose nest was not found.^e Includes those presumed hatched.^f Assumes one egg from a brood whose nest was not found.^g Based on consultation with USFWS, it was determined that Nest 1 and Nest 2 were a single nesting attempt.

Fledge rate (or reproductive rate) is defined as the number of chicks that survive until fledging age per breeding pair. Since 1989, reproductive rates at the Seashore have ranged from 0.00 to 2.00 chicks per breeding pair, with an average rate over the 18 years from 1992 to 2009 of 0.64 chicks per breeding pair (NPS 2009b). During 2009, a total of 9 breeding pairs fledged 6 chicks (a rate of 0.67 chicks per pair) (Muiznieks pers. comm. 2009). However, a rate of 1.25 fledged chicks per breeding pair annually would be needed to sustain the population (USFWS 1996a), and the recovery goal set by the USFWS is 1.50 fledged chicks per breeding pair. Hence, the fledge rate at the Seashore has averaged less than half the recovery goal since 1992.

The decline in the local breeding population (figure 5) from 1995 to 2003 is likely a reflection of the low reproductive rate (NPS 2005a) and resultant lack of recruitment. However, the increase in the numbers of piping plover breeding pairs since 2003 is encouraging.



Source: NPS 2009b; Muiznieks pers. comm. 2009

FIGURE 5. NUMBERS OF PIPING PLOVER BREEDING PAIRS AND FLEDGED CHICKS AT CAPE HATTERAS NATIONAL SEASHORE, 1992–2009

Hatching and Fledging Success at Primary Nesting Sites

The following tables (table 17 through table 22) provide a summary of hatching and fledging success at each of the individual primary breeding sites from the early 1990s through 2009. Average fledge rates³ across the six breeding sites ranged from 0.13 at Bodie Island Spit to 0.90 at South Beach, and each site has a fledge rate below the 1.50 goal set by the 1996 revised recovery plan. However, there were eight instances of years when one or more sites did meet or exceed this goal, indicating that despite poor Seashore-wide recruitment, some primary nesting sites performed at or above this expectation in some years.

Nest Loss/Abandonment

Nest loss and abandonment have had significant impacts on piping plover reproduction at the Seashore. In the 18 seasons from 1992 through 2009, 41% of nests (of 172 discovered) were lost or abandoned (figure 6). Factors contributing to nest loss and abandonment include weather, predation, and human disturbance, which are discussed in detail under the “Risk Factors” section later in this chapter.

³ “Annual fledge rate” is defined as the number of chicks fledged per breeding pair. “Average fledge rate” is the average of the annual fledge rates for years when there was at least one breeding pair.

TABLE 17. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT BODIE ISLAND SPIT, 1992–2009

Year	Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate
				#	%	#	%	#	%	
1992	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1993	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1994	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1995	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1996	1	1	4	1	100.0	3	75.0	0	0.0	0.00
1997	1	2	6	0	0.0	0	0.0	0	0.0	0.00
1998	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1999	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2000	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2001	1	1	3	0	0.0	0	0.0	0	0.0	0.00
2002	1	1	3	1	100.0	1	33.3	0	0.0	0.00
2003	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2004	1	1	2	0	0.0	0	0.0	0	0.0	0.00
2005	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2006	1	0	0	0	0.0	0	0.0	0	0.0	N/A
2007	1	1	3	1	100.0	3	100.0	1	33.3	1.00
2008	1	1	3	0	0.0	0	0.0	0	0.0	0.00
2009	0	0	0	0	0.0	0	0.0	0	0.0	N/A

Average Fledge Rate at Bodie Island Spit = 0.13

TABLE 18. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT CAPE POINT, 1992–2009

Year	Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate
				#	%	#	%	#	%	
1992	4	5	19	4	80.0	11	57.9	4	36.4	1.00
1993	5	6	23	5	83.3	15	65.2	3	20.0	0.60
1994	5	6	24	5	83.3	16	66.7	5	31.3	1.00
1995	6	9	33	5	55.6	15	45.5	2	13.3	0.33
1996	5	5	16	3	60.0	7	43.8	3	42.9	0.60
1997	4	6	18	5	83.3	15	83.3	3	20.0	0.75
1998	4	5	19	3	60.0	10	52.6	6	60.0	1.50
1999	3	3	12	2	66.7	7	58.3	5	71.4	1.67
2000	2	3	11	2	66.7	6	54.5	2	33.3	1.00
2001	1	1	3	0	0.0	0	0.0	0	0.0	0.00
2002	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2003	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2004	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2005	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2006	2	2	7	2	100.0	6	85.7	3	50.0	1.50
2007	4	8	22	4	50.0	10	45.5	3	30.0	0.75
2008	5	6	22	4	66.7	12	54.5	4	33.3	0.80
2009	5	5	20	5	100.0	19	95.0	4	21.1	0.80

Average Fledge Rate at Cape Point = 0.88

TABLE 19. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT SOUTH BEACH, 1992–2009

Year	Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate
				#	%	#	%	#	%	
1992	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1993	1	2	7	1	50.0	4	57.1	0	0.0	0.00
1994	1	1	2	1	100.0	2	100.0	1	50.0	1.00
1995	1	1	3	1	100.0	1	33.3	1	100.0	1.00
1996	1	1	3	1	100.0	2	66.7	0	0.0	0.00
1997	1	2	8	2	100.0	7	87.5	0	0.0	0.00
1998	1	1	4	1	100.0	4	100.0	2	50.0	2.00
1999	1	1	4	1	100.0	4	100.0	2	50.0	2.00
2000	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2001	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2002	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2003	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2004	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2005	1	1	4	1	100.0	4	100.0	3	75.0	3.00
2006	1	1	4	0	0.0	0	0.0	0	0.0	0.00
2007	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2008	1	1	4	1	100.0	2	50.0	0	0.0	0.00
2009	0	0	0	0	0.0	0	0.0	0	0.0	N/A

Average Fledge Rate at South Beach = 0.90

TABLE 20. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT HATTERAS INLET SPIT, 1992–2009

Year	Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate
				#	%	#	%	#	%	
1992	4	5	16	2	40.0	5	31.3	2	40.0	0.50
1993	3	4	16	2	50.0	7	43.8	4	57.1	1.33
1994	3	6	24	3	50.0	10	41.7	3	30.0	1.00
1995	4	6	17	5	83.3	11	64.7	3	27.3	0.75
1996	5	7	26	4	57.1	14	53.8	0	0.0	0.00
1997	3	4	8	1	25.0	4	50.0	0	0.0	0.00
1998	3	1	4	1	100.0	2	50.0	0	0.0	0.00
1999	1	1	4	0	0.0	0	0.0	0	0.0	0.00
2000	2	3	12	1	33.3	4	33.3	1	25.0	0.50
2001	1	1	4	1	100.0	3	75.0	2	66.7	2.00
2002	1	2	5	0	0.0	0	0.0	0	0.0	0.00
2003	1	1	4	1	100.0	4	100.0	0	0.0	0.00
2004	1	1	4	1	100.0	4	100.0	0	0.0	0.00
2005	1	1	4	1	100.0	4	100.0	3	75.0	3.00
2006	1	0	0	0	0.0	0	0.0	0	0.0	N/A
2007	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2008	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2009	0	0	0	0	0.0	0	0.0	0	0.0	N/A

Average Fledge Rate at Hatteras Inlet Spit = 0.61

TABLE 21. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT NORTH OCRACOCKE SPIT, 1992–2009

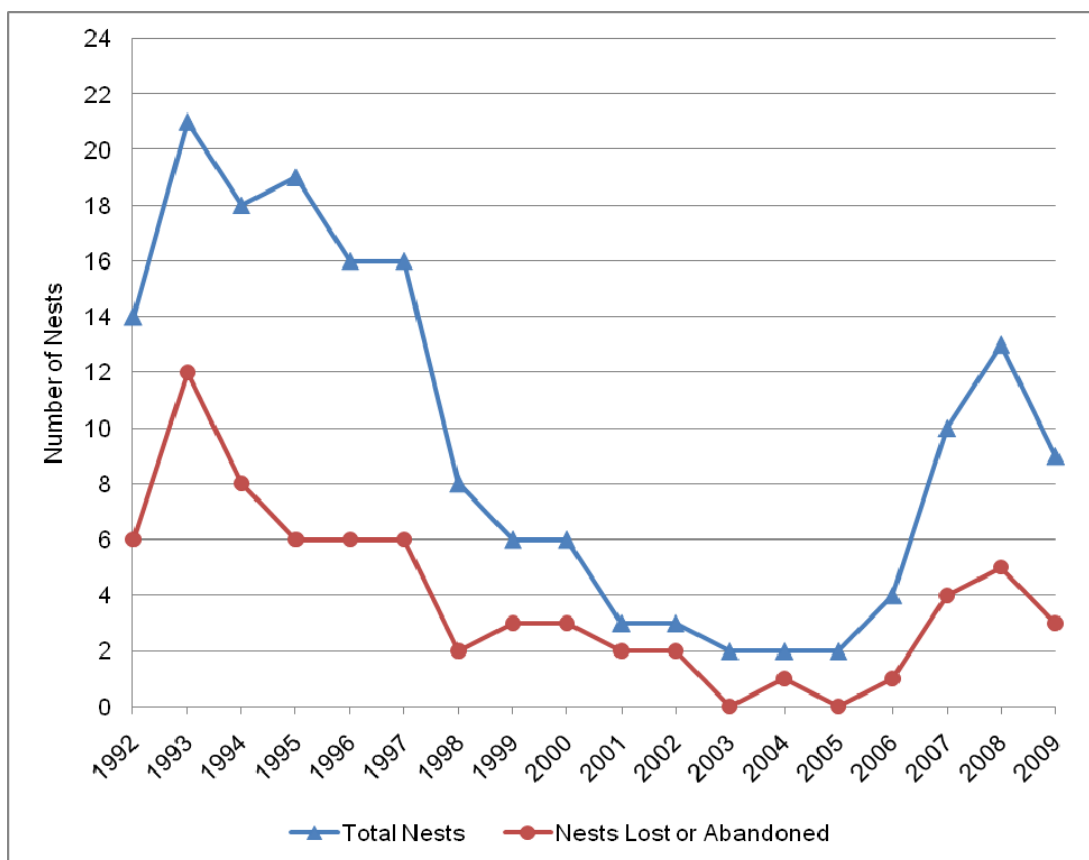
Year	Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate
				#	%	#	%	#	%	
1992	4	4	14	2	50.0	5	35.7	2	40.0	0.50
1993	3	9	23	1	11.1	1	4.3	1	100.0	0.33
1994	2	5	15	1	20.0	4	26.7	0	0.0	0.00
1995	2	2	6	2	100.0	3	50.0	1	33.3	0.50
1996	1	1	3	0	0.0	0	0.0	0	0.0	0.00
1997	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1998	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1999	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2000	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2001	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2002	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2003	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2004	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2005	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2006	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2007	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2008	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2009	0	0	0	0	0.0	0	0.0	0	0.0	N/A

Average Fledge Rate at North Ocracoke Spit = 0.27

TABLE 22. PIPING PLOVER HATCHING AND FLEDGING SUCCESS AT SOUTH POINT, 1992–2009

Year	Total Pairs	# Nests	# Eggs	Nests Hatched		Eggs Hatched		Chicks Fledged		Fledge Rate
				#	%	#	%	#	%	
1992	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1993	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1994	0	0	0	0	0.0	0	0.0	0	0.0	N/A
1995	1	1	4	0	0.0	0	0.0	0	0.0	0.00
1996	1	1	4	1	100.0	4	100.0	0	0.0	0.00
1997	2	2	7	2	100.0	6	85.7	0	0.0	0.00
1998	1	1	4	1	100.0	4	100.0	4	100.0	4.00
1999	1	1	3	0	0.0	0	0.0	0	0.0	0.00
2000	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2001	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2002	0	0	0	0	0.0	0	0.0	0	0.0	N/A
2003	1	1	1	1	100.0	1	100.0	1	100.0	1.00
2004	1	0	0	0	0.0	0	0.0	0	0.0	N/A
2005	1	0	0	0	0.0	0	0.0	0	0.0	N/A
2006	1	1	4	1	100.0	3	75.0	0	0.0	0.00
2007	1	1	4	1	100.0	4	100.0	0	0.0	0.00
2008	4	5	14	3	60.0	8	57.1	3	37.5	0.75
2009	4	4	14	1	25%	3	21.0	2	66.7	0.50

Average Fledge Rate at South Point = 0.52



Source: NPS 2009b; Muiznieks pers. comm. 2009

FIGURE 6. PIPING PLOVER NEST LOSS / ABANDONMENT AT CAPE HATTERAS NATIONAL SEASHORE, 1992–2009

Nonbreeding Population

In addition to supporting a local breeding population, the Seashore also hosts migrating and wintering piping plovers from all three of the North American breeding populations (the threatened Atlantic Coast and Great Plains populations and the endangered Great Lakes population). The Outer Banks is an important stopover area for migrating shorebirds along the Atlantic Coast. Fall migrants arrive at the Outer Banks in July, peak in August and September, and depart by November (Dinsmore et al. 1998). The distribution and abundance of nonbreeding populations at the Seashore are less well documented than the local breeding population. Documenting and protecting nonbreeding piping plovers and their habitats are priorities articulated in the recovery plans for all three North American breeding populations (USFWS 1988; 1996a; 2003). Recognizing the importance of the Outer Banks to wintering piping plovers, the USFWS designated 2,043 acres of critical habitat in Dare and Hyde counties in November 2008 (FR 2008).

Wintering piping plovers on the Atlantic Coast select wide beaches in the vicinity of inlets that are associated with a high percentage of moist substrate habitat (Nicholls and Baldassarre 1990; Wilkinson and Spinks 1994). Because tidal regimes and fall and winter storm patterns often cause piping plovers to move among habitat patches, a diversity of habitat patches may be important to wintering populations (Burger 1994; Nicholls and Baldassarre 1990).

Cohen and others (in press) studied nonbreeding piping plovers at the Seashore from 2000 to 2005. The results of this study indicated that the greatest number of nonbreeding piping plovers at the Seashore

occurs during the fall migration, which begins in July and peaks between July and September (see table 23). The fall migration counts were highest at South Point, followed by Oregon Inlet (Bodie Island Spit, Pea Island NWR, and, formerly, Green Island, which is now largely unusable for plovers because of vegetation growth), then Hatteras Inlet Spit, and finally Cape Point (Cohen et al. in press).

TABLE 23. MONTHLY MEDIAN AND MAXIMUM NONBREEDING BIRDS SEEN DURING FALL, WINTER, AND SPRING SURVEYS, SELECTED SITES AT CAPE HATTERAS NATIONAL SEASHORE, 2000–2005

	Month	Bodie Island Spit	Cape Point / South Beach	Hatteras Inlet Spit	South Point	All Sites
Median	Jul	0.49	0.18	0.45	2.21	5.7
	Aug	0.68	0.31	0.13	3.76	6.4
	Sep	0.66	0.07	0.38	4.22	5.7
	Oct	0.36	0.00	0.86	1.81	3.3
	Nov	0.82	0.00	0.07	1.00	4.2
	Dec	0.77	0.00	0.00	2.07	2.9
	Jan	0.25	0.00	0.00	1.00	1.2
	Feb	3.33	0.00	0.00	1.00	4.3
	Mar	1.25	0.00	0.00	0.75	2.8
	Apr	1.89	0.00	0.62	1.31	3.6
Maximum	Jul	32	5	21	56	56
	Aug	34	6	14	72	72
	Sep	16	5	4	37	37
	Oct	12	1	28	31	31
	Nov	15	0	8	12	15
	Dec	17	0	7	15	17
	Jan	18	0	1	11	18
	Feb	14	0	0	18	18
	Mar	12	3	4	8	12
	Apr	25	3	7	11	25

Source: Cohen et al. in press

NOTE: Not all sites were surveyed during the designated survey days (typically, only one or two sites were surveyed on a given survey day), so the numbers in the table provide only a rough idea of the total size of the nonbreeding population.

During this time, the first banded winter residents appeared in August; however, other wintering birds could have arrived in July. Cohen suggested that the nonbreeding population from December to January probably consisted entirely of winter residents and estimated that although the size of the resident wintering population at the Seashore was not precisely known, it may be on the order of 20 to 35 birds (Cohen et al. in press). In the winter of 2004–2005, the maximum numbers seen were about 50% of the recent norm; however, whether this observed difference was because of a difference in survey methodology is unknown. The highest counts of wintering residents were at Bodie Island Spit and South Point. Based on a sample of banded birds, winter residents can be present until April (Cohen et al. in press). Spring piping plover migrants first appear in February or early March, and their numbers peak in late March or April (table 23). Sites at Bodie Island Spit have had the highest abundance of spring

migrants, followed by South Point, with fewer at Hatteras Inlet Spit and Cape Point / South Beach (Cohen et al. in press).

NPS staff documented nonbreeding piping plovers' use of the Seashore throughout 2006. Migratory birds appeared to peak in August and September, with a high count of 93 birds at South Point on August 10 (table 24). South Point revealed the highest counts during fall migration. Three surveys at South Point were coordinated with Seashore surveys on North Core Banks to investigate bird abundance around Ocracoke Inlet (table 24).

TABLE 24. COUNTS OF PIPING PLOVER ON BOTH SIDES OF OCRACOKE INLET DURING FALL MIGRATION, 2006

Date	South Point	North Core Banks	Total	Tide
Aug 10, 2006	93	7	100	Mid
Aug 14, 2006	69	16	85	Low
Oct 2, 2006	15	16	31	Low

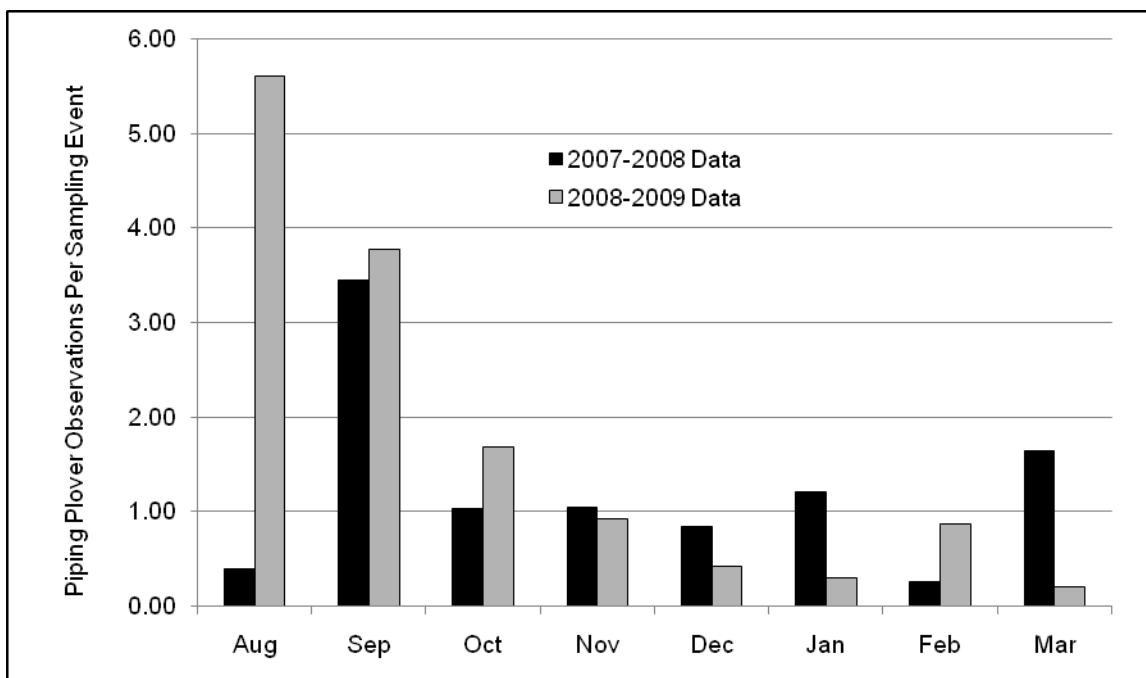
Source: NPS 2007c

Seashore staff also documented nonbreeding plovers' use of the Seashore beginning at the end of the breeding season in August 2007 through March 2008 and from August 2008 to March 2009 (see figure 7), although surveys were limited to the points and spits. Figure 7 indicates the number of piping plover observations recorded per sampling event (or unit of effort), which is also referred to as "normalized" data, which were used as a means to control a varying level of effort across sampling units. In 2007, migratory birds peaked in September, with a high of 33 counted on September 7, 2007, on South Point (NPS 2009b). After the migrants passed through the area in September 2007, plover numbers appeared to stabilize over the winter months except in February 2008, when there was an unexplained drop in numbers. In 2008, the number of migratory plovers peaked in August and numbers declined in September to a level similar to the previous year. The number of birds at the Seashore continued to decline until February 2009, when the migrants started passing through the Seashore again (figure 7).

Seashore staff documented the habitat type in which migratory and wintering piping plovers were observed from August 2007 to March 2008 and from August 2008 to March 2009 (figure 8). Of the 717 observations, 458 were in mudflat / algal flat, 157 were in sand flat, 67 were in foreshore, and 26 were in wrack line habitat (NPS 2009b; Muiznieks pers. comm. 2009).

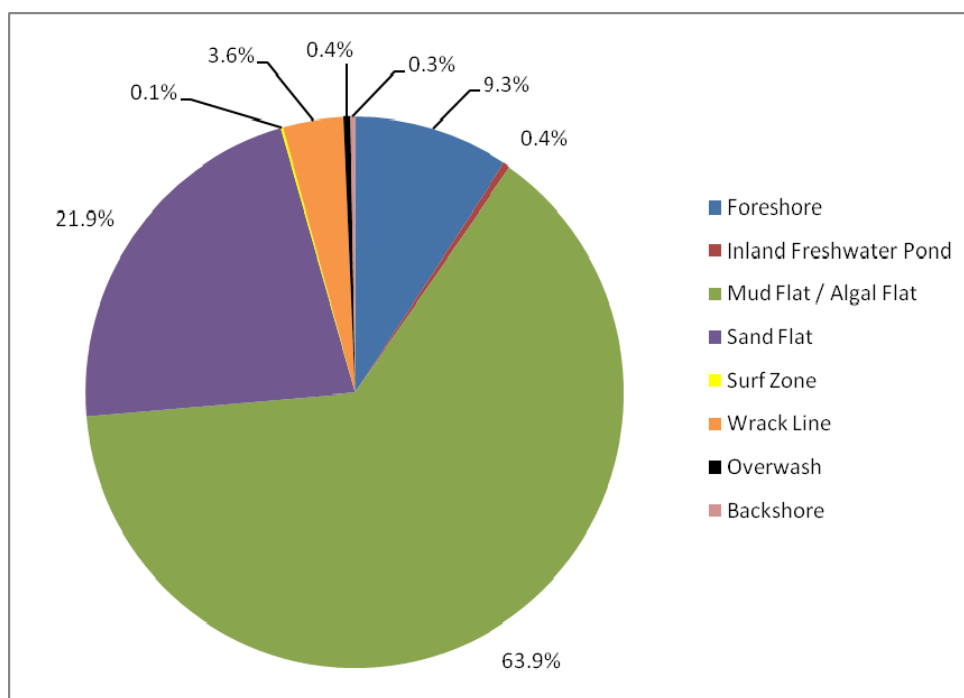
In addition to the monitoring being conducted by Cohen and others (in press) and Seashore staff, the Southeast Coast Network (SECN) Inventory and Monitoring Program conducted a comprehensive study on wintering shorebirds at the Seashore. Pilot implementation of a long-term shorebird monitoring protocol began in mid-July 2006 and the first report was published in March 2009. The study found that the fall migration appeared to peak in August (figure 9) and the spring migration likely peaked in May, but nest initiation by piping plover and logistical issues precluded consistent sampling later than April in any given year. The three highest single-day counts during the pilot study (for sampled areas only) were 24 in July 2006, 50 in August 2006, and 14 in April 2007. Monthly normalized counts (number of birds observed per 30-minute sampling event) are shown on figure 10.

The SECN study found that the majority of piping plover observations occurred in mudflat / algal flat and foreshore habitat types (figure 11).



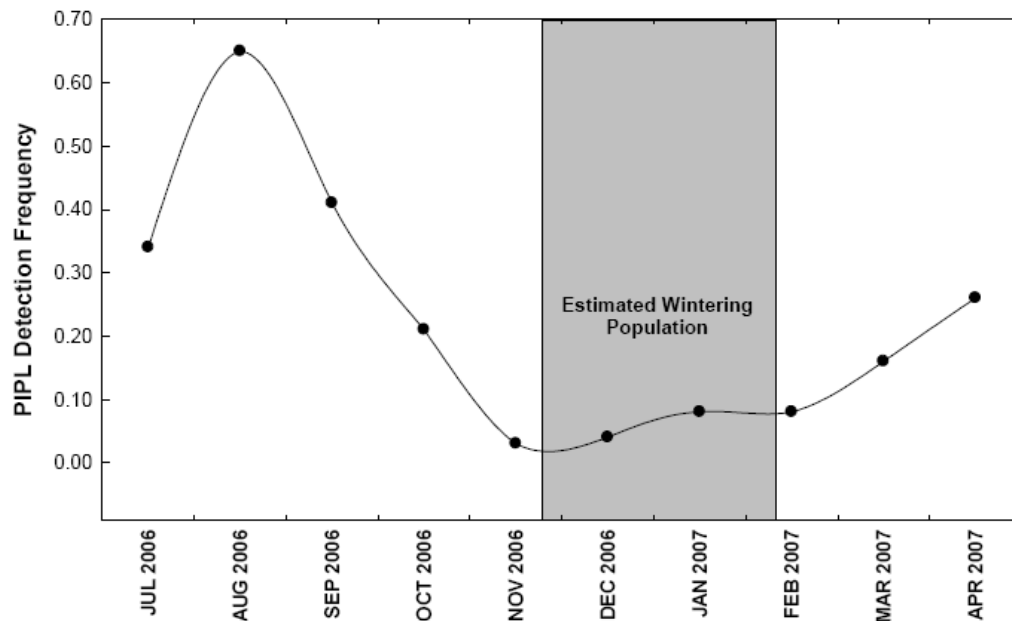
Source: Byrne et al. 2009

FIGURE 7. MONTHLY OBSERVATIONS OF PIPING PLOVERS PER SAMPLING EVENT FROM AUGUST TO MARCH 2007–2009



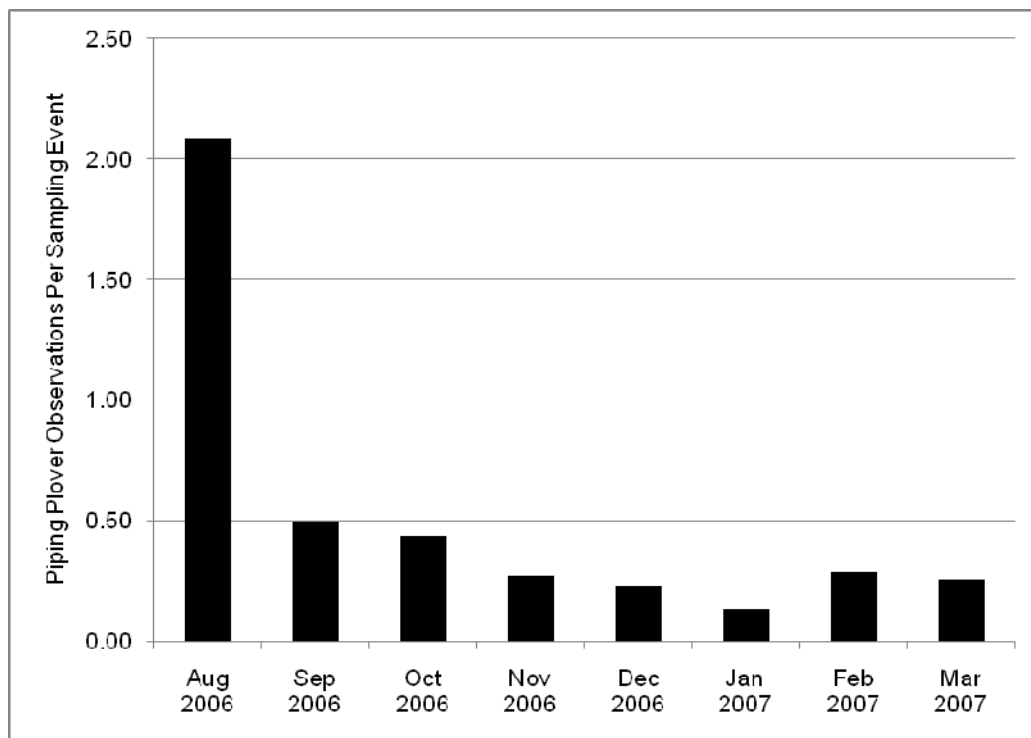
Source: NPS 2009b; Muiznieks pers. comm. 2009

FIGURE 8. WINTERING OBSERVATIONS OF PIPING PLOVER BY HABITAT TYPE



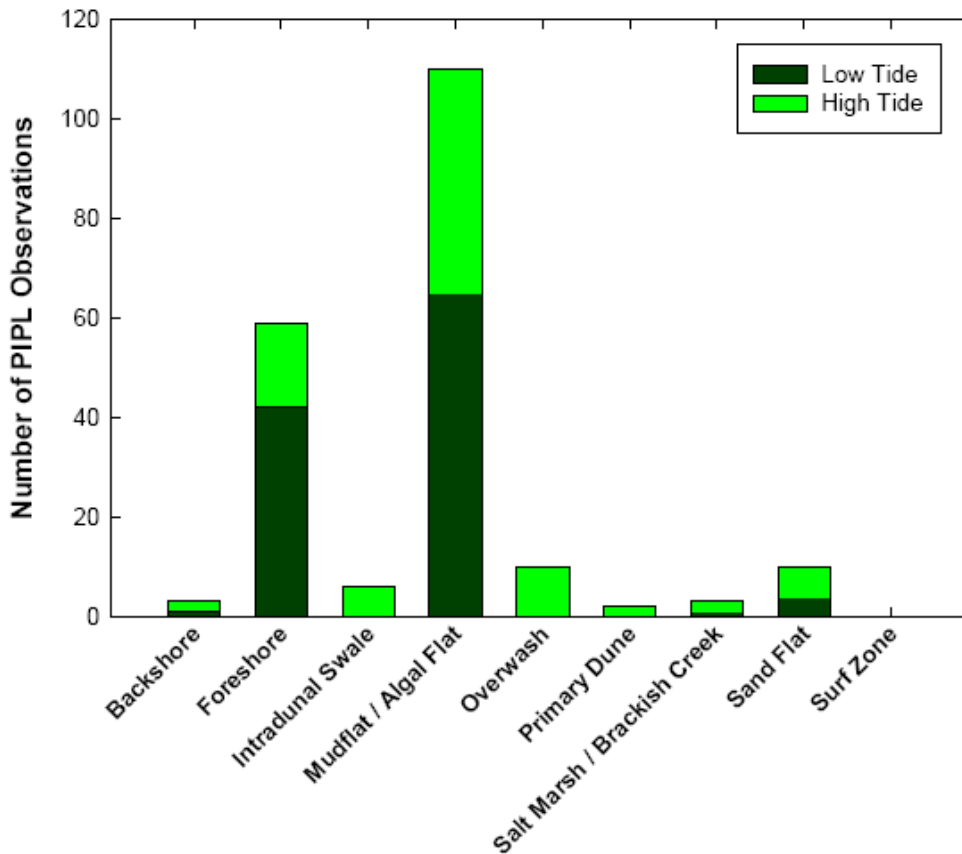
Source: Byrne et al. 2009

FIGURE 9. DETECTION FREQUENCY FOR PIPING PLOVER (PIPL) AT BODIE ISLAND SPIT, CAPE POINT, HATTERAS INLET SPIT, NORTH OCRACOKE SPIT, AND SOUTH POINT—CAPE HATTERAS NATIONAL SEASHORE, 2006–2007



Source: Byrne et al. 2009

FIGURE 10. MONTHLY OBSERVATIONS OF PIPING PLOVER PER SAMPLING EVENT AT CAPE HATTERAS NATIONAL SEASHORE, 2006–2007



Source: Byrne et al. 2009

FIGURE 11. NUMBERS OF NONBREEDING PIPING PLOVER (PIPL) OBSERVATIONS BY HABITAT TYPE AND TIDE STAGE AT CAPE HATTERAS NATIONAL SEASHORE, 2006–2007

The results of the SECN study were consistent with previous studies that found that the moist substrate habitat type is thought to play a vital role in the survival of nonbreeding piping plovers. It was also noted that migratory and wintering piping plovers occurred more frequently in accreted areas (i.e., the points and spits), which are popular spots for recreational ORV use at the Seashore (Byrne et al. 2009). The importance of protecting nonbreeding piping plovers was demonstrated in a research program by the Canadian Wildlife Service between 1998 and 2003, which primarily tracked migration patterns and survival rates of the Eastern Canada population of piping plovers. Individuals from this population were identified migrating and wintering at points along the east coast of the United States, including North Carolina (Amirault et al. 2006). The analysis of this research identified adult survival as the single most important factor influencing the population trends of this piping plover population and showed that expanding protection of nonbreeding habitat was an important factor in the recovery of the species (Amirault et al. 2006). Seashore staff will continue to monitor the abundance of nonbreeding piping plovers at the Seashore and use the data to make management decisions as to where the winter closures need to be placed.

Risk Factors

Small populations such as the Atlantic Coast piping plover populations face a heightened risk of extinction compared to large populations because they are more vulnerable to the following: (1) random

environmental variations, such as storms; (2) reduction in genetic variations that limit a species' ability to adapt to local conditions; (3) sudden, random drops in birth and death rates; and (4) an impaired ability to find suitable mates (Lande 1988).

Given the vulnerability of the small piping plover populations in North America to random events, the persistence of the populations will depend increasingly on controlling sources of mortality to adults, eggs, and chicks throughout their range. Predators, human disturbance, and limited or blocked access to foraging habitat have been identified in past research as contributing to impaired reproductive success for plovers using the Seashore (Kuklinski et al. 1996). Thus, providing a disturbance-free environment early in the season may help piping plovers to establish territories and attract mates (Cohen 2005).

Rates and sources of mortality and disturbance, and the responses of piping plovers to disturbance in the nonbreeding season, have not been specifically assessed at the Seashore. However, it is known that piping plover foraging and roosting habitats at Cape Hatteras are used by pedestrians and ORVs outside of the breeding season (Cohen et al. in press). Where such activity is allowed, studies conducted at several beaches in Massachusetts and New York have shown that there is the potential for piping plovers to be killed by being run over by ORVs (Melvin et al. 1994) or taken by domestic pets. Studies along the Atlantic and gulf coasts (including one at the Seashore) have shown that the density of wintering plovers is higher in areas with limited human presence or disturbance (Cohen et al. 2008; Nicholls and Baldassarre 1990). Furthermore, disturbance to roosting and foraging birds by ORVs, unleashed pets, and pedestrians may reduce foraging efficiency or alter habitat use, thereby increasing the risk of nutritional or thermal stress (Zonick 2000).

Weather and Tides. Nine named hurricanes affected the Outer Banks between 1993 and 2008 (NOAA 2009). Hurricane Isabel, which hit the coast in September 2003, renewed piping plover habitat on portions of the Seashore and may have resulted in a reduction in predator populations (NCWRC 2008a). In the years immediately following the storm, piping plover numbers and productivity increased. However, there have been no significant storms since that time, and much of the created habitat is now deteriorating due to revegetation (NCWRC 2008a). No significant weather events, such as hurricanes or tropical storms, occurred during the 2006 breeding season. However, smaller, localized events may have affected nesting. Nest 4 on South Point was partially buried by high wind and blowing sand. One egg was buried by sand, and the nest was a deep cup rather than a scrape (June 29). One adult remained hunkered down on the nest during the strong winds, and the buried egg was visible again during the nest check. A strong thunderstorm was noted on the night before Nest 2 on South Beach was discovered lost; however, the loss is characterized as "unknown" because it cannot be shown conclusively that weather was the cause. Five nests were lost to weather, predation, or abandonment during the 2007 breeding season. Nest 1, a two-egg nest on Cape Point, was lost during a Nor'easter storm. It is unknown if the eggs were blown out of the nest scrape in the 50- to 60-mile-per-hour winds, buried under the sand, or taken by a predator. In 2008, a series of sandstorms with wind gusts over 35 mph may have caused the pair from Nest 1 (Cape Point) to abandon the nest. A nest on Ocracoke was buried during a Nor'easter prior to the nest being located by resource management staff. One egg was found when compacted sand was removed from a scrape that had been maintained prior to the arrival of the storm (NPS 2009b). In 2009 there were high winds and rain prior to a single egg (first egg of a clutch) disappearing at Cape Point (Muiznieks pers. comm. 2009).

Hurricanes and other ocean storms can lead to unusually high tides, and subsequent flooding can overwash piping plover nests (Cohen et al. in press). In May 2000, a 3-day storm produced high winds, heavy rain, and ocean overwash. One clutch at Cape Point was buried under windblown sand and abandoned, while a second was lost to flooding at Hatteras Inlet Spit (NPS 2001b). Wave action and erosion caused the abandonment of a nest in 2002 when waves undermined a protective dune, resulting in the nest being flooded by ocean overwash. The eggs were scattered from the nest and the adults did not

return to them (NPS 2003d). In 2009 a four-egg nest discovered on June 8 on South Point, Ocracoke, was overwashed by spring tides on June 23 (Muiznieks pers. comm. 2009).

Indeed, some piping plovers that nest too close to mean high tide may lose their nests on normal high tides (Cohen et al. in press). Storms can also result in widespread mortality of chicks (Houghton 2005). Besides these direct effects of storms on piping plover nests, flooding from extreme high tides or storm surges may alter habitat enough to render it unsuitable for nesting. This may lead to the abandonment of habitat within or between breeding seasons (Haig and Oring 1988).

Predation. Predation, especially by mammalian predators, continues to be a major factor affecting the reproductive success of the piping plover (Elliot-Smith and Haig 2004). Predators of eggs, chicks, and/or adults include such predators as mink (*Mustela vison*), gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), opossum (*Didelphis virginiana*), raccoon (*Procyon lotor*), domestic dogs (*Canis lupus familiaris*), feral and domestic cats (*Felis catus*), crows (*Corvus brachyrhynchos*), gulls (*Larus* spp.) (NPS 2008c), and birds of prey (Murphy et al. 2003). The impact of predation has been postulated to be greater on beaches with high human use because the presence of pets and trash (which may attract wild predators) is correlated with the presence of humans (USFWS 1996a).



Foxes outside a Piping Plover Nest Exclusion

Credit: Richard Kuzminski / USFWS

Fox activity was recorded at all active plover nesting areas in 2001 and one late nest initiation and two nest abandonments were linked to this activity (NPS 2002b). No direct evidence of predation of chicks or eggs was recorded from 2001 through 2006, although the presence or tracks of crows, grackles (*Quiscalus* spp.), gulls, ghost crabs (*Ocypode quadrata*), Virginia opossum, mink, raccoon, red fox, gray fox, and domestic cats and dogs were documented within many plover breeding territories. A fox den was discovered within the Bodie Island Spit bird closure in June 2006 (NPS 2007c). During the 2007 season, eggs were missing from a plover nest at Cape Point. Staff observed both raccoon and

opossum tracks in the area of the nest scrape (NPS 2008c). Predators or high winds generated by a Nor'easter storm are thought to be responsible for missing eggs and eggs observed eight feet from scrapes (NPS 2008c). In 2008, Seashore staff documented the loss of two plover chicks at Cape Point due to avian predation. One chick was taken by a gull and another by a crow. Staff also documented the presence or tracks of crows, ghost crabs, grackles, gulls, opossum, mink, raccoon, red fox, gray fox, and feral cats within many of the piping plover breeding territories (NPS 2009b). In 2009, two chicks at Cape Point were lost to suspected opossum predation on day three (Muiznieks pers. comm. 2009). In addition to causing direct mortality, predators in piping plover habitat can also lead to piping plovers' abandoning territories within and between breeding seasons (Cohen 2005).

Ghost crabs have occasionally been implicated in the loss of nests (Watts and Bradshaw 1995) and chicks (Loefering et al. 1995). Research on ghost crabs conducted in the lab and at a breeding site at Assateague Island in Virginia suggests that crab predation is generally uncommon. However, this study indicated that the presence of ghost crabs could have a more indirect effect on plover survival. For example, adult plovers may shepherd their broods away from the foreshore, where the best forage normally exists, due to the abundance of ghost crabs at that location (Wolcott and Wolcott 1999). Poor forage was found to be a more likely contributor to chick mortality than predation by ghost crabs (Wolcott and Wolcott 1999). However, anecdotal records indicate that ghost crabs may be more of a problem in North Carolina than at sites farther north (Cohen et al. in press). In 2007, one egg in an enclosed nest was lost to a ghost crab (NPS 2008c) and in 2008, ghost crab predation was suspected in the loss of three piping plover nests because ghost crab holes were found inside and around the nests and predator exclosures (NPS 2009b). In

2009, a two-egg nest discovered on May 22 on South Point, Ocracoke, was incubated well past its expected hatch date and was eventually predated by ghost crabs (Muiznieks pers. comm. 2009).

Human Activity. Human disturbance, both direct and indirect, can adversely affect piping plovers at the Seashore. Studies on piping plovers have demonstrated that reproductive success is lower in areas with high human disturbance (Burger 1991, 1994). Research has shown that plover behavior is altered by the presence of humans, which ultimately results in chicks exhibiting less time feeding, brooding, and conserving energy. Plovers that are subject to human disturbance spend less than 50% of their foraging time searching for prey and feeding, where undisturbed plovers can spend up to 90% of that time feeding (Burger 1994). These human-caused behavioral changes result in depleted energy reserves, which could leave chicks more susceptible to predation or other stresses (Flemming et al. 1988; Loegering and Fraser 1995). At other sites, it was documented that fledging success did not differ between areas with and without recreational ORV use (Patterson et al. 1991), although pedestrians caused a decrease in brood-foraging behavior in New Jersey (Burger 1994).

Pedestrian and non-motorized recreational activities can be a source of both direct mortality and harassment of piping plovers. Potential pedestrians on the beach include those individuals driving and subsequently parking on the beach, those originating from off-beach parking areas (hotels, motels, commercial facilities, beachside parks, etc.), and those from beachfront and nearby residences. Vehicle impacts can extend to remote stretches of beach where human disturbance would be very slight if access were limited to pedestrians only (USFWS 1996a).

Even with resource closures in place, protected species are still at risk.

Approximately 50 to 60 occurrences of ORVs entering protected areas at the Seashore were recorded each year from 2000 to 2002. In 2003, 13 bird closure posts/signs were driven over by an ORV, and several instances of ORVs within the protected area were observed (NPS 2003d, 2004e, 2005a). A total of 105 occurrences of ORVs entering posted bird closures were recorded in 2003. This number represents a substantial increase as compared to 52 recorded in 2001 and 63 in 2002 (NPS 2004e). In 2004, 227 pedestrians and 65 vehicle tracks were reported within posted bird resource closures, including those for piping plovers. However, no plover nests were known to be disturbed, and no plover chicks were known to be lost, although four other bird species were killed by ORVs in 2004 (NPS 2005a). In 2005, 135 pedestrian, 57 ORV, and 13 illegal dog entries into posted bird closures were recorded (NPS 2006d). In 2006 resource staff recorded 255 pedestrian, 47 ORV, 22 dog, and 5 horse violations of bird closures (NPS 2007c). In 2007, resource staff recorded 249 pedestrian, 25 ORV, 17 dog, and 1 horse violation of bird closures (NPS 2008c). During the 2008 breeding season, resource staff recorded 80 pedestrian, 11 ORV, 5 dog, and 1 boat violation of nesting plover closures (NPS 2009b). During the 2009 breeding season, resource staff documented 192 pedestrian, 8 ORV, 19 dog, 3 horse and 3 boat violations in the prenesting closures (Muiznieks pers. comm. 2009). Most illegal entries were not witnessed but documented based on vehicle, pedestrian, or dog tracks left behind.

*Symbolic Fencing—
Posts with string
tied between them
intended to signify
that an area has
been closed to
protect resources.*

Disturbance from vehicles, pedestrians, and pets can cause incubating birds to be flushed from their nests. Flushing can affect plover behavior and viability in a number of ways. Flushing of incubating plovers from nests can expose eggs to avian predators or excessive temperatures. Repeated exposure of eggs to direct sunlight on hot days can cause overheating, which can kill avian embryos (Bergstrom 1989). In Texas, piping plovers avoided foraging on sand flats close to areas of high human use (Drake et al. 2001). Zonick (2000) found that the number of piping plovers was lower on disturbed bayside flats than on undisturbed flats, and piping plovers experienced lower foraging efficiency when disturbed. Other unpublished data support the assertion that winter habitat selection is negatively correlated with human

activities and development (Houghton 2005). In New York, the response of incubating adults to the presence of humans near the nest was found to be highly variable, and average nest success was unrelated to the number of disturbance sources observed within 100 meters (328 feet) of nests (Houghton 2005). Other studies on the effect of human disturbance on incubating piping plovers documented highly variable flushing distances ranging anywhere between 20 and 200 meters (66 to 656 feet) (USFWS 1996a). However, piping plovers may be more sensitive to disturbance in the Atlantic Coast southern recovery unit, as evidenced by longer flush distances in response to disturbance sources at Assateague Island National Seashore (Loefering 1992). The study on Assateague Island found that on average, incubating plovers flushed from their nests at a distance of 78 meters (256 feet), although some birds flushed when researchers were as far as 174 meters (571 feet) away, indicating a much larger flushing distance than was documented by other studies.

<hr/> <p><i>Canid—The biological family of carnivorous and omnivorous mammals that includes the wolves, foxes, jackals, coyotes, and the domestic dog.</i></p> <hr/>	<p>Unleashed pets have the potential to flush piping plovers, and these flushing events may be more prolonged than those associated with pedestrians or pedestrians with dogs on leash. For example, a study conducted on Cape Cod, Massachusetts, found that the average distance at which piping plovers were disturbed by pets was 46 meters (151 feet), compared with 23 meters (75 feet) for pedestrians. Birds flushed by pets moved farther (an average of 57 meters [187 feet]) than plovers reacting to pedestrians (an average of 25 meters [82 feet]). Duration of observed disturbance behaviors stimulated by pets was significantly greater than that caused by pedestrians (USFWS 1996a). In 2002, there was evidence that a dog may have been responsible for the loss of a piping plover chick at Bodie Island. When a plover brood could not be found, large canid tracks were documented in the area where the brood was often seen foraging and resting. A professional trapper with the U.S. Department of Agriculture examined the prints and verified them as domestic dog tracks. The tracks were found running in a sharp turning pattern, seeming to indicate that the dog had been engaged in a chase. Scrape marks where the dog had clawed in the sand were also evident. The chick was not observed at the site thereafter (NPS 2004e).</p>
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Vehicles have been documented running over nests (Patterson et al. 1991) and birds on Assateague Island in Maryland and Virginia. In Massachusetts and New York, biologists found that 18 chicks and 2 adults were killed by vehicles between 1989 and 1993, even on beaches with only five to ten vehicles passes per day (Melvin et al. 1994). Piping plover chicks often move from the foredune area to forage along the wrack line and intertidal zone, which places them in the paths of vehicles. Chicks can end up in or near tire ruts, and sometimes have difficulty crossing or climbing out of them. The normal response of plover chicks to disturbance could increase their vulnerability to vehicles. Chicks sometimes stand motionless or crouch as vehicles approach, and their lack of rapid movement could lead to mortality (USFWS 1996a).

ORV use may also affect the beach through sand displacement and compaction (Anders and Leatherman 1987), which may lead to steeper dune profiles. This, in turn, may prove less suitable for piping plover nesting. Degradation of the wrack line is possible from as little as one vehicle pass (Leatherman and Godfrey 1979), and may negatively impact reproductive success due to the loss of important habitat used by foraging plovers. Also, the wrack line provides habitat for many beach invertebrates, which are a staple of the plover diet.

Beach and dune renourishment projects can alter the profile of beaches, causing increased erosion and habitat loss (Leatherman 1985). Important dune-creation projects have been carried out along most of the Seashore, beginning in the 1930s. These may be affecting the ability of the Seashore to support piping plovers (Harrison and Trick pers. comm. 2005). A recent study theorized that beach nourishment projects may negatively impact plover habitat because the resulting dredge spoil is often fine-grained, reducing the

availability of pebbles and cobbles, which are a preferred substrate for nesting plovers (Cohen, Wunker, and Fraser 2008). Furthermore, beach stabilization prevents normal storm processes, such as overwash fan formation, thereby leading to long-term loss of moist substrate habitat and to accelerated vegetative succession in potential nesting habitat (Dolan et al. 1973). Construction of artificial structures on beaches eliminates breeding territories and may result in an increased level of predation on and human disturbance of remaining pairs (Houghton 2005).

Research, surveying, and even protective management activities can sometimes expose piping plovers to a risk of disturbance at breeding sites. For example, adult birds may be more vulnerable to predation within exclosures (Murphy et al. 2003), depending on the local predator pool and the type of exclosure used. Adults may also abandon exclosed nests more frequently (Elliot-Smith and Haig 2004).

SEA TURTLES

Sea turtles are large marine reptiles found in subtropical, tropical, and temperate oceans, as well as subarctic areas. They spend the majority of their time in ocean waters, with females coming ashore only to nest on sandy beaches. Five of the seven sea turtle species existing in the world today occur in the coastal waters of North Carolina and the Seashore, and all are listed as either federally threatened or endangered. These five species are the loggerhead sea turtle, the green sea turtle, the Kemp's ridley sea turtle, the leatherback sea turtle, and the hawksbill sea turtle. Of the five species, only three are known to nest at the Seashore: the loggerhead, green, and leatherback sea turtles. The other two species, Kemp's ridley and hawksbill, are known to occur on the beaches of the Seashore only through occasional stranding, usually either due to death or incapacitation due to hypothermia, and are therefore not discussed further.

In 1978, the loggerhead turtle was federally listed as threatened (NMFS and USFWS 2008). The NMFS and the USFWS are currently considering petitions to reclassify the loggerheads in the Northwest Atlantic as endangered. Also in 1978, the green turtle was federally listed as threatened, except for the breeding populations in Florida and on the Pacific Coast of Mexico, which were listed as endangered (NMFS and USFWS 1991). The leatherback turtle was listed as federally endangered in 1970 (NMFS and USFWS 1992a). All three species carry the same state listings as their federal listings (NCWRC 2008b).

The Seashore staff has been consistently monitoring for sea turtle nests since 1987. However, over the years both monitoring and managing techniques have changed, making data comparison difficult; therefore, only nesting data from 2000 to 2009 are presented, for these data are known to be accurate. The number of nests recorded at the Seashore from 2000 to 2009 has fluctuated greatly, with only 43 nests recorded in 2004 and 112 nests recorded in 2008, which was the highest number on record (NPS 2008a). In 2009, there were 104 sea turtle nests recorded at the Seashore (Baker pers. comm. 2009a). Of the three species that nest at the Seashore, the loggerhead turtle is by far the most numerous, comprising approximately 94% of the known nests between 2000 and 2008 (NPS 2005c, 2007e, 2008a; Baker pers. comm. 2009a). Green turtles and leatherbacks breed primarily in the tropics, with only small numbers nesting at higher latitudes. Green turtles have nested regularly at Cape Hatteras, but in fewer numbers, comprising only about 5% of the nests between 2000 and 2008, while leatherback turtles have nested infrequently at the Seashore, comprising only about 1% of the nests (NPS 2005c, 2007e, 2008a; Baker pers. comm. 2009a). The vast majority of sea turtle nests occur on Hatteras and Ocracoke islands, with turtles occasionally nesting on Bodie Island (Baker pers. comm. 2009a).

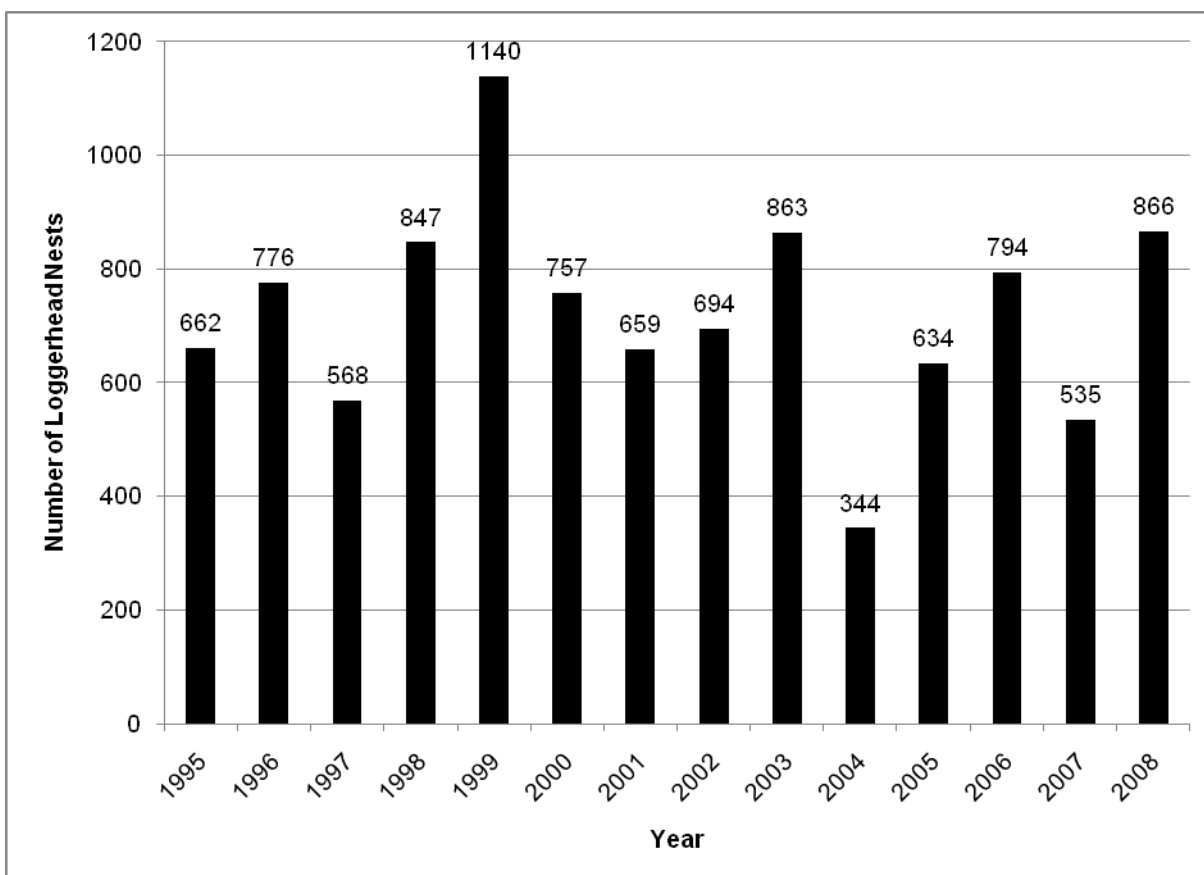
Loggerhead Turtle

The loggerhead sea turtle occurs throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian oceans. However, the two largest nesting rookeries occur along the western rims of the Atlantic and Indian oceans. Within the United States, the loggerhead turtle nests from Texas to Virginia, with the primary nesting concentrations found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida (NMFS and USFWS 2008). Over the last decade, the total estimated nesting in the United States has fluctuated between 47,000 and 90,000 nests per year, with about 80% of the loggerhead nesting activity occurring in six counties in the state of Florida (NMFS and USFWS 2008). Within the northern recovery unit as defined in the Loggerhead Recovery Plan (Florida/Georgia border to southern Virginia), studies of annual nest totals in South Carolina and Georgia have documented a decline in the number of nests (Ehrhart et al. 2003). However, since standardized surveying began in North Carolina in the mid-1990s, the number of loggerhead nests per season has remained fairly stable, averaging 724 nests from 1995 through 2008 (figure 12) (Godfrey pers. comm. 2005b, 2008; Muiznieks pers. com. 2009).



Loggerhead Turtle

Credit: NPS



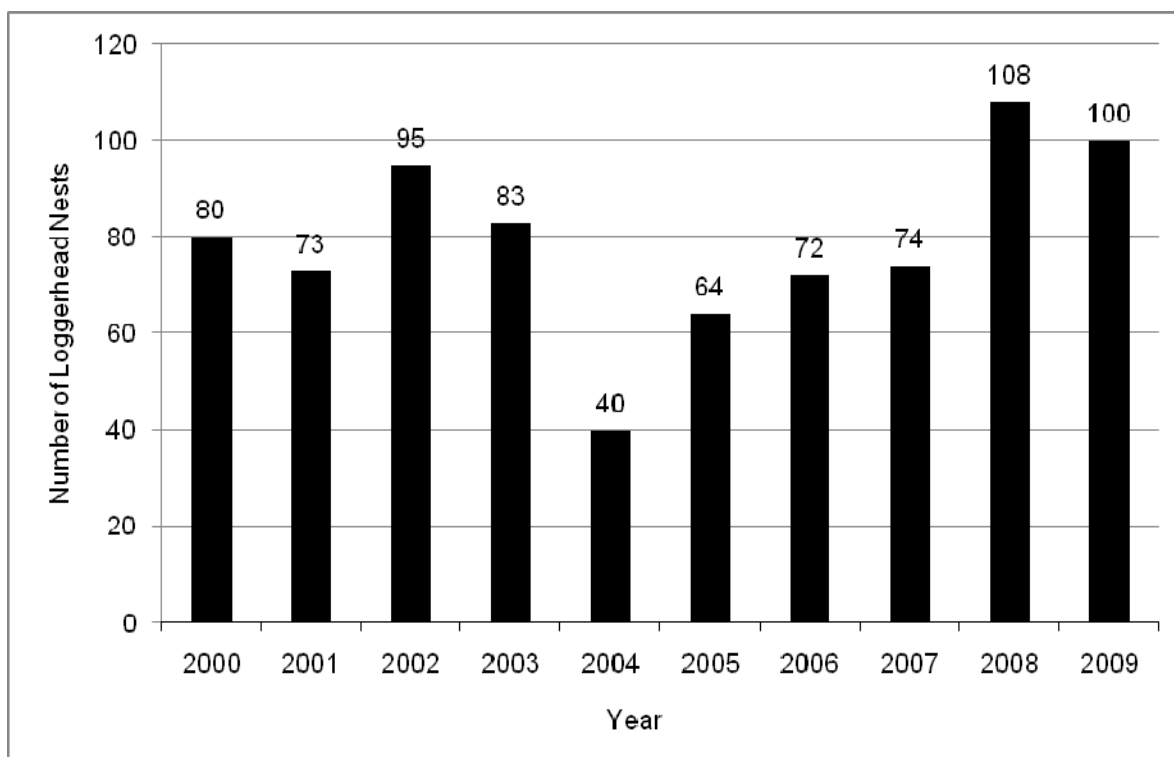
Source: Godfrey pers. comm. 2005b, 2008; Muiznieks pers. comm. 2009

FIGURE 12. NUMBERS OF LOGGERHEAD TURTLE NESTS IN NORTH CAROLINA, 1995–2008

Between 2000 and 2009 the average number of loggerhead nests at the Seashore was 79, with the lowest number of nests occurring in 2004 and the highest number of nests occurring in 2008 (figure 13) (Baker pers. comm. 2009a). While only 40 loggerhead nests were laid at Cape Hatteras in 2004, it was a poor nesting year for the entire southeast Atlantic Coast (NPS 2005c).

Loggerhead turtles spend the majority of their life at sea, with only mature females coming ashore to nest every two to three years, on average (Schroeder et al. 2003). The first turtle nests (all turtle species included) typically begin to appear at Cape Hatteras in mid-May, and the last nests are usually deposited in late August (Baker pers. comm. 2009a). Although three nests were found prior to May 15 (two of which were leatherback nests), and 4 nests have been found after September 1, it is important to note that prior to 2008, nest patrols were conducted only from June 1 through August 31 (2001–2005), or May 15 through September 15 (2006 and 2007). Any nests laid outside of that timeframe were unlikely to be found and protected by resource management staff (Baker pers. comm. 2009a).

Typical nesting areas for loggerheads tend to be sandy, wide, open beaches, backed by low dunes (Miller et al. 2003). Some factors that have been found to determine nest selection include beach slope, temperature, distance to the ocean, sand type, and moisture, though results were occasionally contradictory (Miller et al. 2003).



Sources: NPS 2006b; 2008c; 2009c; Baker pers. comm. 2009a.

FIGURE 13. NUMBERS OF LOGGERHEAD TURTLE NESTS AT CAPE HATTERAS NATIONAL SEASHORE, 2000–2009

Although the process of nest site selection is not well understood, a successful nest must be laid in a low salinity, high humidity, well-ventilated substrate that is not prone to flooding or burying because of tides and storms and where temperatures are optimal for development (Miller et al. 2003).

At the Seashore, between 2000 and 2009, on average, 25% of the nests found (all turtle species included) were relocated from their original location by Seashore staff. Of those nests, 82% were relocated for

natural causes (e.g., in areas prone to flooding [below the high tide line], in an area prone to erosion, etc.), 14% were relocated because of potential human disturbance, primarily because they were within one mile of a lighted fishing pier, 3% were relocated due to both environment and human disturbance issues, and 4% were moved during storm events later into incubation (Baker pers. comm. 2009a).

Of those nests, 79% were relocated for natural causes (e.g., in areas prone to flooding [below the high tide line], in an area prone to erosion, etc.), while the rest were relocated because of potential human disturbance, primarily because they were within one mile of a lighted fishing pier (NPS 2001c, 2002c, 2003e, 2005c, 2006e, 2008a, 2009c; Sayles pers. comm. 2005). The practice of relocating nests for recreation or lighting issues is not encouraged by the USFWS; therefore, beginning in 2006 nests were no longer relocated for recreational access issues and starting in 2007 nests were no longer relocated based on distance to a lighted fishing pier. As a result, the average number of nests relocated each year from 2006 to 2008 decreased to 18% of the nests found (NPS 2006e, 2008a, 2009c).

Loggerheads are nocturnal nesters. Females emerge from the ocean and crawl toward the dune line until they encounter a suitable nest site. The female clears away surface debris with her front flippers, creating a “body pit,” and then excavates a flask-shaped nest cavity with her hind flippers. Loggerheads throughout the southeastern United States lay an average of 100 to 126 eggs per nest (NMFS and USFWS 2008). After laying her eggs, the female covers the nest with sand, and she crawls back to the sea.

Individual females may nest one to six times per nesting season, at an average interval of 12 to 15 days (NMFS and USFWS 2008). Loggerheads do not produce clutches in successive years very often with nesting years typically separated by two to three years of foraging in between (NMFS and USFWS 2008). The nest incubation period (from laying to hatching) depends on temperature and ranges from 49 to 68 days in North Carolina with an average of about 55 days (USFWS n.d.). The sex ratio of hatchlings also depends on temperature during incubation. Below 84.6°F, more males are produced than females, and above that temperature, more females are produced (Mrosovsky 1988). For this reason, the northern part of the U.S. Atlantic population, which includes North Carolina, apparently provides a disproportionate number of males to the larger population, which is important for the stability of the population as a whole (Mrosovsky et al. 1984; Hanson et al. 1998).

Hatchling emergence occurs almost exclusively at night (Mrosovsky 1968; Witherington et al. 1990) and may occur over several nights. Upon emerging from the nest, hatchlings primarily use light cues to find and move toward the sea (Witherington and Martin 1996). Once in the water, they swim incessantly out to sea to offshore habitats where they will spend the next phase of their life history.

Green Turtle

The green turtle is a circumglobal species in tropical and subtropical waters. The major green turtle nesting colonies in the Atlantic Ocean occur on Ascension Island, Aves Island, Costa Rica, and Surinam (NMFS and USFWS 1991). Nesting in the United States occurs in small numbers in the U.S. Virgin Islands and on Puerto Rico and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward counties. North Carolina is near the northern limits of its nesting area.

Nesting habits for the green turtle are very similar to those of the loggerhead turtle, with only slight differences.



Green Turtle

Credit: Michael Lusk / USFWS

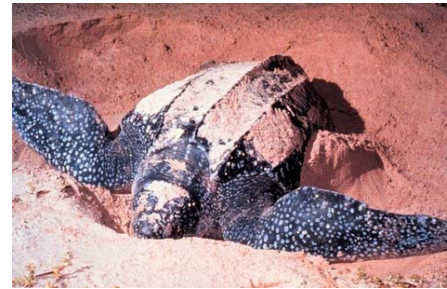
Average clutch sizes range from 110 to 115 eggs, although this varies by population, and females produce clutches in successive years only occasionally. Usually two to four years or more occur between breeding seasons (NMFS and USFWS 1991).

From 2000 to 2009, there was an annual average of four green turtle nests at the Seashore, with a peak of nine nests in 2005 (Baker pers. comm. 2009a).

Leatherback Turtle

Leatherback nesting grounds are distributed circumglobally, with the largest known nesting area occurring on the Pacific Coast of southern Mexico. Nesting in the United States occurs primarily in Puerto Rico, the U.S. Virgin Islands, and southeastern Florida (NMFS and USFWS 1992a).

Leatherback nesting at the Seashore was first documented in 1998 and has subsequently been documented in 2000, 2002, 2007, and 2009, totaling six nests since 2000 (NPS 2001c; NPS 2008a, 2009c; Baker pers. comm. 2009a). Since the species has a minimum of two years between nesting cycles, it is not known if more than one female of the species uses the Seashore as a nesting ground. Until 2009 the Seashore was the northernmost nesting location on record for this species (Rabon et al. 2003). However, in 2009 a leatherback nested in Kill Devil Hills, North Carolina, which currently represents the northernmost nest ever found from this species (Baker pers. comm. 2009a).



Leatherback Turtle

Credit: USFWS

Leatherback nesting habits are very similar to those of the loggerhead turtle, although they tend to begin and end nesting earlier in the year than the loggerhead (NMFS and USFWS 1992a). Since 1999, the only two nests laid in April at the Seashore have been leatherbacks (NPS 2000b, 2008a). Leatherbacks are thought to migrate to their nesting beach about every two to three years (NMFS and USFWS 1992a; Miller 1997). Clutch size averages 116 eggs, and the incubation period averages 55 to 75 days. It is also reported that leatherback turtles nest an average of five to seven times per year, with an average interval of nine to ten days between nesting (NMFS and USFWS 1992a).

Potential Threats

Threats to the loggerhead turtle on nesting grounds, as outlined in their recovery plan (NMFS and USFWS 2008), are representative of those also faced by green and leatherback turtles. The following discussion of threats to sea turtles is taken from the 2008 revised Loggerhead Sea Turtle Recovery Plan, which has been updated with more recent research on potential threats to these species that, in some cases, was not available at the time of the 1991 recovery plan.

Human Presence. The greatest threat posed by humans on the beach at night is disturbance of female turtles before they have finished nesting. From the time a female exits the surf until she has begun covering her nest, she is highly vulnerable to disturbance, especially prior to and during the early stages of egg laying. Females that abort a nesting attempt may attempt to nest again at or near the same location or select a new site later that night or the following night. However, repeated interruption of nesting attempts may cause a turtle to construct her nest in a sub-optimum incubation environment, postpone nesting for several days, prompt movement many kilometers from the originally chosen nesting site, or result in the shedding of eggs at sea. Direct harassment may also cause adult turtles to reduce the time spent covering the nest. Visitors using flashlights or lanterns or lighting campfires on the beach at night during the nesting season may deter nesting females from coming ashore and may disorient hatchlings. In

addition, heavy pedestrian traffic may compact sand over unmarked nests, although the effect of this compaction has not been determined and may be negligible. Depending on the nesting substrate, pedestrian traffic over nests near the time of emergence can cause nests to collapse and result in hatchling mortality. A study in Japan found loggerhead nests laid in beach areas with pedestrian access had higher rates of dead pipped hatchlings than nests laid in restricted beach zones (USFWS and NMFS 2008).

Recreational Beach Equipment. The use and storage of lounge chairs, cabanas, umbrellas, catamarans, and other types of recreational equipment on the beach can hamper or deter nesting by adult females and trap or impede hatchlings during their nest-to-sea migration. The documentation of non-nesting emergences (also referred to as false crawls) at these obstacles is becoming increasingly common as more recreational beach equipment is left on the beach at night. Nesting turtles have been documented being deterred by wooden lounge chairs that prevented access to the upper beach. Additionally, there are documented reports of nesting females being trapped under heavy wooden lounge chairs and cabanas, eggs being destroyed by equipment (e.g., beach umbrellas penetrating the egg chamber), and hatchlings being hampered during emergence by equipment inadvertently placed on top of the nest (USFWS and NMFS 2008).

Beach Vehicular Driving. Operating privately owned vehicles on nesting beaches for recreational purposes or beach access is allowed on certain beaches in northeast Florida (Nassau, Duval, St. Johns, and Volusia counties), northwest Florida (Walton and Gulf counties), Georgia (Cumberland, Little Cumberland, and Sapelo islands), North Carolina (Fort Fisher State Recreation Area, Carolina Beach, Freeman Park, Onslow Beach, Emerald Isle, Indian Beach / Salter Path, Pine Knoll Shores, Atlantic Beach, Cape Lookout National Seashore, Cape Hatteras National Seashore, Nags Head, Kill Devil Hills, town of Duck, and Currituck Banks), Virginia (Chincoteague NWR and Wallops Island), and Texas (the majority of beaches except for a highly developed section of South Padre Island and Padre Island National Seashore, San Jose Island, Matagorda Island, and Matagorda Peninsula where driving is not allowed or is limited to agency personnel, land owners, and/or researchers). Operating vehicles to conduct scientific research and management is generally allowed throughout the loggerhead's nesting range. The presence of vehicles on the beach has the potential to negatively impact sea turtles by running over nesting females, hatchlings, stranded turtles that have washed ashore, and nests. In addition, the ruts left by vehicles in the sand may prevent or impede hatchlings from reaching the ocean following emergence from the nest. Hatchlings impeded by vehicle ruts are at greater risk of death from predation, fatigue, desiccation, and being crushed by additional vehicle traffic. Vehicle lights and vehicle movement on the beach after dark can deter females from nesting and disorient hatchlings. Sand compaction due to vehicles on the beach may hinder nest construction and hatchling emergence from nests. Driving directly above incubating egg clutches can cause sand compaction, which may decrease hatching success and directly kill pre-emergent hatchlings. Additionally, vehicle traffic on nesting beaches may contribute to erosion, especially during high tides or on narrow beaches where driving is concentrated on the high beach and foredune (USFWS and NMFS 2008).

Research and Conservation Management Activities. Research and conservation management activities (e.g., nesting surveys, tagging of nesting females, nest manipulation) are tools to advance the recovery of the loggerhead; however, they have the potential to adversely affect nesting females, hatchlings, and developing embryos if not properly conducted. Research and conservation management activities should be carefully evaluated to determine their potential risks and conservation benefits. The States, in cooperation with the USFWS, have established permitting programs to ensure that proposed research and conservation activities are necessary for recovery, carried out by appropriately trained persons, non-duplicative, the least manipulative possible, and carried out in such a way to minimize chances of mortality. A low level of lethal take is authorized annually for research and conservation purposes. Under conditions where the conservation benefits (e.g., embryo survivorship, hatchling survivorship, conservation knowledge gained) are forecast to substantially outweigh the potential conservation risks,

certain activities can be considered beneficial to loggerhead recovery. Most research and conservation management activities are likely to have minimal effects on nesting turtles, hatchlings, and developing embryos when conducted in accordance with established protocols designed to minimize disturbance and risk. On many beaches, surveyors use small 4-wheeled ATVs with low-pressure (<5 psi) tires that minimally impact nesting habitat. In addition, almost all surveys to count nests are conducted after sunrise when encounters with nesting turtles and emergent hatchlings are unlikely. Research activities, such as flipper and pit tagging, blood sampling, skin sampling, satellite and radio transmitter attachment, and hatchling orientation surveys, have a minimal effect on individual turtles when conducted according to established guidelines (e.g., Florida Fish and Wildlife Conservation Commission Marine Turtle Conservation Guidelines). Potential benefits from this research include important insight into population structure, species health, habitat use, and other important aspects of loggerhead biology and ecology. Nest relocation is a management technique for protecting nests that are predicted to be destroyed by environmental factors, such as erosion or repeated tidal inundation, or permitted human activities, such as beach nourishment during the nesting season. However, the unnecessary relocation of nests may result in negative impacts to eggs and hatchlings. Historically, the relocation of sea turtle nests to higher beach elevations or into hatcheries was a regularly recommended conservation management activity throughout the southeast United States. However, advances in our knowledge of the incubation environment have provided important information to guide nest management practices. Nests located where there are threats from beachfront lighting, foot traffic, and mammalian predators can be effectively managed by addressing the threat directly or by protecting the nest in situ rather than by moving the nest. In situ protection, which addresses the root causes of egg and hatchling mortality, is in keeping with Frazer's (1992) call to move away from "halfway technology." Increased understanding of the potential adverse effects associated with nest relocation, restraint of hatchlings, and concentrated hatchling releases has resulted in less manipulative management strategies to protect nests and hatchlings. The Florida Fish and Wildlife Conservation Commission's sea turtle conservation guidelines consider nest relocation to be a management technique of last resort. At training workshops, nest monitors are advised to relocate nests only if they are certain that the nest will otherwise be lost, and if this certainty is based on extensive experience at the specific beach. Recovery Action 6111 describes development of protocols by which managers could identify threatened nests with greater precision, thereby minimizing the number of nests that are relocated (USFWS and NMFS 2008).

Beach Erosion and Accretion. Natural beach erosion events may influence the quality of nesting habitat. Nesting females may deposit eggs at the base of an escarpment formed during an erosion event where they are more susceptible to repeated tidal inundation. Erosion, frequent or prolonged tidal inundation, and accretion can negatively affect incubating egg clutches. Short-term erosion events (e.g., atmospheric fronts, Nor'easter storms, tropical storms, and hurricanes) are common phenomena throughout the loggerhead nesting range and may vary considerably from year to year. Sea turtles have evolved a strategy to offset these natural events by laying large numbers of eggs and by distributing their nests both spatially and temporally. Thus, the total annual hatchling production is never fully affected by storm-generated beach erosion and inundation, although local effects may be high. For example, storm-induced mortality in the Dry Tortugas Recovery Unit has been high during years of high tropical storm activity and may limit recovery. However, human activities along coastlines can accelerate erosion rates, interrupt natural shoreline migration, and reduce both the quantity and quality of available nesting habitat. During erosion events, some nests may be uncovered or completely washed away. Nests that are not washed away may suffer reduced reproductive success as the result of frequent or prolonged tidal inundation. Eggs saturated with seawater are susceptible to embryonic mortality. However, in spite of the potential for reduced hatching success, loggerhead eggs can successfully survive periodic tidal inundation. Studies have shown that although frequent or prolonged tidal inundation resulted in fewer emergent hatchlings, occasional overwash of nests appeared to have minimal effect on reproductive success. Accretion of sand above incubating nests may also result in egg and hatchling mortality (USFWS and NMFS 2008).

Light Pollution. Both nesting and hatchling sea turtles are adversely affected by the presence of artificial lighting on or near the beach. Experimental studies have shown that artificial lighting deters adult female turtles from emerging from the ocean to nest. A 1986 study noted that loggerheads aborted nesting attempts at a greater frequency in lighted areas. Because adult females rely on visual brightness cues to find their way back to the ocean after nesting, those turtles that nest on lighted beaches may become disoriented (unable to maintain constant directional movement) or misoriented (able to maintain constant directional movement but in the wrong direction) by artificial lighting and have difficulty finding their way back to the ocean. In some cases, misdirected nesting females have crawled onto coastal highways and have been struck and killed by vehicles. Hatchlings exhibit a robust sea-finding behavior guided by visual cues, and direct and timely migration from the nest to sea is critical to their survivorship. Although the mechanism involved in sea-finding is complex, involving cues from both brightness and shape, it is clear that strong brightness stimuli can override other competing cues. Hatchlings have a tendency to orient toward the brightest direction as integrated over a broad horizontal area. On natural undeveloped beaches, the brightest direction is commonly away from elevated shapes (e.g., dune, vegetation, etc.) and their silhouettes and toward the broad open horizon of the sea. On developed beaches, the brightest direction is often away from the ocean and toward lighted structures. Hatchlings unable to find the ocean, or delayed in reaching it, are likely to incur high mortality from dehydration, exhaustion, or predation. Hatchlings lured into lighted parking lots or toward streetlights are often crushed by passing vehicles. Uncommonly intense artificial lighting can draw hatchlings back out of the surf. Although the attributes that can make a light source harmful to sea turtles are complex, a simple rule has proven useful in identifying lights that pose potential problems for sea turtles. Researchers propose that artificial light sources are “likely to cause problems for sea turtles if light from the source can be seen by an observer standing anywhere on the beach.” This visible light can come directly from any glowing portion of a luminaire, including the lamp, globe, or reflector, or indirectly by reflection from buildings or trees that are visible from the beach. Bright or numerous light sources, especially those directed upward, will illuminate sea mist and low clouds, creating a distinct sky glow visible from the beach. Field research suggests hatchling orientation can be disrupted by the sky glow from heavily lighted coastal areas even when no direct lighting is visible. The ephemeral nature of evidence from hatchling disorientation and mortality makes it difficult to accurately assess how many hatchlings are misdirected and killed by artificial lighting. Reports of hatchling disorientation events in Florida describe several hundred nests each year and are likely to involve tens of thousands of hatchlings. However, this number calculated from disorientation reports is likely a vast underestimate. Independent of these reports, researchers surveyed hatchling orientation at nests located at 23 representative beaches in six counties around Florida in 1993 and 1994 and found that, by county, approximately 10 to 30% of nests showed evidence of hatchlings disoriented by lighting. From this survey and from measures of hatchling production, the number of hatchlings disoriented by lighting in Florida is calculated in the range of hundreds of thousands per year (USFWS and NMFS 2008).

Beach Debris. Hatchlings often must navigate through a variety of obstacles before reaching the ocean. These include natural and human-made debris. Debris on the beach may interfere with a hatchling’s progress toward the ocean. Research has shown that travel times of hatchlings from the nest to the water may be extended when traversing areas of heavy foot traffic or vehicular ruts; the same is true of debris on the beach. Hatchlings may be upended and spend both time and energy in righting themselves. Some beach debris may have the potential to trap hatchlings and prevent them from successfully reaching the ocean. In addition, debris over the tops of nests may impede or prevent hatchling emergence.

Natural Catastrophes. Periodic, short-term, weather-related erosion events (e.g., atmospheric fronts, Nor’easter storms, tropical storms, and hurricanes) are common phenomena throughout the loggerhead nesting range and may vary considerably from year to year. It was reported that 24.5% of all loggerhead nests laid on Deerfield Beach, Florida, in 1992 were lost or destroyed by Hurricane Andrew as a result of storm surge (NMFS and USFWS 2008). Similarly, Martin (1996) reported a 22.7% loss of total

loggerhead nest production on the southern portion of Hutchinson Island, Florida, during the passage of Hurricane Erin in 1995. Ehrhart and Witherington (1987) reported a 19% loss of loggerhead nests at Melbourne Beach, Florida, after a 5-day Nor'easter storm in 1985. In Georgia, 16% of loggerhead nests were lost to tropical storm systems in 2001; nest loss was particularly high on Sapelo (54%) and Little Cumberland islands (28%). On Fisher Island in Florida, it was reported that hatchling emerging success decreased significantly following Hurricane Andrew in 1992 (NMFS and USFWS 2008). They found that hatchlings were unable to emerge from nests where sand had accreted in large quantities and that these hatchlings probably died from asphyxiation or exhaustion while struggling to emerge from the nests. Sea turtles have evolved a strategy to offset these natural events by laying large numbers of eggs and by distributing their nests both spatially and temporally.

Threat Occurrences at Cape Hatteras National Seashore. The following data and discussions are from the Seashore's annual sea turtle reports, 1999 to 2008, and include all turtle species (NPS 2000b, 2001c, 2002c, 2003e, 2005c, 2006e, 2008a, 2009c; Sayles pers. comm. 2005).

The majority of turtle nest losses at the Seashore from 1999 to 2007 were weather related, particularly due to hurricanes and other storms. During this time, six hurricanes caused impacts to nests. In 2003, Hurricane Isabel destroyed 52 of the 87 nests (34 had hatched before the storm); there was so much water and sand movement along the beaches that no evidence of any nests could be found afterward. The Seashore also felt the effects of numerous tropical storms and hurricanes as they passed by offshore.

Foxes were first seen at the Seashore in 1999 and on Hatteras Island in the winter of 2001–2002. Foxes disturbed or destroyed turtle nests in 5 of the 10 years between 1999 and 2008, with the number of nests disturbed or destroyed ranging from one to nine nests per year. Ghost crab predation has been reported sporadically from 1999 to 2008, with 0 to 26 nests per year recorded as having either ghost crab holes burrowed deep into the nest cavity and/or eggshell fragments found on top of the sand in association with crab tracks.

Pedestrian tracks have been recorded inside closures, with counts ranging from 8 to 92 intrusions per year. Pedestrians disturbed or destroyed two to six nests per year from 1999 to 2008 by digging at the nest site; however, no pedestrian disturbances occurred in 2003, and no data were available for 2005.

Many, but not all, ORV users respect sea turtle nest protection areas. Since 1999, recorded violations of sea turtle nest protection areas by ORVs have ranged annually from 13 to 45 sets of tracks inside closures, though a total of 130 sets of tracks were documented in 2000 and 102 sets of tracks were documented in 2001. Most, but not all, of these ORV violations occurred when ORVs drove in front of nest areas during periods of low tide. Incidents of ORVs causing property damage to signs, posts, and twine marking the sea turtle nest protection areas have also been documented. From 1999 to 2008, the number of incidents where ORVs caused property damage generally ranged from 3 to 9 incidents annually, although a total of 28 incidents were recorded in 2000 and a total of 146 incidents were recorded in 2001. ORVs drove over four to five nests per year from 2000 to 2002; however, the nests survived. In 2007, two nests were known to have been run over by ORVs before they were found during the morning turtle patrol and fenced off. One nest appeared undamaged, but four eggs were crushed in the second nest. In 2004, a total of ten hatchlings were killed by vehicles in two separate incidents.

In 2009, despite operating under the consent decree, requiring expanded buffers be implemented after acts of deliberate closure violations/vandalism, two occurrences of deliberate violations were recorded (NPS 2009d).

Dogs disturbed or destroyed two nests in 2000, and 5 to 60 sets of dog tracks per year have been recorded inside closures. In 2008, cats were documented predating on emerging hatchlings at several nests, all

within the villages. This was the first year in which this was documented; however, 10 to 50 sets of cat tracks per year were counted inside turtle closures from 2000 to 2002.

The total number of pedestrian, vehicle, and pet violations are conservative estimates, for often the actual numbers could not be determined. Footprints and tracks are often recorded as a single violation, when an undeterminable number of tracks through an area may actually represent multiple violations. Also, tracks below the expanded nest closures are often washed out by the tide before being discovered by the turtle patrol.

Documented beach fires totaled 174 in 2000 and 773 in 2001. Such fires may misdirect adults and emergent hatchlings. In 2006, an adult turtle crawl was discovered going into the coals of a beach fire, and in 2007, a turtle approached a beach fire, which visitors quickly extinguished prior to the turtle laying her nest about 2 feet from the fire site. In 2008, several hatchlings were found entering a fire and were recovered and released. It was unknown how many died prior to the hatchlings being noticed. Hatchlings being misdirected by lights from villages and other human structures is a common occurrence at the Seashore.

There have also been documented reports in 2000, 2001, 2007, and 2008, and an unconfirmed report in 2006, of adult turtles aborting nesting attempts when visitors approached the turtles with flashlights, vehicle lights, or flash photography. Because the beaches are not patrolled 24 hours a day, it is likely that more disturbances of this nature occur but go undocumented.

Since 2001, Seashore staff members have been tying notices to personal property found on the beach after dawn, advising owners of the threats to nesting sea turtles, and then removing the items, when possible, if they remain on the beach 24 hours after tagging (NPS 2008a).

SEABEACH AMARANTH

Seabeach amaranth is an annual plant native to barrier-island beaches along the U.S. Atlantic Coast, including those within the Seashore. Historically, seabeach amaranth was found in nine states, from Massachusetts to South Carolina. It was federally listed as threatened by the USFWS in 1993 because of its vulnerability to human and natural impacts and the fact that it had been eliminated from two-thirds of its historic range (USFWS 1996b). Since its listing, seabeach amaranth has reappeared in several states and is currently found in New York, New Jersey, Delaware, Maryland, Virginia, North Carolina, and South Carolina. Despite its reappearance in several states, the plant remains highly vulnerable to the threats that caused its listing, and in some states, populations continue to decline (USFWS 2005b).



Seabeach Amaranth

Credit: Gene Nieminen / USFWS

This species is listed as threatened by the State of North Carolina (NCNHP 2006). Within North Carolina, from 2002 to 2003, the number of plants increased from 5,700 to 9,300 along 112 miles of beach (Cohen et al. in press), only a fraction of the approximately 40,000 plants reported in the late 1980s and 1995. Within the Seashore, seabeach amaranth numbers ranged from 550 to nearly 16,000 plants between 1985 and 1990 (table 25). However, in the last 10 years a maximum of only 93 plants was observed in 2002. More recently, only one plant was found in 2004 and two plants in 2005. Since 2005, no plants have been found within the Seashore.

TABLE 25. NUMBERS OF NATURALLY OCCURRING PLANTS OF SEABEACH AMARANTH AT CAPE HATTERAS NATIONAL SEASHORE, 1985–2008

	1985	1986	1987	1988	1990	1993	1994
Number of seabeach amaranth	550	600	6,883	15,828	3,332	0	0

	1995	1996	1997	1998	1999	2000	2001
Number of seabeach amaranth	1	98	81	265	8	2	51

	2002	2003	2004	2005	2006	2007	2008
Number of seabeach amaranth	93	30	1	2	0	0	0

Source: NPS 2009e

Seabeach amaranth is a low-growing annual, with stems that trail along the ground but do not root. The stems are reddish in color, fleshy, grow to 4 to 24 inches in length, and have round, fleshy, dark green leaves (0.4 to 0.6 inches long) clustered near the tips. Plants must recruit annually from seed banks, either in place or from other source populations dispersed by wind, water, or sediments distributed by anthropogenic (human) factors, such as beach renourishment (Jolls et al. 2004). Seeds must be scarified (the seed coat broken by nicking or abrasion) or cold stratified (chilling for weeks) before germination can occur (Cohen et al. in press). Germination takes place from April through July; initially, a small sprig forms, which soon begins to branch into a clump. At the Seashore, seedlings are usually visibly detectable beginning in June (Lyons pers. comm. 2005b). Plants are typically 10 to 12 inches in diameter, consisting of 5 to 20 branches, though occasionally a clump may get as large 3 feet or more across, with more than 100 branches (USFWS 1993; NJDEP 2005).

Flowering begins when plants are of sufficient size, often in June but more typically in July, and continues until the plants die in late fall or early winter. The species is a prolific seed producer, with seed production beginning in July or August and usually reaching a peak in September. Seed production continues until the plant dies. The seeds are relatively large (0.1 inch), believed to be viable for long periods of time (decades), and contained in indehiscent utricles (a fruit pouch that does not split open spontaneously at maturity to release its seed). Though the utricles are normally indehiscent, it is not unusual to see them splitting open, either before or after their detachment from the plant. Splitting or fragmentation of the utricles occurs under conditions of agitation (by wind), abrasion (by sand), or simple loss of integrity over time (USFWS 1996b).

Seed dispersal may occur by wind or water, and naked seeds do not disperse nearly as far from the parent plants as seeds retained in utricles. Seeds may also be dispersed by human activities, such as beach replenishment programs. Many utricles remain attached to the plant and never disperse, allowing seeds and fruit to pile up around the bases of the parent plants. This primarily occurs at the end of the growing season when the plant dies (USFWS 1996b).

Seabeach amaranth occupies a fairly narrow habitat niche. It is found on sandy ocean beaches, where its primary habitat consists of overwash flats at accreting ends of islands, and at the sparsely vegetated zone between the high-tide line and the toe of the primary dune on non-eroding beaches. It is intolerant of competition and does not occur on well-vegetated sites. It is also intolerant of even occasional flooding or overwash. Populations are occasionally found in other habitats, including back dunes, soundside beaches, blowouts in foredunes, and beach-replenishment areas, but these populations tend to be small and temporary (USFWS 1996b; NJDEP 2005). In general, in order to survive, this species needs extensive

areas of barrier island beaches and inlets, functioning in a relatively natural and dynamic manner, to allow it to move around in the landscape, occupying suitable habitat as it becomes available (USFWS 1993).

Since 2000, locations where seabeach amaranth has been found within the Seashore include the upper, dry-sand flats at Cape Hatteras Point (Cape Point and South Beach), in a line of small dunes adjacent to the flats at Hatteras Inlet Spit, at Bodie Island Spit, and at the base of dunes on the beach on the northern half of Ocracoke Island. Most areas where the plants have been found were either in established bird closures or other areas closed to vehicular traffic (NPS 2001d, 2001b, 2005a). Despite continuous protection (through the establishment of summer and winter resource closures) of the area on Bodie Island Spit where the plants were found in 2004 and 2005, as well as the area on Cape Point where the plant was historically found, no plants have been found in the Seashore since 2005. Additionally, large portions of the historic range of the plant at Hatteras Inlet Spit no longer exist due to continued erosion. While it is thought that the plant may possibly be extirpated from the Seashore (NPS 2009e), it should be noted that since plants are not evident every year, but may survive in the seed bank, populations of seabeach amaranth may still be present even though plants are not visible for several years (USFWS 2007d).

The predominant threat to seabeach amaranth is the destruction or alteration of suitable habitat, primarily because of beach stabilization efforts and storm-related erosion (USFWS 1993). Other important threats to the plant include beach grooming and some forms of “soft” beach stabilization, such as sand fencing and planting of beach-grasses; vehicular traffic, which can easily break or crush the fleshy plant and bury seeds below depths from which they can germinate; and predation by webworms (caterpillars of small moths) (USFWS 1993). Webworms feed on the leaves of the plant and can defoliate the plants to the point of either killing them or at least reducing their seed production. Beach vitex (*Vitex rotundifolia*) is another threat to seabeach amaranth, as it is an aggressive, invasive, woody plant that can occupy habitat similar to seabeach amaranth and outcompete it (ISSG 2009).

STATE-LISTED AND SPECIAL STATUS SPECIES

This section addresses the habitat, diet, reproduction, population trends, and impacts on several species of shorebirds that are listed or recognized as special status species by the State of North Carolina but are not federally listed as endangered or threatened. Most of these species breed on Cape Hatteras, as well as in other areas of North Carolina. Species described include American oystercatcher; four species of colonial waterbirds, including gull-billed terns, least terns, common terns, and black skimmers; Wilson’s plover; and red knots. The latter species breeds in the Arctic and uses the Seashore as a stopover during its annual migration.

AMERICAN OYSTERCATCHER

The American oystercatcher is a large (16–18 inches long, 14–24 ounces) and conspicuous shorebird with long pink legs and a long, bright reddish-orange bill. The upper body is covered with black feathers that contrast with white feathers on the breast and sides. The sexes are similar in appearance, although females are slightly larger than males.

Oystercatchers are restricted to the coastal zone throughout the year, where they inhabit saltmarshes and coastal islands along the southeastern United States coast (Schulte et al. 2007). They feed primarily on bivalves, mollusks, worms, and other marine invertebrates that inhabit intertidal areas (Nol and Humphrey 1994;



American Oystercatcher

Credit: Steven J. Dinsmore

Cohen et al. in press). This specialized diet is the reason that American oystercatchers are primarily found in coastal areas that support intertidal shellfish beds (Schulte et al. 2007).

Oystercatchers form pair bonds in February and early March. Courtship takes place in saltmarshes and on dunes, beaches, dredge spoils, and oyster bars. They breed from March to August along the Atlantic Coast, from Massachusetts to Florida, in relatively high, open, sandy areas with sparse to no vegetation (Nol and Humphrey 1994; Cohen et al. in press). They also breed along the Gulf Coast from Florida to Mexico and winter from central New Jersey south to the Gulf of Mexico (Simons and Schulte 2008).

American Oystercatcher in North Carolina

A 2007 breeding season survey estimated North Carolina's summer American oystercatcher population at 717 individuals, with 339 breeding pairs (Simons and Schulte 2008), and a 2005 survey estimated a winter population of oystercatchers in North Carolina at 647 birds (Brown et al. 2005). Cape Lookout and Cape Hatteras national seashores are estimated to support 90 breeding pairs (Simons and Schulte 2008), or 27% of the state's breeding oystercatchers. Barrier islands continue to be an important habitat, and supported 43% of the oystercatchers in North Carolina in 2007. Most of the barrier island nesters were found on undeveloped islands, although inlet spits on many developed islands continued to support nesting birds (NCWRC 2008b). Oystercatcher reproductive success in North Carolina has been extremely low, as studies conducted between 1995 and 2008 demonstrated an average of 0.31 chicks per nesting pair surviving to fledge (Simons and Schulte 2008). Other studies conducted at Cape Lookout National Seashore between 1997 and 1999 documented fledge rates ranging from as low as 0.04 to 0.15 (Davis et al. 2001). The American oystercatcher is classified as a Species of High Concern in the U.S. Shorebird Conservation Plan because of its small population (11,000 individuals), widespread habitat loss, and the threats it faces both during the breeding and nonbreeding seasons (Schulte et al. 2007). The oystercatcher was designated as a Species of Special Concern in North Carolina on May 1, 2008 (Pipkin pers. comm. 2009).

Habitat Description

In North Carolina, oystercatchers generally nest on sandy sites characterized by open substrate and little vegetation, far from the water, and slightly elevated to afford at least a 180° view (Nol and Humphrey 1994; Shields and Parnell 1990; Cohen et al. in press). However, there is evidence that



Foraging and Nesting Habitat

Credit: NPS – Cape Hatteras National Seashore



Sand Flats

Credit: NPS – Cape Hatteras National Seashore

oystercatchers have begun to use less traditional nesting habitats such as dredge spoil islands and vegetated marshes (McGowan et al. 2005; Traut et al. 2006). A breeding season study in Virginia documented that over half of the oystercatcher breeding pairs were located on storm-deposited shell rakes (Wilke et al. 2005). Elevation of nest habitat and distance to the water are both important to nest success because nests can be destroyed by tidal flooding (Lauro and Burger 1989). Oystercatchers are more common in habitat with few predators or no terrestrial predators (e.g., feral or domestic predators) (Nol and Humphrey 1994). Oystercatcher foraging habitats include oyster and mussel bars and intertidal sand flats and mudflats. Winter and summer foraging habitats are similar (Nol and Humphrey 1994).

Diet

The elongated and laterally compressed bill of the oystercatcher is especially suited to allow the bird to prey upon and open marine bivalves (class Bivalvia), including oysters (family Ostreidae), soft-shell clams (*Mya arenaria*), razor clams (*Ensis directus*), stout razor clams (*Tagelus plebeius*), and ribbed mussels (*Geukensia demissa*). Other items the oystercatcher consumes include marine worms (phylum Platyhelminthes), mole crabs (*Emerita talpoida*), sandworms (*Nereis virens*), limpets (order Patellogastropoda), jellyfish (phylum Cnidaria), sea urchins (phylum Echinoderma), and crabs (order Decapoda) (Bent 1929; Johnsgard 1981; Nol 1989; Nol and Humphrey 1994).

Breeding Biology

The major stages of the oystercatcher nesting cycle include the following: establishment and holding of nesting territories, courtship and copulation, nest scraping and nest building, egg laying and incubation, chick rearing, and fledging. Breeding pairs of oystercatchers begin nesting in late February and early March by establishing and holding a nesting territory and then scraping multiple shallow depressions in the sand. Eventually, they choose one scrape to build a nest (Nol and Humphrey 1994; McGowan et al. 2005). Nests are 1.5–2.5 inches deep and 7.0–8.0 inches across. They may contain shell fragments, dead plants, small stones, and beach debris (Baicich and Harrison 1997). Oystercatchers are typically monogamous and may mate for life (Nol and Humphrey 1994).

Oystercatchers can nest in proximity to colonial waterbirds, including but not limited to common tern, least tern, and black skimmer.



American Oystercatcher Chicks along Wrackline

Credit: Ted Simons

Both sexes incubate three eggs (rarely two or four) for 24–28 days, and incubation may begin after the second egg is laid (Nol and Humphrey 1994) or after the last egg (Baicich and Harrison 1997).

Oystercatchers will re-nest if eggs or nestlings are lost early in the season. Both adults brood nestlings, which crouch motionless when alarmed, making them difficult to see. Nestlings remain in the nest for 1–2 days and then move with adults within their nesting territory or into nearby foraging areas, which can be 150 to 600 feet away, depending on the habitat. Chicks fledge in about 35 days, but fledglings rely on adults almost entirely until they are 60 days old (Nol and Humphrey 1994).

American Oystercatcher Breeding Performance at Cape Hatteras National Seashore

At the Seashore, the oystercatcher population has experienced declines in numbers of breeding pairs since the 1990s. As seen in table 26 and figure 14, from 1999 to 2009, the number of nesting pairs declined 44% from 41 to 23 pairs on Ocracoke, Hatteras, Bodie, and Green islands (table 26).

From 1999 to 2009 on Ocracoke Island, there were a total of 90 nesting pairs, 127 nests, 55 hatched nests, 44 fledged chicks, and a fledge rate of 0.44. From 1999 to 2009 on Hatteras Island, there were a total of 192 nesting pairs, 256 nests, 107 hatched nests, 72 fledged chicks, and a fledge rate of 0.41. From 1999 through 2009 on Bodie Island, there were a total of 29 nesting pairs, 42 nests, 9 hatched nests, 6 fledged chicks, and a fledge rate of 0.22. From 2004 through 2009 on Green Island, there were a total of 12 nesting pairs, 16 nests, 9 hatched nests, 11 fledged chicks, and a fledge rate of 0.92 (Muiznieks pers. comm. 2009; table 27).



American Oystercatcher Chick and Egg

Credit: Ted Simons

Of all known breeding sites at the Seashore, chicks on Green Island have the greatest chances of surviving until fledging, with an average fledge rate of 0.92, which is more than double the fledge rate on Ocracoke or Hatteras islands and more than four times the fledge rate on Bodie Island. The percentage of nests that survived and successfully hatched has also been substantially lower on Bodie Island when compared to nest survival on the other three islands (table 27). However, since 2007, the number of nesting pairs increased from two to four on Bodie Island and 2008 marked the first time an oystercatcher chick fledged since 2002 (table 27).

TABLE 26. OYSTERCATCHER NESTING PAIR COUNT COMPARISON, CAPE HATTERAS NATIONAL SEASHORE, 1999–2009

Year	Ocracoke Island	Hatteras Island	Bodie Island	Green Island	Total
1999 ^a	15	24	2	—	41
2000	12	23	2	—	37
2001	13	24	2	—	39
2002	12	17	2	—	31
2003	8	16	5	—	29
2004	9	15	3	2	29
2005	5	16	2	2	25
2006	5	14	2	2	23
2007	4	15	2	2	23
2008	3	15	3	2	23
2009	4	13	4	2	23
Total	90	192	29	12	323

Source: Muiznieks pers. comm. 2009, except ^aSimons and Schulte 2007; 2008

NOTE: Data available only for years listed.

TABLE 27. OYSTERCATCHER BREEDING DATA BY SITE, CAPE HATTERAS NATIONAL SEASHORE, 1999–2009

Year	Nesting Pairs	Nests	Nests Hatched	Nest Survival (%)	Chicks Fledged	Fledge Rate
Ocracoke Island						
1999 ^a	15	17	7	41.2	2	0.13
2000	12	17	6	35.3	7	0.58
2001	13	15	11	73.3	17	1.31
2002	12	18	6	33.3	3	0.25
2003	8	12	4	33.3	1	0.13
2004	9	11	7	63.6	8	0.89
2005	5	10	3	30.0	1	0.20
2006	5	8	5	62.5	2	0.40
2007	4	10	3	30.0	1	0.25
2008	3	3	1	33.3	2	0.67
2009	4	6	2	33.3	0	0.00
Total / ^aaverage	90	127	55	43.3	44	0.44^b
Hatteras Island						
1999 ^a	24	31	7	22.6	3	0.13
2000	23	29	10	34.5	2	0.09
2001	24	28	10	35.7	6	0.25

Year	Nesting Pairs	Nests	Nests Hatched	Nest Survival (%)	Chicks Fledged	Fledge Rate
2002	17	25	3	12.0	4	0.24
2003	16	23	10	43.5	6	0.38
2004	15	18	14	77.8	9	0.60
2005	16	23	12	52.2	8	0.50
2006	14	19	11	57.9	5	0.36
2007	15	21	10	47.6	9	0.60
2008	15	20	9	45.0	11	0.73
2009	13	19	11	57.9	9	0.69
Total / average	192	256	107	41.8^b	72	0.41^b
Bodie Island						
1999 ^a	2	3	0	0.0	0	0.00
2000	2	3	0	0.0	0	0.00
2001	2	3	1	33.3	1	0.50
2002	2	5	1	20.0	2	1.00
2003	5	5	1	20.0	0	0.00
2004	3	7	0	0.0	0	0.00
2005	2	3	1	33.3	0	0.00
2006	2	2	1	50.0	0	0.00
2007	2	2	1	50.0	0	0.00
2008	3	5	2	40.0	2	0.67
2009	4	4	1	25.0	1	0.25
Total / average	29	42	9	21.4^b	6	0.22^b
Green Island						
2004	2	3	2	66.7	2	1.00
2005	1	3	2	66.7	0	0.00
2006	2	2	2	100.0	2	1.00
2007	2	2	1	50.0	2	1.00
2008	2	4	1	25.0	2	1.00
2009	2	2	1	50.0	3	1.50
Total / average	12	16	9	56.3^b	11	0.92^b

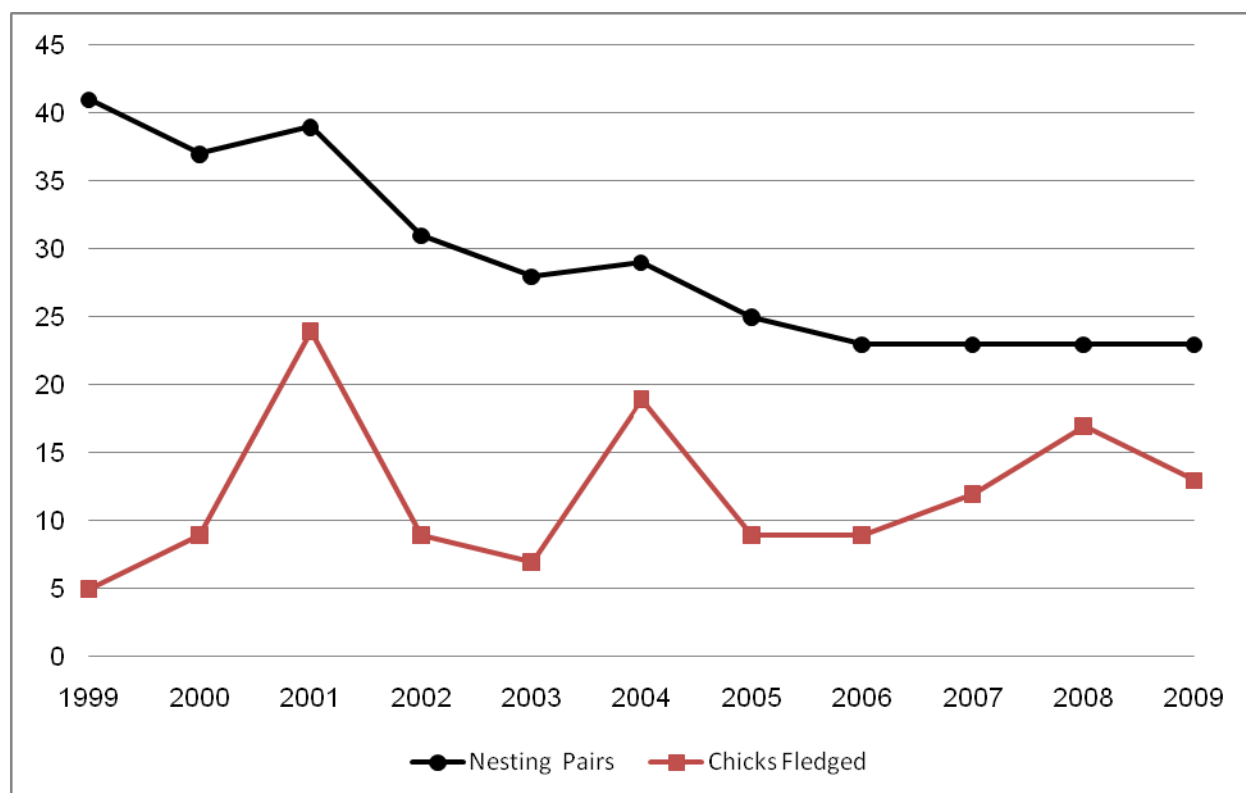
Source: Muiznieks pers. comm. 2009, except ^aSimons and Schulte 2007 and 2008

NOTE: Data available only for years listed.

^b = Average.

Since 1999, the number of nesting pairs at the Seashore has generally declined but has remained stable at 23 nesting pairs for the last four years (see figure 14). The annual number of fledged chicks has ranged

from a low of 5 in 1999 to a high of 24 in 2001. The rapid decrease in chick survival in 2002 is thought to correspond to the arrival of the fox as a predator on Hatteras Island. The advent of predator control efforts at the Seashore in 2003 is thought to be a contributing factor to the noticeable increase in chick survival between the 2003 and 2004 seasons (Simons and Schulte 2008). However, in the absence of hurricane events (which sometimes provide improved habitat), a recent demographic model projected a rapid decline for oystercatchers in North Carolina in the next 50 years (Simons and Schulte 2008).



Source: Muiznieks pers. comm. 2009

Note: Data for Green Island for 2003 were unreliable and were not included in this figure. Data for Green Island prior to 2003 were not available.

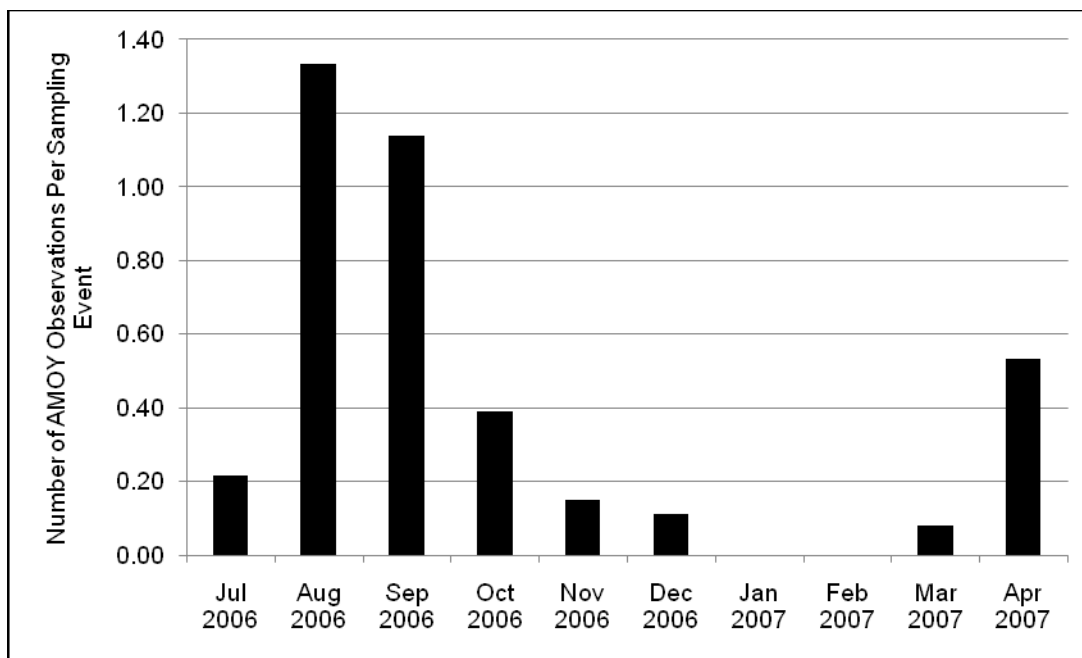
FIGURE 14. AMERICAN OYSTERCATCHER NESTING PAIRS AND CHICKS FLEDGED, CAPE HATTERAS NATIONAL SEASHORE, 1999–2009

Nonbreeding Oystercatchers

American oystercatcher migration generally begins at the end of August and continues through November. American oystercatchers are short-distance, partial migrants and generally winter along the southeast coast of the United States (Schulte et al. 2007).

Winter and migratory habitat appear to be similar to breeding habitat, although additional research is needed to determine preferred habitat in the winter, especially for birds on migration. Limited observations indicate that winter birds roost on open ground without vegetation in areas near foraging habitat (Nol and Humphrey 1994). A study conducted during the winter of 2002–2003 found that oystercatchers commonly use shell rakes as winter roost sites (Brown et al. 2005). Other habitat types used by wintering oystercatchers include sand islands, inlet beaches, sand spits, edges and interior mudflats on marsh islands, and occasionally docks and jetties (Brown et al. 2005; Schulte et al. 2007).

The NPS SECN Winter Monitoring Program conducted a more comprehensive study on wintering shorebirds. Pilot implementation of this SECN shorebird monitoring protocol at the Seashore began in mid-July 2006. Results for the oystercatcher, which are depicted on figure 15, are discussed below.



Source: Byrne et al. 2009

FIGURE 15. MONTHLY OBSERVATIONS OF AMERICAN OYSTERCATCHERS (AMOY) PER 30-MINUTE SAMPLING EVENT AT CAPE HATTERAS NATIONAL SEASHORE, 2006–2007

From July 2006 through April 2007, the majority of American oystercatchers were observed in foreshore and mudflat / algal flat habitat types (figure 16). American oystercatchers appeared to use the foreshore during both tidal extremes and used the mudflat / algal flat habitat primarily during high tide. The highest numbers of birds appeared to occur in August, and the data from the first year of pilot study show that the Seashore does not appear to have a wintering population of oystercatchers.

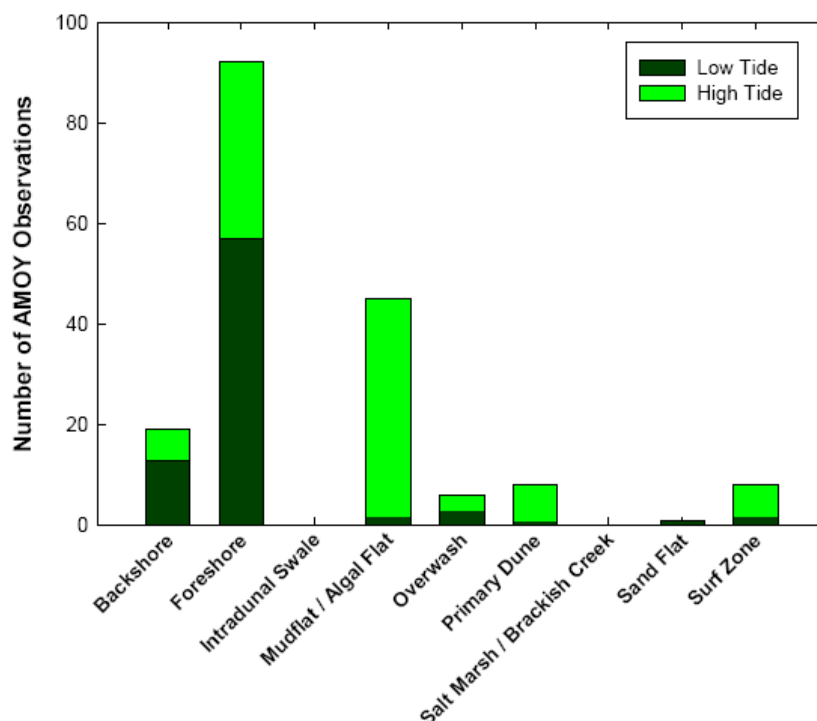
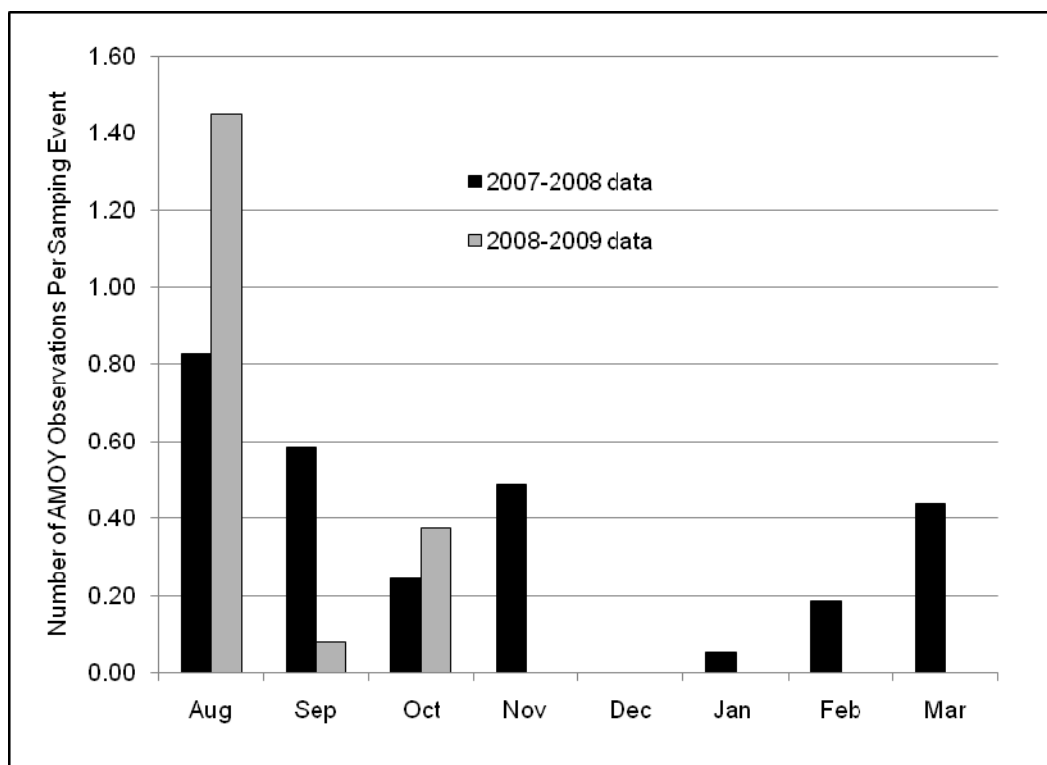


FIGURE 16. NUMBERS OF AMERICAN OYSTERCATCHER (AMOY) OBSERVATIONS BY HABITAT TYPE AND TIDAL STAGE AT CAPE HATTERAS NATIONAL SEASHORE, 2006–2007

Subsequent monitoring of oystercatchers between August and April 2007–2009 by Seashore staff indicated similar results, with very few birds observed from December through February (see figure 17). Figure 17 may be misleading in that the surveys conducted by Seashore staff were only conducted at the points and spits to comply with monitoring requirements for the piping plover. Oystercatchers will forage along the entire shoreline without preference for the points or spits and are therefore probably underestimates of the numbers occurring on the Seashore during the months represented.



Source: Byrne et al. 2009

Note: Data represented in this figure were only collected at the points and spits and most likely underestimate the number of oystercatchers present at the Seashore during these months.

FIGURE 17. MONTHLY OBSERVATIONS OF AMERICAN OYSTERCATCHERS (AMOY) PER SAMPLING EVENT AT CAPE HATTERAS NATIONAL SEASHORE, 2007–2009

Risk Factors to American Oystercatchers

In addition to direct habitat loss, the American oystercatcher faces pressure from recreational disturbance, increases in predators, potential contamination of food resources, and alteration of habitat through beach stabilization (Schulte et al. 2007). Causes of American oystercatcher nest failure on the Outer Banks from 1998 through 2008 could not be determined for 49% of nest failures. However, the causes of failure that could be determined were mammalian predation (54%), ghost crab predation (3%), avian predation (4%), direct human disturbance (4%), abandonment (6%), and overwash (29%) (Simons and Schulte 2008).



American Oystercatcher Chick in ORV Tracks

Credit: Ted Simons

Human Activity. Oystercatchers need large, undisturbed beach areas for successful nesting. Research has shown that disturbance by pedestrians, kayakers, vehicles, and unleashed pets can cause the abandonment of nest habitat as well as direct loss of eggs and chicks (Cohen et al. in press; Sabine et al. 2006, 2008; Toland 1999; Hodgson et al. 2008). Studies of the effects of humans and vehicles on American oystercatchers have indicated lower nest survival and higher chick mortality in places with higher levels of disturbance (McGowan 2004; Sabine 2005; Simons and Schulte 2008). A study at Cape Lookout National Seashore documented lower nesting success for oystercatchers in areas

where human disturbance was higher and also noted that oystercatchers avoided nesting in areas with high levels of human activity (Davis 1999). Another study in North Carolina found evidence that oystercatcher nests that were frequently disturbed by beach vehicles suffered higher rates of nest predation (McGowan and Simons 2006).

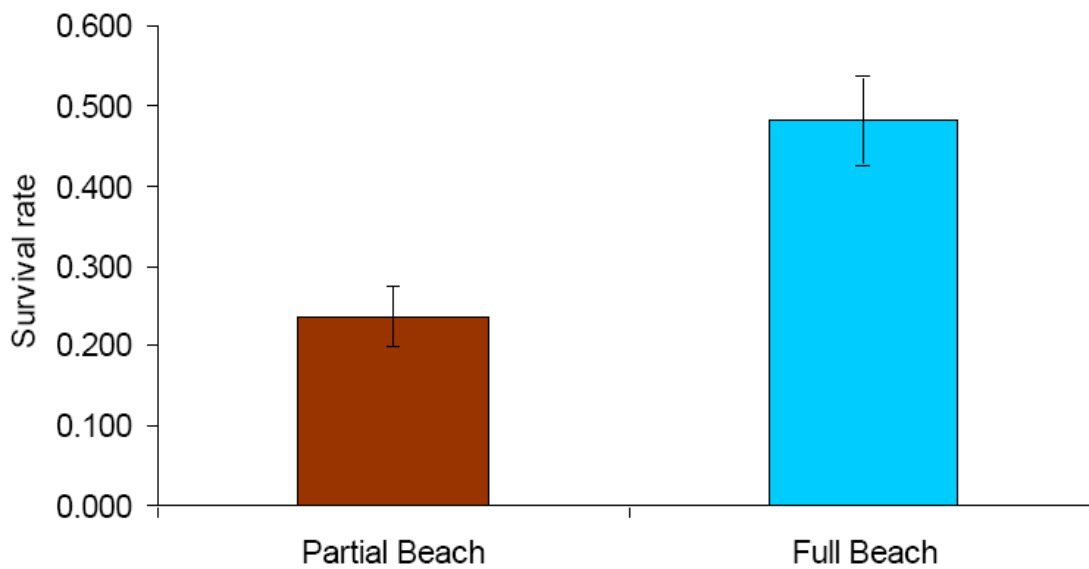
In addition to direct impacts or mortality, reasons for lower reproductive success in areas of high disturbance may include reduced time spent foraging (Sabine et al. 2008), thermal stress to eggs caused by a lack of incubation when reacting to disturbance (Sabine 2006), and expenditure of energy reserves during flushing or defensive displays (Toland 1999). Studies at Cumberland Island National Seashore in Georgia found that foraging behavior was lower in the presence of vehicular activity, which could alter chick provisioning and ultimately affect chick survival. Researchers recommended prohibiting beach driving in oystercatcher territories when chicks are present (Sabine 2005). Research on flush responses of oystercatchers to human disturbance indicates that protection of this species requires a buffer distance of up to 656 feet from nesting areas (Cohen et al. in press; see table 28).

TABLE 28. BUFFER DISTANCES RECOMMENDED FOR AMERICAN OYSTERCATCHERS

Buffer Distance	Source	Disturbance Types	Behavior/Location	Region
450 feet (137 meters)	Sabine 2005	Pedestrians, ORVs / other vehicles, boats, pets	Nesting	Cumberland Island National Seashore, Georgia
492 feet (150 meters)	Sabine 2005	Pedestrians, ORVs / other vehicles, boats, pets	Brood rearing	Cumberland Island National Seashore, Georgia
100 feet (30 meters)	Maine Department of Environmental Protection 2009	Development, vegetation removal	Feeding Area ^a	Maine
250 feet (76 meters)	Maine Department of Environmental Protection 2009	Development, vegetation removal	Roosting Area ^b	Maine
338 feet (103 meters)	Rodgers and Schwikert 2002	Personal watercraft	Nonbreeding adult foraging and loafing	West and east coasts of Florida
656 feet (200 meters)	Cohen et al. in press	All human disturbance	Nesting	Cape Hatteras National Seashore

^a Shorebird feeding areas include the intertidal zone and a 100-foot adjacent buffer area.

^b Shorebird roosting areas include the intertidal zone, the roosting area, and a 250-foot area adjacent buffer area.



Source: Simons and Schulte 2008

FIGURE 18. AMERICAN OYSTERCATCHER CHICK SURVIVAL BY CLOSURE TYPE AT CAPE HATTERAS NATIONAL SEASHORE, 1999–2008

The reproductive success of oystercatchers at Cape Hatteras has been impacted by vehicle and pedestrian disturbance. From 1999 to 2008, 48% of chicks in full beach closures on Cape Hatteras survived to fledging, while only 24% survived when the beach had an open lane for vehicles and pedestrians (Simons and Schulte 2008; see figure 18). Seashore staff also documented that the highest hatching rate (87%) was found at sites that did not have ORV use or concentrated pedestrian use (NPS 2005e).

Direct mortality of oystercatcher chicks from vehicles has been documented since 1995, when three chicks were found crushed in a set of vehicle tracks at the Seashore (Simons and Schulte 2008). Similar events have been documented at neighboring Cape Lookout National Seashore, where studies documented five chick deaths related to vehicles in 1995 (Davis et al. 1999), and one chick and two clutches lost in 1997 when they were run over by vehicles (Davis et al. 2001). Three oystercatcher chicks were killed during the 2003 and 2004 breeding seasons at Cape Hatteras by being run over by vehicles (NPS 2004f, 2005e), as documented by Seashore resource protection staff. A recent radio telemetry study conducted at Cape Hatteras and Cape Lookout national seashores identified human activity as the source of 16% of known chick mortality from 2005 through 2007 (Simons and Schulte 2008), with 8% of that related to vehicle collisions and 8% to other human disturbance.

Weather and Tides. Nine named hurricanes have affected the Outer Banks between 1993 and 2008 (NOAA 2009). Storms and associated high tides during breeding season can reduce nesting success. Overwash and other weather-related events accounted for 29% of documented nest failures at Cape Hatteras from 1999 through 2008. However, periodic hurricanes (outside the breeding season) can benefit oystercatcher nesting success in the long term through the creation of new habitat and the reduction of predators. For example, on Cape Lookout National Seashore, nests lost to predators dropped significantly after Hurricane Isabel flooded the island in September 2003. This drop was attributed to the reduction of the predator population due to hurricane-related flooding (Simons and Schulte 2008).

Predation. Numerous studies and reports have identified nest predation as a major source of oystercatcher nest failure (Davis et al. 2001; Sabine et al. 2006; McGowan et al. 2005; McGowan 2004;

Hodgson et al. 2008; Traut et al. 2006; Wilke et al. 2007). Mammalian predation was the major identifiable cause of nest failure for study sites in North Carolina from 1998 through 2008 (Simons and Shulte 2008). Predators include gray fox, red fox, raccoon, mink, dogs, cats, American crows, and gulls (Nol and Humphrey 1994). More recently, video nest recordings have documented raccoon, bobcat (*Lynx rufus*), and ghost crab predation of oystercatcher eggs and chicks at Cumberland Island National Seashore, Georgia (Sabine et al. 2006). Oystercatchers may lay another clutch if their eggs are lost or destroyed (Nol and Humphrey 1994).

As previously discussed, predation of oystercatchers is thought to be associated with human activities such as ORV use and pedestrian recreation (McGowan and Simons 2006; Simons and Schulte 2007; Sabine et al. 2008). McGowan and Simons (2006) hypothesized that human recreation might increase the activity of incubating oystercatchers, thereby leading to increased predation rates. Their research found a clear association between recreation and incubation behavior at Cape Hatteras and Cape Lookout during the 2002 and 2003 breeding seasons (McGowan and Simons 2006). The presence of ATV traffic was associated with increased numbers of trips parents made back and forth to nests and a decrease in duration of incubation. Recreational activities such as truck use and pedestrian traffic showed a weaker association with nesting behaviors, although the proximity of the disturbance to the nest was a factor. Evidence points to a reduction of nest success as the result of an alteration of incubation behavior due to recreational disturbance. McGowan and Simons (2006) hypothesized that mammals, which were found to be the main nest predators during this study (Davis et al. 2001), can better locate disturbed nests because adults leave a scent trail when going back and forth to nests. Human behavior and actions may also result in higher predator populations. For example, raccoon sightings and signs were greater in areas of increased human activity at Cape Lookout (Davis et al. 2001), and raccoon and bobcat signs appeared to be more abundant around areas of frequent human activity at Cumberland Island National Seashore, Georgia (Sabine et al. 2006).

In areas of frequent human activity, pedestrians were commonly observed in close proximity to nests, causing oystercatchers to leave their nests and exposing eggs and chicks to temperature extremes and greater risk of predators (Sabine et al. 2006).

COLONIAL WATERBIRDS

Colonial waterbirds at the Seashore include gull-billed terns, common terns, least terns, and black skimmers. Gull-billed terns are considered to be threatened in North Carolina, while the other three are listed as Species of Special Concern by the NCWRC and the NPS (Cohen et al. in press). None of these species is federally listed.

The Seashore was designated a Globally Important Bird Area by the American Bird Conservancy (American Bird Conservancy 2005). This designation recognizes those areas with populations and habitat important at the global level but does not carry any regulatory obligations. Ground-nesting colonial waterbirds breed along the Seashore beaches, which also host nesting sites for other birds, as well as a range of recreational activities for humans. Studies have documented that populations of some species of colonial waterbirds are declining. Beach nesters such as common terns, gull-billed terns, and black skimmers have shown the most significant declines. Coastal development, disturbances by humans, and increased nest predation all contribute to the decline in numbers of colonial waterbirds (NCWRC 2005).

Colonial Waterbirds—Descriptions

Gull-Billed Tern

The gull-billed tern is a medium-sized (13 to 15 inches long, weighing about 5.6 to 7.0 ounces), black-capped waterbird found widely in Eurasia, the Mediterranean, northern Europe, and the United States. In the United States, it occurs as two subspecies, with the Atlantic Coast and Gulf subspecies being designated *Sterna nilotica aranea* and the *S. n. vanrossemei* subspecies occurring from the Salton Sea in California south to western Mexico (Parnell et al. 1995).



Gull-Billed Tern and Chick

Credit: NPS

Common Tern

The common tern can be found across the temperate region of the northern hemisphere. It also occurs in Bermuda and the southern Caribbean region (Nisbet 2002). It is one of the medium-sized, black-capped terns (12 to 14 inches long, weighing 3.8 to 5.1 ounces) (Nisbet 2002). In North America, it is distributed along the Atlantic Coast, the St. Lawrence River, and in most of the Great Lakes (Nisbet 2002).



Common Tern with Fish

Credit: Phyllis Cooper / USFWS

Least Tern

The least tern is the smallest of the black-capped terns in North America. Five races are recognized in North America, although there are few differences genetically or morphologically among them (Thompson et al. 1997). The least tern weighs only about 1.7 ounces, on average, and is only 8 to 9 inches in length (Thompson et al. 1997).



Least Tern and Chick

Credit: NPS

Black Skimmer

Black skimmers are the only waterbirds on the Atlantic Coast that feed by skimming along the surface of the water with their lower jaw. They are also unique in that males are on average 35% to 40% larger than females, and both exhibit a high degree of nocturnal behavior. Females average about 9.3 ounces and are 16 to 24 inches long, while males average about 13 ounces and are 19 to 24 inches long (Gochfeld and Burger 1994).



Black Skimmers with Gull-Billed Terns and Chick

Credit: NPS



Black Skimmer

Credit: NPS

Beach-Nesting Colonial Waterbirds in North Carolina

The Outer Banks region of North Carolina supports a large number of colonial waterbird species that depend upon its extensive sounds and the nearshore waters for feeding, and its relatively undisturbed islands for nesting. Most species of colonial waterbirds are in jeopardy in North Carolina (Parnell and Committee 1977) because of a decline in numbers over the past 20 to 30 years. During the period from 1977 to 2007, the number of gull-billed tern nests declined from approximately 268 to only 90, common tern nests from 2,761 to 498, and black skimmer nests from 976 to 555. The number of least tern nests, however, increased from 1,925 to 2,827 (NCWRC 2008b). Numbers of most breeding, colonially nesting shorebirds within North Carolina have declined over the past 20 to 30 years (Cohen et al. in press; see table 29). For example, from 1977 to 2007, colonial waterbird nesting declined 30%, from 7,068 to 5,004 nests (table 29). Barrier island beaches provide important habitat for gull-billed terns, common terns, least terns, and black skimmers. Many of these beaches are severely degraded due to coastal development and associated increases in human disturbance and in predation by overabundant species. These factors have most likely contributed to the decline in colonial waterbird numbers in North Carolina (Cameron and Allen 2008).

TABLE 29. NUMBERS OF COLONIAL WATERBIRD NESTS IN NORTH CAROLINA, 1977–2007

	1977	1983	1988	1993	1995	1997	Species	2001	2004	2007	Average
Gull-billed tern	268	233	161	155	249	137	154	258	99	90	180.4
Common tern	2,761	2,247	2,618	2,122	1,699	952	888	1,131	570	498	1,548.6
Least tern	1,925	1,653	1,528	2,188	1,993	882	1,271	1,742	2,408	2,827	1,841.7
Black skimmer	976	797	743	1,084	819	570	681	594	623	555	744.2
Total	5,930	4,930	5,050	5,549	4,760	2,541	2,994	3,725	3,700	3,970	N/A

Source: NCWRC 2008

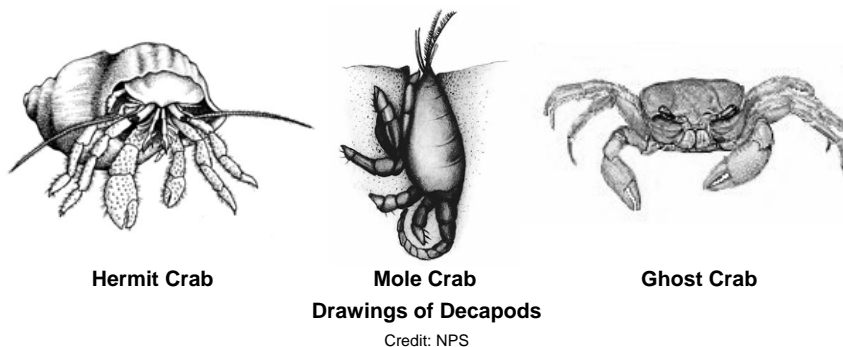
N/A = Not applicable.

Descriptions of Breeding, Foraging, and Nonbreeding Habitats

Gull-Billed Tern

Breeding Habitat. Gull-billed terns typically nest among other tern and skimmer species on open, sandy shell beaches, on large barrier islands, on dredge-spoil islands, or on overwash fans (also used by piping plovers) that are mostly devoid of vegetation. They also nest on elevated-shell ridges (“rakes”) along the edges of marsh islands, which they share with American oystercatchers and common terns (Erwin et al. 1998; Cohen et al. in press; Molina et al. 2009).

Foraging Habitat. In contrast to other terns, gull-billed terns do not feed primarily on fish but are opportunistic, taking insects on the wing and feeding on a variety of invertebrates, including fiddler crabs (*Uca* spp.), decapods, marine worms, and clams, as well as small



marsh fish (Cohen et al. in press; Molina et al. 2009). Consequently, gull-billed terns can be seen feeding over marshes and creeks and along ocean and bay beaches, as well as over agricultural fields many miles from their nesting sites (Cohen et al. in press; Molina et al. 2009).

Nonbreeding Habitat.

North American birds winter along the Gulf Coast, the Pacific Coast of Mexico, and into Central and South America. Little is known of gull-billed tern use of habitat while migrating, except that the habitat is generally considered

similar to nesting habitat (i.e., open beach, sand spits) (Cohen et al. in press). Nonbreeding gull-billed turns can be found in coastal ponds, lagoons, mudflats, and flooded inland fields (Molina et al. 2009).



Sand Spit / Coastal Pond



Mudflats

Photos of Gull Billed Tern Habitat

Credit: NPS

Common Tern

Breeding Habitat. Common terns typically nest on open, sandy shell beaches on ocean coastal islands, as well as at inland island sites in freshwater lakes, or, as in Europe, on rivers (Nisbet 2002). However, they also nest in saltmarshes, either on shell or on wrack, especially where human disturbance along the beaches is significant, and even on man-made structures, including large rooftops in urban areas (Erwin 1980).

Foraging Habitat. Common terns prey on small fish and shrimp in inlets and along the coast, often within a few miles of their breeding colonies (Nisbet 2002).

Nonbreeding Habitat. There is little information on habitats used by migrating common terns. However, most continue to feed close to shore. Migration staging areas are known at large sandy spits and bars at a number of North Atlantic sites, with concentrations numbering in the thousands at some places (Nisbet 2002). In winter, common terns migrate to the Caribbean and South America; both coasts of Africa; coasts and islands in the Indian Ocean; and the western Pacific from Japan to the Solomon Islands, New Guinea, and Australia (Nisbet 2002), where they often concentrate in large numbers in coastal lagoons (Nisbet 2002).

Least Tern

Breeding Habitat. Least terns typically select the barest sand- and shell-covered substrates available on coastal, riverine, or dredge-spoil islands (Thompson et al. 1997). They also nest on rooftops in a number of coastal areas, where pea gravel is used as part of the roofing material (Thompson et al. 1997). On coastal barrier islands, they often select colony sites either adjacent to inlets or in overwash areas that are often interspersed among piping plover nests. Unlike common terns, least terns are typically found in small single-species colonies, where their nests are often widely spaced (Thompson et al. 1997). In New Jersey, inter-nest distance ranged from 2 to 66 meters (6 to 216 feet) at the time of egg laying and from 1 to 60 meters (3 to 197 feet) at the end of incubation (Burger and Gochfeld 1990).

Foraging Habitat. Least tern foraging habitat is similar to that of common terns, except that least terns seldom feed in large flocks.

Nonbreeding Habitat. Least terns migrate from the Outer Banks in August and September, with migration flocks staging at certain sandy island sites (Thompson et al. 1997). In late July or August, remote sandbars or sandy spits serve as roost sites. Least terns winter from Florida through the Caribbean and into Central and South America (Thompson et al. 1997).

Black Skimmer

Breeding Habitat. Black skimmers prefer to nest on open, sandy substrates on barrier and dredge-spoil islands or at the tips of barrier islands (Gochfeld and Burger 1994). They invariably nest with other tern species along the Atlantic Coast (Erwin 1977; Cohen et al. in press). Black skimmers occasionally nest on wrack or on shell ridges in saltmarshes and even on rooftops with least terns (Gochfeld and Burger 1994).

Foraging Habitat. Black skimmers feed on small fish, shrimp, and other invertebrates that they capture by skimming the surface with their lower jaws just below the surface of the water. They typically feed very close to their nesting colonies and prefer quiet waters in saltmarsh creeks, lagoons, or protected coves and inlets near barrier islands (Erwin 1977; Cohen et al. in press; Gochfeld and Burger 1994).

Nonbreeding Habitat. Black skimmers migrate from the Outer Banks region from September to November, forming very large concentrations on sandy spits and sandbars (Gochfeld and Burger 1994). They winter from Florida through the Caribbean and South America (Cohen et al. in press; Gochfeld and Burger 1994).

Breeding Biology

Gull-Billed Tern

Birds arrive in North Carolina by mid-April. The mating system is monogamous, and like many other waterbirds, gull-bills probably have long-lasting pair bonds. Nest-site establishment and egg laying usually occur in mid- to late May. The nests consist of a shell-lined scrape in the sand or sometimes on wrack in saltmarshes. Nests contain from two to three brownish-blotched eggs (in the United States, the mean is around 2.2 eggs per nest [Molina et al. 2009]) that are incubated for 22 to 23 days. Members of a pair share incubation duties, but females take the dominant role. Gull-billed terns appear to be less tolerant of disturbance and less faithful to nest sites than other *Sterna* terns (Molina et al. 2009). Both parents share brooding duties, and both feed the young, often for an extended period after fledging occurs (birds generally fledge at 26 to 30 days of age). The chicks are highly camouflaged and more precocial (mobile and independent) than either common tern or black skimmer chicks, with which they coexist. The young may leave the immediate area of the nest within a few days if disturbance is high. Pairs may re-nest if a nest is lost early in the breeding season (Cohen et al. in press).

Common Tern

Birds arrive in North Carolina in late April to early May and begin nesting most years from mid-May to early June (Nisbet 2002). The mating system is monogamous, and like many other waterbirds, common terns probably have long-lasting pair bonds. Clutch sizes vary, but three medium-dark-brown-mottled eggs are the norm. The eggs are incubated for 22 to 23 days. Both sexes incubate and feed the brood. As in other terns, feeding of the young occurs after fledging and can continue into the fall migration. Upon hatching, the young remain near the nest (unless disturbed) for the entire pre-fledging period. Re-nesting may occur if early nests fail. Fledging ranges from about 25 to 30 days. Common terns appear to serve as a social locus for mixed-species colony formation, possibly because of their aggressively protective nature (Erwin 1979; Cohen et al. in press; Nisbet 2002). Hence, gull-billed terns and black skimmers often nest among common terns (Cohen et al. in press).

Least Tern

Birds arrive in North Carolina from late March to mid-April. Unlike most other Outer Banks terns, least terns usually nest in single-species colonies, with nests often spread far apart. Courtship lasts for two to three weeks in April and May, and egg laying occurs from late May until June. Clutch sizes range from one to three eggs, with two being the norm in North Carolina. Eggs are highly camouflaged, with the background color beige to light olive-brown. Members of a pair share incubation duties, but females take the dominant role. Incubation lasts for 21 to 22 days, and the highly mobile young move from the nest within a few days. They are able to fly at about 20 days of age. Post-fledging parental feeding can occur for several weeks away from the colony (Thompson et al. 1997; Cohen et al. in press).

Black Skimmer

Birds arrive in North Carolina from late April to mid-May, and nest building and egg laying usually occur from late May to mid-June (Erwin 1977; Cohen et al. in press; Gochfeld and Burger 1994). Clutch sizes range from two to four eggs (Erwin 1977). Eggs are light buff with black blotches, and are laid and hatch at different times. Both sexes incubate the eggs, brood, and feed the young. Incubation ranges from 22 to 25 days. The young remain near the nest (unless disturbed) for most of the pre-fledging period of 28 to 30 days (Erwin 1977). As with other waterbirds, if nests fail early in the season, skimmers will re-nest (sometimes several times). Skimmers are sometimes seen incubating eggs as late as August in the mid-Atlantic region (Burger and Gochfeld 1990). Fledged young are fed by their parents, often right up until migration (Erwin 1977; Cohen et al. in press). Human disturbance can seriously affect the breeding success of black skimmers (Gochfeld and Burger 1994). Pre-laying skimmers have been known to abandon a colony that is frequently disturbed (Erwin 1980; Safina and Burger 1983). Research has indicated that disturbed subcolonies of black skimmers had lower nest density, later nesting dates, and lower hatching and fledging success (Safina and Burger 1983).

Breeding Performance at Cape Hatteras National Seashore

The beaches of the Seashore have been important in providing suitable habitat for these colonial nesters. In 2004, more than half of all nesting black skimmers and common terns in North Carolina were found at the Seashore, as well as one-third of the state's gull-billed terns (see tables 29 and 30).

Colonial waterbird breeding at Cape Hatteras generally occurs between the beginning of May and the middle of August. In many cases, colonial waterbirds use areas that were colonized in previous seasons, which include areas protected as prenesting closures for piping plovers. Colonies are commonly composed of small groups of least terns, but more diverse colonies sometimes occur.

Although different survey protocols have been used at the Seashore between 1977 and 2009, recent estimates of colonial waterbird nests at the Seashore are clearly much lower than they were 30 years ago (see table 30). Common terns, gull-billed terns, and black skimmers have shown the greatest declines over the last 30 years, both statewide and at the Seashore. These species are early nesters that require habitats of bare sand or shell with little or no vegetation for nesting. Historically, these species have nested primarily on barrier island beaches and have suffered declines most likely due to habitat loss and degradation (Cameron and Allen 2008). Other reasons for the decline in North Carolina's colonial waterbirds include mammal and bird predation, human development, beach stabilization, recreational disturbance, and perhaps, impacts on the wintering grounds (Parnell et al. 1995; Cohen et al. in press). Recommended methods for colonial waterbird conservation include continued monitoring and management, habitat protection and restoration, predator management, and protection from human disturbance (Cameron and Allen 2008).

Within the Seashore, six gull-billed tern nests were recorded in 2007 on Green Island and none were found in 2008 or 2009, representing a decline from the Seashore's average of approximately 32 nests during surveys between 1977 and 2009. A total of 19 common tern nests were documented at the Seashore in 2008, although that number rose to 53 nests for the 2009 season. The number of least tern nests rose dramatically at the Seashore in 2009, when 577 were documented by resource management staff. Black skimmer nest numbers have sharply declined at the Seashore, with only 11 nests in 2007 and 4 nests counted in 2008. However, 61 black skimmer nests were documented in 2009 (table 30). The number of nests recorded in 2007 for three of the four species was the lowest in the history of waterbird surveys in North Carolina (Cameron and Allen 2008). With the exception of the gull-billed tern, colonial waterbird numbers at the Seashore showed substantial increases during the 2009 breeding season (table 30).

TABLE 30. NUMBERS OF COLONIAL WATERBIRD NESTS AT CAPE HATTERAS NATIONAL SEASHORE, 1977–2009

Species	1977 ^a	1983 ^a	1988 ^a	1992 ^a	1993 ^a	1995	1997	1998	1999	2000	2001	2004 ^b	2007 ^b	2008	2009	Avg.
Gull-billed tern	27	7	26	0	12	58	84	21	103	3	108	31	6	0	0	32.4
Common tern	802	763	678	278	422	503	718	715	440	129	573 ^c	376	109	19	53	438.5
Least tern	121	508	450	454	761	342	278	173	355	184	202	212	194	232	577	336.2
Black skimmer	286	296	144	30	226	139	454	366	306	149	193	342	11	4	61	200.5
Total	1,236	1,574	1,298	762	1,421	1,042	1,534	1,275	1,204	465	1,076 ^c	961	320	255	691	N/A

Source of 1977–2004 data is NPS 2007a

Source of 2007–2009 data is Muiznieks pers. comm. 2009

^a Surveys conducted by J. Parnell, University of North Carolina, Wilmington.

^b Surveys conducted by NCWRC using non-NPS protocol.

^c Updated from 2001 report to include nests found on Green Island at Oregon Inlet, which is now included in the Seashore boundary.

N/A = Not applicable.

Nonbreeding

Gull-Billed Tern

Fledged young and adults usually leave North Carolina's colonies by August, moving north for a short period before turning south for the fall and winter. Little is known of concentration areas during migration or winter, although wintering birds are known in Florida and the Gulf coastal region, from western Florida all the way south to Honduras and to Panama on the west coast. The gull-billed tern occasionally winters along the Atlantic Coast of North America as far north as North Carolina (Parnell et al. 1995; Cohen et al. in press).

Common Tern

Fledged young and adults usually leave North Carolina's colonies in late July to August. They often move north before staging at sandbars near inlets in September and then heading south. Little information is known about winter range, but they are known from Florida south through the Caribbean to Peru and southern Brazil, where tens of thousands have been recorded in late winter (Nisbet 2002).

Least Tern

Fledged young and adults usually leave North Carolina's colonies in late July to August after breeding and also move northward into the New York to New England region before turning south to South

America and the Caribbean. However, data are very limited on winter ranges (Thompson et al. 1997). Like other terns, least terns tend to congregate at staging areas along the Gulf Coast in August before departing for the winter (Thompson et al. 1997; Cohen et al. in press).

Black Skimmer

Fledged young and adults usually leave North Carolina's colonies by early August and disperse northward before heading south. Large flocks congregate at staging areas, often with terns. Adults may remain with their young during fall migration. Most birds from the mid-Atlantic region winter from southern North Carolina to Florida, the Caribbean, and into Central and South America (Gochfeld and Burger 1994; Cohen et al. in press).

Risk Factors

Human Activity. Ground-nesting colonial waterbirds are particularly vulnerable to impacts from human disturbance from ORVs, pedestrians, photographers, wildlife managers, and scientists because of the birds' usually high colony density and co-occurrence with human recreation (Erwin 1980; Cohen et al. in press; Rodgers and Smith 1995; Rodgers and Schwikert 2002). Disturbances affect the birds' ability to feed, rest, and breed by evoking a flush response (Rodgers and Smith 1995; Rodgers and Schwikert 2002). Adverse effects from disturbance include egg and chick mortality, premature fledging, and reduced body mass (Rodgers and Smith 1995). Human activities that have indirect effects on bird behavior include sonic booms from military operations, aircraft disturbances, the presence of pets, and the leaving of garbage that subsequently attracts both avian and mammalian predators. Early in the spring, when the birds are first arriving and prospecting for breeding sites, even modest disturbances can be highly disruptive to colonial species (Buckley and Buckley 1976). Studies indicate that buffer distances between nesting areas and sources of human disturbances should be between 328 feet (100 meters) and 984 feet (300 meters), depending on the species and the particular behavior or reproductive stage (Rodgers and Smith 1995; Erwin 1989; Cohen et al. in press). Recommended buffer distances from human disturbance are shown in table 31.

Human disturbance to waterbirds is frequently documented at the Seashore. At Cape Hatteras, four least tern chicks between ramps 23 and 30 and seven black skimmer chicks at Ocracoke Inlet were found dead or dying in ORV tracks during the 2003 breeding season. In all cases, the chicks were found adjacent to, but outside of, posted closures (NPS 2004g). Chicks become mobile after hatching, increasing their vulnerability. Colonial waterbird chick mortality from beach vehicles was documented every season from 2001 through 2004. Several chicks were killed by vehicles in 2001, 6 were killed in 2002, 11 were killed in 2003, and 6 were killed in 2004 (NPS 2002e, 2003b, 2004g, 2005d). Although no colonial waterbird deaths were directly attributed to impacts of human activity, instances of human disturbance to birds were reported in each colonial waterbird annual report from 2005 through 2008 (NPS 2006g, 2007g, 2008d, 2009k). Although informational signs are posted around all resource closures (including those for colonial waterbirds), violations by pedestrians, ORVs, and dogs are common at the Seashore. In 2008, there were several violations involving vehicles in colonial waterbird closures, including one that resulted in the crushing of a least tern egg by an ATV (NPS 2008h).



Least Tern Egg Crushed by Unauthorized ATV Use

Credit: NPS – Cape Hatteras National Seashore

TABLE 31. RECOMMENDED BUFFER DISTANCES FOR COLONIALY NESTING WATERBIRDS

Species	Buffer Distance	Disturbance Type	Behavior/Stage	Source	Location
Mixed tern / skimmer colonies	591 feet (180 m)	Pedestrians and motor boats	Incubating and brooding adults	Rodgers and Smith 1995	Florida
Black skimmer	328 feet (100 m)	Pedestrian, ATV, ORV, boats	Adult foraging and loafing	Rodgers and Smith 1997	Florida
Least tern	328 feet (100 m)	All human disturbance	Established colonies post egg laying	Erwin 1989	Virginia, North Carolina
Common tern Black skimmer	656 feet (200 m)	All human disturbance	Established colonies, post egg laying	Erwin 1989	Virginia, North Carolina
Common tern Least tern	150 feet ^a (50 yds)	All human disturbance	Nesting	Blodget and Melvin 1996	Massachusetts
Common tern Least tern	300 feet (100 yds)	All human disturbance	Chicks	Blodget and Melvin 1996	Massachusetts
Least tern	656 feet (200 m)	All human disturbance	Courtship/nesting	Erwin 1989	Virginia, North Carolina
Common tern Black skimmer	984 feet (300 m)	All human disturbance	Courtship/nesting	Erwin 1989	Virginia, North Carolina
All colonial waterbirds	1000 feet (305 m)	All human disturbance	Established colonies	Buckley and Buckley 1976	New York New England
Least tern	328 feet (100 m)	All human disturbance	Buffer entire colony after nesting	Cohen et al. in press	Cape Hatteras National Seashore
Black skimmer Common tern Gull-billed tern	200 m	All human disturbance	Buffer entire colony after nesting	Cohen et al. in press	Cape Hatteras National Seashore
Least tern	282 feet (86 m)	Personal watercraft	Foraging and loafing	Rodgers and Schwikert 2002	Florida
Common terns	328 feet (100m)	Personal watercraft	Nesting	Burger 1998	New Jersey

^a Buffer should be expanded as needed to prevent disturbance to incubating birds.

Weather and Tides. Nine named hurricanes affected the Outer Banks between 1993 and 2007 (NOAA 2009). Flooding and high winds from storms can result in nest loss or failure, which was demonstrated in 1999 when Hurricane Dennis hit the North Carolina coast. Impacts from the hurricane flooded the entire Ocracoke Inlet colony, resulting in the loss of all chicks and eggs (NPS 2000c). Winter storms can also impact shorebirds. High mortality of many coastal bird species was noted after a snowstorm swept the entire North Carolina coast in 1989 (USFWS 1996a). Storms can also result in beneficial impacts to shorebirds, as seen in 2003 when Hurricane Isabel's passing resulted in the creation of a great deal of suitable beach nesting habitat (NPS 2004g).

Predation. Resource Management staff at the Seashore is of the opinion that the leading cause of colonial waterbird nest and brood failure is predation (NPS 2009k). Predators of colonial waterbirds include red fox, gray fox, mink, opossum, dogs, cats, American crows, gulls, and raccoon. Foxes, raccoons, opossum,

and feral cats have increased in recent years as human populations have grown in coastal regions (Buckley and Buckley 1976; Erwin et al. 2001; Cohen et al. in press). The result of this predation has been poor reproduction or major redistributions of species such as gull-billed terns, common terns, least terns, and black skimmers (Erwin et al. 2001, 2003; Cohen et al. in press). In addition, gulls are often predators of terns (Nisbet 2002). These include great black-backed gulls (*Larus marinus*), herring gulls (*Larus argentatus*), and the smaller laughing gulls (*Leucophaeus atricilla*). In addition, in certain areas other bird species may prey on terns and skimmers (or their eggs), such as peregrine falcons (*Falco peregrinus*), great-horned owls (*Bubo virginianus*), fish crows (*Corvus ossifragus*), and others (Cohen et al. in press). In 2008, the Seashore modified the existing predator trapping program to provide a more sustained trapping effort than occurred in previous seasons. The trapping program focused on depredation in the vicinity of shorebird nesting areas in an effort to reduce localized populations of raccoons, opossums, feral cats, red and gray foxes, and mink, which are all known predators of colonial waterbirds. However, raccoons at the Cape Point colony and mink at the South Ocracoke colonies severely hampered waterbird breeding success in those areas during the 2008 season (NPS 2009k).

WILSON'S PLOVER

Wilson's plover is a medium-sized, ringed plover of coastal habitats. Its overall length is 6.5 to 7.5 inches, and its weight ranges between 2 and 2.5 ounces. At all times of the year and in all plumages, its bill is entirely black, large, and heavy; its upperparts are generally grayish to grayish brown, and its underparts are white, with a black-to-brownish breast-band. Its legs and feet are flesh-colored to pinkish. It is readily distinguished from other, similar, ringed plovers by its larger size; by its large, heavy, all-black bill; and by its flesh-colored legs. The piping plover is smaller than Wilson's plover, having obviously paler upperparts, orange legs, and a much



Wilson's Plover

Credit: Terry Hartley / Due South Photography

smaller, stubbier, two-toned bill that has an orange-yellow base and a black tip (Corbat and Bergstrom 2000; Hayman et al. 1986; Howell and Webb 1995). Wilson's plover has no federal protection status in the United States; however, it was classified as a species of conservation concern by the USFWS in 2002. Birds that appear on this list are those that, without additional conservation actions, are likely to become candidates for listing under the ESA (USFWS 2002; 16 USC 1531–1544). Brown et al. (2001) list Wilson's plover as a species of high concern in their prioritization of shorebird species according to relative conservation status and risk. Wilson's plover is listed as endangered in Virginia and Maryland, threatened in South Carolina, rare in Georgia, state protected in Alabama (National Audubon Society 2005), and as a species of special concern in North Carolina (NCAC 10I.0105, Subchapter 101 15A).

Distribution

Breeding. Wilson's plover is distributed locally along the Atlantic Coast, from Virginia south to southern Florida, including the Florida Keys, and from southern Florida west along the Gulf Coast to Veracruz, Mexico, the Yucatán, and Belize (Stevenson and Anderson 1994). Breeding locations are uncertain farther south along the Caribbean Coast of Central America.

In South America, Wilson's plover breeds locally along the Atlantic Coast, from Colombia south to Brazil, and includes the islands of Trinidad, Aruba, Bonaire, Margarita, and Curaçao, located off the coast of Venezuela (Meyer de Schauensee and Phelps 1978). In the West Indies, it breeds throughout the Bahamas, the Greater Antilles, the Virgin Islands, the Lesser Antilles, and in the Grenadines (Raffaele et al. 1998).

Along the Pacific Coast, Wilson's plover breeds locally along the west coast of Baja California, and from the Gulf of California south to Nayarit, Mexico (Howell and Webb 1995). Farther south along the Pacific Coast, it breeds from Mexico to Ecuador and Peru (Hilty and Brown 1986).

Nonbreeding. Wintering occurs mainly in northeast and central Florida (Corbat and Bergstrom 2000), as well as in west Louisiana and south Texas throughout the remainder of the breeding range (see above), to northern South America (Hayman et al. 1986).



Wilson's Plover Chick

Credit: NPS

Wilson's Plover in North Carolina and at Cape Hatteras National Seashore

A 2004 survey of the entire coast of North Carolina yielded 232 pairs of Wilson's plover. Of those, the Seashore supported two pairs of Wilson's plover on Ocracoke Island. In contrast, in 2004, Cape Lookout National Seashore supported 61 pairs and two individuals, which represented 26% of North Carolina's population of Wilson's plover (Cameron pers. comm. 2005). Wilson's plovers are often seen by Seashore staff during their piping plover observations, but no indications of nesting had been documented until 2009 when a three-egg nest was found in June. The nest hatched in July and produced one chick. The chick was not observed during subsequent observations and is not believed to have fledged (Muiznieks pers. comm. 2009).

More comprehensive surveying of wintering shorebirds is being conducted per the NPS SECN Winter Monitoring Program. Implementation of the SECN Migratory, Wintering, and Beached Shorebird Monitoring Protocol at Cape Hatteras began in mid-July 2006. Only a few Wilson's plovers were observed at the Seashore from July to early December, and all birds were seen in foreshore habitat at low tide. SECN staff attributed the low numbers to insufficient training of field staff on the proper identification of Wilson's plover (Byrne et al. 2009). Seashore staff have not completed a comprehensive survey of nonbreeding Wilson's plovers, so it is not known if the Seashore supports wintering populations.

Habitat Description

Wilson's plovers are typically associated with coastal areas of high salinity and sparse vegetation, including salt flats, coastal lagoons, sand dunes, foredunes, and overwash areas above the high-tide line (Tomkins 1944; Hayman et al. 1986; Corbat and Bergstrom 2000). At the Seashore, Wilson's plover breeding sites have only been known to occur within piping plover closures. Hence, all closures, and much of the management of piping plovers, also apply indirectly to Wilson's plover.

Diet

Wilson's plover is a visual feeder on crustaceans, particularly fiddler crabs, and some insects (Strauch and Abele 1979; Morrier and McNeil 1991; Thibault and McNeil 1994), which they prey upon at intertidal mudflats, sand flats, ephemeral pools, and shores of brackish ponds. They usually forage at low tide on intertidal mudflats (Strauch and Abele 1979; Thibault and McNeil 1994; Corbat and Bergstrom 2000).

Breeding Biology

Before territories are established in mid-March to early April (Tomkins 1944; Corbat and Bergstrom 2000), Wilson's plovers form pairs, and most breeding territories are established by mid-April. As with the piping plover, the nest is a scrape in sand that requires little construction (Bergstrom 1988). Egg laying peaks from late April through late May (Bergstrom 1988). Re-nesting after failure of a first nest can continue through the end of June. The estimated time required to complete a clutch of three eggs is four to six days (Bergstrom 1988; Corbat and Bergstrom 2000).

Reproductive Success at Cape Hatteras National Seashore

There are no data pertaining to Wilson's plover reproductive success at the Seashore.

Risk Factors

Because Wilson's plovers commonly nest on beaches with wide berms, which are also favored by birds like piping plovers, Wilson's plovers are subject to disturbances at their nests and roosts by the same factors as those that affect the piping plover, including beachgoers, pets, and ORV traffic on beaches. Wilson's plovers leave their nests when disturbed and are extremely reluctant to return when intruders are anywhere near, a practice that exposes eggs to predation and overheating (Corbat and Bergstrom 2000).

RED KNOT

The red knot is a shorebird that breeds in the Canadian Arctic and is known to visit North Carolina, the Outer Banks, and the Seashore, as well as the entire eastern seaboard of the United States, only as a migrant and an occasional winter resident (Harrington 2001). There are five subspecies currently recognized (*Calidris canutus canutus*, *C.c. rufa*, *C.c. islandica*, *C.c. rogersi*, *C.c. roselaari*) (Harrington 2001). Two of these (*C.c. rufa* and *C.c. roselaari*) are found in the United States but only during migration and in the winter. Southward migration of *C.c. rufa* and *C.c. roselaari* begins in mid-July, with staging occurring along the United States Atlantic Coast (Harrington 2001). Only those aspects of the red knot's life pertinent to its management and conservation in North Carolina, the Outer Banks, and the Seashore are covered in this section. The red knot is not listed as threatened or endangered by the USFWS, but it is a federal candidate species. The red knot does not carry state status in North Carolina.

Emergency Endangered Listing and Taxonomy

On August 1, 2005, in response to the 80% decline in red knot population over the past 10 years, leading conservation groups filed an emergency petition asking the USFWS to list the red knot as an endangered species under the ESA. The listing request came from an alliance of wildlife groups, including Defenders of Wildlife, New Jersey Audubon Society, American Bird Conservancy, the National Audubon Society, Delaware Audubon Society, Citizens Campaign for the Environment, Audubon New York, Audubon Maryland–DC, and the Virginia Audubon Council. On September 12, 2006, the USFWS announced that it had designated the red knot as a candidate for ESA protection. On February 27, 2008, conservation groups again petitioned the Department of the Interior to list as endangered the *rufa* subspecies of the red knot, and a broader taxon comprising both the *rufa* subspecies and the *roselaari* subspecies.

**Red Knot**

Credit: USFWS

Another indication of conservation concern for the red knot is the fact that in August 2004, the U.S. Shorebird Conservation Plan (2004) published its list of U.S. and Canadian shorebird populations that are considered highly imperiled or of high conservation concern. The Canadian Arctic–Atlantic Coast population of the red knot was one of eight taxa classified as Highly Imperiled. In 2008, the USFWS, which proposes candidates for listing under the ESA, determined that the ranking for the red knot should be raised from 6 to 3. The species' listing priority dictates the relative order in which proposed listing rules are prepared, with the species at greatest risk (listing priority 1 through 3) being proposed first (American Bird Conservancy 2008).

Description

The red knot is characteristically found along the east coast of the United States, with its greatest population staging on Delaware Bay (Tsipoura and Burger 1999) on its migration from its breeding ground in the Canadian Arctic to the Tierra del Fuego region of Chile and Argentina in South America. It is this subspecies that is the subject of the emergency petition.

Males in breeding plumage have a dark red or salmon breast, throat, and flanks, with a white belly. Their crowns and backs are flecked with gray and salmon (Harrington 1996, 2001; Paulson 1993). Female coloration is similar to that of males but is typically less intense. Nonbreeding plumage is a plain gray on the head and back, with light fringes of gray and white along the wings, giving an appearance of a white line running the length of the wing when in flight. The breast is white, mottled with gray, and the belly is dull white. For both male and female, the bill is black (year-round), and the legs are dark gray to black (Harrington 1996, 2001). The average weight of the red knot is 5 ounces (which varies considerably through the year), with a body length between 9 and 10 inches.

Range and Migration

Red knots are found in the Arctic regions of Canada during the breeding season, which is mid-June through mid-August. They winter from November to mid-February primarily in two separate areas in South America—Tierra del Fuego in Chile and Argentina, and in Maranhão, northern Brazil (American Bird Conservancy 2005). Additional, smaller numbers of red knots also winter farther northwest in French Guiana and in the coastal, southeastern United States, including North Carolina, the Outer Banks, and the Seashore.

Red knots have one of the longest migrations of any shorebirds. Those individuals that winter in southern South America embark on their northern migration in February, with peak numbers leaving Argentina and southern Chile in mid-March to mid-April (Harrington 1996, 2001). The first stopover is along the coast of southern Brazil (Vooren and Chiaradia 1990), and the final stopover is the Delaware Bay. Their southward migration from the Canadian Arctic begins in mid-July. They arrive in South America along the coast of the Guianas in mid- to late August (Spaans 1978). From the Guianas, red knots continue to move southward along the Atlantic coastline of South America, and the greater part of the population will continue on to Tierra del Fuego to winter (Morrison et al. 2004).

These long-distance migrations can only occur when the birds have access to productive refueling stops, particularly on their northern migrations, which involve fewer stops than the southern ones. For red knots on the eastern seaboard of the United States, Delaware Bay is the most crucial spring stopover because it is the primary final stop at which the birds can refuel in preparation for their nonstop leg to the Arctic.

When they arrive at their final destination, weather conditions can be harsh, and food is scarce. Their fat reserves from the Delaware Bay must sustain them not only during their 2,400-kilometer (1,488-mile) final flight, but also upon arrival in the Arctic until food resources become more plentiful (Baker et al. 2004).

Red knots do not breed at the Seashore, but use it in the winter and during spring and fall migration.

Nonbreeding Habitat

Harrington (1996, 2001) describes how, during the winter, the red knot frequents intertidal habitats, notably along ocean coasts and large bays. Both areas usually display high waves or strong currents while supplying a sandy habitat. These areas are selectively chosen in South America, with the most abundant population on the island of Tierra del Fuego in Argentina and Chile (Morrison and Ross 1989).

On migration, the red knot principally uses marine habitats in both North and South America. Coastal habitats along the mouths of bays and estuaries are preferred, providing sandy beaches on which to forage (Harrington 1996, 2001). Niles et al. (2007) suggested that red knots consistently use coastal areas of North Carolina during spring and fall migration and indicated that approximately 1,000 red knots were observed on Ocracoke Island in early May 2005. Red knots are also known to use tidal flats in more sheltered bays or lagoons in search of benthic invertebrates or horseshoe crab eggs (Harrington 1996, 2001; Tsipoura and Burger 1999). In some cases, beach habitats are preferred because of high densities of benthic bivalves (Harrington 1996). Red knots also use tidal flats in more sheltered bays or lagoons, where they hunt for benthic invertebrates (Harrington 2001) or for special foods, such as horseshoe crab eggs (Harrington 1996; Tsipoura and Burger 1999). Delaware Bay hosts the largest number of spawning horseshoe crabs (a primary food source for the red knot) in the United States. At Delaware Bay, the red knots feed and put on weight needed for winter migration. The increasing human harvest of the horseshoe crab has reduced this food source for red knots, and this dearth is believed to be contributing to the red knot's failure to reach its needed threshold departure weight of 6.3 to 7.0 ounces. Hence, there has been a systematic reduction in the body weight of red knots leaving Delaware Bay for the Arctic, which negatively impacts their ability to survive and breed (Baker et al. 2004). Since 1999, reductions in commercial harvesting of horseshoe crabs in New Jersey and Delaware have been substantial, although the effect on horseshoe crab populations is not yet known. Preliminary 2009 information indicated that red knots were able to attain threshold departure weights and left the Delaware Bay stopover in good condition. However, it remains to be seen if this will become a long-term trend (FR 2009).

Nonbreeding Observations at Cape Hatteras National Seashore

During their wintering shorebird study, SECN staff observed red knots at the Seashore from August 2006 through February 2007. Monthly counts were highly variable with the two highest single-day counts in November 2006 and February 2007. Almost all red knots documented during this time were located in the foreshore habitat type (Byrne et al. 2009). Resource management staff at the Seashore have not yet begun surveying the entire Seashore for red knots, which are known to use areas outside the points and spits.

Risks

Red knots are highly vulnerable to degradation of the resources on which they depend to accomplish their migrations. Morrison et al. (2004) have identified four factors that cause this vulnerability: (1) a tendency to concentrate in a limited number of locations during migration and on the wintering grounds so that deleterious changes can affect a large proportion of the population at once; (2) a limited reproductive output, subject to vagaries of weather and predator cycles in the Arctic, which, in conjunction with a long lifespan, suggests slow recovery from population declines; (3) a migration schedule closely timed to

seasonally abundant food resources, such as horseshoe crab eggs during spring migration in Delaware Bay (Tsipoura and Burger 1999), suggesting that there may be limited flexibility in migration routes or schedules; and (4) occupation and use of coastal wetland habitats that are affected by a wide variety of human activities and developments (Bildstein et al. 1991).

WILDLIFE AND WILDLIFE HABITATS

In addition to the federally listed threatened and endangered species and other protected species detailed in previous sections of this chapter, other wildlife species depend on the habitats within the Seashore. This section describes those invertebrate species and other bird species that could be found in the study area and could be affected by ORV management alternatives.



Coquina Clam Shells

Credit: NPS



Limpet Shells

Credit: NPS

OTHER BIRD SPECIES

The Outer Banks of North Carolina provide a critical link in the migratory path of several shorebird species. The barrier island ecosystems at the Seashore provide habitat for large numbers of migratory and nesting bird species, and coastal marshes are critical to wintering populations of many waterbirds. Nearly 400 species of birds have been sighted within the Seashore and its surrounding waters (Fussell et al. 1990). Migration routes for many raptor species include southeastern barrier islands. Thousands of migrating shorebirds use the barrier islands as a stopover point to rest, forage, or spend the winter (Manning 2004). In 1999, the American Bird Conservancy designated Cape Hatteras National Seashore as a Globally Important Bird Area in recognition of the Seashore's value in bird migration, breeding, and wintering (American Bird Conservancy 2005).



Marbled Godwit

Credit: Lee Karney / USFWS

Studies have recorded 21 species of shorebirds (table 32) on the beaches of the Outer Banks of North Carolina, such as whimbrels (*Numenius phaeopus*), willets (*Catoptrophorus semipalmatus*), and sanderlings (*Calidris alba*). These shorebirds are most abundant in May and August. Least terns, common terns, gull-billed terns, black skimmers, piping plovers, Wilson's plovers, willets, and American oystercatchers can all be found nesting on North Carolina beaches (North Carolina Audubon 2008). Several of these species are designated as state-listed and/or federally listed threatened or endangered species and are discussed in a previous section of this chapter. However, nonlisted shorebirds such as willets have similar nesting and foraging habitats to those of state- and federally listed species. The eastern willet, for instance, breeds in coastal saltmarshes and nests on the ground, often in colonies, usually in well-hidden locations in short grass. These birds forage on mudflats or in shallow water, probing or picking up food by sight. Their diet consists of insects, crustaceans, and marine worms, as well as some plant material. Although not state-listed or federally listed, several of the shorebirds found at the Seashore appear on the USFWS Birds of Conservation Concern list, which identifies migratory birds that, without additional conservation actions, are likely to become candidates for listing under the ESA.

(USFWS 2008b). Other waterbirds found at the Seashore include gulls, pelicans (*Pelecanus* spp.), terns, and egrets (family Ardeidae) (NCWRC 2005).

TABLE 32. SHOREBIRDS ON THE OUTER BANKS OF NORTH CAROLINA, 1992–1993

Scientific Name	Common Name
<i>Pluvialis squatarola</i>	Black-bellied plover
<i>Charadrius wilsonia</i>	Wilson's plover
<i>Charadrius semipalmatus</i>	Semipalmated plover
<i>Charadrius melodus</i>	Piping plover
<i>Haematopus palliatus</i>	American oystercatcher
<i>Catoptrophorus semipalmatus</i>	Willet
<i>Numenius phaeopus</i>	Whimbrel
<i>Limosa fedoa</i>	Marbled godwit
<i>Arenaria interpres</i>	Ruddy turnstone
<i>Calidris canutus</i>	Red knot
<i>Calidris alba</i>	Sanderling
<i>Calidris pusilla</i>	Semipalmated sandpiper
<i>Calidris mauri</i>	Western sandpiper
<i>Calidris minutilla</i>	Least sandpiper
<i>Calidris alpina</i>	Dunlin
<i>Limnodromus griseus</i>	Short-billed dowitcher
<i>Charadrius vociferous</i>	Killdeer
<i>Tringa melanoleuca</i>	Greater yellowlegs
<i>Tringa flavipes</i>	Lesser yellowlegs
<i>Actitis macularia</i>	Spotted sandpiper
<i>Calidris fuscicollis</i>	White-rumped sandpiper

Source: Dinsmore et al. 1998

Migratory birds are often found at the Seashore throughout the year. During the winter months, the common loon (*Gavia immer*), pied-billed grebe (*Podilymbus podiceps*), northern gannet (*Morus bassanus*), tundra swan (*Cygnus columbianus*), and Canada goose (*Branta canadensis*) are common sights at the Seashore. During the summer migratory season, several varieties of herons (*Ardea* spp.), Audubon's shearwater (*Puffinus lherminieri*), and the barn swallow (*Hirundo rustica*) populate the Cape Hatteras shores. While less frequently sighted, grebes (*Podiceps auritus*), mallard ducks (*Anas platyrhynchos*), hawks (genus *Accipiter*), bald eagles (*Haliaeetus leucocephalus*), peregrine falcons, and various species of sandpipers also inhabit the Seashore at one point or another throughout the year. Studies have demonstrated the importance of the Outer Banks as a staging area for piping plovers, whimbrels, and sanderlings when compared to other areas along the Atlantic Coast and confirmed that the area provides a critical link in the migratory path of several shorebird species (Dinsmore et al. 1998).

INVERTEBRATES

The Seashore beach ecosystem is home to a vast quantity of invertebrates, which form a valuable link in the coastal food chain. Many of the protected bird species found within the Seashore, including the piping plover, Wilson's plover, red knot, American oystercatcher, and gull-billed tern, feed on invertebrates in areas that are open to ORV use, such as the intertidal zone and the wrack line. High-energy, intertidal beaches in the southeastern United States generally support approximately 20 to 30 types of invertebrate species (Ruppert and Fox 1988), with the most identifiable being mole crabs, ghost crabs, and coquina clams (*Donax variabilis*). Both mole crabs and coquina clams are a primary prey base for fish, crabs, and shorebirds, and the population density of some predators may actually be dependent on the availability of these invertebrate species (Greene 2002). Other invertebrates within the Seashore beach ecosystem include clamworms (*Nereis succinea*), limpets (*Patella vulgata*), which can be found in the intertidal zone, and varieties of jellyfish, sea urchins and sea stars (class Asteroidea), all of which spend their entire lives in the water.



Ghost Crab

Credit: George Harrison / USFWS

Ghost crabs are sand-colored, terrestrial animals with square-shaped bodies, which are generally no more than 2 to 3 inches wide (Lippson and Lippson 1997). Ghost crabs are a top predator of the beach ecosystem and can be used as an indicator species to analyze the health of the beach ecosystem due to their prominence and high susceptibility to anthropogenic disturbances (Hobbs et al. 2008). They are primarily nocturnal and create burrows for shelter from heat and desiccation (drying) stress during the warmer afternoon periods. Burrows are usually 0.6 to 1.2 meters in length and are generally located in an area from the high-tide line landward up to 400 meters. Ghost crabs emerge from their burrows at night to feed in

the intertidal zone, and travel up to 300 meters while foraging (Hobbs et al. 2008). Ghost crabs retreat deep into their burrows during the winter months (Lippson and Lippson 1997).

Like ghost crabs, mole crabs are a common inhabitant of the high-energy, exposed beach environment. In contrast to other species of crabs, they do not have claws or pincers. Mole crabs are generally less than 2 inches in length and have egg-shaped bodies that allow for rapid digging in wet sand (Ruppert and Fox 1988). Mole crabs are filter feeders that burrow and anchor themselves into the sands within the swash zone, collecting organic matter that they trap within their feeding antennae when water recedes over the buried crabs. Unlike ghost crabs, mole crabs move off the beach to deeper offshore waters during the winter (Lippson and Lippson 1997).

Marine bivalves such as oysters (*Crassostrea virginica*), razor clams, coquina clams, and ribbed mussels (*Geukensia demissa*) also inhabit the Seashore, forming the diet for many birds. Clams characteristically lie buried just beneath the surface of the sand, although they can burrow to greater depths as necessary. Much like the mole crab, coquina clams are filter feeders and migrate up and down the ocean beach in the intertidal area during the spring and summer (Ruppert and Fox 1988). Due to its importance in food webs, the coquina clam is considered an indicator species for the sandy beach oceanfront habitat. It feeds on small particles such as unicellular algae and detritus and in turn, is consumed by fish and birds (SCDNR 2009).

In addition to the intertidal zone, another important habitat for invertebrates is the wrack line. A wrack line is a line of stranded debris along a beach face marking the point of maximum run-up during a previous high tide. The wrack line is often composed of drying seaweed, tidal marsh plant debris, decaying marine animals, shells, and miscellaneous debris washed up and deposited on the beach. The wrack line provides a habitat suitable for many invertebrates such as amphipods, beetles, mites, flies, and spiders. Studies have demonstrated that ORV use in and around the wrack line reduces the density of invertebrates in beach environments.



Intertidal Zone

Credit: NPS

A 3-year study on Cape Cod and Fire Island, New York (Kluft and Ginsberg 2009), found that the shrimp-like crustaceans called amphipods are particularly vulnerable to drying out in immature stages, and use the wrack line as cover. Several species of flies also use the site to lay their eggs, and wolf spiders (family Lycosidae) migrate back and forth from the beach grass to the wrack line to feed on these amphipods. The study observed that higher ORV traffic resulted in dispersal and desiccation of the wrack line, thereby reducing the populations of invertebrates in these areas.

SOUNDSCAPES

According to the NPS, the acoustical environment is comprised of a combination of acoustic resources, including natural, cultural, and historical sounds. A soundscape is defined as the way in which humans perceive this acoustic environment (NPS 2009g). Specifically, the natural soundscape encompass all of the natural sounds that occur in parks, including the physical capacity for transmitting those natural sounds and the interrelationships among park natural sounds of different frequencies and volumes (NPS *Management Policies 2006* [NPS 2006c, sec 4.9]). Natural sounds may range from bird and bat calls and insect chirps, to sounds produced by physical processes like wind rushing through leaves on trees, thunder, and rushing and falling water through rivers, creeks and streams within a park. According to the NPS, 72% of visitors indicate that a crucial reason for the need to preserve national parks is that parks provide opportunities to experience natural peace and the sound of nature (NPS 2009g). Therefore, the NPS works to preserve, to the greatest extent possible, the natural soundscapes of parks.

NOISE FUNDAMENTALS

According to the NPS, “although noise has been used as a synonym for sound, it is essentially the negative evaluation of sound by people, is extraneous, or undesired. Humans perceive sound as an auditory sensation created by pressure variations that move through a medium such as water or air and is measured in terms of amplitude and frequency” (NPS 2009g). Sources of noise within national parks are dependent upon the particular park and may include vehicular sources (cars, buses, or other vehicles) used for tours and access to trails and campgrounds, aircraft overflights from planes, helicopters and military jets along with airport development, snowmobiles and watercraft, park operations and energy development (NPS 2009i).

The magnitude of noise is usually described by its sound pressure. Since the range of sound pressure varies greatly, a logarithmic scale is used to relate sound pressures to some common reference level, usually the decibel (dB). Sound pressures described in decibels are called sound pressure levels and are often defined in terms of frequency-weighted scales (A, B, C, or D).

The A-weighted decibel scale is commonly used to describe noise levels because it reflects the frequency range to which the human ear is most sensitive (1,000–5,000 Hertz) (Caltrans 1998). Sound levels

measured using an A-weighted decibel scale are generally expressed as dBA. Throughout this section, all noise levels are expressed in dBA. Several examples of sound pressure levels in the A-weighted (dBA) scale are listed in table 33, while table 34 presents examples of sound pressure levels measured in national parks.

TABLE 33. EXAMPLES OF COMMON SOUNDS

A-weighted Sound Level (dBA)	Overall Level	Noise Environment
120	Uncomfortably loud (32 times as loud as 70 dBA)	Military jet airplane takeoff at 50 feet
100	Very loud (8 times as loud as 70 dBA)	Jet flyover at 1,000 feet Locomotive pass-by at 100 feet
80	Loud (2 times as loud as 70 dBA)	Propeller plane flyover at 1,000 feet. Diesel truck 40 mph at 50 feet
70	Moderately loud	Freeway at 50 feet from pavement edge at 10:00 a.m. Vacuum cleaner (indoor)
60	Relatively quiet (one-half as loud as 70 dBA)	Air condition unit at 100 feet. Dishwasher at 10 feet (indoor)
50	Quiet (1/4 as loud as 70 dBA)	Large transformers Small private office (indoor)
40	Very quiet (1/8 as loud as 70 dBA)	Birds calls. Lowest limit of urban ambient sound
10	Extremely quiet	Just audible (1/64 as loud as 70 dBA)
0	Threshold of hearing	Quietest sound detectible by a healthy human ear

Source: FICN 1992

Modified by: The Louis Berger Group, Inc., October 1998.

TABLE 34. SOUND PRESSURE LEVELS MEASURED IN NATIONAL PARKS

Sound	dBA
Threshold of human hearing	0
Haleakala National Park: Volcano crater	10
Canyonlands National Park: Leaves rustling	20
Zion National Park: Crickets (5 meters)	40
Whitman Mission: Conversational speech (5 meters)	60
Yellowstone National Park: Snowcoach (30 meters)	80
Arches National Park: Thunder	100
Yukon-Charley Rivers National Park: Military jet (100 meters above ground level)	120

Source: NPS 2009h

HUMAN AND WILDLIFE RESPONSE TO CHANGES IN NOISE LEVELS

Noise may have adverse effects on the human population in a variety of ways. Noise may interfere with human activities, such as sleep, speech communication, and tasks requiring concentration or coordination. At a physiological level, noise may also cause annoyance, hearing damage, and other health-related problems. The degree of disturbance from unwanted sound depends essentially on (1) the amount and nature of the intruding noise; and (2) the type of activity occurring where the noise is heard. In considering the first of these factors, it is important to note that individuals have different sensitivity to noise. Loud noises bother some people more than others, and some patterns of noise also affect a person's perception of whether or not a noise is offensive. With regard to the second factor, individuals tend to judge the annoyance of noise relative to the natural sounds (i.e., without the intruding noise source) and activities occurring where the noise is heard. For example, if regions of a park are dedicated to enjoying the tranquility and serenity of the natural environment, sounds from motor boating and hunting would be distracting to the visitor experience. However, if these activities are consistent with the purpose of a particular region of the park, these sounds would be considered appropriate. Therefore, noise is a subjective term, and it is important to characterize the activities essential to the park's purpose (NPS 2000a).

It is widely accepted that the average healthy ear can barely perceive noise level changes of 3 dBA or less. A change of 5 dBA is readily perceptible and an increase or decrease of 10 dBA is perceived as being twice or half as loud, respectively (see table 35).

TABLE 35. DECIBEL CHANGES, LOUDNESS AND ENERGY LOSS

Sound Level Change	Relative Loudness	Acoustic Energy Loss
0 dBA	Reference	0.0%
- 3 dBA	Barely perceptible change	50.0%
- 5 dBA	Readily perceptible change	67.0%
- 10 dBA	Half as loud	90.0%
- 20 dBA	1/4 as loud	99.0%
- 30 dBA	1/8 as loud	99.9%

Source: FHWA 1995

NOTE: This table underestimates changes in perceived loudness for low frequency noise, including transportation noise, which falls within the frequency range of 100 Hz to 1 kHz.

In addition to its effect on humans, studies have shown that intrusive and other human-induced noises can result in adverse physiological and behavioral changes in wildlife communities; however, the severity of impacts is dependent upon the particular species. For example, some sound sources have been associated with increased stress levels, as well as suppression of the immune system in wildlife. Additionally, increases in ambient noise levels may interrupt important communication networks for survival and reproduction between insects, birds, and mammals. Specifically, wildlife communications may signify mating calls, danger from predators, and territorial claims (NPS 2009j). An increase in ambient noise levels from the presence of intrusive noise sources may also reduce the listening area over which predators can hear their prey, as well as reduce the distance at which prey can begin to hear their predators (California State Lands Commission 2005).

EXISTING SOUND LEVELS

The presence of millions of visitors to the Seashore engaging in various activities, coupled with the vehicular traffic through this Seashore along NC-12 and associated ramps, including ORV usage on the beaches, serve as sources of unnatural sounds within this Seashore. However, these sources are also considered to be consistent with the Seashore's purpose.

In order to determine the natural ambient sound levels within the Seashore and characterize the natural soundscape, the NPS Natural Sounds Program assisted the Seashore conduct acoustical monitoring within the Seashore. The sound level data collected by the Natural Sounds Program will facilitate the estimation of noise impacts from the use of ORV, serving as a comparative baseline condition to ORV noise.

A summary report of the sound level measurements, known as an "Acoustical Monitoring Snapshot," was developed by the NPS Natural Sounds Program and includes the locations of two representative sites where measurements were conducted, as well as a brief vegetative description for the sites and measured sound levels. The measured sound levels represent exceedance levels (L_x) that describe the measurement data in terms of the decibel level that is exceeded x percent of the time during a given measurement period (i.e., an L_{10} value of 55 dBA indicates that the sound level is 55 dBA for 90% of the measurement and exceeds this level 10% of the measurement period). As the NPS is required to protect the natural soundscape, impact assessment is based on comparisons against the natural ambient sound levels. Natural ambient sound levels represent the natural environment, absent human-caused sounds, and may be well estimated based on the L_{90} metric. The L_{90} metric represents the sound level exceeded 90 percent of the time.

Sound level measurements were conducted at two sites over a period of 31 days between May 2008 and June 2008. Sound level data were collected during a daytime (7:00 a.m. to 7:00 p.m.) and a nighttime (7:00 p.m. to 7:00 a.m.) period. Monitors were placed in secure locations, away from traffic and the beaches. Site one, labeled CH1 (figure 19), was located on Bodie Island Bone Yard just north of the fishing center and west of NC-12 on the side of the island near the sound. The site is composed of woody wetlands and mixed forest. Daytime existing L_{90} sound levels are 33.6 dBA while nighttime L_{90} sound levels are 33.8 dBA. Site CH2 (figure 20) is located at Cape Point on the ocean side within woody wetlands and shrublands. Existing L_{90} sound levels are 33.4 dBA during the daytime and 41.0 dBA during the nighttime period.

NPS protocols for acoustic monitoring at national parks (NPS 2006c) were followed in the collection of acoustic data at Cape Hatteras National Seashore to determine ambient conditions. The protocols attempt to capture spatial and temporal variability within the Seashore. Therefore, monitors are typically not placed near sound sources that would dominate and mask other acoustic resources (i.e., birds, insects). As noise from the surf is a predominant natural sound source along the beaches within this Seashore, the NPS Natural Sounds Program also provided published information on surf sounds to further characterize the natural soundscape within the Seashore.

Sounds from the surf vary, depending on how active the surf is (i.e., during high tide or stormy conditions the surf has more acoustic energy), and therefore sound levels may range between 20 dBA during less active periods and 55 dBA during more active periods (California State Lands Commission 2005). Additionally, surf noise is predominant on the beaches, but diminishes with increasing distance from the beaches, where vehicular noise sources may prevail from NC-12 and associated ramps and smaller feeder roadways. Acoustic conditions at the surf were extrapolated using the collected data. The results of the extrapolation were verified and corroborated by published sources (*Disposition of Offshore Cooling Water Conduits SONGS Unit 1 EIR*) and the experiences of Seashore managers.

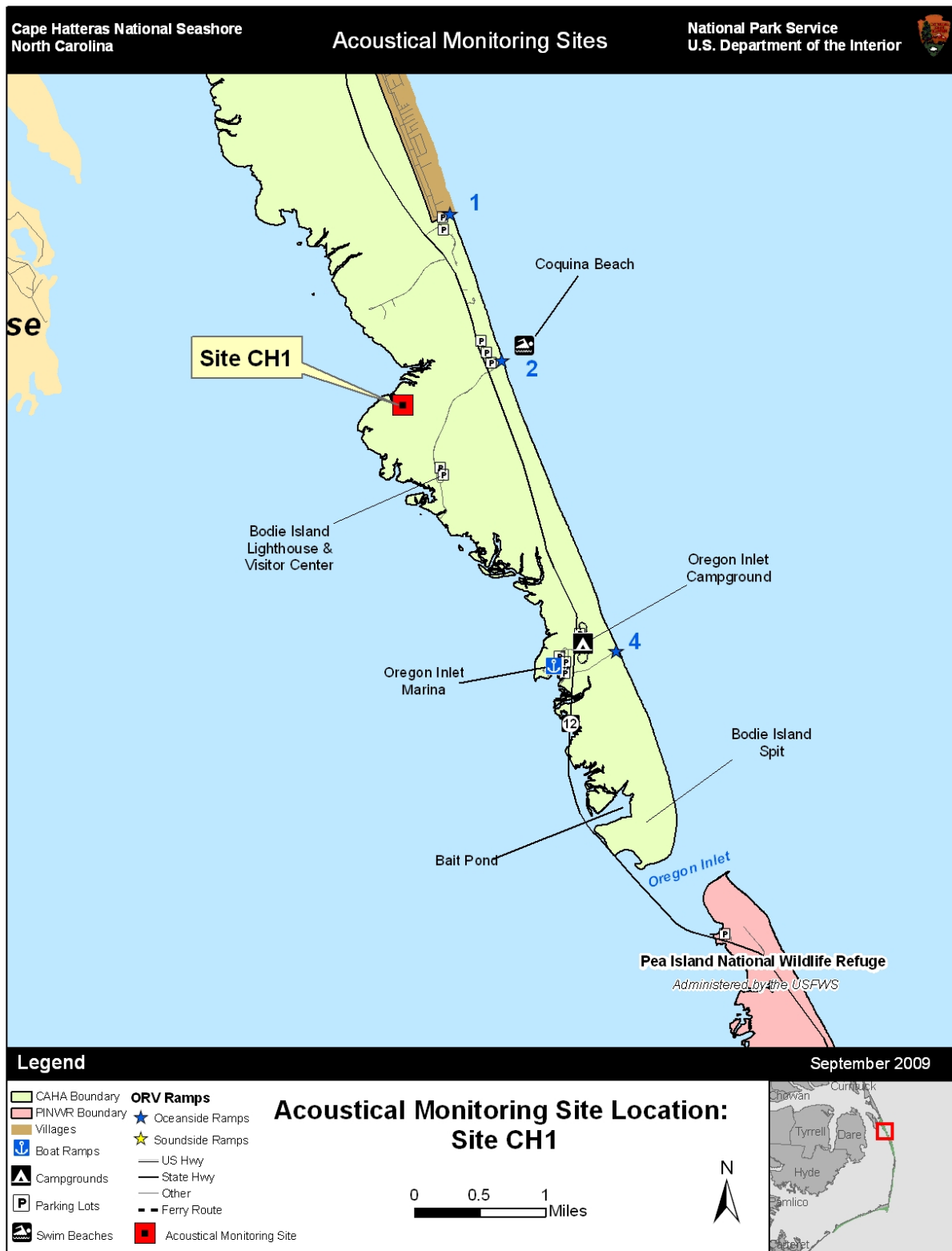


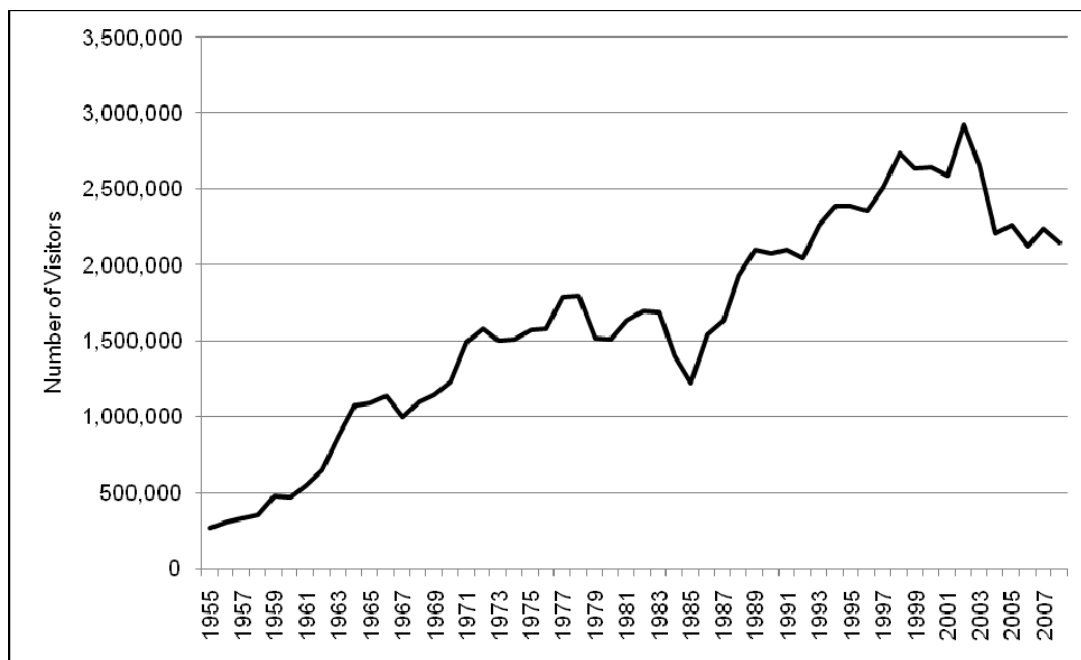
FIGURE 19. ACOUSTICAL MONITORING SITE LOCATION FOR CH1



FIGURE 20. ACOUSTICAL MONITORING SITE LOCATION FOR CH2

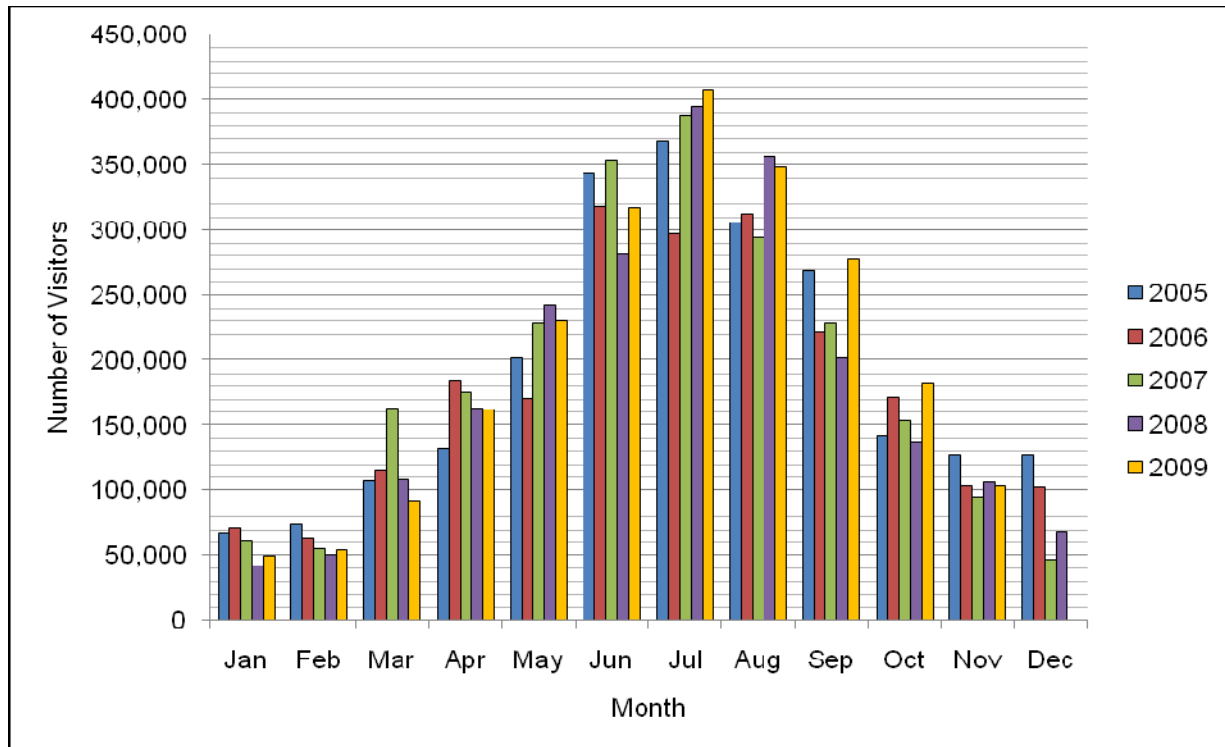
VISITOR USE AND EXPERIENCE

Visitation to the Seashore has shown a relatively steady increase, with occasional dips, particularly in the mid-1980s and recently from 2003 to the present. More than 2 million visitors have recreated at the Seashore every year since 1990 (see figure 21). Figure 22 illustrates visitor use data for 2005 through November 2009, which indicate that highest use occurs during June, July, and August; this accounts for approximately 46% of the annual recreation visits (based on 2007 data). Another 21% of annual visitation occurs during the fall (September, October, and November), 25% in the spring (March, April, and May), and 7% in the winter (December through February) (NPS 2008e). Overall, visitation at the Seashore in 2009 has been higher than 2008, with July 2009 visitation of 407,754 being the highest since 2003 (Murray pers. comm. 2009b).



Source: NPS 2008e

FIGURE 21. ANNUAL RECREATIONAL VISITATION AT CAPE HATTERAS NATIONAL SEASHORE, 1955–2008



Source: NPS 2008e; Broili pers. comm. 2009

FIGURE 22. MONTHLY RECREATIONAL VISITATION AT CAPE HATTERAS NATIONAL SEASHORE, JANUARY 2005–NOVEMBER 2009

VISITOR CHARACTERISTICS

A study conducted by the University of Idaho during 1 week in July 2002 showed that many visitors (44%) were from North Carolina and Virginia, approximately 10% were from Ohio, and smaller proportions of visitors came from 29 other states and Washington DC. Over 50% of visitors were between 30 and 50 years of age (University of Idaho 2003).

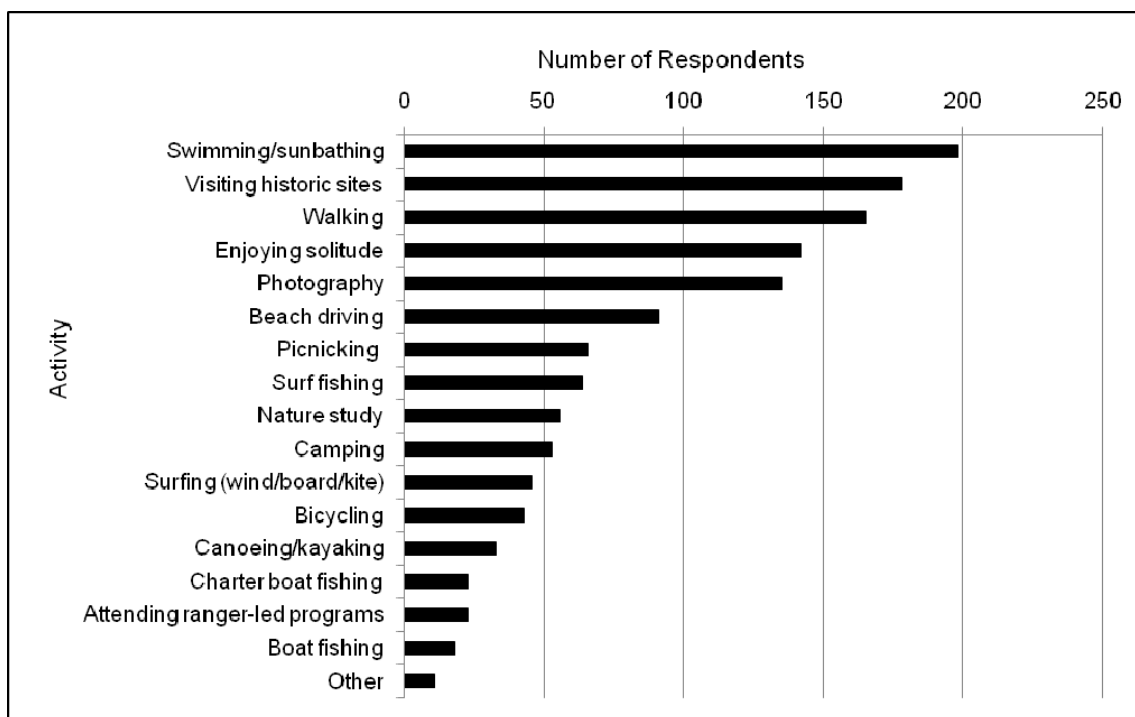
RECREATIONAL OPPORTUNITIES AND USE AT CAPE HATTERAS NATIONAL SEASHORE

The Seashore provides a diverse range of recreational opportunities including auto touring, biking, bird watching, boating, camping, fishing, hiking, hunting, kayaking, taking nature walks, horseback riding, stargazing, swimming, wildlife viewing, surfing, kiteboarding, and wind surfing. According to the study conducted by the University of Idaho in 2002, the three most important reasons mentioned by visitors for visiting the Seashore were the lighthouses, the beach/beachcombing, and fishing. Historical significance and swimming followed closely (University of Idaho 2003). This study also asked visitor groups to list the activities in which they participated during their visit to the Seashore. The results are displayed in figure 23. Other activities that respondents participated in included family time / reunions, clamming/crabbing, shelling, shopping, and history study.



Historic Photo of Recreating at the Seashore

Credit: NPS



Source: University of Idaho 2003

FIGURE 23. VISITOR ACTIVITIES SURVEY RESULTS

Major developed facilities, such as visitor centers and campgrounds, as well as more informal visitor use areas at the Seashore that provide for these recreational activities, are shown on the Seashore map in chapter 1 of this document. Visitor centers are located on each island in association with Ocracoke, Cape Hatteras, and Bodie Island lighthouses, and campgrounds include Ocracoke, Frisco, Cape Point, and Oregon Inlet. Fishing piers are located near Frisco and at Avon and Rodanthe on Hatteras Island, and a major marina is located at Oregon Inlet on Bodie Island. Bathhouses and/or designated swimming beaches are available near Frisco on Cape Hatteras Island, Coquina Beach on Bodie Island, and on Ocracoke Island north of the village. Information stations, day use areas, and informal recreation opportunities, such as nature trails, are also found throughout the Seashore.

Recreational Fishing



Historic Photo of Recreational Fishing

Credit: NPS

The cold Labrador Current and the warm waters of the Gulf Stream meet adjacent to the Outer Banks of North Carolina. The waters off the Seashore are known throughout the world as highly productive fishing areas. The fish that congregate in the waters off the Outer Banks attract anglers from throughout the region, but largely from North Carolina and Virginia. In the spring and fall, when bluefish (*Pomatomus saltatrix*), spotted sea trout (*Cynoscion nebulosus*), red drum (*Sciaenops ocellatus*), and other species are present in offshore waters, surf fishermen line the beaches to cast their baits and lures over the incoming breakers and into the schooling fish. Most of the beach and sound are open to fishing as are the fishing piers in the villages of Rodanthe, Frisco, and Avon. NPS boat ramps are located at the Oregon Inlet Marina and near the ferry office in Ocracoke Village. Charters and

head-boat services (boats that carry a large number of anglers who pay by the person) are available at local marinas.

Particularly productive and high-demand fishing areas include Ocracoke, Hatteras, and Oregon inlets and Cape Point, which are often accessed via ORVs. ORV counts at ramps accessing these inlets exceeded those of other beach access ramps. This use is discussed in the “Visitor Access and Off-road Vehicle Use” section that follows below.

Typically, fishing tournaments occur in the spring and fall in locations throughout the Seashore, as shown in table 36. Tournament data from 2001 to 2008 indicate that, normally, about eight or nine fishing tournaments occur annually (Thompson pers. comm. 2008). While data are not available for actual attendance, the events are well attended. For 2005, estimates indicate that more than



Recreational Fishing in Modern Times

Credit: NPS

720 people participated in one event that lasted for 2 days. Some tournaments may only have 25 participants, depending on the availability of fish and weather. Restrictions are placed upon the events as to location and times to ensure the availability of recreational areas for other Seashore visitors. These restrictions change from time to time depending on the time of the year, seasonal visitation figures, past experience with the sponsors, and how the proposed event is structured. Typically, Seashore beaches 0.5 mile on either side of Cape Point and 0.5 mile on either side of an inlet are closed to tournament fishing.

Like other Seashore visitors, tournament participants are not allowed in any resource closure areas. Tournaments take place in the designated ORV corridor, which has presented conflict with recreational anglers during the tournaments on a few occasions (NPS 2007e).

Visitor Access and Off-road Vehicle Use

As noted in chapter 1 of this document, before 1954, local residents and visitors used the beaches and sound trails for vehicular transportation purposes because there were few formal roads in this remote area. With the paving of NC-12, the completion of the Bonner Bridge connecting Bodie and Hatteras islands, and the introduction of the NCDOT Ferry System to Ocracoke Island, visitor access to the islands resulted in increased vehicle use on beaches for recreational purposes. ORVs were used by residents to facilitate commercial netting of fish, and sport fishermen used ORVs to pursue migrating schools of game fish and to reach more productive areas such as Cape Point or the inlets, which are often a mile or more from the nearest paved surface. ORVs are currently used at the Seashore for commercial and recreational fishing, sightseeing, travel to and from swimming and watersport areas, and pleasure driving (NPS 2004b). On the other hand, Seashore visitors choose to access the Seashore by foot for swimming, sunbathing, birdwatching, fishing, enjoying scenic ocean views, and other recreational activities.



Beach Driving at the Seashore

Credit: NPS

TABLE 36. FISHING TOURNAMENTS, 2004–2008

Applicant/Event	Tournament Date	# People Authorized	Tournament Location within the Seashore
4 Plus Four Wheel Drive Club	Late April from 2004 to 2008	600	Ocean beaches excluding 0.5 mile either side of Cape Point, 0.5 mile from Hatteras Inlet and Ocracoke Inlet, and 0.5 mile on the north side of Oregon Inlet
Ocracoke Invitational Surf Fishing Tournament	Late April / early May from 2004 to 2008	240	Ocean beach between ramps 68 and 72
Outer Banks Association of Realtors	5/20/2005	150	Ocean beach from Coquina Beach to ramp 4
Hatteras Village Invitational	Early September from 2006 to 2008	540	Hatteras Island
Hatteras Village Civic Association	9/10/2004 9/9/2005	240	Ocean beaches on Hatteras Island open to 4x4 vehicles from ramp 43 south and west to 0.5 mile from Hatteras Inlet, but excluding 0.5 mile either side of Cape Point
Salt Water Grill	9/28/2008	120	Bodie Island
Nags Head Surf Tournament	Early October from 2004 to 2008	240	Ocean beach from Coquina Beach to ramp 4
FFFF Tournament	Early October from 2006 to 2008	120	Bodie Island
Capitol City Four Wheelers	Mid-October from 2004 to 2008	600	Ocean beaches excluding 0.5 mile either side of Cape Point, 0.5 mile from Hatteras Inlet, and all areas closed to vehicular access including ramps temporarily closed due to flooding
Outer Banks Association of Realtors	Mid-October from 2006 to 2008	240	Bodie Island
Red Drum Tournament	10/24/2007 10/22/2008	600	Parkwide
Cape Hatteras Anglers Club	11/4/2004 11/3/2005	600	Public ocean beaches excluding 0.5 mile either side of Cape Point, 0.5 mile from Hatteras Inlet and Ocracoke Inlet, and 0.5 mile on the north side of Oregon Inlet; also excluding 0.2 mile on either side of ramps 1, 4, 23, 27, 30, 34, 43, 49, and 55, and the beaches of Pea Island NWR
Cape Hatteras Anglers Club	11/8/2007 11/6/2008	720	Hatteras Island
Outer Banks Angler	11/30/2007 12/5/2008	600	Parkwide
Surf Fishing Info.	12/2/2005	240	Ocean beaches excluding 0.5 mile either side of Cape Point, 0.5 mile from Hatteras Inlet and Ocracoke Inlet, 0.5 mile on the north side of Oregon Inlet, and other closures ordered by the Seashore

Source: Thompson pers. comm. 2008



ORVs Accessing the Beach using a Ramp

Credit: NPS

ORVs access the beach via a system of ramps located off NC-12. This vehicular beach access ramp system provides controlled entry and exit to beach areas. Originally, planks were placed on the dune crossing site, hence the name “ramp,” to prevent the sand from moving and to prevent the dune from being further breached. The ramps began as an informal system of unimproved access points connecting the roadway to the beaches. Over time, this system was formalized and ramps are now numbered, maintained, and identified on the Seashore’s ORV route maps as official vehicle routes for beach access. In 1978, there were 28

identified ramps, 22 of which were located on NPS lands. Although the NPS opened a new ramp to the public in 1998, the number of ramps has decreased since 1978 as some were lost to erosion and others were closed to the public and are now used for administrative vehicle access only (NPS 2004a). The NPS currently has 17 oceanside access ramps available for public ORV use. These ramps are listed on table 37. Each ramp number on the map (figure 24) refers to the approximate mile on NC-12 south of Nags Head on Bodie Island.

TABLE 37. OCEAN BEACH ACCESS

Ramp	Open to Public Use
Ramp 2 (Coquina)	Seasonal
Ramp 4	Year-round
Ramp 23	Year-round
Ramp 27	Year-round
Ramp 30	Year-round
Ramp 34	Year-round
Ramp 38	Year-round
Ramp 43	Year-round
Ramp 44	Year-round
Ramp 45	Year-round
Ramp 49	Year-round
Ramp 55	Year-round
Ramp 59	Year-round
Ramp 67	Year-round
Ramp 68	Seasonal
Ramp 70	Year-round
Ramp 72 (South Point Road)	Year-round

Source: NPS 2008g



FIGURE 24. OFF-ROAD VEHICLE RAMPS AT CAPE HATTERAS NATIONAL SEASHORE

Number and Distribution of ORVs at the Seashore

From 2007–2008, the Seashore installed infrared counters at ORV ramps to determine the number of ORVs using the Seashore, as well as their distribution in the Seashore. However, in addition to counting ORVs, the counters were found to count anything that breaks the infrared beam, including pedestrians, rain, and untrimmed plants. The counters also failed to register some counts and must be properly aligned to count. Testing showed that the ramp counters overestimated the number of ORVs substantially and that pedestrian crossings often added to the inaccurate counts. For these reasons, the data from the ramp

counters were deemed not reliable for constructing estimates of ORV use at the seashore (RTI pers. comm. 2009a).

On Memorial Day and the Fourth of July, the Seashore counts the number of ORVs on the beach by an aerial survey. Research Triangle Institute, International (RTI) (RTI pers. comm. 2009a) used this information, along with assumptions based on rental occupancy and patterns of use, to create a range of estimates for the total number of ORVs using the Seashore in a year. Although there are some data from various sources about the number of vehicles on the beach, none of the sources have the scope or reliability to provide a robust annual estimate of vehicles on the beach. A survey is being conducted according to a random sampling plan to provide an estimate of the number of vehicles on the beach between April 1, 2009, and March 30, 2010, with a 95% confidence interval. Data collection will be completed in March 2010.

The data from the aerial counts were used to provide counts for ORVs at the following locations, which include some of the most popular ramps leading to the points and spits:

- Ramp 4: Includes Bodie Island Spit.
- Ramp 23 to ramp 27: Approximately 4-mile area directly south of Salvo.
- Ramp 27 to ramp 38: Approximately 11 mile area including Avon.
- Ramp 43 to ramp 49: Includes Cape Point.
- Ramp 55: Includes Hatteras Inlet Spit.
- Ocracoke: All of Ocracoke Island.

Figure 25 shows the distribution of ORVs across these areas on Memorial Day and the Fourth of July in 2008. About 75% of the ORVs counted on those days were located around the points and spits (including all of Ocracoke as one count); over half of the ORVs were located around Cape Point and the Bodie Island Spit.

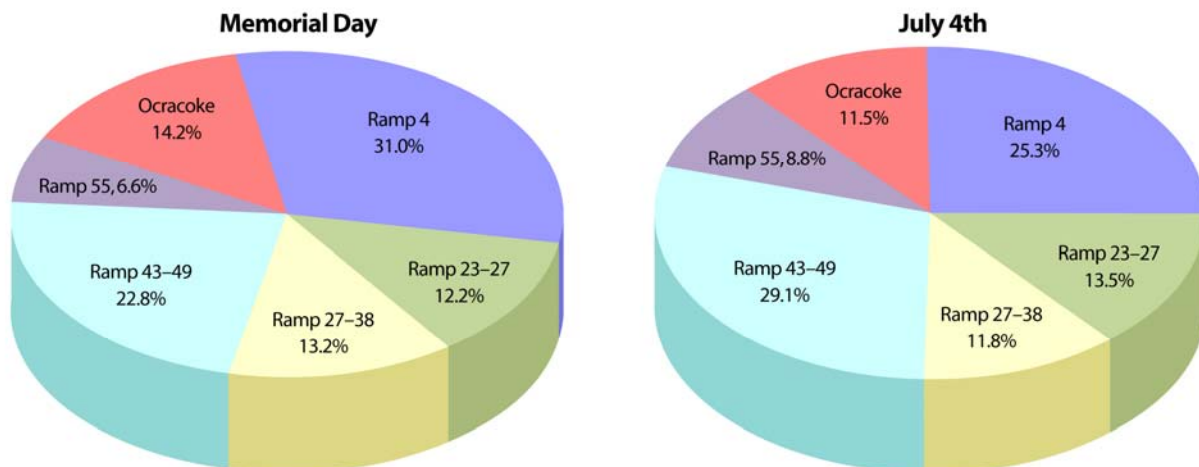


FIGURE 25. ORV DISTRIBUTION BASED ON AERIAL COUNTS, FOURTH OF JULY AND MEMORIAL DAY 2008

Closures. A number of areas throughout the Seashore have been closed to ORV travel over the years, either due to safety issues or for resource protection purposes. Temporary closures to ORVs also occur along the beaches to protect sea turtle nests and bird species such as piping plovers, American oystercatchers, and colonial waterbirds. The Seashore contains approximately 68 miles of shoreline that are available for public use, when not closed for resource or safety concerns. The 13 miles of beach that comprise Pea Island NWR are within the Seashore boundary and are managed separately and under a different regulatory framework by the USFWS; ORVs are not permitted on Pea Island beaches.

Currently, all the Seashore beaches are potentially open to ORV use during the winter, except a section near the Cape Hatteras Lighthouse (which is closed year-round), and those beaches under a safety closure. Some beaches are also closed to ORV use if they become too narrow. During the summer months, the amount of Seashore beach open can vary depending on resource closures and seasonal ORV closures of village beaches, as detailed in chapter 2 of this document. On the soundside, 18 access points are publicly available to ORVs. However, vehicular access is typically limited to short distances along sandy portions of the sound shoreline because the Seashore prohibits ORV use on vegetated areas, and most of the soundside areas have vegetation. Closures vary from year to year depending on a range of management considerations.

Following Hurricane Isabel, ORV use areas (restrictions) were put in place in March 2004 to protect sensitive habitat that opened up as a result of dune destruction and to provide for more consistent management of breeding and nesting bird closures. These closures did not significantly decrease the sum total of shoreline miles open to ORV access and public recreation nor did it impact the number of ramps open to allow ORV access to Seashore beaches. White posts were placed 150 feet landward from the average, normal high-tide line, or, if existing, at the vegetation or remnant dune line. Beach areas landward of the post line, although not open to ORV use, were open to pedestrian use (NPS 2004b).

Temporary resource closures are established throughout the Seashore, including within areas of ORV and pedestrian use, to comply with protection measures afforded nesting sea turtles and protected shorebirds. These closures are implemented at crucial periods during the life of these species. During these closures, the NPS routes ORV beach traffic around the temporary resource closure when possible. Temporary resource closures apply to both ORV and pedestrian use, although occasionally pedestrian access can be provided in pedestrian corridors.

Bird Closures. The open sand flats near the three inlets in the Seashore (Oregon, Hatteras, and Ocracoke) and Cape Point are used by protected bird species and are also favorite fishing areas that visitors access in ORVs. Piping plover, American oystercatcher, and colonial waterbird breeding activity has been documented on and near the ocean beach in all of these locations.

In 2005, temporary resource closures occurred at multiple beach locations (including popular recreational fishing areas at the points and spits) to protect piping plovers, American oystercatchers, and colonial waterbirds from ORV and pedestrian use. These closures occurred on all three islands but were most concentrated on Hatteras Island, followed by Ocracoke. The Interim Strategy was published in January 2006 and finalized by a FONSI in July 2007 (NPS 2007a). The Interim Strategy presented a multifaceted approach that included the establishment of prenesting closures, species protection buffers, wintering habitat protection, and temporary resource closures. Although for the most part the Interim Strategy established specific distances for species buffers, it allowed for the reduction or expansion of buffers based on professional judgment of the resource management staff. Species and ORV management under the Interim Strategy resulted in beach closures similar to those that occurred in previous years. Management and resource closures were altered by a lawsuit in 2007 and subsequent consent decree in 2008.

In October 2007, Defenders of Wildlife and the National Audubon Society filed a lawsuit against the NPS alleging inadequacies in the management of protected species at the Seashore under the Interim Strategy and failure of the Seashore to comply with the requirements of the ORV executive order and NPS regulations regarding ORV use. On December 18, 2007, the Dare County Commissioners, Hyde County Commissioners, and the board of the Cape Hatteras Access Preservation Alliance were allowed to join the lawsuit as intervenor-defendants. However, a consent decree was filed on April 16, 2008, in U.S. District Court (signed on April 30, 2008), whereby the parties involved in the lawsuit agreed to a settlement of the case. The consent decree resulted in larger



Typical Closure

Credit: NPS

buffers than those prescribed in the Interim Strategy being established during portions of the spring and summer around bird breeding and nesting areas; this included creating a 1,000-meter (3,280-foot) vehicle buffer and a 300-meter (984-foot) pedestrian buffer around piping plover chicks until they have fledged. From May 15 through August 21, 2008, an average of 10 miles of oceanfront beach at the Seashore was closed to both pedestrians and ORVs. The largest amount of beach closures was reported on May 29, 2008, when 12.8 miles of beach were closed to all recreational use to protect piping plovers exhibiting breeding, nesting, and/or foraging behavior. The consent decree also established a prohibition on night driving on beaches between the hours of 10:00 p.m. and 6:00 a.m. from May 1 through September 15, with night driving allowed from September 16 through November 15 under the conditions of a permit.

Sea Turtle Closures. Temporary resource closures, which apply to ORVs and pedestrians, are implemented during nesting and hatching activities for all three sea turtle species that are known to nest at the Seashore. Generally, ORVs and pedestrians can negotiate around these posted closures for sea turtle nests. However, when the turtle eggs are ready to hatch, the NPS implements a beach closure with fencing from the nest to the water's edge. If sufficient room exists, ORVs and pedestrians can go around the landward side of the fence. In some cases, a full beach closure must be implemented because of the location of a nest relative to a dune or vegetation, preventing ORV and pedestrian access through the area. As mentioned previously, the consent decree signed in April 2008 included a prohibition on night driving to protect nesting sea turtles. The consent decree also contains provisions for full beach closures in the fall to allow existing turtle nests to hatch safely.

Safety Closures. Areas normally open to ORVs may close for safety reasons. Adverse weather conditions can result in narrow beach areas or flooded conditions, among other hazards, necessitating closures to vehicles. In November 2005, safety closures included 1.6 miles on Bodie Island, 22.8 miles on Hatteras Island, and 6.5 miles on Ocracoke Island (Stevens pers. comm. 2005). However, from May 15 through August 21, 2008, safety closures throughout the season consistently included a total of 11.1 miles of beach (NPS 2008m). Under current management, village beaches are closed to ORVs to protect pedestrians during the busy summer season.

CROWDING, VISITOR ENCOUNTERS, AND VISITOR SAFETY

A University of Idaho study indicated that one of the reasons people visited the Seashore was to escape crowds and seek solitude. When asked about crowding, 27% of visitors said they felt "crowded" to "extremely crowded," while 43% of visitors felt "somewhat crowded." Thirty percent of visitors surveyed indicated that they felt "not at all crowded." Many visitor groups (49%) reported that crowding "detracted from" their park experience (University of Idaho 2003).

As part of the visitor experience, visitor safety is also considered. During public scoping for this plan/EIS, comments were received that indicated that some visitors felt that there was a potential for conflicts between visitors on foot and visitors using ORVs. In early 2009, Seashore law enforcement staff indicated that in the prior 10 years, there were no known case incident reports documenting pedestrians being struck by ORVs on Seashore beaches; however, public comment indicated a concern about the speed of ORVs on the beach and how close they are to other Seashore users. On September 27, 2009, a 7-year-old boy was accidentally hit by an ORV that was backing up on the beach in front of ramp 38. While the boy's parents and other family members were swimming and playing in the ocean, the boy decided to play on the beach digging holes and making sand castles with his hands. The driver of the vehicle that struck the boy had driven onto the beach to see if he and his passenger would surf at this location. The individuals decided not to surf at this location and turned around to exit the beach. The beach is sloped from the ramp down to the water and the sand is soft in this area. The vehicle driver was having difficulty driving his vehicle up the slope and was backing up and going forward to try to get up the slope, (they had not reduced air pressure in their tires). While backing up, the driver did not see the boy playing in the sand. The vehicle struck the boy with the right rear bumper and tire. Neither of the boy's parents had observed the actual incident but had observed the vehicle maneuvering on the beach prior to the accident. They did not believe the vehicle was being operated carelessly or too fast. The boy was transported to the Outer Banks Hospital for examination and was released. Injuries included bruising to the arm and leg. The ORV operator was not charged with any violation (Murray pers. comm. 2009a).

VISITOR SATISFACTION

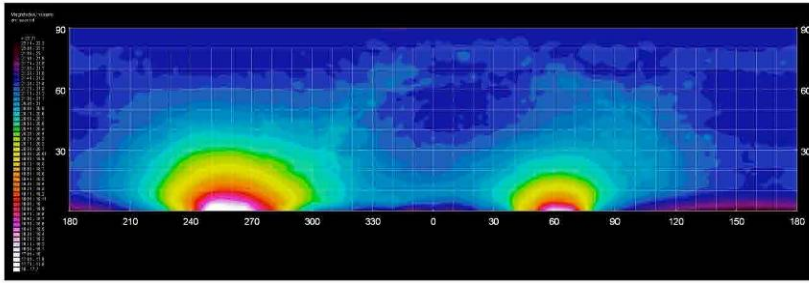
A visitor survey was conducted by the University of Idaho Park Studies Unit for units of the NPS in 2008. The survey was developed to measure each park unit's performance related to NPS *Government Performance Results Act* (GPRA) Goals IIa1 (visitor satisfaction) and IIb1 (visitor understanding and appreciation). Survey cards were distributed at the Seashore to a random sample of visitors from July 1 to July 31, 2008. The report included three categories of data: park facilities (which included visitor centers, exhibits, restrooms, walkways/trails/roads, and campgrounds / picnic areas), visitor services (assistance from park employees, park maps/brochures, ranger programs, and commercial services), and recreational opportunities (nature/history/cultural learning and outdoor recreation). Overall, the percentage of Seashore visitors satisfied with the facilities, services, and recreational opportunities was 95%. Individually, 93% of visitors were satisfied with park facilities, 85% of visitors were satisfied with visitor services, and 89% were satisfied with recreational opportunities (University of Idaho 2008).

In the 2002 University of Idaho study, the researchers solicited visitor opinions about selected factors that affect visitor experience. As would be expected, vehicles on the beach were perceived very differently by different visitors, but most stated that the use of vehicles on the beach did not detract from their visitor experience. The factors receiving the highest proportion of "no effect" ratings were airplane overflights (50% of those surveyed), dogs off leash (35%), vehicles on the beach (34%), and visitors drinking alcohol (33%). Factors receiving the highest proportion of "added to my experience" ratings included vehicles on the beach (20%) and fires on the beach (16%), while those receiving the highest "detracted from my experience" ratings were litter (40%) and vehicles on the beach (18%). About 29% of those surveyed did not experience vehicles on the beach (University of Idaho 2003).

Night Skies

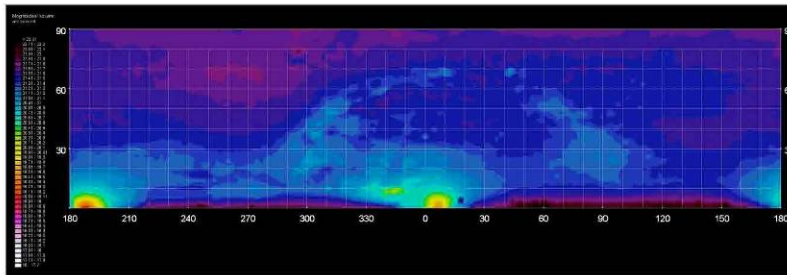
The NPS defines a natural lightscape as “a place or environment characterized by the natural rhythm of the sun and moon cycles, clean air, and of dark nights unperturbed by artificial light. Natural lightscapes, including dark night skies, are not only a resource unto themselves, but are an integral component of countless park experiences”

(NPS 2007b). The NPS created the Night Sky Team in 1999 to address increasing alarm over the loss of night sky quality throughout the network of national parks. The Night Sky Team functions as a center of expertise that provides advice, guidance, and technical support in characterizing and preserving park lightscapes (NPS 2007b). According to the Night Sky Team, the Seashore is one of only a handful of sites in the eastern United States with a nearly natural regimen of light and dark, where light patterns are made up primarily of the dark sky, moon, and stars (NPS 2008f).



This picture was compiled from images captured on a boardwalk between Frisco and Hatteras. Frisco lies at about 60° azimuth and Hatteras at about 260° azimuth.

Credit: Night Sky Team Visit Report



This picture was compiled from images captured on a boardwalk between Salvo and Avon. The combined light of Rodanthe, Salvo, and Waves can be seen at about 6° and Avon at 191°. Also note the presence of a few clouds reflecting the town lights at about 345°.

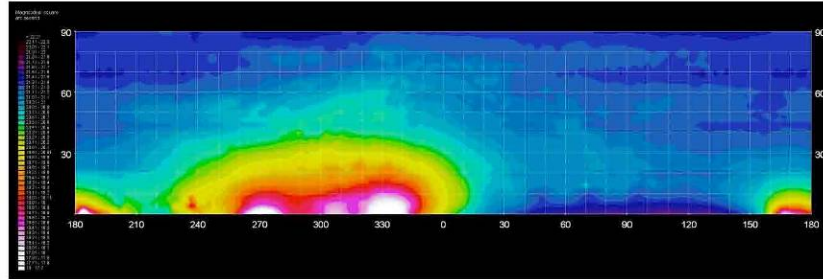
Credit: Night Sky Team Visit Report

In November 2007, the NPS Night Sky Team visited the Seashore to record preliminary measurements of night sky quality from three sites: the Bodie Island Maintenance Facility (Bodie Island); the boardwalk at ramp 27 (Hatteras Island); and the boardwalk south of Frisco (Hatteras Island) (NPS 2008f). During this visit, the team concluded that the Seashore has better night sky quality as compared to most other NPS

units east of the Mississippi River. Furthermore, measurements showed that light pollution sources beyond the Seashore boundary illustrated the need to be aware of the easily impacted night skies (NPS 2008f).

Measurements of the night sky at the Seashore were taken with a charge-coupled device (CCD) camera (a scientific-grade digital camera) that captures the known magnitude (a measure of stellar brightness) of known stars as an index to determine the ambient brightness of the nighttime sky. These measurements are influenced by atmospheric conditions, which affect how light travels through the sky. To account for these changes, multiple measurements are taken over a period of time. The initial measurements at the Seashore occurred over two nights, with more planned in the future (NPS 2008f).

Results from the November 2007 measurements found that sky brightness ranged from approaching a natural level of darkness to significantly light polluted, with the potential to threaten the ecological health of the coastal environment in some areas (NPS 2008f). To address those areas where there are high levels of light pollution, the Night Sky Team recommended retrofitting or swapping existing light fixtures in favor of turtle-friendly and night-sky-friendly fixtures, as well as working with park neighbors to enact night sky measures such as lighting ordinances (NPS 2008f).



This picture was compiled from images on Bodie Island, just south of the maintenance facility. A number of light domes are evident in this image, including the combined light from Harbor, Rodanthe, and Salvo between 165° and 168°; the lighthouse at 184°; Wanchese at 267°; and the combined light from Manteo, Kill Devil Hills, Nags Head, and Kitty Hawk between 304° and 333°. A considerable amount of light scattering occurs in this picture due to high humidity.

Credit: Night Sky Team Visit Report

SOCIOECONOMIC RESOURCES

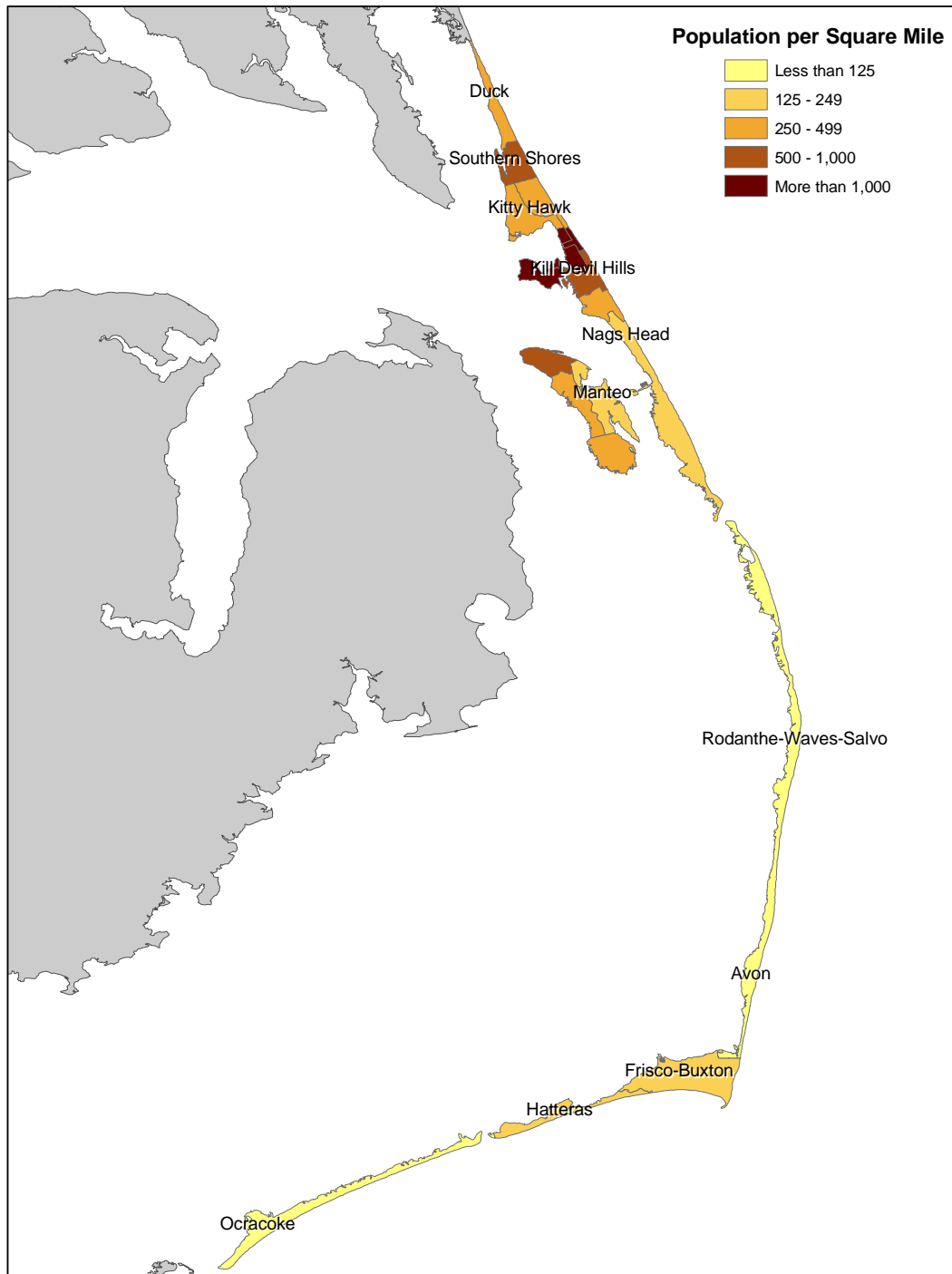
This section describes the social and economic environment that potentially would be affected by the proposed alternatives. The social and economic environment of a region is characterized by its demographic composition, the structure and size of its economy, and the types and levels of public services available to its citizens.

The socioeconomic environment evaluated for this plan/EIS encompasses the Outer Banks portion of two counties in North Carolina—Dare and Hyde. Hatteras and Bodie islands are part of Dare County while Ocracoke Island is within Hyde County. This area contains thirteen zip codes, eighteen of the nineteen block groups in Dare County, and one of the four block groups in Hyde County.

The Outer Banks portion of Dare and Hyde counties forms the economic region of influence (ROI) and defines the geographic area in which the predominant social and economic impacts from the proposed alternatives are likely to take place. The villages of Ocracoke, Hatteras, Frisco, Buxton, Avon, Salvo, Waves, and Rodanthe would be most affected by the proposed actions because they are located within the Seashore. The largest towns within the ROI include Nags Head, Kill Devil Hills, and Kitty Hawk, which are located on Bodie Island north of the Seashore. Data not available at the block group or zip code level will be reported at the county level.

DEMOGRAPHICS

The economic ROI is primarily rural in character, although portions of Dare County, especially in the north, are developed with large tracts of vacation homes and small businesses that support the area's robust tourism industry. Much of Dare County's permanent population also resides in this area, the most densely populated portion of the ROI (figure 26). Note that data presented are often taken from the U.S. Census Bureau. The census places people according to "usual residence" guidelines, so people are counted where they live most of the year.



Source: Environmental Systems Research Institute, Inc. 2002

FIGURE 26. 2000 POPULATION DENSITY BY BLOCK GROUP

In recent years, population trends have differed substantially for Dare and Hyde counties. Table 38 provides population statistics for the state of North Carolina, Dare and Hyde counties, and the Dare and Hyde County block groups located on the Outer Banks. Between 2000 and 2008, Dare County's population grew 12%, from 29,967 to 33,584. This is a slightly lower percentage change in population than the state of North Carolina as a whole. However, the portion of the state population occupying Dare County remained 0.4%. During this same time period, the population of Hyde County decreased by 11%, from 5,826 to 5,181 (U.S. Census Bureau 2008), lowering the portion of the state population occupying Hyde County from 0.07% to 0.06%. The Dare County block groups within the ROI account for 96% of Dare County's population, while Hyde County block group represents only 13% of Hyde County's population (U.S. Census Bureau 2000a).

TABLE 38. POPULATION STATISTICS

Geographic Area	2000 ^a	2007 ^b	2015 ^c	2029 ^c	Percent Change, 2000–2007	Percent Change, 2000–2029
North Carolina	8,049,313	9,222,414	10,429,282	12,769,797	15%	59%
Dare County	29,967	33,584	31,225	26,053	12%	-13%
Dare County block groups ^d	28,798	—	—	—	—	—
Hyde County	5,826	5,181	5,256	4,717	-11%	-19%
Hyde County block group ^e	730	—	—	—	—	—

Sources:

^a U.S. Census Bureau 2000a

^b Population Division, U.S. Census Bureau 2009a

^c Office of State Budget and Management, North Carolina 2009

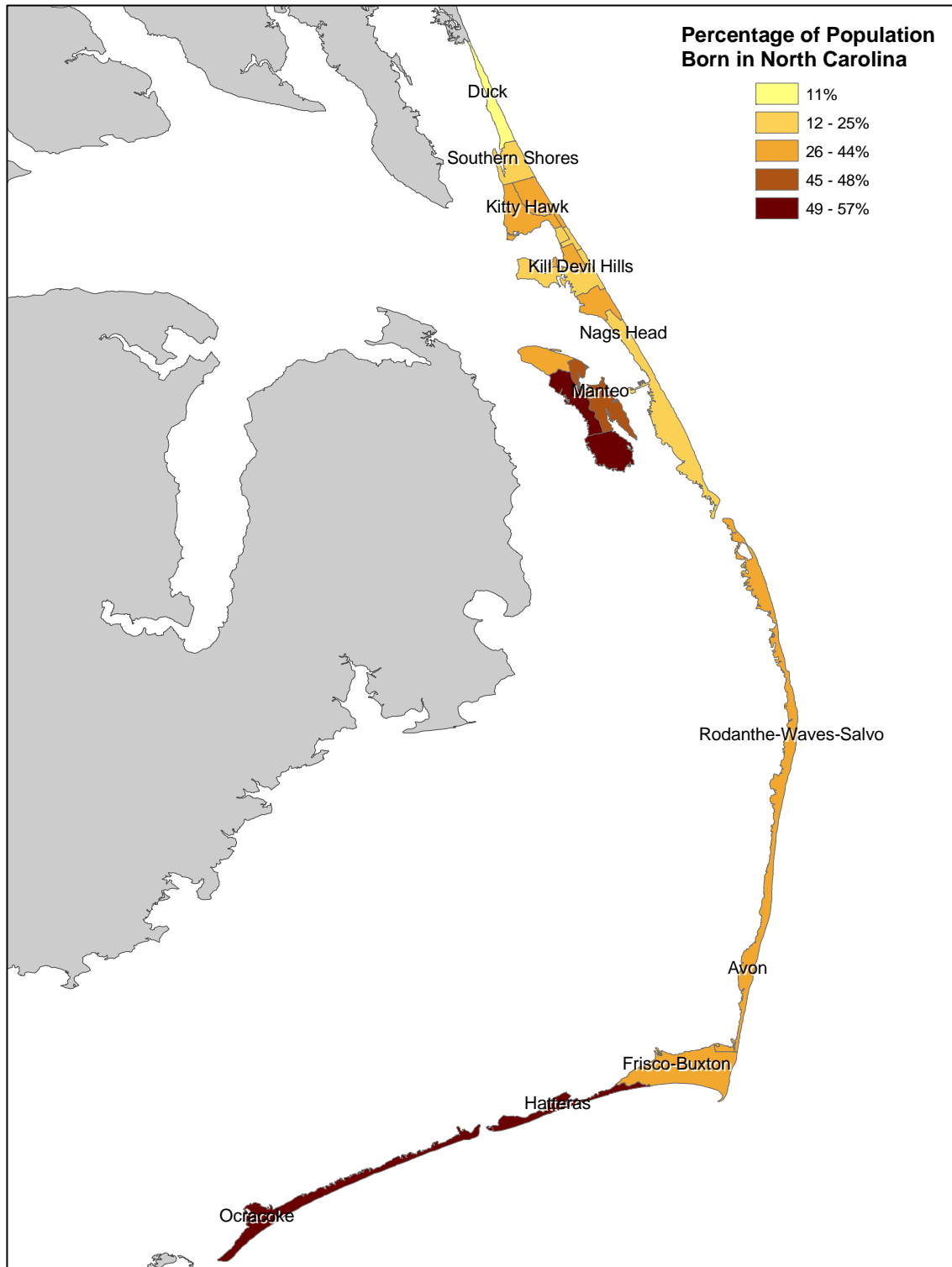
^d The 18 Dare County block groups in the ROI

^e The one Hyde County block group in the ROI

According to population projections published by the North Carolina Office of State Budget and Management's State Demographics unit, the state and Hyde County population trends are expected to continue into the foreseeable future, while Dare County is projected to lose residents. By 2029, the population in Dare County is projected to decrease to 26,053, a 13% reduction relative to 2000. The population of Hyde County is expected to fall further to 4,717, a 19% decrease relative to 2000 (Office of State Budget and Management North Carolina 2009).

Demographic and economic trends during the last three decades have contributed to growing differences in the population characteristics and income levels in the different areas of the ROI. The rate of change is especially rapid in northern Dare County, where a smaller percentage of residents were born in North Carolina, shown in figure 27.

In 1999, the areas within the ROI had a 13% greater per capita income than North Carolina as a whole, and 6% greater than the country as a whole (table 39). This distribution varies across the ROI. Ocracoke, southern Dare County, and portions of Roanoke Island all had a lower per capita income than the more densely populated block groups in the northern part of the ROI (figure 28).



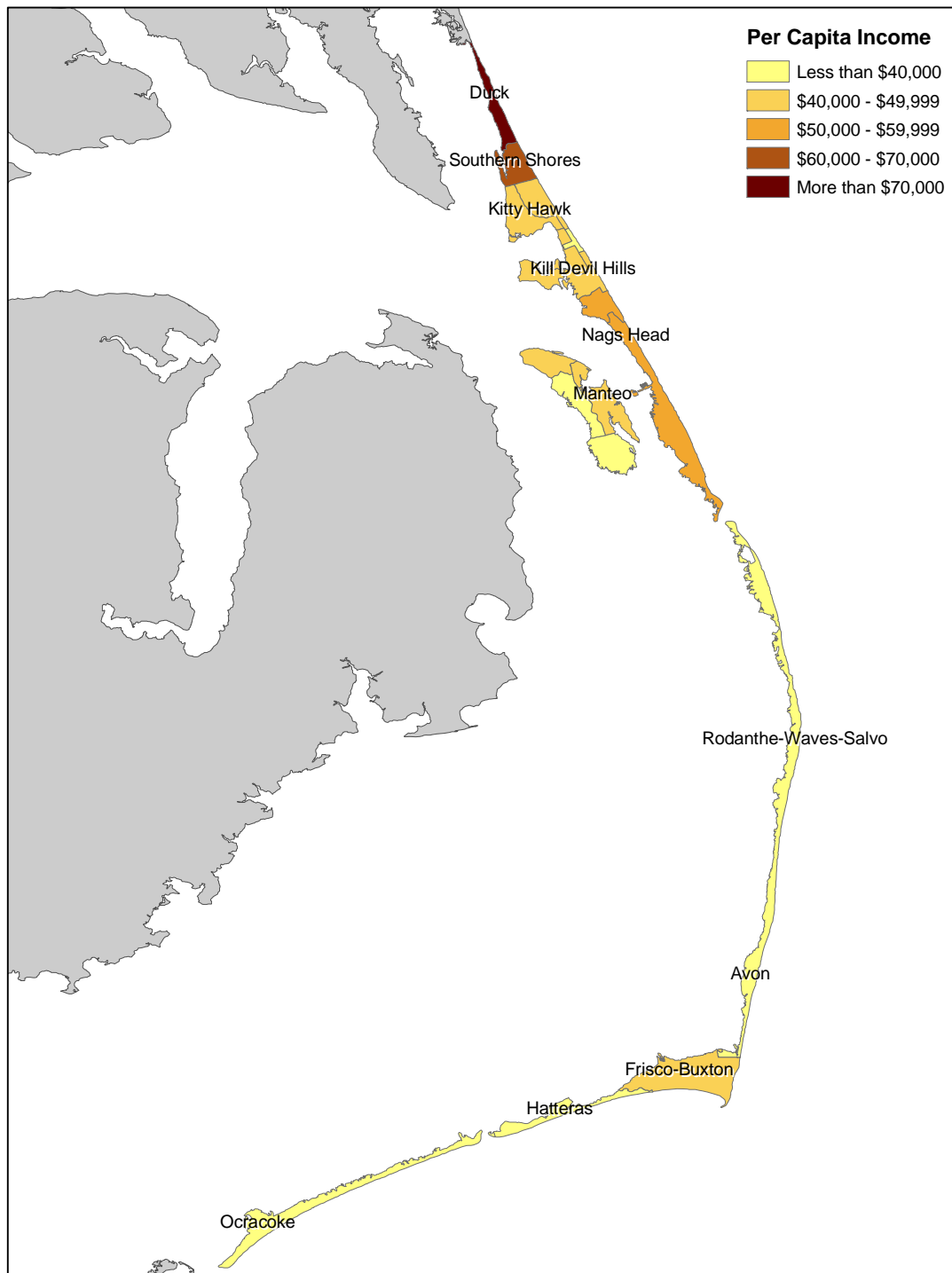
Source: U.S. Census Bureau 2000a

FIGURE 27. PERCENTAGE OF RESIDENTS BORN IN NORTH CAROLINA BY BLOCK GROUP, 2000

TABLE 39. EMPLOYMENT BY SECTOR, 2000

Industry	Number of Employees	Percentage			Difference	
		ROI	NC	US	ROI-NC	ROI-US
Construction	2,102	14%	8%	7%	5%	7%
Accommodation and food services	1,857	12%	6%	6%	6%	6%
Real estate, rental and leasing	1,078	7%	2%	2%	5%	5%
Retail trade	2,296	15%	12%	12%	3%	3%
Agriculture; forestry; fishing and hunting	491	3%	1%	1%	2%	2%
Public administration	992	6%	4%	5%	2%	2%
Arts; entertainment; and recreation	453	3%	1%	2%	2%	1%
Utilities	162	1%	1%	1%	0%	0%
Management of companies and enterprises	0	0%	0%	0%	0%	0%
Other services (except public administration)	714	5%	5%	5%	0%	0%
Mining	4	0%	0%	0%	0%	0%
Administrative and support and waste management services	432	3%	3%	3%	0%	-1%
Information	379	2%	2%	3%	0%	-1%
Wholesale trade	414	3%	3%	4%	-1%	-1%
Professional; scientific; and technical services	688	4%	5%	6%	0%	-1%
Transportation and warehousing	365	2%	4%	4%	-1%	-2%
Educational services	986	6%	8%	9%	-2%	-2%
Finance and insurance	365	2%	4%	5%	-2%	-3%
Health care and social assistance	890	6%	11%	11%	-5%	-5%
Manufacturing	764	5%	20%	14%	-15%	-9%

Source: U.S. Census Bureau 2000a



Source: U.S. Census Bureau 2000a

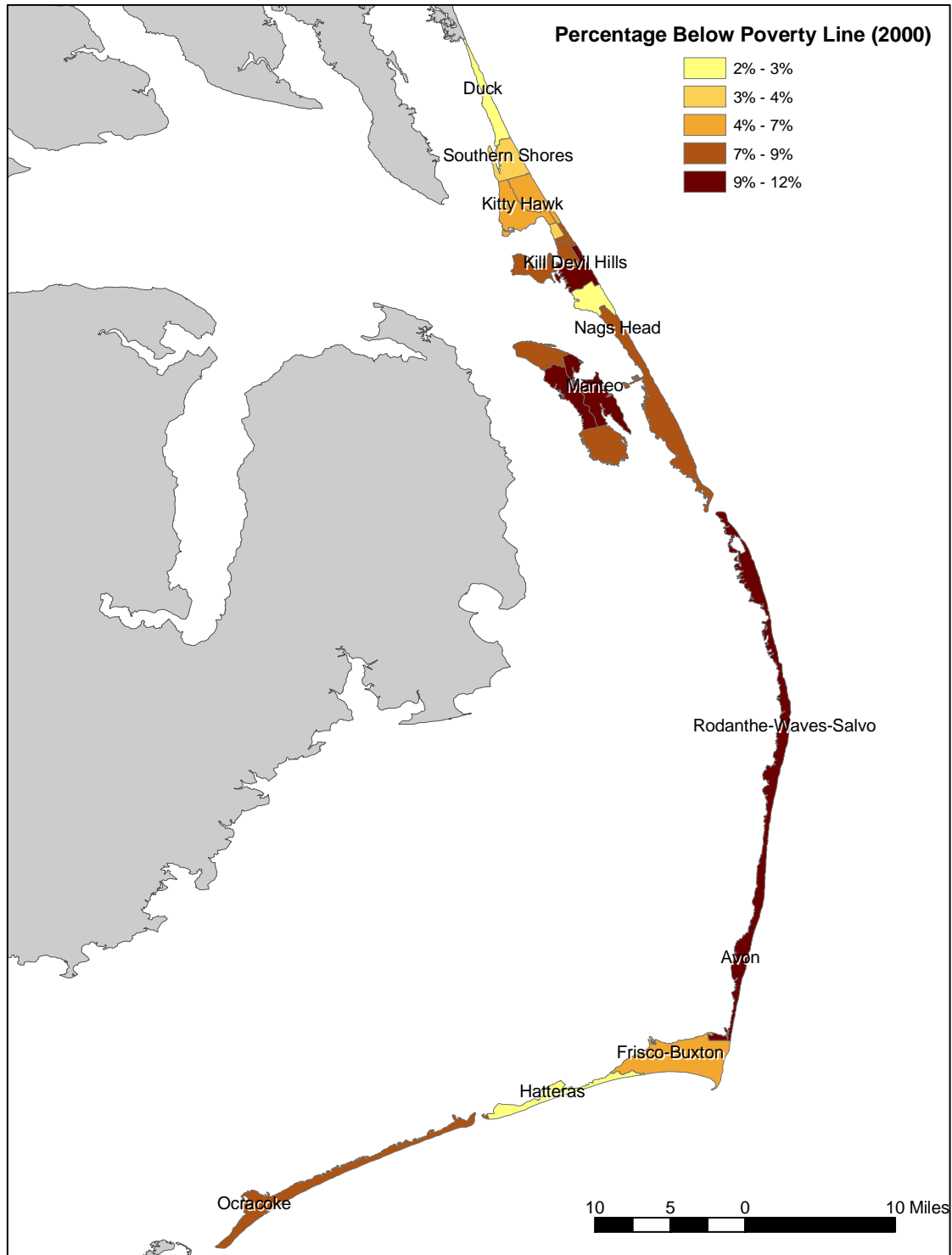
FIGURE 28. 1999 PER CAPITA INCOME BY BLOCK GROUP

In 2000, the ROI had a minority population of only 6% of the total (table 40). This is less than in North Carolina and the U.S. as a whole, which had 30% and 31% minority populations respectively. The ROI also had a lower percentage of individuals below the poverty level and a lower percentage of individuals without high school diplomas. The distribution of poverty rates by block groups is shown in figure 29.

TABLE 40. ENVIRONMENTAL JUSTICE STATISTICS, 2000

Geographic Area	Per Capita Income	Percent of Population		
		Minority	Below the Poverty Level	Without High School Diploma
United States	\$41,994	31%	12%	20%
North Carolina	\$39,184	30%	12%	22%
ROI	\$44,462	6%	8%	11%

Source: U.S. Census Bureau 2000a



Source: U.S. Census Bureau 2000a

FIGURE 29. PERCENTAGE OF POPULATION BELOW THE POVERTY LINE BY BLOCK GROUP, 2000

EMPLOYMENT

As noted above, with the exception of the northern portion of Dare County, the ROI is primarily rural. There are no military bases, major federal facilities, state prisons, commercial airports, or four-year colleges in the ROI.

Within the ROI, much of the employment caters to tourists visiting the area. The sectors of construction; accommodation and food services; real estate, rental and leasing; and the retail trade accounted for 47.52% of the total employment within the ROI and 49.98% within the Hatteras block groups in 2000. These sectors only account for 26.50% of employment in the United States as a whole (table 39).

The majority of businesses within the ROI are located in the northern three zip codes of Dare County, encompassing the towns of Duck, Southern Shores, Kitty Hawk, Kill Devil Hills, and Nags Head. This area accounts for 64.8% of establishments and 69.6% of employment within the ROI in 2007 and has seen robust employment growth since 2000. Other areas of the ROI have experienced smaller gains or reductions in employment (figure 30). In 2007, Hatteras and Ocracoke islands contained 13.1% of the employees within the ROI. Small businesses are especially important within the ROI, with 1,713 of 2,104 establishments (81.42%) in the ROI operating with fewer than 10 employees in 2007, compared to 73.37% nationwide (Population Division, U.S. Census Bureau 2009).

In addition to these employees, Dare and Hyde counties had 5,764 of self-employed individuals in 2007. The construction, real estate, rental and leasing, and agriculture, forestry, fishing and hunting (of which 61% are commercial fishermen) industries comprise 49% of all nonemployers⁴ in the two counties (table 41).

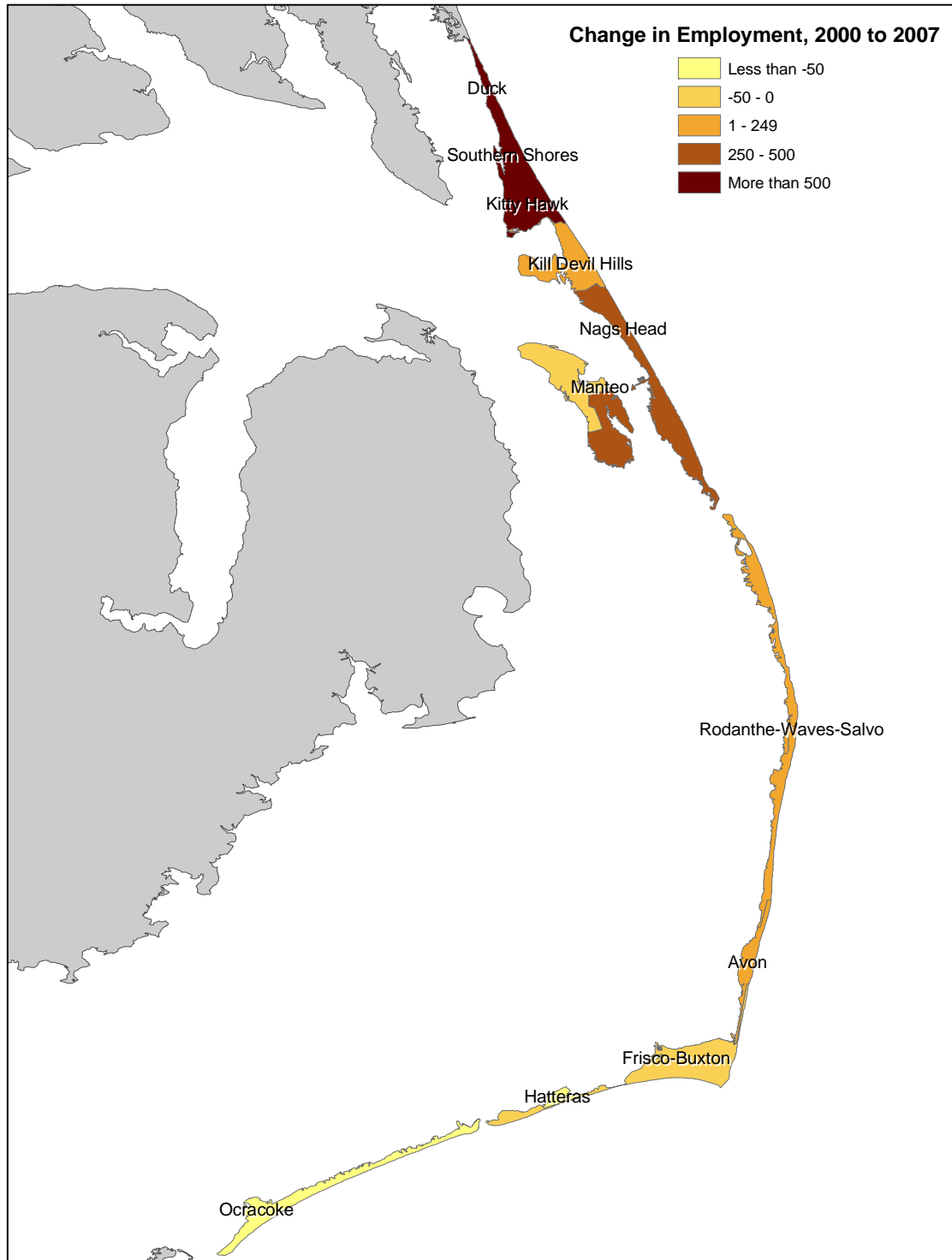
UNEMPLOYMENT

In 2008, an average of 6.5% of the civilian labor force in Dare County was unemployed (1,437 individuals) and 7.1% in Hyde County (187 individuals, compared with an unemployment rate of 6.3% for North Carolina as a whole) (table 42). For June 2009, the North Carolina (seasonally unadjusted) unemployment rate has risen to 11.1%, higher than Dare and Hyde counties (6.7% and 5.5%, respectively).

Within Dare County, establishments in construction, manufacturing, and retail trade industries accounted for the majority of private job losses from 2007 to 2008. Within the retail trade, job losses in furniture and home furnishings stores; building material and garden equipment and supplies dealers; food and beverage stores; and health and personal care stores were partially offset by employment gains in clothing and clothing accessories stores; gasoline stations; and sporting goods, hobby, and musical instrument stores.

Unemployment rates in North Carolina, Dare, and Hyde counties remain elevated relative to their 2004–2006 average in the summer of 2009. Dare and Hyde counties have recovered slightly since the winter of 2008/2009 (figure 31).

⁴ From <http://www.census.gov/econ/nonemployer/intro.htm> : “Nonemployers are typically self-employed individuals operating very small businesses, which may or may not be the owner's principal source of income...Data are primarily comprised of sole proprietorship businesses filing IRS Form 1040, Schedule C, although some of the data is derived from filers of partnership and corporation tax returns that report no paid employees.”



Sources: U.S. Census Bureau 2002

FIGURE 30. CHANGE IN EMPLOYMENT BY ZIP CODE

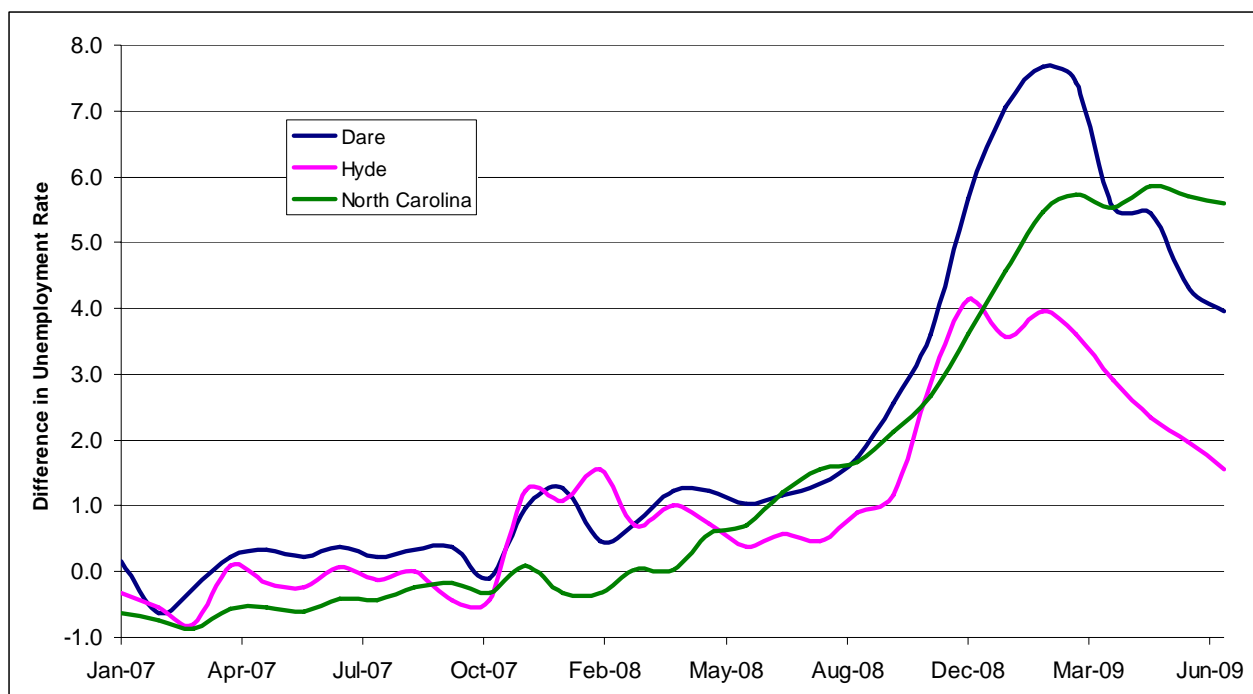
TABLE 41. NONEMPLOYERS BY INDUSTRY, 2007

	Number of Nonemployers	Percentage			Difference	
Industry	Dare and Hyde Counties	Dare and Hyde Counties	NC	US	Counties - NC	Counties - US
Agriculture, forestry, fishing and hunting	667	12%	1%	1%	10%	10%
Construction	1,262	22%	16%	12%	6%	10%
Real estate and rental and leasing	912	16%	11%	11%	5%	5%
Administrative and Support and Waste Management and Remediation Services	529	9%	10%	8%	-1%	1%
Accommodation and food services	109	2%	1%	1%	1%	0%
Utilities	3	0%	0%	0%	0%	0%
Manufacturing	>67	1%	2%	2%	0%	0%
Mining, quarrying, and oil and gas extraction	0	0%	0%	0%	0%	0%
Wholesale trade	72	1%	2%	2%	0%	-1%
Information	>37	1%	1%	1%	-1%	-1%
Educational services	80	1%	2%	2%	-1%	-1%
Arts, entertainment, and recreation	234	4%	4%	5%	0%	-1%
Finance and insurance	>99	2%	3%	4%	-1%	-2%
Other services (except public administration)	611	11%	15%	14%	-5%	-3%
Transportation and warehousing	>86	1%	4%	5%	-3%	-3%
Retail trade	309	5%	9%	9%	-4%	-4%
Health care and social assistance	195	3%	6%	8%	-3%	-5%
Professional, scientific, and technical services	461	8%	12%	14%	-4%	-6%
Total for all sectors	5,764	100%	100%	100%		

TABLE 42. EMPLOYMENT CHARACTERISTICS, 2008

	North Carolina	Dare County	Hyde County
Labor Force	4,543,754	22,087	2,644
Employment	4,256,815	20,650	2,457
Unemployment	286,939	1,437	187
Unemployment Rate	6.3%	6.5%	7.1%

Source: Bureau of Labor Statistics 2009



Source: Bureau of Labor Statistics 2009

FIGURE 31. DIFFERENCE IN UNEMPLOYMENT RATE FROM 2004–2006 MONTHLY AVERAGE

TOURISM CONTRIBUTIONS TO THE ECONOMY

The economy of the ROI is largely driven by the region's tourist draw, mainly during the summer months. As estimated by the North Carolina Department of Commerce, travel expenditures in Dare County have increased faster than those for the state as a whole (table 43); however, travel expenditures in Hyde County have decreased since 2000. In 2008, the Department of Commerce estimated that tourism was responsible for 11,250 jobs in Dare County and 370 jobs in Hyde County (North Carolina Department of Commerce 2009).

TABLE 43. ESTIMATED DOMESTIC TRAVEL EXPENDITURES (\$2008 MILLIONS)

Geographic Area	1991	2000	2008	2000 to 2008 CAGR
North Carolina	\$11,092.58	\$15,089.89	\$16,864.60	1.6%
Dare County	\$377.40	\$624.14	\$777.41	3.2%
Hyde County	\$17.93	\$29.58	\$28.11	-0.7%

Source: North Carolina Department of Commerce 2009

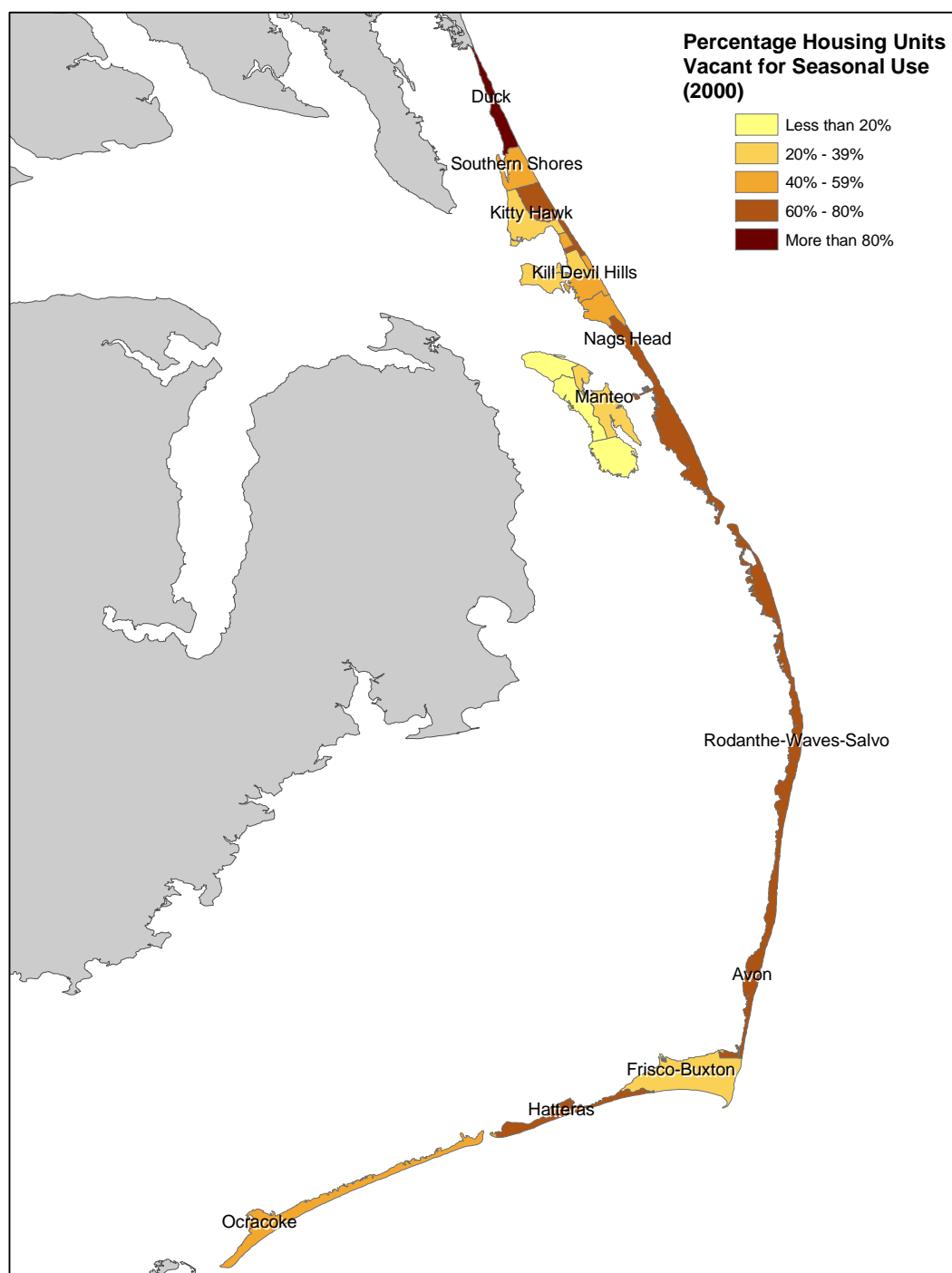
Housing

In 2000, the ROI had a total of 26,891 housing units, with 97% of these located in the Dare County block groups. The ROI's housing is roughly 54% urban and 46% rural, with 100% of the urban housing units being located in Dare County block groups. Over 50% of the housing units in the ROI are for seasonal, recreational, or occasional use (table 44). The distribution of vacant housing units for seasonal, recreational, or occasional use is shown in figure 32. This is further evidence of the importance of tourism's contributions to the region's economy.

TABLE 44. HOUSING UNIT STATISTICS, 2000

	United States	North Carolina	ROI
Total	115,904,641	3,523,944	26,891
Urban	89,966,555	2,080,729	14,578
% of Total	78%	59%	54%
Occupied	105,480,101	3,132,013	12,588
Vacant	10,424,540	391,931	14,303
For seasonal, recreational, or occasional use	3,872,468	147,087	13,771
% of Total	3%	4%	51%

Source: U.S. Census Bureau 2000a



Source: U.S. Census Bureau 2000a

FIGURE 32. PERCENTAGE OF HOUSING UNITS VACANT FOR SEASONAL, RECREATIONAL, OR OCCASIONAL USE BY BLOCK GROUP, 2000

Since 2000, Dare County has experienced a 21% increase in the number of housing units, relative to a 14% change state wide (table 45). However, in October of 2008, Dare County had the fifth highest foreclosure rate of any county in North Carolina, with one in every 679 housing units in foreclosure (RealtyTrac.com 2008).

TABLE 45. CHANGE IN HOUSING UNITS

Geographic Area	2000	2008	Percent Change 2000–2008
United States	115,904,641	129,065,264	11%
North Carolina	3,523,944	4,201,378	19%
Dare County	26,671	32,749	21%
Hyde County	3,302	3,495	5%

Source: Population Division, U.S. Census Bureau 2009b, 2009c

Quality of Life

Quality of life encompasses those attributes of resources (man-made or naturally occurring) of a region that contribute to the well-being of its residents. The relative importance of these attributes to a person's well-being is subjective (e.g., some individuals consider outdoor recreational opportunities essential to their well-being, others require access to cultural institutions essential to their quality of life, and still others may hold public safety as their primary quality-of-life concern). Quality-of-life analyses typically address issues relating to potential impacts of the proposed action on the availability of public services and leisure activities that contribute to the quality of life of an affected ROI's inhabitants. For the purpose of this study, the quality-of-life affected environment includes the natural environment, public schools, law enforcement, medical facilities, and fire protection services.

The natural environment, including beaches and wildlife, provide the primary basis for quality of life on the Outer Banks. As discussed above, beach-related tourism drives the economy of the area. Local residents also receive significant recreational benefits from the area's natural assets. In addition to the Seashore, the ROI includes Jockey's Ridge State Park and Pea Island NWR (Outer Banks Chamber of Commerce 2008). There are also public beaches, marinas, piers, and other recreational outlets. Two categories of outdoor recreation pertinent to the assessment of alternative management plans, recreational fishing and bird watching, are discussed further below using data from the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

North Carolina is the sixth most popular state for fishing, with an estimated 1,263,000 residents and nonresidents participating in 2006 (U.S. Department of the Interior et al. 2008). Recreational fishing is a significant part of North Carolina's economy, attracting spending from both local and out-of-state anglers. Approximately 519,000 anglers in North Carolina engaged in saltwater fishing in 2006 (table 46). Expenditures from fishing trips totaled an estimated \$692,977,000 in 2006, with \$450,313,000 coming from saltwater anglers. While only 40% of anglers report participating in saltwater fishing, nearly 65% of all trip-related expenditures go toward this activity.

TABLE 46. RECREATIONAL FISHING IN NORTH CAROLINA, BY RESIDENTS AND NONRESIDENTS

	Resident	Nonresident	Total
Total participants	868,000	395,000	1,263,000
% Total participants	69%	31%	100%
# Saltwater	253,000	266,000	519,000
% Saltwater	49%	51%	100%
Total trip-related expenditures	\$395,296,000	\$297,681,000	\$692,977,000
Average trip-related expenditures per participant	\$456	\$753	\$549

Source: U.S. Department of the Interior et al. 2008

Nonresident angler expenditures are important to regional economic impacts, as they represent an addition to area wealth rather than a change in the mix of spending by residents. Nonresidents make up only 31% of all anglers in North Carolina but comprise 51% of saltwater anglers. Nonresidents, who often must pay greater lodging and transportation fees, spend an average of 65% more than residents for trip-related expenditures over all types of fishing.

Separate expenditure data for residents and nonresidents on saltwater fishing were not available. However, trip-related expenditures (including food, lodging, transportation, ice, bait, guide and usage fees, rental equipment, and other items, but excluding the cost of purchased equipment) are much higher for saltwater anglers than for all anglers combined, averaging \$754 per person for both residents and nonresidents, compared to \$549 per person for all fishing. Saltwater fishermen spend more per angler on food and lodging, transportation, and other trip costs, but spend proportionally less on transportation and slightly more on food, lodging, and other costs. Overall, saltwater fishing such as that on Cape Hatteras attracted a greater percentage of out-of-state residents and averaged 56% greater trip-related expenditures than all types of fishing combined.

Dare and Hyde counties sold 40% of coastal recreational fishing licenses sold within the eight coastal counties in North Carolina and 18% of all coastal recreational fishing licenses sold in 2008. Dare County ranks first among all North Carolina counties in coastal recreational fishing license sales (table 47).

Among all states, North Carolina ranks nineteenth for number of wildlife watchers, with 2,641,000 participants in 2006. Wildlife watching is classified as activities for which wildlife watching is the primary purpose, and does not include trips to zoos or museums or accidental observation of wildlife. Wildlife watchers may be feeding, photographing, or observing wildlife. Approximately 15% of wildlife watchers in North Carolina were nonresidents in 2006.

TABLE 47. NUMBER OF COASTAL RECREATIONAL FISHING LICENSES SOLD BY NORTH CAROLINA COUNTY OF SALE (LOCATION WHERE LICENSE SALES AGENT RESIDES), EXCLUDING BLANKET COASTAL RECREATIONAL FISHING LICENSES, BY CALENDAR YEAR

County	2007	2008
Dare	93,225	82,635
Hyde	6,322	5,358
Brunswick	38,721	33,303
Carteret	46,813	38,456
Currituck	2,660	2,435
New Hanover	34,556	28,558
Onslow	16,098	15,185
Pender	17,462	14,733
Total	469,521	411,886

Source: NCWRC 2008a

Away-from-home wildlife watching is defined as wildlife observation occurring at least one mile away from home. Table 48 presents information about away-from-home wildlife watching in North Carolina. Among away-from-home wildlife watchers in North Carolina, approximately 56% are nonresidents. Away-from-home bird watchers made up 620,000 or 90% of all away-from-home wildlife watchers. Of these, 50% reported watching “other waterbirds.” This category includes shorebirds, cranes, herons, and all other waterbirds not classified as waterfowl and serves as the best representation of birds on Cape Hatteras. Among wildlife watchers observing “other waterbirds,” nonresidents made up 69% of participants. Thus, wildlife watching for birds like those on Cape Hatteras is far more likely to be participated in by nonresidents than other wildlife watching.

TABLE 48. AWAY-FROM-HOME WILDLIFE WATCHING IN NORTH CAROLINA, BY RESIDENT AND NONRESIDENT

	Resident	Nonresident	Total
Total away-from-home participants	300,000	386,000	686,000
Percent of total participants	44%	56%	100%
Total away-from-home birders	284,000	336,000	620,000
Total birders	46%	54%	100%
Away-from-home “other waterbird” observers	95,000	215,000	310,000
Percent of “other waterbird” observers	31%	69%	100%
Total trip-related expenditures	\$84,245,000	\$162,662,000	\$246,906,000
Average trip-related expenditure per participant	\$281	\$421	\$360

Source: U.S. Department of the Interior et al. 2008

Wildlife watchers in North Carolina spent a total of \$246,906,000 in trip-related costs in 2006. This number includes food, lodging, transportation, rented equipment, and guide or permit fees, but not expenditures on purchased equipment. Away-from-home resident wildlife watchers spent an average of

\$281 per person per trip, while nonresident participants spent \$421. Although separate expenditure data for other waterbird watchers were not available, other waterbirds such as shorebirds are more likely to attract out-of-state wildlife watchers, who then spend on average 50% more than resident wildlife watchers.

Preservation and Nonuse Values

Preservation or nonuse impacts represent a category of values held by people independent of their use of the resources that also includes existence value and bequest value. The main assumption underlying the concept of nonuse values is that individuals' welfare can be enhanced simply by the *knowledge* that specific ecosystems are being protected or improved. As the name implies, individuals receive these types of services without any specific use of or interaction with the ecosystems. For example, nonuse values from preserving a natural area may come from the knowledge that future generations are more likely to experience and enjoy the area (i.e., "bequest values").

Economic theory recognizes that individuals can hold value for the Cape Hatteras National Seashore and the ecosystems contained within its boundaries because they want future generations to enjoy the area, because they value the protected species supported by the area, or because they feel the natural communities contained within the National Seashore have intrinsic value separate from the value they provide to visitors.

Measuring values for these "nonuse" services is more difficult and involves more uncertainty than for recreational and aesthetic services. Nevertheless, a variety of studies demonstrate that nonuse values exist and may be quite large depending on the resource in question. Loomis and White (1996) synthesized key results from 20 threatened and endangered species valuation studies using meta-analysis methods. They were able to identify variables that explain the observed variation in estimated willingness-to-pay (WTP) values for threatened and endangered species and examine how per-household benefit estimates compare with cost estimates for protection. In their meta-analysis, Loomis and White reviewed 20 contingent value studies coming from both the published and gray literature. They found that annual WTP estimates range from a low of \$8 for the Striped Shiner fish to a high of \$124 for the Northern Spotted Owl. Using these 20 studies, they applied regression based methods to combine valuation findings and to identify statistically significant determinants of estimated values for threatened and endangered species. Some of their key findings include statistically significant effects on WTP of (1) the size of the change in a species population; (2) whether those expressing values for the species are users of the affected resource; and (3) whether the species is a marine mammal or bird. Loomis and White also used the meta-analysis results to conduct a rough benefit-cost analysis. They noted that even in supposedly "high cost" cases, such as the Northern Spotted Owl, costs per household are relatively low and are well below the benefits found in WTP studies.

SEASHORE OPERATIONS AND MANAGEMENT

Management of ORV use at the Seashore, and implementation of the related administrative activities and field operations, involves all five NPS operational divisions, as well as the Superintendent's Office (Park Management). The baseline for Seashore operations and management will be discussed both in terms of pre-consent decree (under the Interim Strategy) (before 2008) and post-consent decree (2008).

Management and Administration. Management and administrative staff members at the Seashore have a variety of responsibilities related to ORV management, including compiling and sending out weekly access and resource updates, managing payroll for the Seashore, fielding questions from visitors regarding ORV management, fulfilling human resources functions and supervisory roles, and providing information technology and other technical support, in addition to the superintendent's role in ORV

management. Administrative costs address the need to provide technical assistance to the approximately 25 field and administrative staff members associated with ORV management. Administrative support related to ORV management required approximately 4.75 full-time equivalent (FTE) (\$428,750) under the Interim Strategy. This number increased to 5.35 (\$480,950) plus approximately \$3,000 of direct materials costs (total cost \$483,950) in 2008 with the implementation of measures under the consent decree. The increased level of effort for administration is primarily related to the increased need for information technology support as the use of technology was increased to inform the public about areas open for ORV use or closed for species protection.

Visitor Protection. Law enforcement officers at the Seashore are responsible for enforcing all applicable regulations, including those related to ORV and species management. In relation to ORV management, duties of law enforcement include patrolling the Seashore, as well as providing on-the-spot interpretation to visitors as to the reason for certain ORV regulations and species management efforts. Other duties include responding to violations and conducting investigations. Support (or materials) costs for these Seashore staff members include vehicles, fuel, training, travel, field supplies, and radio support. Visitor protection support related to ORV management required approximately 13 FTE (\$1,047,500) and \$100,000 in support costs (total cost approximately \$1,147,500) under the Interim Strategy. This number increased to 16.5 FTE (\$1,321,500) and \$160,000 in support costs (total cost approximately \$1,481,000) in 2008 with the implementation of measures under the consent decree. This increased level of effort for law enforcement is primarily related to the increased amount of time patrol rangers are devoting to ORV management, such as addressing the night-driving restrictions under the consent decree.

Resources Management. Resources management staff members at the Seashore are responsible for all monitoring and surveying of species at the Seashore, as well as establishing and changing the required resource closures once state- or federally listed species are found at the Seashore. This staff includes supervisory roles as well as full- and part-time field staff to implement species management measures. Support (or materials) costs for these Seashore staff members include vehicles (such as four-wheel drive vehicles, ATVs/Utility Terrain Vehicles [UTVs]), fuel, training, field supplies (such as signs, string, flagging, and rope), monitoring supplies, and travel. Resources management efforts at the Seashore required approximately 9.5 FTE (\$423,500) and \$85,000 in support costs (total cost approximately \$508,500) under the Interim Strategy. This number increased to 15 FTE (\$778,000) and \$35,000 in support costs (total cost approximately \$813,000) in 2008 with the implementation of measures under the consent decree. This increased level of effort for resource management staff is primarily related to the need for additional field staff and Geographic Information Systems (GIS) staff to address the closure requirements and to be able to provide weekly reports and mapping of the closures to keep the public informed of their activities. Resources management staff is also responsible for preparation of all required annual reports for protected species, research on protected species or factors that affect the species, predator control activities, and coordination of regulatory and scientific activities with other entities such as the USFWS and NCWRC.

Interpretation. Interpretation staff members at the Seashore are responsible for providing information programs to Seashore visitors, specifically on the subject of species management. Support (or materials) costs for these Seashore staff include printing newsletters and brochures, and obtaining materials for visitor programs. Interpretation efforts at the Seashore required approximately 1.5 FTE (\$58,500) and \$10,000 in support costs (total cost approximately \$68,500) under the Interim Strategy. This number increased to 3.0 FTE (\$181,500) and \$12,000 in support costs (total cost approximately \$193,000) in 2008 with the implementation of measures under the consent decree. This increased level of effort for interpretation staff is primarily related to the increased level of programs and information provided to the public regarding areas available for ORV use, as well as providing information about why certain ORV and species management measures are being implemented at the Seashore. With the increase in programs, the number of staff members devoted to ORV management issues has also increased.

Facility Management. Facility management staff members at the Seashore are responsible for providing maintenance and repairs for beach ramps and parking lots, as well as installation of informational signs along the beach. This division of the Seashore is also responsible for maintaining and repairing the vehicles used by all other divisions of the Seashore, including those used for law enforcement and resource management patrols. Support (or materials) costs for these Seashore staff members include ramp fill material, vehicle parts, and vehicle maintenance supplies. Facility management efforts required approximately 0.6 FTE (\$46,500) and \$10,000 in support costs (total cost approximately 56,500) under the Interim Strategy. This number increased to 3.6 FTE (\$158,600) and \$20,000 in support costs (total cost approximately \$178,600) in 2008 under the implementation of the consent decree. This increased level of effort for facility management staff is primarily related to the need to increase the number of maintenance workers and laborers. The increase in both law enforcement and resource management staff results in an increased number of vehicles that need to be maintained. The additional signage and educational requirements require more staff and effort to install, and an increased level of effort.

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Chapter 4:

Environmental Consequences

CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

This “Environmental Consequences” chapter analyzes both beneficial and adverse impacts that would result from implementing any of the alternatives considered in this long-term ORV plan/EIS. This chapter also includes a summary of laws and policies relevant to each impact topic, definitions of impact thresholds (e.g., negligible, minor, moderate, and major), methods used to analyze impacts, and the analysis methods used for determining cumulative impacts. As required by the CEQ regulations implementing NEPA, a summary of the environmental consequences for each alternative is provided in table 13, which can be found at the end of chapter 2. The resource topics presented in this chapter, and the organization of the topics, correspond to the resource discussions contained in “Chapter 3: Affected Environment.”

SUMMARY OF LAWS AND POLICIES

Three overarching environmental protection laws and their implementing policies guide the actions of the NPS in the management of the parks and their resources—the *Organic Act of 1916*, NEPA and its implementing regulations, and NPOMA. For a complete discussion of these and other guiding authorities, refer to the section titled “Related Laws, Policies, Plans, and Constraints” in “Chapter 1: Purpose of and Need for Action.” These guiding authorities are briefly described below.

The *Organic Act of 1916* (16 USC 1), as amended and supplemented, commits the NPS to making informed decisions that perpetuate the conservation and protection of park resources, leaving them unimpaired for the benefit and enjoyment of future generations.

NEPA is implemented through regulations of the CEQ (40 CFR 1500–1508). The NPS has, in turn, adopted procedures to comply with these requirements, as found in Director’s Order 12 (NPS 2001a) and its accompanying handbook.

NPOMA (16 USC 5901 et seq.) underscores the NEPA provisions in that both acts are fundamental to park management decisions. Both acts provide direction for connecting resource management decisions to the analysis of impacts and communicating the impacts of those decisions to the public, using appropriate technical and scientific information. Both acts also recognize that such data may not be readily available, and they provide options for resource impact analysis should this be the case.

Section 4.5 of Director’s Order 12 adds to this guidance by stating, “when it is not possible to modify alternatives to eliminate an activity with unknown or uncertain potential impacts, and such information is essential to making a well-reasoned decision, the National Park Service will follow the provisions of the CEQ regulations (40 CFR 1502.22).” In summary, the NPS must state in an environmental assessment or impact statement (1) whether such information is incomplete or unavailable; (2) the relevance of the incomplete or unavailable information to evaluating reasonably foreseeable significant adverse impacts on the human environment; (3) a summary of existing credible scientific adverse impacts that is relevant to evaluating the reasonably foreseeable significant adverse impacts; and (4) an evaluation of such impacts based on theoretical approaches or research methods generally accepted in the scientific community. Collectively, these guiding regulations provide a framework and process for evaluating the impacts of the alternatives considered in this plan/EIS.

GENERAL METHODOLOGY FOR ESTABLISHING IMPACT THRESHOLDS AND MEASURING EFFECTS BY RESOURCE

The following elements were used in the general approach for establishing impact thresholds and measuring the effects of the alternatives on each resource category:

- General analysis methods as described in guiding regulations, including the context and duration of environmental effects.
- Basic assumptions used to formulate the specific methods used in this analysis.
- Thresholds used to define the level of impact resulting from each alternative.
- Methods used to evaluate the cumulative impacts of each alternative in combination with unrelated factors or actions affecting Seashore resources.
- Methods and thresholds used to determine if impairment of specific resources would occur under any alternative.

These elements are described in the following sections.

GENERAL ANALYSIS METHODS

The analysis of impacts follows CEQ guidelines and Director's Order 12 procedures (NPS 2001a) and incorporates the best available scientific literature applicable to the region and setting, the resource evaluated, and the actions considered in the alternatives.

For each resource topic addressed in this chapter, the applicable analysis methods are discussed, including assumptions and impact intensity thresholds.

ASSUMPTIONS

Duration and Type of Impacts

The following assumptions are used for all impact topics (the terms "impact" and "effect" are used interchangeably throughout this document):

- Short-term: Impacts are temporary (i.e., they occur for a matter of hours up to weeks at a time) without lasting effects. Examples include impacts from the ability of a visitor to access a certain area during a resource closure event.
- Long-term: Impacts are continuous throughout the life of the plan, with potentially permanent effects. Examples include ongoing impacts to Seashore management and operations.
- Direct: Impacts would occur as a direct result of ORV management actions.
- Indirect: Impacts would occur from ORV management actions but would occur later in time or farther in distance from the action.
- Beneficial: A positive change in the condition or appearance of the resource or a change that moves the resource toward a desired condition.
- Adverse: A change that moves the resource away from a desired condition or detracts from its appearance or condition.

Impacts of Climate Change

Studies predict that coastal barrier islands and their natural and cultural resources will be affected by sea level rise and potentially stronger storm events resulting from climate change. Relative sea level is currently rising in northeastern North Carolina at a rate of 16 to 18 inches per century, a substantially higher rate than the 7 inches per century one hundred years ago and the 3 inches per century rate 200 years ago. The current rate will likely continue to increase into the future as the climate continues to warm (Riggs et al. 2008). Various alternatives for human adaption to changing conditions on the barrier islands have been proposed (Riggs et al. 2008), but much of government, business, organization and individual response to the challenges of climate change is undetermined. Future threats of deterioration, segmentation, and collapse of the barrier islands along the North Carolina Outer Banks coast as a result of increased sea-level rise and storm activity have been described (Culver et al. 2007, 2008; Riggs and Ames 2003; Riggs et al. 2009). Given the complex interactions among multiple factors and the uncertainties over human response to climate change on the barrier islands, the level of uncertainty about possible effects on specific resources or impact topics over the 10–15 year planning period makes analysis for impacts of climate change in this document speculative. It is assumed that management that would build resiliency into the Seashore's wildlife and plant resources (e.g., management measures to allow increases in populations of protected species during the next 10–15 years) would be beneficial to those resources as they adapt to changed conditions over future decades.

Impact Thresholds

Determining impact thresholds is a key component in applying NPS *Management Policies 2006* and Director's Order 12. These thresholds provide the reader with an idea of the intensity of a given impact on a specific topic. The impact threshold is determined primarily by comparing the effect to a relevant standard based on applicable or relevant/appropriate regulations or guidance, scientific literature and research, or best professional judgment. Because definitions of intensity vary by impact topic, intensity definitions are provided separately for each impact topic analyzed in this document. Intensity definitions are provided throughout the analysis for negligible, minor, moderate, and major impacts. Except for the threatened and endangered species topic, the impact thresholds are defined for adverse impacts, and beneficial impacts are addressed qualitatively. For endangered and threatened species, both beneficial and adverse impacts are qualified to facilitate Section 7 compliance.

CUMULATIVE IMPACTS

The CEQ regulations to implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for all alternatives, including the no-action alternatives.

Cumulative impacts were determined by combining the impacts of the alternative being considered with other past, present, and reasonably foreseeable future actions. Therefore, it was necessary to identify other ongoing or reasonably foreseeable future projects and plans at the Seashore and, if applicable, the surrounding region. Table 49 summarizes the actions that could affect the various resources at the Seashore. These actions are described in more detail in the “Related Policies, Laws, Plans, and Actions” section of this document (see “Chapter 1: Purpose of and Need for Action”). Recreational use, past, present, and future, is considered as an integral part of the action alternatives and is, therefore, not addressed within the cumulative impact scenario.

The analysis of cumulative effects was accomplished using four steps:

Step 1—Resources Affected. Fully identify resources affected by any of the alternatives.

Step 2—Boundaries. Identify an appropriate spatial and temporal boundary for each resource.

Step 3—Cumulative Action Scenario. Determine which actions to include with each resource.

Step 4—Cumulative Impact Analysis. Summarize the cumulative impact of the proposed action plus the other actions affecting the resource in question, defining context, intensity, duration and timing; defining thresholds, methodology, etc.

TABLE 49. CUMULATIVE IMPACT SCENARIO

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Wetlands and floodplains	Seashore boundary, plus adjacent non-NPS lands on Bodie, Hatteras, and Ocracoke islands	Oregon Inlet dredging Storms and other weather events County Land Use Development Plan for Dare and Hyde counties Hurricane recovery Resource Management Plan Berm construction under the CCC and subsequent maintenance Continued maintenance of NC-12 and berms	Same as past actions	Same as present actions, plus NC-12 improvements on Bodie Island Bonner Bridge replacement
Federally listed threatened, or endangered species	Specific to species as identified in USFWS recovery plans (piping plover, sea turtles) or based on habitat range (seabeach amaranth)	Oregon Inlet dredging Storms and other weather events County Land Use Development Plan for Dare and Hyde counties Hurricane recovery Resource Management Plan Berm construction under the CCC and subsequent maintenance Continued maintenance of NC-12 and berms Long-range Interpretive Plan Previous attempts to complete ORV plans Concession permits/operations Species research efforts USFWS species recovery plans Commercial fishing	Same as past actions, plus Predator Management Plan (under development)	Same as present actions, plus NC-12 improvements on Bodie Island Bonner Bridge replacement Development of Cape Lookout National Seashore ORV Management Plan/EIS Revision of the Cape Hatteras General Management Plan Revision of the Land Use Development Plan for Dare County

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
State-listed or special status species	North Carolina populations	Same as rare, unique, threatened, or endangered species	Same as rare, unique, threatened, or endangered species	Same as rare, unique, threatened, or endangered species
Wildlife and wildlife habitat (birds, invertebrates)	Seashore boundary, plus adjacent non-NPS lands on Bodie, Hatteras, and Ocracoke islands	Same as rare, unique, threatened, or endangered species	Same as rare, unique, threatened, or endangered species	Same as rare, unique, threatened, or endangered species
Soundscapes	Seashore boundary	Oregon Inlet dredging Storms and other weather events Continued maintenance of NC-12 and berms	Same as past actions, plus Increased vehicle traffic and village events Designation of Outer Banks Scenic Byway	Same as present actions, plus: Bonner Bridge replacement NC-12 improvements on Bodie Island Potential for military training operations, overflights
Visitor use and experience	Seashore boundary	Oregon Inlet dredging Storms and other weather events Hurricane recovery Resource Management Plan Previous attempts to complete ORV plans Continued maintenance of NC-12 and berms General Management Plan Long-Range Interpretive Plan Commercial fishing	Same as past actions, plus: Predator Management Plan (under development) Designation of Outer Banks Scenic Byway	Same as present actions, plus NC-12 improvements on Bodie Island Bonner Bridge replacement Development of Cape Lookout National Seashore ORV Management Plan/EIS Revision of the Cape Hatteras General Management Plan Revision of Land Use Development Plan for Dare County
Socioeconomic resources including local commercial fishing activities	Regional—counties	Storms and other weather events Commercial fishing Continued maintenance of NC-12 and berms	Same as past actions, plus: Designation of Outer Banks Scenic Byway	Same as present actions, plus: Development of Cape Lookout National Seashore ORV Management Plan/EIS Revision of Land Use Development Plan for Dare County

Impact Topic	Study Area	Past Actions	Present Actions	Future Actions (life of plan/EIS)
Seashore management and operations	All NPS facilities and lands managed by the Outer Banks Group	Oregon Inlet dredging Storms and other weather events Hurricane recovery Resource Management Plan General Management Plan Long-range Interpretive Plan Commercial fishing Continued maintenance of NC-12 and berms	Same as past actions, plus Ongoing law enforcement (note related to species or ORV management) Ongoing research studies Ongoing maintenance Ongoing surveying Predator Management Plan (under development)	Same as present actions, plus NC-12 improvements on Bodie Island Revision of the General Management Plan

IMPAIRMENT ANALYSIS METHOD

Chapter 1 describes the related federal acts and policies regarding the prohibition against impairing Seashore resources and values in units of the national park system. According to NPS *Management Policies 2006*, an action constitutes an impairment when an impact “would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values” (NPS 2006c, sec. 1.4.5). To determine impairment, the NPS must evaluate “the particular resources and values that would be affected; the severity, duration, and timing of the impact; the direct and indirect effects of the impact; and the cumulative effects of the impact in question and other impacts” (NPS 2006c, sec. 1.4.5).

National park system units vary based on their enabling legislation, natural and cultural resources present, and park missions; likewise, the activities appropriate for each unit and for areas in each unit also vary. For example, an action appropriate in one unit could impair resources in another unit. Thus, this document analyzes the context, duration, and intensity of impacts of the alternatives, as well as the potential for resource impairment, as required by Director’s Order 12 (NPS 2001a). As stated in the NPS *Management Policies 2006* (NPS 2006c, sec. 1.4.5), an impact on any park resource or value may constitute an impairment, but an impact would be more likely to constitute an impairment to the extent that it affects a resource or value whose conservation is

- necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park; or
- key to the natural or cultural integrity of the park; or
- identified as a goal in the park’s General Management Plan or other relevant NPS planning documents.

The following process was used to determine whether the various ORV management alternatives had the potential to impair Seashore resources and values:

- Step 1—The enabling legislation and the park’s General Management Plan were reviewed to ascertain its purpose and significance, resource values, and resource management goals or desired conditions.

- Step 2—Resource management goals were identified.
- Step 3—Thresholds were established for each resource of concern to determine the context, intensity, and duration of impacts, as defined earlier in this chapter under “Impact Thresholds.”
- Step 4—An analysis was conducted to determine if the magnitude of impact would constitute an “impairment,” as defined by NPS *Management Policies 2006* (NPS 2006c).

The impact analysis includes a determination of whether there would be an impairment of Seashore resources for each of the management alternatives. Visitor use, Seashore operations and management, and the socioeconomic environment are not considered resources per se, although they are dependent on the conservation of Seashore resources. Impairment findings are not included as part of the impact analysis for these topics.

WETLANDS AND FLOODPLAINS

GUIDING REGULATIONS AND POLICIES

Impacts on wetlands and floodplains are addressed under two federal executive orders: Executive Order 11990, Protection of Wetlands, and Executive Order 11988, Floodplain Management. NPS Director’s Order 77-1 establishes policies, requirements, and standards for implementing Executive Order 11990 for wetlands, while NPS Director’s Order 77-2 applies to all NPS-proposed actions that could adversely affect the natural resources and functions of floodplains, including coastal floodplains, or increase flood risks.

According to Director’s Order 77-1 and accompanying Procedural Manual 77-1, direct or indirect adverse impacts on wetlands should be avoided, or where impacts cannot be avoided, degradation or loss must be minimized by every practicable effort. The order adopts a “no net loss of wetlands” policy and states that the NPS will use the Cowardin classification system as the standard for defining wetlands for purposes of compliance with Executive Order 11990, which means that non-vegetated shorelines and mudflats are included in the wetlands classification. Any NPS activities that involve the discharge of dredged or fill materials into wetlands or “other waters of the United States” must also comply with the *Clean Water Act* and Section 404 regulations (33 CFR 1344) and Section 10 of the *Rivers and Harbors Act* (33 CFR 403), which prohibits the unauthorized obstruction or alteration of navigable waters of the United States.

If adverse impacts to wetlands would occur from a proposed project, a Statement of Findings is prepared, unless the actions are exempted for the various reasons provided in Procedural Manual 77-1, Section 4.2(A). Exceptions may include actions designed for restoring wetlands and water dependent actions that have minor impacts. As described more fully in the impact analysis, the rebuilding or expansion of any parking areas or access roads under any action alternative would be limited to developed or non-wetland areas, thereby avoiding impacts to wetlands. Indirect impacts may include minor effects from runoff to nearby wetlands. Impacts related to the management or improvement of access for ORVs would not require a Statement of Findings as long as new areas are not opened up for ORV use in wetland areas (Green and Noon pers. comm. 2008), although impacts related to this use are addressed in this section of the EIS. For these reasons, and as further detailed under the impact analysis, a Statement of Findings for wetlands was not required for this project.

Director’s Order 77-2 states that when it is not practicable to locate or relocate development or inappropriate human activities to a site outside of and not affecting the floodplain, the NPS will prepare and approve a Statement of Findings, in accordance with procedures described in Procedural Manual 77-2, Floodplain Management, and take all reasonable actions to minimize the impact to the natural resources of floodplains. Because the study area is located entirely within a floodplain, and the action

alternatives include construction of additional parking areas (or expansion of existing parking areas) and access in the floodplain, the NPS prepared a Statement of Findings for the preferred alternative (alternative F) in accordance with procedures described in Procedural Manual 77-2 (see appendix B for the Statement of Findings).

NPS *Management Policies 2006* also specifically address wetlands and floodplains in Sections 4.6.5 and 4.6.4, respectively. Section 4.6.5 refers to compliance with Executive Order 11990 and states that, when practicable, the NPS will not simply protect but will also seek to enhance wetland values. For any proposed new development or other activities that could adversely impact wetlands, the NPS will first avoid impacts, then minimize impacts, and then compensate for impacts on at least a one-to-one basis. Section 4.6.4 states that the NPS will protect, preserve, and restore the natural resource function of floodplains, avoid the long- and short-term environmental effects associated with the occupancy and modification of floodplains, and avoid floodplain development that could cause adverse impacts or flood risks.

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

To assess the magnitude of impacts to Seashore wetlands and floodplains under the various alternatives, wetland types and floodplain boundaries were identified as needed for impact analysis, based on the sources described in “Chapter 3: Affected Environment.” Actions under each alternative were considered and impacts were assessed by examining the types of uses and impacts that could occur in or near various wetlands or in floodplains, examining the area that could be directly or indirectly affected by the proposed development of parking and access, and assessing impacts on wetland and floodplain functions and values using best professional judgment, input from NPS staff and EIS team members, and a review of relevant literature.

WETLANDS

Impact Thresholds

The impact thresholds for wetlands are based on the size, integrity, and connectivity of the wetlands affected. These indicators are defined as follows:

Size. The severity of impacts to wetlands depends on the size of the wetland impacted. A small area of impact in a large wetland would be likely to have less of an effect than a large area of impact in a small wetland. The change in the size of a wetland, as a result of an impact, would also influence the integrity and connectivity of the wetland.

Integrity. Highly intact wetland areas with little prior disturbance would be more susceptible to impacts from direct development than a wetland previously degraded by development or other activities. The loss of function and productivity of the higher quality wetland would be a greater loss than that of a lower quality wetland. Additionally, indirect impacts due to human trampling or a change in vegetation or hydrology would also impact the integrity of the wetland.

Connectivity. The relationship of wetlands to other wetlands or other valuable natural resources is also important in determining the degree of impact. Plant communities that are isolated from each other are less productive and functional than those that are connected. For example, narrow, previous trail corridors that are infrequently or seasonally used would have less fragmenting effect than would a wide hard-surface roadway with high volumes of vehicular or pedestrian traffic. Establishment of structures in wetland areas could also create barriers to the natural dispersal of plants and animals and impact the connectivity of wetlands.

A summary of wetland impacts under all alternatives is provided in table 50 at the end of this section. The following thresholds for evaluating impacts to wetlands were defined.

- Negligible:* No measurable or perceptible effects on size, integrity, or connectivity of wetlands would occur.
- Minor:* The effect on wetlands would be measurable or perceptible, but small in terms of area and the nature of the impact. A small effect on size, integrity, or connectivity would occur; however, the overall viability would not be affected. If left alone, an adversely affected wetland would recover, and the impact would be reversed.
- Moderate:* The impact would cause a measurable effect on one of the three wetlands indicators (size, integrity, connectivity) or would result in a permanent loss or gain in wetland acreage, but not to large areas. Wetland functions would not be affected in the long term.
- Major:* The impact would cause a measurable effect on all three wetlands indicators (size, integrity, connectivity) or a permanent loss or gain of large wetland areas. The impact would be substantial and highly noticeable. The character of the wetland would be changed so that the functions typically provided by the wetland would be substantially altered.
- Duration:* Short-term effects for vegetative wetlands: recovers in less than three years from any action taken.

Long-term effects for vegetative wetlands: takes longer than three years to recover, or effect is almost permanent.

Short-term effects for non-vegetated wetlands (shorelines): recovers within days to months.

Long-term effects for non-vegetated wetlands (shorelines): effects last longer than a few months.

Study Area

The study area for assessment of the various alternatives is the Seashore. The study area for the cumulative impacts analysis is the Seashore plus the adjacent lands outside of the Seashore boundaries on Bodie, Hatteras, and Ocracoke islands.

Impacts Common to All Alternatives

Non-vegetated marine wetlands. Non-vegetated marine intertidal wetlands are located at the Seashore between extreme high tide and extreme low tide. Each alternative provides for some ORV access (whether for surveying and management or recreational use) in varying areas of the Seashore according to where an ORV corridor is provided. The ORV corridor generally occurs approximately 150 feet landward of the average, normal high tide line, or if less than 150 feet of space is available, at the vegetation or the toe of the remnant dune line. This width may vary among alternatives, dependent on sensitive species location, but generally stays the same.

Impacts to wetland areas where ORVs are used include rutting and compaction of soils from ORV use by visitors or by staff during species management activities; however, due to the dynamic nature of the intertidal area, impacts would be expected to be short-term negligible adverse. These impacts would be short-term due to the continuous movement and deposition of sand in the intertidal areas and the ability of the shoreline to “restore” itself in the long term. Due to the nature of the impacts and the consistent regeneration of wetland soils impacted by ORV use due to wave action, impacts on marine intertidal wetlands are not discussed in detail under each alternative below; rather, it was assumed that impacts from ORV driving to non-vegetated marine intertidal wetlands would be short-term negligible adverse across all alternatives. The impact analysis therefore focuses on impacts to vegetated estuarine (soundside and interior) wetlands and addresses impacts to marine intertidal wetlands in the conclusions only.

Impacts to marine wetland habitats also affect invertebrate species that reside there, and are discussed in detail in the “Wildlife and Wildlife Habitat” section.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Under alternative A, there would be no new construction of ramps or roads and, therefore, no direct adverse impacts to wetlands in the Seashore as a result of construction activities. The only other actions associated with this alternative that could result in wetland impacts would be impacts from the continued use of ORVs throughout the Seashore.

Under alternative A, Seashore staff would continue to survey for various species as identified in the FONSI for the Interim Protected Species Management Plan/EA. Seashore staff would use ATVs/UTVs and occasionally ORVs to conduct species surveys and to establish resource closures as required based on species behavior. There would be no impacts to estuarine wetlands, however, because species surveying and management would not typically occur in any areas where vegetated wetlands are located.

Under this alternative, visitors would be allowed to operate ORVs in all areas of the Seashore 24 hours per day year-round, subject to temporary resource closures, seasonal ORV closures in front of the villages, and temporary ORV safety closures (see figure 2, chapter 2, alternative A and B maps). Anecdotal evidence from Seashore staff has demonstrated that some areas of estuarine wetlands at the Seashore have been denuded of vegetation from ORV use along the soundside shoreline. Studies at Cape Cod National Seashore also have noted the impacts from ORV use on vegetation (Broadhead and Godfrey 1977). Wetlands are also damaged when drivers attempt to avoid standing water on interior ORV routes at Cape Hatteras and, instead, drive over vegetation adjacent to these routes, as noted by Seashore staff. This use has the potential to result in wider roads and crushed or dead wetland vegetation. Long-term minor adverse impacts to estuarine vegetated wetlands at the Seashore would continue to occur under alternative A, as ORV drivers would continue driving over wetland vegetation along the soundside shoreline and adjacent to interior ORV routes.

Overall, under alternative A, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.

Cumulative Impacts. Other past, present, and future planned actions within and around Cape Hatteras National Seashore have the potential to impact wetlands. The dredging of Oregon Inlet has occurred in the past and would continue to be conducted on an annual basis by the Corps. Material from the dredging of Oregon Inlet is used primarily for replenishment of Pea Island NWR beaches. Because the dredged material is not deposited in vegetated wetlands, there should be no measurable impact to wetlands from

this activity. However, the replacement of the Herbert C. Bonner Bridge is likely to adversely affect wetlands outside the NPS property because the preferred alternative for the bridge project would result in the filling and permanent loss of 3.1 acres of wetlands and open water habitat and would also involve temporary impacts to 12.5 acres of wetlands. To mitigate the permanent loss of 3.1 acres of wetlands, the Corps would restore, create, or enhance wetlands at agency-approved ratios at locations to be determined. Potential compensatory wetland mitigation would include on-site restoration and enhancement of in-kind wetlands as compensation for as much of the permanently affected area as possible; however, the limited availability of potential mitigation sites in the immediate vicinity of the project area would necessitate an exploration of additional options, which include off-site restoration, creation, and enhancement of wetlands (FHWA 2007).

The final bridge alignment could result in the closure of ramp 4 and the construction of a new ramp 3 and associated parking north of Oregon Inlet Campground. However, there would be sufficient upland area in which to construct ramp 3 and any associated parking. Therefore, there would be no impacts to wetlands related to the construction of this new ramp and parking facilities. Because the bridge project would fill wetlands, it would have long-term impacts to wetlands, but mitigation would lessen these impacts. Other planned actions, such as improvements slated for NC-12 on Bodie Island, would not impact wetlands because there are no wetlands in the proposed project areas. The overall impacts of these past, current, and future actions on wetlands would be long-term minor to moderate adverse because construction would occur in wetland areas and would result in permanent wetland loss that would have a measurable effect on wetland indicators, but it would only impact 3.1 acres out of more than 1,000 acres of wetlands in the Bonner Bridge project area.

Local planning efforts and their policies toward development could also affect wetlands in the surrounding area. For example, the Hyde County Land Use Plan contains policy statements that indicate that the county will not adopt any local land use ordinances to regulate development in non-tidal wetlands. However, both Dare and Hyde counties recognize the importance of coastal wetlands, and these resources are protected as Areas of Environmental Concern (AECs) under the land use plans of both jurisdictions. In its 2003 Land Use Plan, Dare County recognizes the Buxton Woods forest as an example of one of the most unique maritime forests in North Carolina and establishes a special environmental zoning district (SED). SED-1 generally allows only single-family residential development, provides limits on vegetation clearing and impervious cover, and establishes a 50-foot buffer from wetlands. Almost all the wetlands in the study area are coastal, so they would also be afforded protection as an AEC under the North Carolina CAMA, which limits development in these areas to water-dependent uses only. Impacts to wetlands from potential new projects in Dare and Hyde counties, which would follow local planning policies, would be long-term adverse, but only negligible as these policies would ensure that development in coastal wetlands is minimized.

The effects of the actions described above—when combined with the short- and long-term negligible to minor adverse impacts to wetlands under alternative A—would result in long-term minor to moderate adverse cumulative impacts on wetlands in the area of analysis.

Conclusion. There would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.

Cumulative impacts to wetlands would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative A would not impair wetlands because of the low magnitude of impacts to wetlands. There are no construction activities in alternative A. Species management activities would not typically occur in wetland areas, and effects on the size, integrity, or

connectivity of marine intertidal wetlands from ORVs crossing these areas would not be measurable or perceptible. Where driving on limited portions of the soundside is allowed, generally on sandy beach areas, incidental driving on vegetation at the fringes of these sandy areas may occur when vehicles are passing each other, turning around, or during periods of high water because the soundside sandy beach areas tend to be narrow and bordered by vegetation. Incidental driving on vegetation along the margins of interior ORV routes may occur at times to avoid standing water. The effects of the small amount of damage to soundside and interior wetland vegetation were deemed to be minor in the plan/EIS analysis because there would be only a small effect on size, integrity or connectivity and overall viability of wetlands would not be affected. Cumulative impacts from combining the effects of alternative A with effects of other past, present, and future planned actions in and around the Seashore would likely result in a small permanent loss of wetlands, mostly from the construction of the Bonner Bridge, which would affect 3.1 acres. Large areas would not be affected and wetland functions would not be affected over the long-term. Therefore, the wetland impacts would not result in impairment.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Under alternative B, there would be no new construction of ramps or roads and therefore no direct adverse impacts to Seashore wetlands as a result of construction activities. The only other actions associated with this alternative that could result in wetland impacts would be impacts from the continued use of ORVs throughout the Seashore.

Seashore staff would continue to conduct species surveying and management actions, as indicated in the FONSI and modified by the consent decree. The Seashore staff would use ATVs/UTVs and occasionally ORVs to conduct species surveys and establish resource closures as required based on species behavior. There would be no impacts to estuarine wetlands, however, because species surveying and management would not typically occur in any areas where vegetated wetlands are located. The level of impact from species surveying and management practices would be the same under the management that occurred before the modification of the consent decree on June 2, 2009.

Recreational use and other activities under alternative B would be similar to alternative A, except for seasonal restrictions on night driving and increased resource protection buffer distances. Although ORV traffic would be restricted in certain areas of the Seashore due to temporary resource closures and eliminated seasonally during the evening hours, there would still be ORV use along the soundside and interior, where damage to vegetated wetlands would continue during the day year-round and at nighttime from September 15 to April 30. Therefore, new restrictions on recreational ORV use under alternative B would not result in a measurable change in wetland impacts when compared to alternative A. Therefore, wetland impacts from recreational ORV use under alternative B would be long-term minor adverse.

Overall, under alternative B, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative B would be identical to those under alternative A. The effects of these actions—when combined with the short- and long-term minor adverse impacts to wetlands under alternative B—would result in long-term minor to moderate adverse impacts on wetlands in the area of analysis.

Conclusion. Overall, under alternative B, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.

Cumulative wetland impacts would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative B would not impair wetlands because of the low magnitude of impacts to wetlands. There are no construction activities in alternative B; species management activities would not typically occur in wetland areas; and effects on the size, integrity, or connectivity of marine intertidal wetlands from ORVs crossing these areas would not be measurable or perceptible. ORV damage to soundside and interior vegetation would continue to be confined to small areas, and would not affect the overall viability of the Seashore's wetlands. Where driving on limited portions of the soundside is allowed, generally on sandy beach areas, incidental driving on vegetation at the fringes of these sandy areas may occur when vehicles are passing each other, turning around, or during periods of high water because the soundside sandy beach areas tend to be narrow and bordered by vegetation. Incidental driving on vegetation along the margins of interior ORV routes may occur at times to avoid standing water. The effects of the small amount of damage to soundside wetland vegetation were deemed to be minor in the plan/EIS analysis. Cumulative impacts from combining the effects of alternative B with effects of other past, present, and future planned actions in and around the Seashore would likely result in a small permanent loss of wetlands, mostly from the construction of the Bonner Bridge, which would affect 3.1 acres. Large areas would not be affected and wetland functions would not be affected over the long-term. Therefore the wetland impacts would not result in impairment.

Impacts of Alternative C: Seasonal Management

Unlike the no-action alternatives, alternative C would involve the construction and relocation of ORV access ramps (with some additional ramps being added), the construction or expansion of public parking areas, and the establishment of a new interdunal road. In addition to the construction activities proposed under alternative C, surveys for species presence or absence, associated management activities, and the recreational use of ORVs could potentially impact wetlands within the Seashore.

Access for recreational use and other activities under alternative C would be similar to alternatives A and B, except for the establishment of specific seasonal closures at the approximately 18 miles of SMAs under alternative C. Other areas outside of SMAs would be seasonally closed to ORV use under alternative C, according to table 7 in chapter 2. Under alternative C, the number of soundside access points would not change, but signs would be installed at the terminus of the soundside access points to reduce potential damage from vehicles to estuarine wetlands. Although alternative C includes additional measures for wetland protection on the soundside, long-term negligible adverse impacts to vegetated wetlands would occur due to the potential for ORVs driving over wetland vegetation along and adjacent to interior routes (including the expanded interdunal road network) and access roads that lead to soundside destinations.

Implementation of alternative C would involve the construction or relocation of six ORV access ramps, construction or expansion of seven public parking areas, and the establishment of a new interdunal road between ramps 45 and 49. All new access ramps and parking lots would be located exclusively in upland areas, thereby avoiding direct wetland impacts. Ramps would be surfaced with a semi-permeable clay/shell base, reducing runoff to any adjacent wetlands. New or expanded parking lots would be designed and constructed with a semi-permeable clay/shell base, turf block, or some other porous material, using environmentally sensitive standards to minimize stormwater runoff. The new interdunal road proposed under alternative C would extend from the existing interdunal road at ramp 45 to ramp 49

(see figure 2, chapter 2 alternative C maps). Wetland maps indicate there is a sufficient upland area to extend the interdunal road, while avoiding wetland areas. The interdunal road would be primitive in nature (for example, not paved or otherwise hardened) and would not require surfacing. Wetland impacts resulting from the extension of the interdunal road would be avoided, although heavy use of the road could result in inadvertent wetland damage if vehicles were to leave the road surface for any reason, as wetlands are immediately adjacent to this area. Construction activities under alternative C would avoid wetland areas and use materials and management practices that would reduce surface runoff, resulting in indirect long-term negligible adverse impacts to wetlands.

Overall, under alternative C, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a negligible level due to the protection provided by the installation of signage under this alternative. Construction activities under alternative C would avoid wetland areas, resulting in indirect long-term negligible adverse impacts to wetlands.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative C would be identical to those under alternative A. The effects of these actions—when combined with the short- and long-term negligible adverse impacts to wetlands under alternative C—would result in long-term minor to moderate adverse impacts on wetlands in the area of analysis.

Conclusion. There would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a long-term negligible adverse level due to the protection provided by the installation of signage under this alternative. Construction activities under alternative C would avoid wetland areas and use materials and management practices that would reduce surface runoff, resulting in long-term negligible adverse impacts to wetlands.

Cumulative impacts under alternative C would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative C would not impair wetlands because of the low magnitude of impacts to wetlands. Species management activities would not typically occur in wetland areas; and effects on the size, integrity, or connectivity of marine intertidal wetlands from ORVs crossing these areas would not be measurable or perceptible. Signs and fencing would protect the soundside shoreline from damage. Where driving on limited portions of the soundside is allowed, generally on sandy beach areas, incidental driving on vegetation at the fringes of these sandy areas may occur when vehicles are passing each other, turning around, or during periods of high water because the soundside sandy beach areas tend to be narrow and bordered by vegetation. Incidental driving on vegetation along the margins of interior ORV routes may occur at times to avoid standing water. Parking area, ramp and interdunal road construction would avoid wetland areas and would use materials and management practices that would reduce surface runoff. The effects of the small amount of damage to wetland vegetation were deemed to be negligible in the plan/EIS analysis. Cumulative impacts from combining the effects of alternative C with effects of other past, present, and future planned actions in and around the Seashore would likely result in a small permanent loss of wetlands, mostly from the construction of the Bonner Bridge, which would affect 3.1 acres. Large areas would not be affected and wetland functions would not be affected over the long term. Therefore, the wetland impacts would not result in impairment.

Impacts of Alternative D: Increased Predictability and Simplified Management

Alternative D would involve the construction or relocation of four ORV access ramps. In addition to the ramp construction proposed under alternative D, species surveying and management activities and the recreational use of ORVs could potentially impact wetlands within the Seashore.

Vehicular access for recreational use and other activities under alternative D would be limited with the year-round “vehicle free” designation of all points, spits, and village beaches (see figure 2, chapter 2, alternative D maps). Soundside access would be managed the same as in alternative A, resulting in long-term negligible to minor adverse impacts to estuarine vegetated wetlands.

The proposed access ramps would be located exclusively in upland areas, thereby avoiding direct wetland impacts. Ramps would be constructed using environmentally sensitive standards to minimize stormwater runoff, as detailed in alternative C.

Overall, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible to minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands along interior routes and on the soundside, which would not be protected with signage under this alternative. Construction activities under alternative D would avoid wetland areas, resulting in indirect long-term negligible adverse impacts to wetlands.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative D would be identical to those under alternative A. The effects of these actions—when combined with the short- and long-term negligible to minor adverse impacts to wetlands under alternative D—would result in long-term minor to moderate adverse impacts on wetlands in the area of analysis.

Conclusion. There would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible to minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands along interior routes and on the soundside, which would not be protected with signage under this alternative. Construction activities under alternative D would avoid wetland areas and use materials and management practices that would reduce surface runoff, resulting in indirect long-term negligible adverse impacts to wetlands.

Cumulative impacts to wetlands under alternative D would be long-term minor to moderate adverse in the area of analysis.

Impairment Determination. Implementation of alternative D would not impair wetlands because of the low magnitude of impacts to wetlands. Species management activities would not typically occur in wetland areas; and effects on the size, integrity, or connectivity of marine intertidal wetlands from ORVs crossing these areas would not be measurable or perceptible. ORV damage to soundside vegetation would continue to be confined to small areas, and would not affect the overall viability of the Seashore’s wetlands. Where driving on limited portions of the soundside is allowed, generally on sandy beach areas, incidental driving on vegetation at the fringes of these sandy areas may occur when vehicles are passing each other, turning around, or during periods of high water because the soundside sandy beach areas tend to be narrow and bordered by vegetation. Incidental driving on vegetation along the margins of interior ORV routes may occur at times to avoid standing water. The effects of the small amount of damage to soundside wetland vegetation were deemed to be negligible to minor in the plan/EIS analysis. Ramp construction would avoid wetland areas and would use materials and management practices that would reduce surface runoff. The effects of this construction were deemed to be negligible in the plan/EIS

analysis. Cumulative impacts from combining the effects of alternative D with effects of other past, present, and future planned actions in and around the Seashore would likely result in a small permanent loss of wetlands, mostly from the construction of the Bonner Bridge, which would affect 3.1 acres. Large areas would not be affected and wetland functions would not be affected over the long term. Therefore, the wetland impacts would not result in impairment.

Impacts of Alternative E: Variable Access and Maximum Management

Implementation of alternative E would involve the installation or relocation of 7 ORV access ramps, construction or expansion of 14 public parking areas, and the establishment of 1 new interdunal road and 1 pedestrian trail. All new access ramps and parking lots would be located exclusively in upland areas, thereby avoiding direct impacts to wetlands. Ramps and parking areas would be constructed using environmentally sensitive standards to minimize stormwater runoff, as detailed in alternative C. The interdunal road under alternative E would extend from the existing interdunal road at ramp 45 to ramp 49. Wetland maps indicate that there is a sufficient upland area in which to extend the interdunal road, although there are adjacent wetland areas. Therefore, wetland impacts from the interdunal road extension would be avoided, although heavy use of the road could result in inadvertent wetland damage if vehicles were to leave the road surface for any reason, as Seashore staff indicates currently occurs. The proposed pedestrian trail and interdunal road extension would not involve any formal surfacing or removal of vegetation and would avoid all wetland features. Construction activities under alternative E would avoid wetland areas and use materials and management practices that would reduce surface runoff, resulting in long-term indirect negligible adverse impacts to wetlands.

To protect soundside wetland resources, several soundside access areas would be closed and protective signage would be installed at those areas that remain open to vehicular use. Closing some of the soundside access points would reduce the potential for damage to estuarine wetlands from vehicles and provide beneficial impacts to wetlands in these areas. Although wetlands on the soundside would be given more protection under this alternative, long-term negligible adverse impacts to wetlands would occur in areas where ORV access continues due to the potential for ORVs driving over wetland vegetation adjacent to the extended interdunal road network.

Overall, under alternative E, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a negligible level due to the protection provided by signage and closure of access points under this alternative. Construction activities under alternative E would avoid wetland areas resulting in indirect long-term negligible adverse impacts to wetlands.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative E would be identical to those under alternative A. The effects of these actions—when combined with the short- and long-term negligible adverse impacts to wetlands under alternative E—would result in long-term minor to moderate adverse impacts on wetlands in the area of analysis.

Conclusion. There would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a long-term negligible adverse level due to the protection provided by signage and closure of access points under this alternative. Construction activities under

alternative E would avoid wetland areas and use materials and management practices that would reduce surface runoff, resulting in indirect long-term negligible adverse impacts to wetlands.

Cumulative impacts under alternative E would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative E would not impair wetlands because of the low magnitude of impacts to wetlands. Species management activities would not typically occur in wetland areas; and effects on the size, integrity, or connectivity of marine intertidal wetlands from ORVs crossing these areas would not be measurable or perceptible. ORV damage to soundside vegetation would continue to be confined to small areas, and would not affect the overall viability of the Seashore's wetlands. Where driving on limited portions of the soundside is allowed, generally on sandy beach areas, incidental driving on vegetation at the fringes of these sandy areas may occur when vehicles are passing each other, turning around, or during periods of high water because the soundside sandy beach areas tend to be narrow and bordered by vegetation. Incidental driving on vegetation along the margins of interior ORV routes may occur at times to avoid standing water. Under alternative E some currently open soundside areas would be closed to driving and the vegetation would recover. The effects of the small amount of damage to soundside wetland vegetation were deemed to be negligible in the plan/EIS analysis. Parking area and ramp construction would avoid wetland areas and would use materials and management practices that would reduce surface runoff. The effects of this construction on the size, integrity, or connectivity of wetlands would not be measurable or perceptible and were deemed to be negligible in the plan/EIS analysis. Cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore would likely result in a small permanent loss of wetlands, mostly from the construction of the Bonner Bridge, which would affect 3.1 acres. Large areas would not be affected and wetland functions would not be affected over the long term. Therefore, the wetland effects would not result in impairment.

Impacts of Alternative F: Management Based on Advisory Committee Input

Implementation of alternative F would include the construction (or replacement) of 9 ORV access ramps, 12 new or expanded parking lots, 3 new interdunal roads, and pedestrian trails on Bodie and Ocracoke islands. All new access ramps and parking lots would be located exclusively in upland areas, thereby avoiding impacts to wetlands. Ramps and parking areas would be constructed using environmentally sensitive standards to minimize stormwater runoff, as detailed under alternative C. Under alternative F, new interdunal roads are proposed from ramp 45 to ramp 49, off of the Pole Road near Hatteras Inlet, and extending off of ramp 59 near North Ocracoke Spit. Wetland maps indicate that there is a sufficient upland area in which to develop these interdunal roads. Therefore, direct wetland impacts from the interdunal road extensions would be avoided, although heavy use of the roads could result in inadvertent wetland damage if vehicles were to leave the road surface for any reason. The proposed pedestrian trail and interdunal road extensions would not require any formal surfacing or removal of vegetation and would avoid all wetland features.

To protect soundside wetlands and vegetation under alternative F, protective signage would be installed at all soundside access points to reduce the potential for resource damage from ORV use, thereby resulting in a beneficial impact. Although alternative F includes additional measures for wetland protection on the soundside, long-term negligible adverse impacts to wetlands would occur due to the potential for ORVs driving over wetland vegetation along and adjacent to interior routes (including the expanded interdunal road network) and access roads that lead to soundside destinations.

Overall, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.

Impacts to soundside wetlands would remain at a negligible level due to the protection provided by the installation of signage. Construction activities under alternative F would avoid wetland areas, resulting in indirect long-term negligible adverse impacts to wetlands.

In accordance with NPS Director's Order 77-1: Wetlands Protection (and associated Procedural Manual 77-1), the preferred alternative, alternative F, was also evaluated for compliance with Executive Order 11990: Protection of Wetlands. Executive Order 11990 requires federal agencies to assess potential impacts to wetlands and avoid those impacts where possible. NPS activities that may adversely impact wetlands are subject to the provisions of Executive Order 11990 as implemented through Director's Order 77-1 and Procedural Manual 77-1. As stated in Procedural Manual 77-1, "the basic test for determining if a proposed action will have adverse impacts on wetlands is if the activity has the potential to degrade any of the natural and beneficial ecological, social/cultural, or other functions and values of wetlands...Such activities may require compliance due to direct impacts (e.g., placement of fill in a wetland) or due to indirect impacts (e.g., secondary or offsite impacts that reach into wetlands). Examples of activities with the potential to have adverse impacts on wetlands include drainage, water diversion, pumping, flooding, dredging, channelizing, filling, nutrient enrichment, diking, impounding, placing of structures or other facilities, livestock grazing, and other activities that degrade natural wetland processes, functions, or values" (Section 4.1.3).

Based on the above analysis, the continued use of ORVs and proposed construction activities under alternative F would not have new or additional measurable or perceptible effects on the size, integrity, or connectivity of wetlands. In addition to physical impacts to wetlands, new or additional impacts to the biological functions of wetlands, which provide habitat for invertebrates and birds foraging on the shoreline, were also considered. As described in the impact analysis under "Other Wildlife and Wildlife Habitat," impacts to these species from ORV use could be detectable (e.g., shorebirds foraging on the shoreline could be observed flushing due to disturbance by passing ORVs in those areas where ORVs would be allowed). These effects are considered minor because they would not be outside the range of natural variability. The preferred alternative would not create new or additional adverse impacts on wetland-dependent wildlife compared to existing ORV use. Alternative F would provide more area of shoreline that would not be open to ORV use than the existing and long-standing past management, which allowed ORV travel on almost all of the Seashore's oceanside beach, and also increased pedestrian impacts to foraging birds by carrying people to more distant locations. Therefore, it was determined that alternative F would not increase the degradation of wetlands functions and values as described in the NPS Procedural Manual 77-1, and in fact would decrease such impacts compared to existing ORV use. Therefore, a Statement of Findings for Wetlands was not prepared for this action.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative F would be identical to those described under alternative A. The effects of these actions—when combined with the short- and long-term negligible adverse impacts to wetlands under alternative F—would result in long-term minor to moderate adverse impacts on wetlands in the area of analysis.

Conclusion. There would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas and long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a long-term negligible adverse level due to the protection provided by the installation of signage. Construction activities under alternative F would avoid wetland areas, resulting in indirect long-term negligible adverse impacts to wetlands.

Cumulative impacts under alternative F would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative F would not impair wetlands because of the low magnitude of impacts to wetlands. Species management activities would not typically occur in wetland areas; and effects on the size, integrity, or connectivity of marine intertidal wetlands from ORVs crossing these areas would not be measurable or perceptible. ORV damage to soundside vegetation would continue to be confined to small areas, and would not affect the overall viability of the Seashore's wetlands. Where driving on limited portions of the soundside is allowed, generally on sandy beach areas, incidental driving on vegetation at the fringes of these sandy areas may occur when vehicles are passing each other, turning around, or during periods of high water because the soundside sandy beach areas tend to be narrow and bordered by vegetation. Incidental driving on vegetation along the margins of interior ORV routes may occur at times to avoid standing water. Signage would help protect soundside vegetation. The effects of the small amount of damage to soundside wetland vegetation were deemed to be negligible in the plan/EIS analysis. Parking area and ramp construction would avoid wetland areas and would use materials and management practices that would reduce surface runoff. The effects of this construction on the size, integrity, or connectivity of wetlands would not be measurable or perceptible and were deemed to be negligible in the plan/EIS analysis. Cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore would likely result in a small permanent loss of wetlands, mostly from the construction of the Bonner Bridge, which would affect 3.1 acres. Large areas would not be affected and wetland functions would not be affected over the long-term. Therefore, the wetland effects would not result in impairment.

TABLE 50. SUMMARY OF IMPACTS TO WETLANDS UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Under all alternatives, there would be short-term negligible adverse impacts to marine intertidal wetlands due to continued ORV use in these areas.					
Under alternative A, there would be long-term minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.	Under alternative B, there would be long-term minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes.	Under alternative C, there would be long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a negligible level due to the protection provided by the installation of signage.	Under alternative D, there would be long-term negligible to minor adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside, which would not be protected with signage. Impacts to vegetated wetlands along interior ORV routes would continue.	Under alternative E, there would be long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a negligible level due to the protection provided by signage and closures of soundside access points.	Under alternative F, there would be long-term negligible adverse impacts to wetlands due to direct damage from ORV use in and around vegetated wetlands on the soundside and along interior ORV routes. Impacts to soundside wetlands would remain at a negligible level due to the protection provided by the installation of signage.
There would be no construction (or related impacts) under the no-action alternatives.		Construction activities would avoid wetland areas, resulting in indirect long-term negligible adverse impacts to wetlands.			

FLOODPLAINS

Assumptions

Assumptions made in assessing potential impacts to floodplains include the following:

- FEMA Flood Insurance Rate Maps indicate almost the entire Seashore is within the 100-year floodplain.
- The floodplains in the project area do not serve the same function (i.e., as a natural moderator of floods) as floodplains in non-coastal areas because water levels in the project area are not dependent on floodplain storage capacity. Rather the project area is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge.
- Recreational ORV use in the project area would not result in impacts to floodplain functions or values. The only impacts to floodplains from the implementation of the alternatives would be those impacts associated with proposed construction activities.

Impact Thresholds

A summary of floodplains impacts under all alternatives is provided in table 51 at the end of this section. The following thresholds for evaluating impacts to floodplains were defined.

Negligible: Impacts would result in a change to floodplain functions and values, but the change would be so slight that it would not be of any measurable or perceptible consequence.

Minor: Impacts would result in a detectable change to floodplain functions and values, but the change would be expected to be small, of little consequence, and localized. There would be no appreciable increased risk to life or property. Mitigation measures, if needed to offset adverse effects, would be simple and successful.

Moderate: Impacts would result in a change to floodplain functions and values that would be readily detectable and relatively localized. Location of operations in floodplains could increase risk to life or property. Mitigation measures, if needed to offset adverse effects, could be extensive, but would likely be successful.

Major: Impacts would result in a change to floodplain functions and values that would have substantial consequences on a regional scale. Location of operations would increase risk to life or property. Extensive mitigation measures would be needed to offset any adverse effects, and their success would not be guaranteed.

Duration: Short-term: the floodplain recovers in less than one year from any action taken.

Long-term: the floodplain takes longer than one year to recover or the effect is almost permanent.

Study Area

The study area for assessment of the various alternatives is the Seashore. The study area for the cumulative impacts analysis is the Seashore plus the adjacent lands outside of the Seashore boundaries on Bodie, Hatteras, and Ocracoke islands.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Under alternative A, no construction is proposed. The management actions associated with alternative A (including the use of ORVs and ATVs/UTVs for recreation and species management activities) would not have a measurable effect on floodplains because driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain.

Cumulative Impacts. Because there would be no impacts on floodplain functions or values under the no-action alternative, no cumulative impacts would occur.

Conclusion. Implementation of alternative A would result in no impacts to the functions or values of the currently existing floodplains found within the study area.

Because there would be no impacts on floodplain functions or values under the no-action alternative, no cumulative impacts would occur.

Impairment Determination. Implementation of alternative A would not impair floodplains because the use of ORVs for recreation or commercial fishing and the use of ATVs/UTVs and ORVs for management in the project area would not have a measurable effect on floodplains. Driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain or affect floodplain values. Floodplains in the study area do not function as a natural moderator of floods because water levels in the Seashore are not dependent on floodplain storage capacity. The Seashore is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge. No construction is proposed under alternative A. Implementation of alternative A would not result in cumulative impacts because it would not affect the functions or values of the floodplains in the study area. Therefore, the floodplain impacts would not result in impairment.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Analysis. No construction is proposed under alternative B. No management actions associated with alternative B (including the use of ORVs and ATVs/UTVs for recreation or species management activities) would have a measurable effect on floodplains as driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain. Management practices in use prior to the modification of the consent decree on June 2, 2009, would not result in any impacts to floodplains.

Cumulative Impacts. Because there would be no impacts on floodplain functions or values under alternative B, no cumulative impacts would occur.

Conclusion. Implementation of alternative B would result in no adverse, beneficial, or cumulative impacts on the functions or values of the currently existing floodplains found within the study area. Because there would be no impacts on floodplain functions or values under the no-action alternative, no

cumulative impacts would occur. Therefore, there would be no impairment of floodplain functions or values associated with alternative B.

Impairment Determination. Implementation of alternative B would not impair floodplains because the use of ORVs for recreation or commercial fishing and the use of ATVs/UTVs and ORVs for management in the project area would not have a measurable effect on floodplains. Driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain or affect floodplain values. Floodplains in the study area do not function as a natural moderator of floods because water levels in the Seashore are not dependent on floodplain storage capacity. The Seashore is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge. No construction is proposed under alternative B. Implementation of alternative B would not result in cumulative impacts because it would not affect the functions or values of the floodplains in the study area. Therefore, the floodplain impacts would not result in impairment.

Impacts of Alternative C: Seasonal Management

The use of vehicles for species management and recreational access would not result in any impacts to floodplain functions or values, as described under the no-action alternatives. However, construction activities proposed under alternative C have the potential to impact the floodplain, as discussed below.

Alternative C would involve the construction or relocation of six ORV access ramps, construction or expansion of seven public parking areas, and the establishment of one new interdunal road, as shown on figure 2 in chapter 2. Because all of the area between access roads (interdunal or NC-12) and the shoreline is in the 100-year floodplain, no options for constructing the proposed facilities outside of the regulatory floodplain exist. Ramps would be surfaced with a natural semi-permeable clay/shell base, reducing stormwater runoff and limiting the potential for impacts to the floodplain's function. New or expanded parking lots would be designed and constructed with a semi-permeable clay/shell base, turf block, or some other porous material, using environmentally sensitive standards to minimize stormwater runoff. All of the parking lots would be located within the 100-year floodplain, with none of the new or expanded lots located in areas seaward of the primary dune line. New or expanded parking areas would be located outside of coastal high hazard areas subject to flash flooding, when possible. Although Director's Order 77 allows the construction of day-use parking facilities within the 100-year floodplain in high hazard areas, signs informing visitors of flood risk and suggested actions in the event of flooding must be posted, and are included as part of alternative C, if it is not possible to locate all of the proposed parking areas outside of high hazard areas. The interdunal road proposed under alternative C would extend from the existing interdunal road at ramp 45 to ramp 49. The road, constructed at grade, would not alter topography or require a finished surface, limiting the potential for impacts to floodplain function. The construction or expansion of the seven parking lots would result in the placement of hardened, pervious surface in the 100-year floodplain and would have a limited effect on the ability of the floodplain to convey floodwaters from storm surge. Although impacts would result in a detectable change in floodplain functions and values, the change would be of little consequence and localized in nature. Therefore, under alternative C, there would be long-term minor adverse impacts to floodplains due to the construction or expansion of seven parking areas in the floodplain.

Cumulative Impacts. Other past, present, and future planned actions within and around the Seashore have the potential to impact floodplains. The dredging of Oregon Inlet has occurred in the past and would continue to occur on an annual basis. Material from the dredging of Oregon Inlet is used primarily for the replenishment of Pea Island NWR beaches. The deposition of this material has the potential to impact the function of the floodplain if substantial changes to topography resulted in the diversion of floodwaters into developed or inhabited areas. However, due to the dynamic coastal processes that continually reshape the area of deposition and the lack of development in the vicinity, impacts to the floodplain from dredging

activities would be negligible at most. The replacement of the Herbert C. Bonner Bridge is likely to affect floodplains because all of the replacement bridge corridor alternatives—as well as the existing Bonner Bridge and NC 12—are within the floodplain. However, the replacement bridge should not have measurable impacts on floodplain values because the piles of the bridge substructure would not create backwater or adverse hydraulic conditions, and floodplain functions would not be expected to be impacted. All alternatives for the replacement of the Herbert C. Bonner Bridge conform to applicable state and local floodplain protection standards because they would not affect the storm surge elevation. However, the location of structures and impervious surfaces in the floodplain could result in localized flooding during heavy rain events. Other planned actions, such as improvements slated for NC-12 on Bodie Island would contribute limited adverse impacts to floodplains because they would result in additional development or hardened surfaces in the floodplain that could impact the overall floodplain functions. The overall impacts of these past, current, and future actions on floodplains would be long-term minor to moderate adverse due to the development that would occur in the floodplain and the resulting potential to impact floodplain functions.

Local planning efforts and their policies toward development could also affect floodplains in the surrounding area. Both Dare and Hyde counties recognize the risks associated with floodplain development and support the administration and enforcement of all applicable floodplain management regulations and the National Flood Insurance Program. Almost all of the shoreline in the study area is in a high hazard flood area and would also be protected as an AEC under the CAMA, which limits development in these areas. Impacts to floodplains from local planning policies would be beneficial because the local policies, along with existing federal regulations, would limit development in these areas. However, some level of development would be expected to occur in these areas in the future, so these floodplains would continue to be impacted.

The effects of the actions described above—when combined with the long-term minor adverse impacts to floodplains under alternative C—would result in long-term minor to moderate adverse impacts on floodplains in the area of analysis.

Conclusion. There would be long-term minor adverse impacts to floodplains resulting from the implementation of alternative C due to the construction or expansion of seven parking lots within the 100-year floodplain. Installation of ORV access ramps would not impact floodplains because they would be composed of pervious materials. Interdunal roads would not be surfaced and would therefore not result in floodplain impacts.

Past, present, and reasonable foreseeable future actions—when combined with the impacts of implementing alternative C—would result in long-term minor to moderate adverse cumulative impacts to floodplains in the area of analysis.

Impairment Determination. Implementation of alternative C would not impair floodplains because the use of ORVs for recreation or commercial fishing and the use of ATVs/UTVs and ORVs for management in the project area would not have a measurable effect on floodplains. Driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain or affect floodplain values. Floodplains in the study area do not function as a natural moderator of floods because water levels in the Seashore are not dependent on floodplain storage capacity. The Seashore is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge. Construction or relocation of six ORV access ramps, construction or expansion of seven public parking areas, and the establishment of one new interdunal road are proposed under alternative C. Ramps would be surfaced with a natural semi-permeable clay/shell base, reducing stormwater runoff during heavy rain events and limiting the potential for impacts to floodplain function. New or expanded parking areas would be located landward of the primary dune. They would be designed

and constructed with a semi-permeable clay/shell base, turf block, or other porous material, using environmentally sensitive standards to minimize stormwater runoff, and would have a limited effect on the ability of the floodplain to convey floodwaters from storm surge. The interdunal road would be constructed at grade and would not alter topography or require a finished surface. The plan/EIS impact analysis deemed the impacts from construction to be minor because they would result in a change in floodplain functions and values that would be detectable but small, of little consequence, and localized. Cumulative impacts from combining the effects of alternative C with effects of other past, present, and future planned actions in and around the Seashore, such as the location of structures and impervious surfaces in the floodplain, development of NC-12, the Bonner Bridge and its replacement, and local development, would result in a change to floodplain functions and values. The cumulative impacts were deemed minor to moderate in the plan/EIS impact analysis because they would be readily detectable and could increase risk to life or property, but would be relatively localized and could be successfully mitigated. Therefore, the floodplain impacts would not result in impairment.

Impacts of Alternative D: Increased Predictability and Simplified Management

The use of vehicles for species and management and recreational access would not result in any impacts to floodplain functions or values, as described under the no-action alternatives. However, construction activities proposed under alternative D have the potential to impact the floodplain, as discussed below.

Alternative D would require the least amount of construction of the action alternatives and would involve the construction or relocation of four ORV access ramps. Because nearly the entire Seashore is within the floodplain, there would be no options for constructing the proposed facilities outside of the regulatory floodplain. The four ramps proposed under alternative D would be surfaced with a natural semi-permeable clay/shell base, thereby reducing stormwater runoff and limiting the potential for impacts to floodplain function. There would be no additions or alterations to interdunal roads or parking areas under alternative D. Therefore, under alternative D, there would be long-term negligible adverse impacts to floodplains due to the location of four ORV access ramps in the 100-year floodplain.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative D would be identical to those under alternative C. The effects of these actions—when combined with the long-term negligible adverse impacts to floodplains under alternative D—would result in long-term minor to moderate adverse impacts to floodplain functions and values in the area of analysis.

Conclusion. There would be long-term negligible adverse impacts to floodplains resulting from the implementation of alternative D due to the installation or relocation of four ORV access ramps.

Past, present, and reasonable foreseeable future actions—when combined with the impacts of implementing alternative D—would result in long-term minor to moderate adverse cumulative impacts to floodplains in the area of analysis. There would be no impairment of floodplains as a result of the implementation of alternative D.

Impairment Determination. Implementation of alternative D would not impair floodplains because the use of ORVs for recreation or commercial fishing and the use of ATVs/UTVs and ORVs for management in the project area would not have a measurable effect on floodplains. Driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain or affect floodplain values. Floodplains in the study area do not function as a natural moderator of floods because water levels in the Seashore are not dependent on floodplain storage capacity. The Seashore is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge. Construction or relocation of four ORV access ramps is proposed under

alternative D. Ramps would be surfaced with a natural semi-permeable clay/shell base, reducing stormwater runoff during heavy rain events and limiting the potential for impacts to floodplain function. The plan/EIS impact analysis deemed the impacts from construction to be negligible because the four ramps would result in a change in floodplain functions and values that would be so slight that it would not be of any measurable or perceptible consequence. Cumulative impacts from combining the effects of alternative D with effects of other past, present, and future planned actions in and around the Seashore, such as the location of structures and impervious surfaces in the floodplain, development of NC-12, the Bonner Bridge and its replacement, and local development, would result in a change to floodplain functions and values. The cumulative impacts were deemed minor to moderate in the plan/EIS impact analysis because they would be readily detectable and could increase risk to life or property, but would be relatively localized and could be successfully mitigated. Therefore the floodplain impacts would not result in impairment.

Impacts of Alternative E: Variable Access and Maximum Management

The use of vehicles for species management and recreational access would not result in any impacts to floodplain functions or values, as described under the no-action alternatives. However, construction activities proposed under alternative E have the potential to impact the floodplain, as discussed below.

Implementation of alternative E would involve the construction or relocation of 7 ORV access ramps, construction or expansion of 14 public parking areas, and the establishment of 1 new interdunal road and 1 pedestrian trail. As discussed under alternative C, the establishment of ramps and extension of interdunal roads would not result in floodplain impacts because no impervious surfaces or above-grade structures would be constructed and floodplain functions would not be altered. The development of a pedestrian trail near Oregon Inlet under alternative E also would not result in floodplain impacts because the trail would be primitive in nature and would not be paved or surfaced. Because all of the area between access roads (interdunal or NC-12) and the shoreline is in the 100-year floodplain, no options for constructing the proposed facilities outside of the regulatory floodplain exist. Ramps and parking lots would be designed and constructed using environmentally sensitive standards and materials to minimize stormwater runoff, as detailed in alternative C. All of the parking lots would be located within the 100-year floodplain, with none of the new or expanded lots located in areas seaward of the primary dune line. New or expanded parking areas would be located outside of coastal high hazard areas subject to flash flooding when possible. Although Director's Order 77 allows the construction of day-use parking facilities within the 100-year floodplain in high hazard areas, signs informing visitors of flood risk and suggested actions in the event of flooding must be posted, and are included as part of alternative E, if it is not possible to locate all of the proposed parking areas outside of high hazard areas. The construction or expansion of the seven parking lots would result in the placement of hardened, pervious surface in the 100-year floodplain and would have a limited effect on the ability of the floodplain to convey floodwaters from storm surge. Although impacts would result in a detectable change in floodplain functions and values, the change would be of little consequence and localized in nature. Therefore, under alternative E, there would be long-term minor adverse impacts to floodplains due to the construction or expansion of 14 parking areas in the floodplain.

Cumulative Impacts. Under alternative E, the same past, present, and planned future activities within the Seashore that have the potential to affect floodplains would occur, and impacts would be the same as described under alternatives C and D. The effects of these actions—when combined with the long-term minor adverse impacts to floodplains under alternative E—would result in long-term minor to moderate adverse impacts to floodplain functions and values in the area of analysis.

Conclusion. There would be long-term minor adverse impacts to floodplains resulting from the implementation of alternative E due to the construction or expansion of 14 parking lots throughout the Seashore.

Past, present, and reasonable foreseeable future actions—when combined with the impacts of implementing alternative E—would result in long-term minor to moderate adverse cumulative impacts to floodplains in the area of analysis. There would be no impairment of floodplains as a result of the implementation of alternative E.

Impairment Determination. Implementation of alternative E would not impair floodplains because the use of ORVs for recreation or commercial fishing and the use of ATVs/UTVs and ORVs for management in the project area would not have a measurable effect on floodplains. Driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain or affect floodplain values. Floodplains in the study area do not function as a natural moderator of floods because water levels in the Seashore are not dependent on floodplain storage capacity. The Seashore is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge. Construction or relocation of seven ORV access ramps, construction or expansion of 14 public parking areas, and the establishment of one new interdunal road and one new pedestrian trail are proposed under alternative E. Ramps would be surfaced with a natural semi-permeable clay/shell base, reducing stormwater runoff during heavy rain events and limiting the potential for impacts to floodplain function. New or expanded parking areas would be located landward of the primary dune. They would be designed and constructed with a semi-permeable clay/shell base, turf block, or other porous material, using environmentally sensitive standards to minimize stormwater runoff, and would have a limited effect on the ability of the floodplain to convey floodwaters from storm surge. The interdunal road would be constructed at grade and would not alter topography or require a finished surface. The pedestrian trail would not result in floodplain impacts because it would be primitive in nature and would not be paved or surfaced. The plan/EIS impact analysis deemed the impacts from construction to be minor because they would result in a change in floodplain functions and values that would be detectable but small, of little consequence, and localized. Cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore, such as the location of structures and impervious surfaces in the floodplain, development of NC-12, the Bonner Bridge and its replacement, and local development, would result in a change to floodplain functions and values. The cumulative impacts were deemed minor to moderate in the plan/EIS impact analysis because they would be readily detectable and could increase risk to life or property, but would be relatively localized and could be successfully mitigated. Therefore, the floodplain impacts would not result in impairment.

Impacts of Alternative F: Management Based on Advisory Committee Input

The use of vehicles for species and management and recreational access would not result in any impacts to floodplain functions or values, as described under the no-action alternatives. However, construction activities proposed under alternative F have the potential to impact the floodplain, as discussed below.

Implementation of alternative F would include the construction (or replacement) of 9 ORV access ramps, 12 new or expanded parking lots, 3 new interdunal roads, and pedestrian trails on Bodie and Ocracoke islands. As discussed under alternative C, the establishment of ramps and interdunal roads would not result in floodplain impacts because no impervious surfaces or above-grade structures would be constructed, and floodplain functions would not be altered. The development of pedestrian trails under alternative F would also not result in floodplain impacts because the trails would be primitive in nature and would not be paved or surfaced in any way.

Because all of the area between access roads (interdunal or NC-12) and the shoreline is in the 100-year floodplain, no options for constructing the proposed facilities outside of the regulatory floodplain exist. Ramps and parking areas would be designed and constructed using environmentally sensitive standards and materials to minimize stormwater runoff, as detailed in alternative C. All of the parking lots would be located within the 100-year floodplain, with none of the new or expanded lots located in areas seaward of the primary dune line. New or expanded parking areas would be located outside of coastal high hazard areas subject to flash flooding when possible. Although Director's Order 77 allows the construction of day-use parking facilities within the 100-year floodplain in high hazard areas, signs informing visitors of flood risk and suggested actions in the event of flooding must be posted, and are included as part of alternative F, if it is not possible to locate all of the proposed parking areas outside of high hazard areas. The construction or expansion of 10 of the 12 proposed parking lots would result in the placement of hardened, pervious surface in the 100-year floodplain and would have a limited effect on the ability of the floodplain to convey floodwaters from storm surge. The two parking areas accessible by 4-wheel drive vehicles at the terminus of the new interdunal routes would not require a hardened surface because vehicles would travel over sand to reach them. Although impacts would result in a detectable change in floodplain functions and values, the change would be of little consequence and localized in nature. Therefore, under alternative F, there would be long-term minor adverse impacts to floodplains due to the construction or expansion of 10 surfaced and 2 unsurfaced parking areas in the floodplain. Per Director's Order 77, a Statement of Findings for floodplains has been prepared for this alternative and is attached in appendix B of this document.

Cumulative Impacts. Under alternative F, the same past, present, and planned future activities within the Seashore that have the potential to affect floodplains would occur, and impacts would be the same as described under alternatives C, D, and E. The effects of these actions—when combined with the long-term minor adverse impacts to floodplains under alternative F—would result in long-term minor to moderate adverse impacts to floodplain functions and values in the area of analysis.

Conclusion. There would be long-term minor adverse impacts to floodplains resulting from the implementation of alternative F due to the construction or expansion of 12 parking areas in the 100-year floodplain.

Past, present, and reasonable foreseeable future actions—when combined with the impacts of implementing alternative F—would result in long-term minor to moderate adverse cumulative impacts to floodplains in the area of analysis. There would be no impairment of floodplains as a result of the implementation of alternative F.

Impairment Determination. Implementation of alternative F would not impair floodplains because the use of ORVs for recreation or commercial fishing and the use of ATVs/UTVs and ORVs for management in the project area would not have a measurable effect on floodplains. Driving on beaches, interior ORV routes, or along soundside ORV access routes would not impact the natural function of the floodplain or affect floodplain values. Floodplains in the study area do not function as a natural moderator of floods because water levels in the Seashore are not dependent on floodplain storage capacity. The Seashore is subject to coastal flooding caused by both hurricanes and other storm systems that can raise water levels substantially via storm surge. Construction or relocation of nine ORV access ramps, construction or expansion of 12 public parking areas, and the establishment of three new interdunal roads and three new pedestrian trails are proposed under alternative F. Ramps would be surfaced with a natural semi-permeable clay/shell base, reducing stormwater runoff during heavy rain events and limiting the potential for impacts to floodplain function. New or expanded parking areas would be located landward of the primary dune. Ten of the areas would be designed and constructed with a semi-permeable clay/shell base, turf block, or other porous material, using environmentally sensitive standards to minimize stormwater runoff, and would have a limited effect on the ability of the floodplain to convey floodwaters from storm

surge. The two new parking areas accessible by 4-wheel drive vehicles at the end of two of the new interdunal roads would have no floodplain impact because they would not require a hardened surface since vehicles would travel over sand to reach them. The interdunal roads would be constructed at grade and would not alter topography or require a finished surface. The pedestrian trails would not result in floodplain impacts because they would be primitive in nature and would not be paved or surfaced. The plan/EIS impact analysis deemed the impacts from construction to be minor because they would result in a change in floodplain functions and values that would be detectable but small, of little consequence, and localized. Cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore, such as the location of structures and impervious surfaces in the floodplain, development of NC-12, the Bonner Bridge and its replacement, and local development, would result in a change to floodplain functions and values. The cumulative impacts were deemed minor to moderate in the plan/EIS impact analysis because they would be readily detectable and could increase risk to life or property, but would be relatively localized and could be successfully mitigated. Therefore, the floodplain impacts would not result in impairment.

TABLE 51. SUMMARY OF IMPACTS TO FLOODPLAINS UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
There would be no construction under alternative A. As a result, there would be no impacts to the functions or values of floodplains.	There would be no construction under alternative B. As a result, there would be no impacts to the functions or values of floodplains.	Under alternative C, there would be long-term minor adverse impacts to floodplains due to the construction or expansion of seven parking areas in the floodplain.	Under alternative D there would be long-term negligible adverse impacts to floodplains due to the location of four ORV access ramps in the 100-year floodplain.	Under alternative E, there would be long-term minor adverse impacts to floodplains due to the construction or expansion of 14 parking areas in the floodplain.	Under alternative F, there would be long-term minor adverse impacts to floodplains due to the construction or expansion of 10 surfaced and 2 un-surfaced parking areas in the floodplain.

FEDERALLY LISTED THREATENED OR ENDANGERED SPECIES

GUIDING REGULATIONS AND POLICIES

The ESA (16 USC 1531 et seq.) mandates that all federal agencies consider the potential effects of their actions on species listed as threatened or endangered. If the NPS determines that an action may affect a federally listed species, consultation with the USFWS is required to ensure that the action would not jeopardize the species' continued existence or result in the destruction or adverse modification of critical habitat. NPS *Management Policies 2006* state that the NPS will survey for, protect, and strive to recover all species native to NPS units that are listed under the ESA, and proactively conserve listed species and prevent detrimental effects on these species (NPS 2006c, sec. 4.4.2.3). NPS *Management Policies 2006* also state that "[the NPS will] manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible" (NPS 2006c, sec. 4.4.2.3).

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

The following information was used to assess impacts on all listed species from ORV management actions:

1. Species found in areas likely to be affected by actions described in the alternatives.
2. Habitat loss or alteration caused by the alternatives.
3. Displacement and disturbance potential of the actions and the species' potential to be affected by the activities.

According to the ESA, the term “take” means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Specific methodologies and assumptions pertaining to the piping plover, sea turtles, or seabeach amaranth are described under the relevant descriptions in the following text.

When examining the impacts of artificial light on threatened and endangered species (primarily sea turtles), the lighting zones developed for Cape Hatteras National Seashore by the NPS Night Skies Team were considered. In these zones, special consideration is given to areas with sensitive wildlife, and alternate guidance is provided to enhance the protection of nocturnal habitat. These special lighting zones represent the conditions that should be present at the Seashore, not necessarily actual current conditions, and create a buffer when two varying zones abut each other.

Although the action alternatives involve the construction of ramps, parking areas, and interdunal roads, construction activities would occur outside of the bird breeding season, during daylight hours, and outside of any protected species breeding or foraging habitat. In the unlikely event that threatened and endangered species are found in a construction area, the area would be under a resource closure and no construction would occur. Therefore, impacts from construction were assumed to be negligible.

The following assumption was made regarding the analysis for all alternatives:

An indirect impact from recreation use is the attraction of mammalian and avian predators to trash associated with recreation use (USFWS 1996a). Predation continues to be a major factor affecting the reproductive success of piping plovers (Elliot-Smith and Haig 2004). The Seashore would enforce proper trash disposal and anti-wildlife feeding regulations to reduce the attraction of predators to the area under all alternatives. Nevertheless, as demonstrated by the Seashore's annual piping plover reports, predation continues to be a threat to piping plover success at the Seashore (see “Chapter 3: Affected Environment”). Recreational use that brings humans into areas where plovers reside would continue to have indirect impacts by attracting predators, resulting in long-term moderate impacts under all alternatives as impacts could be detectable and outside the range of natural variability, but would not result in large declines in population as the Seashore takes steps to protect listed species from predation.

The ESA defines the terminology used to assess impacts to the piping plover, sea turtles, and seabeach amaranth as follows.

<i>No effect:</i>	When a proposed action would not affect a listed species or designated critical habitat.
<i>May affect / not likely to adversely affect:</i>	When effects on listed species are expected to be discountable, insignificant, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and should never reach the scale where “take” occurs. Discountable effects are those extremely unlikely to occur. Based on best judgment, a person would not (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur.
<i>May affect / likely to adversely affect:</i>	When any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not discountable, insignificant, or beneficial. If the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, the proposed action “is likely to adversely affect” the listed species. If incidental take is anticipated to occur as a result of the proposed action, then it “is likely to adversely affect” the species. Incidental take is the take of a listed species that results from, but is not the purpose of, carrying out an otherwise lawful activity.
<i>Is likely to jeopardize species / adversely modify critical habitat:</i>	The appropriate conclusion when the NPS or the USFWS identifies an adverse effect that could jeopardize the continued existence of a species or destroy or adversely modify critical habitat of a species within or outside Seashore boundaries.

The EIS will serve as the biological assessment in compliance with Section 7 consultation requirements and analyzes impacts using the above terminology. Each alternative includes an ESA summary after the conclusion section to facilitate this compliance. To provide the public with additional information on the intensity of impacts, the NEPA thresholds for each species were defined and used throughout the analysis.

Study Area

The study area for assessment of the various species is described separately for each listed species.

PIPING PLOVER

Species-Specific Methodology and Assumptions

Potential impacts on the federally threatened piping plover populations and habitat were evaluated based on available data on the species’ past and present occurrence at Cape Hatteras National Seashore, scientific literature on the species, life history, scientific studies on the impacts of human disturbance on piping plovers, as well as documentation of the species’ association with humans, pets, predators, and ORVs. Information on habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the USFWS, and available literature.

Piping Plover Impact Thresholds

A summary of piping plover impacts under all alternatives is provided in table 52 at the end of this section.

The following thresholds for evaluating impacts to piping plovers were defined.

Negligible: There would be no observable or measurable impacts to piping plovers, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.

Minor Adverse: Impacts on piping plovers would be detectable, but would not be outside the natural range of variability. Occasional responses by some individuals to disturbance could be expected, and may result in minimal interference to feeding, reproduction, resting, or other factors affecting population levels, but would not be expected to result in changes to local population numbers, population structure, and other demographic factors. Some impacts might occur during critical reproduction periods for piping plover, but would not result in injury or mortality. Sufficient habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Minor Beneficial: Impacts on piping plover, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Improvements to key characteristics of habitat and/or protection to key life history stages in the Seashore would sustain or slightly improve existing population levels, population structure, or other factors and maintain a sustainable population in the Seashore.

Moderate Adverse: Impacts on piping plover, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Frequent responses by some individuals to disturbance could be expected, with some negative impacts to feeding, reproduction, resting, or other factors affecting local population levels. Small changes to local population numbers, population structure, and other demographic factors may occur. Some impacts might occur during critical periods of reproduction or in key habitats in the Seashore and result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Moderate Beneficial: Impacts on piping plover, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to key characteristics of habitat in the Seashore and/or protection to key life history stages would minimize or prevent harassment or injury to individuals and improve the sustainability of the species in the Seashore.

Major Adverse: Impacts on piping plover, their habitats, or the natural processes sustaining them would be detectable and would be expected to be outside the natural range of variability. Frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Impacts would occur during critical periods of reproduction or in key habitats in the Seashore and result in direct mortality or loss of habitat. Local population numbers, population structure, and other demographic factors might experience large declines.

Major Beneficial: Impacts on piping plover, their habitats in the Seashore, or the natural processes sustaining them during key life history stages would be detectable and would be expected to be outside the natural range of variability. Changes to key characteristics of habitat in the Seashore and/or protection to key life history stages would substantially lessen mortality or loss of habitat and would result in notable increases in Seashore population levels.

Duration: Short-term effects would be one to two breeding seasons for piping plover.

Long-term effects would be anything beyond two breeding seasons for piping plover.

Study Area

The study area for assessment of the various alternatives is the Seashore. The study area for the cumulative impacts analysis is the Seashore and the region, including the Carolina area included in the recovery plan for the piping plover (USFWS 1996a).

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Resources Management Activities. Under alternative A, piping plover surveys would occur at the spits, Cape Point, and South Beach once a week from March 15 to March 31, and increase to three times a week from April 1 to June 15. When nests are located, surveying would further increase to once daily.

Establishment of Prenesting Closures. Prenesting closure areas would be established in areas used by piping plover sometime during the past three breeding seasons (defined as “recent breeding” habitat) with symbolic fencing to minimize human disturbance. An annual habitat assessment would be conducted in February or March. Based on this assessment, new habitat and suitable portions of recent breeding habitat, such as some shoreline foraging areas and nesting habitat, would be closed to the public with symbolic fencing by April 1 each year. This annual habitat assessment would include Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point. Alternative A would provide protection at recent breeding sites, closing portions of them to access by April 1, but would not protect habitat not used prior to the last three years. This could cause adverse impacts, because any piping plovers attempting to use these unprotected areas in the early spring (prior to April 1) may abandon their attempts due to human disturbance (e.g., vehicles, pedestrians, kites) prior to being detected by weekly surveys. Under alternative A, piping plovers would likely benefit from surveying and resultant closures in the prenesting phase, however since closures are not established until April 1, individuals nesting prior to that would not benefit from these closures and would receive protection only if found during surveying (see below). As early nesting piping plover would not be afforded protection from prenesting closures, there would be long-term minor to moderate adverse impacts, since there may be impacts during critical

periods of reproduction. Once the prenesting closures are in place, long-term moderate beneficial impacts would occur for piping plover at the Seashore.

Surveying and Monitoring. Beginning March 15 staff would survey recent piping plover breeding areas once a week and beginning April 1, staff would survey recent piping plover breeding areas three times per week. A range of observations, as required by the USFWS Amended Biological Opinion (USFWS 2007a, outlined in table 1 of the FONSI), would occur for each bird species by qualified staff across all life stages. Staff would observe species activities and potentially close areas, outside of defined prenesting closures, being used by piping plovers or other protected bird species. Closures would be removed if no bird activity is seen by July 15 or when the area has been abandoned for a 2-week period, whichever comes later. When piping plover nests are found in existing or newly established closure areas, Seashore staff would collect a variety of data including number of observations of plovers performing territorial defense or courtship outside symbolic fencing; number of observations of plovers making nest scrapes outside the symbolic fencing; and the number of vehicles, pedestrians, or pets within the symbolic fencing and/or in which tracks are observed crossing into posted habitat. Although surveying would bring people and/or essential vehicles into direct short-term contact with piping plovers and their habitat, and these activities themselves are a known risk factor, implementing precautions to minimize impacts, for example, using scopes to watch the birds from a distance and remaining outside closures to the extent possible, and the protection that results from surveying may result in long-term minor to moderate beneficial impacts.

Buffer/Closure Establishment. Under alternative A, outside of prenesting closures, if courtships or copulations are observed for two consecutive survey days, a buffer would be established, or expanded, to ensure a 150-foot buffer for the observed birds. When nesting occurs, a 150-foot buffer/closure would be established around piping plover nests outside existing closures. These closures would be expanded, if necessary to prevent disturbance, using flexible increments dependent on observed bird behavior. When resource closures are created around nests, the ORV corridor would be adjusted whenever possible to allow for vehicle passage, and the width of this corridor would be reduced if necessary. Closures could also be expanded if adults are observed foraging outside of a closure on two consecutive surveys, and in this case, the buffer would be expanded to include the foraging site. For unfledged chicks, alternative A would establish a minimum 600-foot buffer on either side of the brood based on observation of bird behavior and terrain conditions at the site. Chicks would be observed continuously during daylight hours during the first week. Based on observed behavior, the buffer area may require expansion up to 3,000 feet if chicks are highly mobile. Based on observed behavior (i.e., mobility of the brood) and the capability to continually observe mobility and behavior, the buffer zone could be reduced after the first week to no less than 300 feet, but might require expansion up to 3,000 feet if chicks are subsequently observed to exhibit high mobility. After the first week, if the closure is reduced or remains the same, continuous observation would continue and if the closure is enlarged, observations would be reduced to once daily. These buffers would move with the chicks and provide them with more protection than stationary buffers. Bypass routes would be closed at night if the buffer zone is less than 600 feet.

When closures are created around broods, the ORV corridor would be adjusted whenever possible to allow vehicle passage. For areas in which the buffer zone eliminates the ORV corridor, alternate ORV routes would be identified if available. If there are no alternate ORV routes, a bypass would be established if possible. Under alternative A, beaches would be closed to recreational access down to the waterline, if necessary, to allow chicks access to foraging areas, thereby providing chicks with maximum protection during this sensitive life stage. Under this type of management, staff would observe piping plover chicks from a distance to minimize disturbing the birds and allow the birds to forage or rest as they would under undisturbed conditions.

Alternative A provides for protection of piping plover nests through the use of buffer distances recommended in the Piping Plover Recovery Plan (USFWS 1996a). Further, additional information would be collected during this life stage from daily observations via use of optical equipment outside the symbolic fencing and from close approaches to nests once per week to observe and record data. Staff observing bird location and behavior would have the flexibility to adjust closure buffers, as some individual piping plovers might require larger buffers than others (USFWS 1996a). Adverse impacts could result to piping plovers if adjustments to the buffer are not made in a timely manner or if nests are missed by observers. Except for the once per week nest examination, the buffers under alternative A would be expected to have long-term minor beneficial effects on the species as Seashore personnel and recreationists who respect resource closures would be kept a safe distance (at least 150 feet) from incubating adults and their nests.

Piping plovers would likely experience minor long-term benefits from the size of resource closures and observation intensity adjustments in response to chick behavior, which would be especially responsive to highly mobile broods. However, basing buffer size on chick behavior and adjusting these buffers as necessary may also result in long-term moderate adverse impacts as frequent adjustment of the buffers may result in additional disturbance to piping plover, and buffers that are not adjusted in a timely manner could result in less than optimal protection for the species.

Management of Wintering/Nonbreeding Populations. As provided in the USFWS Amended Biological Opinion (USFWS 2007a), the NPS would monitor the presence, abundance, and behavior of migrating and wintering piping plovers from August 1 to March 31 of each year. During surveys, specific observations would be made regarding vehicle, pedestrian, and pet tracks in posted habitat; signs of predators, including species; specific management measures in place at the time of the observation; observed behaviors; and reactions to disturbance by pedestrians, pets, or vehicles. Data collected would result in minor to moderate beneficial impacts to plovers by providing Seashore managers with information on the types and locations of habitats used, seasonality of plover use of the Seashore, tidal influence on habitat use, and potential threats the habitat may contain. Surveying would increase knowledge on how and when piping plovers use the Seashore.

Under alternative A, suitable interior habitats at spits and at Cape Point would be closed year-round to all recreational users and would result in long-term minor beneficial impacts as this would prevent degradation or disturbance of habitat during key life stages of the species. Suitable habitats could include ephemeral ponds and moist flats at Cape Point, Hatteras Inlet Spit, North Ocracoke Spit, South Point (Ocracoke), and Bodie Island Spit. Actual locations of suitable foraging and resting habitat would change periodically due to natural processes such as tides and storms.

Education/Public Outreach. Under alternative A, the public would continue to receive information at the visitor centers about piping plovers and their ecology and the measures the Seashore is taking to protect the species. The public would also continue to be notified about closures that would limit ORV or pedestrian traffic, as well as when these closures reopen. Such public outreach is beneficial to the species as it educates the public to the specific needs of the species and alerts the public ahead of time to areas where they cannot go due to potential impacts to the species. Therefore, public outreach as part of species management would have long-term minor beneficial impacts.

Overall Impacts of Resources Management Activities. Overall, impacts to piping plover from resources management activities (primarily resulting from the effects of species surveying and field activities), would be long-term minor to moderate adverse. Although the management of the species would provide a certain level of benefit, the manner in which buffers would be established, along with the need to adjust buffers frequently would have an adverse impact on the species.

ORV and Other Recreational Use

ORV and Pedestrian Access. Implementation of alternative A would result in the designation of the entire ocean beach of the Seashore as an ORV route or area 24 hours a day. This would have potential adverse impacts, since it would not guarantee that all piping plover foraging and nesting habitat would be protected as one contiguous unit. Alternative A would designate an approximately 100-foot-wide ORV corridor above the mean high tide line in breeding areas used within the past three years and would delineate the corridor with posts placed up to 100 feet above the high tide line. In areas of reduced corridor width (i.e., less than 100 feet), traffic signs would be posted indicating a 10 mph speed limit. The ORV corridor would be adjusted whenever possible to allow vehicle passage. If the ORV corridor is not feasible for safety reasons or insufficient area, an alternate ORV route would be identified, if possible. If no alternate route is available, Seashore staff would consider establishing a bypass route. Under alternative A, Seashore staff would allow observations to be responsive to individuality in bird behavior when determining adequate size of closure zones.

A temporary ORV bypass could be used under alternative A, but based on past management this would be expected to be an uncommon occurrence. Such bypasses, if established, would be far removed from piping plover territory as impacts to plovers from human disturbance are well documented in scientific literature and could result in direct mortality (Melvin et al. 1994; Patterson et al. 1991; Flemming et al. 1988) and behavioral changes, resulting in lower reproductive success (Zonick 2000; Burger 1991). These bypasses would not have an impact on piping plovers as they would be established in a manner that protects habitat and does not impede the brood from foraging.

Although buffers established under alternative A were designed to protect piping plover, as demonstrated in “Chapter 3: Affected Environment,” compliance with buffers, corridors, and closures is not absolute, which can result in people, vehicles, and pets in proximity to plovers and within plover habitat. Under alternative A, chances for non-compliance (either intentional or unintentional) would be increased as the buffers are variable based on chick behavior and could change frequently. Regular patrols of areas by law enforcement rangers, trained observers, and field biologists would help to deter closure violations. In addition, partnerships with local organizations would help to provide peer-based compliance with closures. However, under alternative A, there is an ORV corridor that provides a conduit or access to the Seashore and no closed ORV areas, so non-compliance would be more possible. A lack of compliance with resource protection closures, including non-compliance (intentional or unintentional) due to variable buffer sizes, could result in short-term moderate to major adverse impacts at a particular location, and would result in long-term moderate to major adverse impacts if there is a chronic lack of compliance.

Night-Driving Restrictions. Under alternative A, there would be no limitations on night driving. Plovers are known to be active at night (Staine and Burger 1994; Majka and Shaffer 2008), and plover chick response to vehicles can increase their vulnerability to ORVs (USFWS 1996a). Allowing night driving under alternative A would result in long-term moderate adverse impacts as some impacts might occur during critical periods of reproduction and result in harassment, injury, or mortality to one or more individuals.

Commercial Fishing. Under alternative A, commercial fishing would be managed under special use permit. As part of this permit, terms and conditions would be placed on the permit holder, including a prohibition on entering resource closures. All other closures (safety and seasonal) would be accessible by commercial fishing permit holders. As resource closures would be off limits to commercial fishermen, there would be long-term negligible adverse impacts to piping plover from this use.

Permitting/Carrying Capacity Requirements. Under alternative A, there would be no permit or carrying capacity requirements placed on ORV users at the Seashore. A permit system would provide the Seashore

with a method for dealing with non-compliance, as well as providing education to ORV users regarding piping plover habitat at the Seashore and its importance to the species. Lack of a permit system would have long-term moderate adverse impacts. Lack of a carrying capacity requirement is not expected to impact piping plover as ORVs would not be allowed in resource protection areas.

Pet/Other Recreational Activity Restrictions. Alternative A would prohibit camping, restrict beach fires to the hours of 6:00 a.m. to 12:00 a.m., and permit pets at the Seashore year-round, in accordance with 36 CFR 2.13. The prohibition of camping and restriction of beach fires would have long-term minor benefits to piping plover, as disturbance from these activities would be reduced. The presence of pets at the Seashore, including during breeding season, has the potential to adversely impact piping plover as some visitors to the Seashore do not observe the requirement for pets to be restrained in some manner, as observed by Seashore staff. If there is little or limited compliance with pet restrictions in the areas of closures, a negative effect on the plovers could result (USFWS 1996a). This would be mitigated by the prohibition of pets from the landward side of the posts delineating the ORV corridor at the spits and Cape Point, the prohibition of pets within symbolic fencing around any bird closure area, and through education and outreach efforts via the Seashore field personnel and partnerships with local volunteers and organizations, but could still result in long-term minor to moderate adverse impacts, due to non-compliance.

Overall Impacts from ORV and Other Recreational Use. Overall, impacts to piping plover from ORV and other recreational use would be long-term moderate to major adverse as much of the Seashore would be open to recreational use, with an increased potential that piping plover could be impacted due to disturbance from ORV use and other recreational activities. Lack of a permit system for education and law enforcement, no night-driving restrictions, and lack of compliance with pet leash requirements would contribute substantially to these adverse impacts.

Cumulative Impacts. Past, present, and future actions discussed under the cumulative impact scenario could be expected to have a range of impacts on piping plover. Various dredging activities are occurring in the vicinity of the Seashore, such as the dredging of the federally authorized navigation channel at Oregon Inlet. These dredging activities fall under two categories, major dredging projects and maintenance activities. For the dredging of Oregon Inlet, major projects occur every four to five years, with sand being deposited in areas outside the Seashore, such as on Pea Island. Major dredging of Oregon Inlet is typically avoided during the breeding season; however, maintenance dredging does occur and could result in short-term minor adverse impacts due to disturbance. When major dredging projects do occur, it is common for piping plover foraging and nesting habitat at the southern end of Bodie Island Spit to slough off into the channel for a number of months after the dredging operation, which could cause minor to moderate adverse effects to piping plover.

Storms and other weather events during the piping plover breeding season (March–August) can result (depending upon storm intensity) in temporary displacement of and disturbance to nesting birds or even in the washing away or flooding of nests and eggs (Haig and Oring 1988; Houghton 2005; Cohen et al. in prep; Muiznieks pers. comm. 2009). In addition to the timing of summer storms, storm severity is also an important variable. Powerful storms can surge and overwash large areas of piping plover habitat including even up to the toe of the dune and beyond and result in loss of scrapes, nests, eggs, chicks, and even breeding adults. Conversely, winter, late fall, and early spring storms are capable of having benefits to piping plovers by depositing new materials and creating overwash areas and hence new nesting and foraging habitat for piping plovers or negative impacts by eroding and removing otherwise suitable habitat. Hence, the impacts of storms and piping plovers depend on the timing and severity of storm events and whether they result in piping plover habitat creation or destruction.

Hurricanes can also affect the piping plover because of their impact on staff resources. Storm recovery that pulls staff from resources management (including species monitoring or law enforcement) duties during piping plover breeding season would have adverse impacts. Conversely, hurricane recovery that takes place outside of the breeding season would have no direct effect on piping plover and could enhance piping plover habitat.

Commercial fish harvesting would have negligible impact on piping plovers because plovers do not feed on any commercially important fish. However, plovers do feed on some of the same prey items of fish species that may be harvested and, as such, harvest of fish may mean greater prey encounters for plovers. In this case, the impact of commercial fishing could result in long-term minor to moderate increases in prey availability that would have a beneficial impact on piping plover foraging.

Several of the local and NPS past, current, and future planning efforts can also affect locally sensitive bird species. For example, new development could result from the implementation of the County Land Use Development Plans for Dare and Hyde counties, including expected revisions to the Dare County Plan. The details of any plan revisions are not certain and the potential for impacts on piping plovers is indeterminate at this time. If increased development within the Seashore's boundaries would result from the implementation of these plans and increase recreational use of the beaches, adverse impacts to plovers could occur.

The education component of the Seashore's Long-Range Interpretive Plan would provide long-term minor to moderate benefits as it would help to educate visitors about the conservation needs of the birds that inhabit the Seashore and the conservation measures enacted to help protect them.

Current predator control and the Predator Management Plan would provide long-term major benefits by helping to control mammalian predators, such as fox and others, which prey upon plover adults, eggs, and young. Continuing to remove fox (both red and gray fox), raccoons, cats, and other predators from the Seashore and continuing to use predator exclosures would be beneficial to the piping plover. However, predator management actions such as the placement and checking of predator exclosures and traps would bring people, essential vehicles, and equipment into direct contact with piping plovers and their habitat because actions and some essential vehicle traffic would occur inside the established buffer. This could cause short-term minor adverse impacts. Predator trapping might result in short-term minor disturbance to nests and young, or result in loss of nests or hatchlings if trappers are not cognizant of nest locations. However, overall predator management actions would be highly beneficial.

The Cape Lookout Interim Protected Species Management Plan provides long-term moderate to major beneficial impacts to piping plover at the neighboring Seashore through the management policies that it employs. The outcome of the Cape Lookout National Seashore ORV Management Plan/EIS would also have direct long-term impacts on bird populations within the Seashore, as well as within the state of North Carolina. Specifically, it would have an impact on the region's goal of achieving compliance with the Piping Plover Recovery Plan (USFWS 1996a). However, whether the impact of the ORV plan would be moderate to major beneficial or adverse to piping plovers would depend upon the management decisions that are made and ultimately implemented.

The replacement of the Herbert C. Bonner Bridge would occur in the vicinity of the Seashore. An EIS and Biological Opinion for this project found, "the proposed replacement of the Bonner Bridge... as proposed, is not likely to jeopardize the continued existence of these species [including piping plover], and is not likely to destroy or adversely modify proposed critical wintering habitat for the piping plover." Given these findings, this project would be expected to result in short-term negligible adverse impacts to piping plovers if minimal disturbance from construction noise and lighting to courting, nesting, and foraging plovers would potentially be experienced.

The overall cumulative impacts of these past, current, and future actions would be long-term negligible to minor, depending on the intensity and duration of unpredictable factors such as storm events, with long-term moderate beneficial impacts from actions such as increased interpretive programs as part of the long-range interpretive plan and predator management within the Seashore. Many of these actions do not directly impact piping plover habitat in the area, as most of this habitat is located within the Seashore and is impacted by NPS management actions more than any of the aforementioned past, present, and future actions. These impacts, combined with the impacts of alternative A, would be long-term moderate to major adverse, as actions within the Seashore would act as a driver for overall cumulative impacts.

Conclusion. Overall, impacts to piping plover from resources management activities would be long-term minor to moderate adverse. Although the management of the species would provide a certain level of benefit, the manner in which buffers would be established, along with the need to adjust buffers frequently, would have an adverse impact on the species. Overall, impacts to piping plover from ORV and other recreational use would be long-term moderate to major adverse as much of the Seashore would be open to recreational use, with an increased potential that piping plover could be directly impacted by disturbance from recreational activities. Lack of a permit system for education and law enforcement purposes, no night-driving restrictions, and lack of compliance with pet leash requirements would contribute substantially to these adverse impacts. The impacts to piping plover under alternative A (and all other alternatives) are shown in table 52.

Cumulative impacts under alternative A would be long-term moderate to major adverse.

Impairment Determination. Implementation of alternative A would not impair piping plover because sufficient population numbers and functional habitat would remain to maintain sustainable populations of piping plover in the Seashore. To minimize human disturbance to piping plover during the breeding season, prenesting closures would be established by April 1 in suitable habitat in areas used by piping plover during the past three breeding seasons or in new habitat identified during the annual habitat assessment. Piping plover arriving before April 1 may abandon their attempts to establish a territory and attract a mate or may choose less optimal habitat because of human disturbance during a critical period of reproduction. However, Seashore staff would begin surveying once a week from March 15 to March 31 and, if courtships or copulations are observed for two consecutive survey days outside of prenesting closures, a buffer would be established, or expanded, to ensure a 150-foot buffer for the observed birds. Although, under alternative A, the need to adjust buffers frequently (e.g., to include observed foraging sites, to provide nest buffers for nests outside existing closures) would result in disturbance, the buffers would help prevent further disturbance. Buffer distances for nests would be the recommended distances in the USFWS Piping Plover Recovery Plan (USFWS 1996a), but may be adjusted if observation indicates that a pair requires a larger buffer. If adjustments to the buffer are not made quickly or if nests are missed by observers, the birds may be adversely affected. Because chick buffers are relatively small, would be variable based on chick behavior, and could change frequently, additional disturbance to piping plover may occur, including from the increased chances for intentional or unintentional visitor noncompliance with the closures. However, the minimum 600-foot (minimum 300-foot after the first week) chick buffer, which would move with the chicks, would provide more protection than a stationary buffer of the same size.

Alternative A would provide a 24-hour-per-day ORV corridor to almost the entire ocean beach of the Seashore including, where beach width is sufficient, a corridor adjacent to areas used by piping plover, except for chick closures. This would increase opportunities for noncompliance with resource protection closures. Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. Plovers are known to be active at night and plover chick response to vehicles can increase their vulnerability to ORVs. Unrestricted night driving during critical periods of reproduction may result in harassment, injury, or mortality to one or

more individuals. Under alternative A, ORVs would bring more people into the vicinity of plover areas, where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of piping plovers. The indirect impacts of attracting predators would be detectable and could result in changes to the population structure and declines in the local population, but are not expected to result in large declines in population because the Seashore takes management action to protect piping plover from predation.

Suitable interior habitat is closed to ORV and other recreational use during the nonbreeding season, resulting in year-round protected interior habitat for piping plover. Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore. Under alternative A, pets are allowed on the beach year-round at the Seashore, but prohibited from the landward side of the posts delineating the ORV corridor at the spits and Cape Point and inside bird closures. Because some visitors do not keep their pets restrained on a 6-foot or shorter leash or crated as required, allowing pets in the vicinity of resource closures could result in harassment, injury, or mortality to one or more individual plover.

The overall impacts from ORV and other recreational use on piping plover were deemed by the plan/EIS impact analysis to be between moderate and major adverse because expected impacts on piping plover or their habitats would be beyond the level of disturbance and harm that would occur naturally, including small changes to local population numbers, population structure, and other demographic factors. Some impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals. However, large declines in population numbers would not occur. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. During the two years that management under alternative A was implemented at the Seashore (2006 and 2007), numbers of breeding pairs of piping plover (six pair) were higher than the historic low (two pair) during 2002 and 2003, or the three pair in 2001, 2004, and 2005. The robust piping plover data collection under alternative A would alert the Seashore to trends that might portend large declines, and additional management action would be taken to prevent such declines.

The plan/EIS analysis of cumulative impacts from combining the effects of alternative A with effects of other past, present, and future planned actions in and around the Seashore (such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the Seashore, and increased interpretative programs as part of the Seashore's long range interpretive plan) indicates that NPS management actions within the Seashore would act as a driver for overall cumulative impacts. The cumulative impacts were deemed to be between moderate and major adverse in the impact analysis because large declines in population numbers would not result and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

Determination of Effect. Under the ESA, the actions taken under alternative A may affect / are likely to adversely affect piping plover due to the minor adverse effects from monitoring and surveying and from moderate to major adverse effects of ORV and other recreational use, including the potential for an increase in the presence of pets and predators that often accompany recreation/ORV use. ORV and other recreational use could result in short- and long-term moderate to major adverse impacts, especially with the high level of non-compliance that could result from buffers that adjust often and unpredictably. Further, the lack of night-driving restrictions could contribute to long-term moderate adverse impacts to plovers under alternative A as they are known to forage on the shoreline during all hours. These impacts would result in a finding of may affect/ are likely to adversely affect piping plovers under the ESA

because the action would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. And while there may be beneficial impacts from species monitoring and surveying, and management of recreation, the actions under alternative A would also likely result in adverse effects.

Under the ESA, the actions taken under alternative A may affect / are likely to adversely affect designated critical habitat for wintering piping plover due to the level of recreational access provided within these critical habitat areas and the impact of that access on the value of the habitat. There would be long-term, minor beneficial effects from closing suitable interior habitats at spits and at Cape Point to all recreational users, as these interior habitats are considered one of the PCEs that comprise the designated critical habitat for wintering piping plover. However, year-round recreational use would continue to occur on the majority of the intertidal sand beaches, spits, and backshore, which are also PCEs of designated critical habitat. The level of recreational use (through the designation of the majority of the Seashore an ORV route or area year-round) could result in vehicular and pedestrian disturbance to foraging plovers and a reduction of invertebrate prey due to disturbance or destruction of the wrack from vehicles driving in and around the wrack line. Although this alternative would not result in a direct loss of critical habitat, the impacts of recreational use would result in a reduction in the value of the designated critical habitat for wintering plovers.

Implementation of alternative A would result in a finding of may affect / is likely to adversely affect designated critical habitat for wintering piping plover under the ESA because the action would result in direct or indirect impacts to the critical habitat for the species that are not discountable, insignificant, or beneficial. And while there would be beneficial impacts from the protection of suitable interior habitat, there would be adverse effects on the value of the primary constituent elements of critical habitat, due to the majority of spits, intertidal sand beaches, and ocean backshore being open to recreational use during wintering.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Resources Management Activities

Establishment of Prenesting Closures. Under alternative B, piping plovers would likely benefit from the increased surveying and resultant closures in the prenesting phase. Specifically, in February or early March of each year, Seashore staff would conduct an annual assessment of piping plover breeding habitat and implement prenesting closures in recent breeding areas by posting symbolic fencing by March 15. The prenesting areas would not be reduced to accommodate an ORV corridor, including in the event of naturally occurring erosion or accretion of the area, except in emergency situations. The closures would remain in place until the later of July 15 or two weeks after the last piping plover, tern, black skimmer, American oystercatcher, or Wilson's plover chick within the area has fledged, as determined by two consecutive monitoring events. The establishment of these closures earlier in the season would ensure those piping plovers arriving early are afforded protective buffers, and would result in long-term moderate benefits for the species.

Surveying and Monitoring. Under alternative B, surveying would follow guidelines in the 1996 USFWS Piping Plover Recovery Plan, as well as survey procedures identified in the Interim Protected Species Management Strategy, as modified by the consent decree. Seashore staff would survey piping plover habitat at Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point at least once every two days from March 15 to April 15, and daily from April 16 to July 15, to determine if any birds are exhibiting prenesting and/or breeding behavior. The Seashore would monitor Bodie Island Spit

at least daily from March 15 to July 15. Potential new habitat, if any, at other locations would be surveyed two times per week.

By surveying the historic areas and new potential habitat beginning March 15, the likelihood that any piping plovers establishing territories in these areas would be detected increases. Observations of piping plover in these areas would continue until at least July 15, which would positively affect plovers that might not establish nests until later in the season. Prenesting areas would be left in place until July 15 or two weeks after all chicks of any species in the area have fledged, whichever occurs later. Other buffers for piping plovers (e.g., buffers installed based on observed breeding or foraging behavior) would be removed two weeks after the last observed activity, or after chicks have fledged.

Surveying would bring people and/or essential vehicles into direct short-term contact with piping plovers and their habitat, and these activities themselves are a known risk factor, especially during the more sensitive life stages of early prenesting and territory establishment. However, many precautions would be taken by staff to minimize impacts, for example, using scopes to watch the birds from a distance and remaining outside closures to the extent possible, and the protection that results from surveying would result in long-term moderate beneficial impacts, as any changes in species behavior would be detected and appropriate management measures implemented.

Buffer/Closure Establishment. Under alternative B, if breeding behavior, including but not limited to territorial behavior, courtship, mating, confirmed scrapes, or other nest building activity, or breeding adult piping plover foraging occurs outside of an established closure, Seashore staff would establish a 50-meter (164-foot) buffer around the observed activity. If disturbance from ORVs and/or pedestrians occurs within the given buffer distance, the buffer zone would be expanded in 50-meter (164-foot) increments until no disturbance occurs. Behaviors indicating disturbance would include defensive displays, alarm calls, flushing, leaving a nest or feeding area, or diving and mobbing pedestrians, dogs, or vehicles. Deliberate acts of vandalism or acts that result in disturbance to bird behavior would result in an automatic expansion of prenesting areas or buffers in increments of 50 meters, 100 meters, and 500 meters.

If buffers are expanded for any of the reasons stated above, the ORV corridor would not be adjusted to accommodate ORV use. For observed piping plover prenesting and/or breeding behavior, NPS would establish the prescribed buffers as quickly as possible, but always within eight daylight hours. Upon discovery of an active nest or chicks that are outside an existing closure, protective measures would be taken immediately to close and establish the buffers described above. Symbolic fencing with the applicable buffer distances stated above would be installed as soon as Seashore staff can reasonably be mobilized to install the fencing, but always within six daylight hours.

Under alternative B, all broods would be observed in the mornings and late afternoons; however, buffer distances for piping plover chicks would be substantially larger for the first two weeks after hatching and may sometimes stay in effect until fledging. The larger buffers would be longer lasting under Alternative B, and would result in moderate benefits to piping plover chicks. The size of buffers for piping plover chicks could be reduced after two weeks, but special monitoring provisions would apply, as described in the next section.

Alternative B provides for protection of piping plover nests through the use of buffer distances recommended under the Piping Plover Recovery Plan (USFWS 1996a). Further, additional information would be collected during this life stage from daily observations via use of optical equipment from an adequate distance to prevent disturbance and from close approaches to nests once per week to visually inspect the nest and check on the exclosure. Staff observing bird location and behavior would implement the prescribed buffers as a minimum, but would have the flexibility to increase the size of closures, as

some individual piping plovers may require larger buffers than others (USFWS 1996a). Except for the potential disturbance caused by the once per week nest examination, the larger and more responsive buffers under alternative B would be expected to have long-term minor to moderate beneficial effects on the species as Seashore personnel and recreationists who respect resource closures would be kept a safe distance from incubating adults and their nests.

Management of Wintering/Nonbreeding Populations. As provided in the USFWS Amended Biological Opinion (USFWS 2007a) and described in alternative A, Seashore staff would monitor the presence, abundance, and behavior of migrating and wintering piping plovers from August 1 to March 31 of each year following the SECN survey protocol, and close suitable habitat as described under alternative A. These closures would provide beneficial impacts to species during this life stage, as described under alternative A, and the addition of a surveying plan would provide Seashore managers with information on the types and locations of habitats used, seasonality of plover use of the Seashore, tidal influence on habitat use, and potential threats the habitat may contain. Surveying would increase knowledge on how and when piping plovers use the Seashore and enable adaptive management initiatives. These actions would result in long-term moderate beneficial impacts.

Education and Outreach. Under alternative B and as described under alternative A, the public would continue to receive information at the visitor centers about piping plovers and their ecology and the measures the Seashore is taking to protect the species. In addition, the Seashore would provide public education by posting protected species information at all access points. As with alternative A, public outreach as part of species management would have long-term minor beneficial impacts, with the expanded outreach having greater impacts than alternative A.

Overall Impacts of Resources Management Activities. Overall, impacts under alternative B from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term minor to moderate beneficial. Buffers for piping plover would be larger and provide more protection compared to buffers under alternative A. Minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of prenesting closures early in the breeding season, monitoring activities, education and outreach efforts, and establishment of prescribed buffers would provide long-term minor to moderate beneficial impacts to the species.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative B, management of ORV and pedestrian access at the Seashore would be a continuation of management under alternative A, except where modified by specific species protection measures from the April 30, 2008, consent decree. These management modifications include installation of prenesting areas by March 15 (two weeks earlier than under alternative A), increasing the size of some of the buffers provided to various species at the Seashore, as well as restrictions imposed related to night driving. Specifically, ORV corridors under alternative B are the same as alternative A, except that from March 15 to November 30 at all locations not in front of the villages that are open to ORV use, NPS would provide an ORV-free zone in the ocean backshore at least 10 meters wide, wherever there is sufficient beach width to allow an ORV corridor of at least 20 meters above the mean high tide line.

Alternative B would designate the entire ocean beach of the Seashore as an ORV route or area and would provide for closures of piping plover prenesting areas, as well as closures based on observations of breeding behavior, foraging, and chick movement. Alternative B would designate an approximately 100-foot (30-meter) wide ORV corridor above the mean high tide line outside of prenesting areas in breeding areas used within the past three years. The speed limit on Seashore beaches would be 15 mph from May 15 to September 15, unless otherwise posted; and 25 mph from September 16 to May 15,

unless otherwise posted. Under alternative B and as described in the previous section, staff would monitor piping plover habitat for signs of breeding behavior and human disturbance, ensure the timely installation of resource closures, and ensure adequacy of prescribed buffers. Resource closures, including prenesting areas, would not be adjusted to accommodate ORV use.

Impacts to plovers from human disturbance are well documented in scientific literature and could result in direct mortality (Melvin et al. 1994; Patterson et al. 1991; Flemming et al. 1988) and behavioral changes resulting in lower reproductive success (Zonick 2000; Burger 1991). Alternative B is designed to redirect ORV routes and corridors to areas that would not impact the brood, and any ORV route would be closed if it were within 1,000 meters (3,281 feet) of a brood. Trained Seashore staff in the area would be able to monitor bird behavior, as well as observe acts of disturbance. Through contact on the beach, websites, posted information at access points, and information available at the visitor centers, the public would be informed of alternate routes and ways to reduce their effect on the plovers (e.g., removing trash, reduced speed limit, etc.).

If Seashore staff observes disturbance of piping plovers from ORV or pedestrians, the buffer zone would be expanded in 50 meter increments until no disturbance occurs. When piping plover chicks are present, an ORV closure area would extend for 1,000 meters (3,281 feet) on each side of a line drawn through the nest site and perpendicular to the long axis of the beach for the first two weeks after hatching. The resulting ORV closure would extend from the oceanside low water line to the soundside low water line or the dune line if no soundside habitat exists, and ORV use would be prohibited in these areas. Under alternative B, a pedestrian buffer of 300 meters would be established when chicks are present.

ORVs may be allowed to pass through portions of the protected area, where the protected area is considered by Seashore staff to be inaccessible to piping plover chicks because of steep topography, dense vegetation, or other naturally occurring obstacles. All of the ocean beach at Cape Point, South Beach, and North Ocracoke Spit and the entire soundside and ocean beach at Bodie Island Spit and South Point would be considered accessible to piping plover chicks. Within the 1,000-meter piping plover unfledged chick buffer at Hatteras Inlet Spit, all of the ocean beach and that part of the soundside beach at the overwash fans and from the inlet east to a point 200 meters east of the point where the Spur Road from the Pole Road meets the sound would be considered accessible to piping plover chicks in these areas.

Under alternative B, during daylight hours only, Seashore staff may allow ORV access within the 1,000-meter unfledged piping plover chick buffer two weeks after the chicks have hatched. When ORV access is allowed, a buffer distance of 300 meters between piping plover chicks and ORVs would be maintained at all times. The chicks would be monitored from dawn to dusk by Seashore staff with at least one full season of experience monitoring piping plovers or snowy plovers. The modified access area would not be open to ORVs each morning until the location of the brood has been determined by a qualified monitor and an adequate buffer has been assured. If a piping plover adult or chick moves within 200 meters of ORVs or an ORV access corridor, Seashore staff on site would immediately take protective measures to close the access corridor and re-establish the 1,000-meter buffer, including contacting law enforcement to begin evacuation of the area; no additional nonessential ORVs would be allowed within the 1,000-meter unfledged piping plover chick buffer. NPS would retain the discretion to re-establish the 1,000-meter buffer at any time, if it deems the full closure to be necessary. Locations of the described buffers would be adjusted to accommodate chick movement.

Given the increased level of monitoring at the key piping plover breeding areas and the significantly larger buffers when piping plover chicks are present, alternative B would offer more protection from recreational use than alternative A. However, due to the entire ocean beach of the Seashore being

designated as an ORV route, the potential for impacts to piping plover from recreational use would still exist, resulting in long-term moderate adverse impacts.

Night-Driving Restrictions. Under alternative B, night driving of all recreational ORV traffic would be prohibited from 10:00 p.m. until 6:00 a.m. from May 1 to September 15. However, from September 16 to November 15, night-driving permits would be available for authorized nonessential driving between the hours of 10:00 p.m. and 6:00 a.m. The permit has an educational component, and the permit would contain restrictions on light use during the September 16 to November 15 permitted night-driving period. Furthermore, NPS retains the discretion to limit night driving to certain areas or routes, based on resource protection considerations. Because plovers are known to be active at night (Staine and Burger 1994; Majka and Shaffer 2008), and plover chick and fledgling response to vehicles can increase their vulnerability to ORVs (USFWS 1996a), restrictions on night driving under alternative B would provide long-term minor to moderate benefits to piping plovers; however, alternative B could still result in long-term minor adverse impacts during times when night driving is allowed (until 10:00 p.m. May 1 – September 15 and all nighttime hours from September 16 through April 30).

Commercial Fishing. Commercial fishing restrictions under alternative B would be the same as those under alternative A, with those holding commercial fishing permits restricted from night driving from 10:00 p.m. until 5:00 a.m. (as opposed to 6:00 a.m. for recreational users) from May 1 to September 15. As with recreational users, commercial fishing permit holders can get a permit for night driving from September 16 to November 15. Presence of commercial fishing operations would have a long-term negligible adverse impact to piping plovers, with long-term minor to moderate beneficial impacts occurring due to night-driving restrictions.

Permit/Carrying Capacity Requirements. As described above under the night-driving restrictions and education/outreach sections, alternative B would require a night-driving permit from September 16 to November 15. As stated in these sections, the night-driving permit applies after the piping plover breeding season is over and would have no impact on the species protection offered from these elements. There would be no impacts related to carrying capacity, as it would not be a requirement under alternative B.

Pet/Other Recreational Activity Restrictions. Alternative B would have the same restrictions on camping, beach fires, and pets as alternative A, although no ORV use would be allowed from 10:00 p.m. to 6:00 a.m. between May 1 and September 15. As with alternative A, there would be the potential for non-compliance with pet regulations, although the presence of law enforcement and other Seashore staff would help ensure compliance with the pet leash requirement. Education and outreach efforts of Seashore staff would help minimize adverse impacts and would result in long-term minor to moderate adverse impacts, due to the potential for non-compliance.

Overall Impacts from ORV and Other Recreational Use. Overall, impacts to piping plover from ORV and other recreational use would be long-term moderate adverse. While some buffers would be increased in an attempt to separate recreational uses from piping plover, access up to these buffers would be provided at all Seashore beaches and could result in intentional or unintentional non-compliance (i.e., when signs are washed out), which would impact the species. Adverse impacts would also occur due to limited prenesting protection outside of the points and spits, and the potential for protective buffers to be reduced during critical life stages of plover chicks.

Cumulative Impacts. The past, present, and future actions discussed under the cumulative impact scenario for alternative A would be expected to be the same under alternative B. The overall cumulative impacts of these past, current, and future actions, would be long-term negligible to minor, depending on the intensity and duration of unpredictable factors such as storm events, with long-term moderate

beneficial impacts from actions such as increased interpretive programs as part of the long-range interpretive plan and predator management within the Seashore. Many of these actions do not directly impact piping plover habitat in the area, as most of this habitat is located within the Seashore and is impacted by NPS management actions more than any of the aforementioned past, present, and future actions. These impacts, combined with the impacts of alternative B, would be long-term moderate adverse, as actions within the Seashore would act as a driver for overall cumulative impacts.

Conclusion. Overall impacts under alternative B from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term minor to moderate beneficial. Buffers for piping plover would be larger, and would provide more protection compared to those under alternative A, resulting in less of an adverse impact. The benefits from the prenesting closures, along with the benefits from increased surveying and monitoring efforts, would result in long-term minor to moderate beneficial impacts to piping plover. Minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of prenesting closures early in the breeding season, monitoring activities, education and outreach efforts, and establishment of prescribed buffers would provide long-term minor to moderate beneficial impacts to the species. Overall, impacts from alternative B to piping plover from ORV and other recreational use would be long-term moderate adverse. While some buffers would be increased and more constant to keep recreational uses separated from the species, access up to these buffers would be provided throughout the Seashore and could result in intentional or unintentional non-compliance, which would adversely impact the species. Adverse impacts would also occur due to the substantial amount of beach mileage open to ORV use year-round, limited prenesting protection outside of the points and spits, and the potential for protective buffers to be reduced during critical life stages of plover chicks.

Cumulative impacts to piping plover under alternative B would be long-term moderate adverse.

Impairment Determination. Implementation of alternative B would not impair piping plover because sufficient population numbers and functional habitat would remain to maintain a sustainable population of piping plover in the Seashore. To minimize human disturbance to piping plover during the breeding season, prenesting closures would be established by March 15 in suitable habitat at Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point and in new habitat identified during the annual habitat assessment. Establishing the closures by March 15 would ensure that early arriving plovers would be protected from disturbance during a key reproductive period. Seashore staff would survey piping plover habitat for prenesting or breeding behavior at Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point at least once every two days, and daily at Bodie Island Spit from March 15 to April 15. These areas would be surveyed daily from April 16 to July 15. Early and frequent surveying increases the chance to detect piping plovers establishing territories in these areas, which would then be protected by a resource closure. Continuing surveys through at least July 15 would increase the chance of detecting plovers that establish a nest later in the season. Prenesting closures would not be reduced to accommodate an ORV corridor, except in emergency situations, and would remain in place until July 15 or two weeks after the last piping plover, tern, black skimmer, American oystercatcher, or Wilson's plover chick within the area has fledged, whichever occurs later. A 50-meter buffer for breeding and nests would be established; if disturbance is observed, the buffer would be expanded in 50-meter increments until no disturbance occurs. Alternative B provides minimum times for Seashore staff to establish or expand buffers to ensure timely response and thus lessen the potential for disturbance. A 1,000-meter unfledged chick buffer would be established for the first two weeks after hatching. ORVs would not be allowed within this buffer, but during daylight within 10 meters landward from the mean high tide line, a corridor for pedestrians would be established provided that a 300-meter buffer was retained. After the first two weeks, with dawn to dusk monitoring and after the brood is located in the morning, the 1,000-meter buffer could be reduced to 300 feet for ORVs. The buffer would move with the chicks and would provide more protection than a stationary buffer of the same size.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, or pets may result in harassment, injury, or mortality to one or more individuals. Alternative B provides that at all established prenesting closures and buffers, if, in the opinion of NPS, a confirmed deliberate act that disturbs or harasses wildlife or vandalizes fencing, nests, or plants, is documented by NPS personnel, the prenesting area or buffer would be expanded automatically by 50 meters. If a second such act occurs at the same area, the buffer would be expanded automatically by an additional 100 meters. If a third such act occurs, the buffer would be expanded automatically by an additional 500 meters or more, if NPS determines it is necessary to minimize the extent of further disturbance. Under alternative B, ORVs would bring people into the vicinity of plover areas where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of piping plovers; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance and harm that would occur naturally, but would not be expected to result in large declines in population because the Seashore takes management action to protect piping plover from predation.

Suitable interior habitat is closed to ORV and other recreational use during the nonbreeding season, resulting in year-round protected interior habitat for piping plover. Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore. Under alternative B, pets are allowed on the beach year-round at the Seashore, but prohibited from the landward side of the posts delineating the ORV corridor at the spits and Cape Point and inside bird closures. Because some visitors do not keep their pets restrained on a 6-foot or shorter leash or crated as required, allowing pets in the vicinity of resource closures could result in harassment, injury, or mortality to one or more individuals.

From March 15 to November 30, in all locations not in front of the villages, outside of the avian prenesting areas and open to ORV use, alternative B would close to ORVs a linear strip of potential habitat (ocean intertidal zone, ocean backshore and dunes) in the ocean backshore zone at least 10 meters wide, if sufficient beach width is available to allow at least a 20-meter ORV corridor above the mean high tide. This would provide a protected area for nesting turtles, birds, and seabeach amaranth. The NPS would provide a 24-hour phone line for citizens to report illegal activity and unsafe conditions on the beach, educational information about protected species at all ORV access points, and a beach driving brochure to concisely communicate regulations and potential penalties for violations.

The overall impacts from ORV and other recreational use on piping plover were deemed by the plan/EIS impact analysis to be between moderate and major adverse because expected impacts on piping plover or their habitats would be beyond the level of disturbance and harm that would occur naturally, including small changes to local population numbers, population structure, and other demographic factors. Some impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals. However, large declines in population numbers would not occur. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. During the two years that management under alternative B was implemented at the Seashore (2008 and 2009), numbers of breeding pairs of piping plover (11 in 2008 and 9 in 2009) were higher than the historic low (two pair) during 2002 and 2003; the three pair in 2001, 2004, and 2005; and the six pair in 2006 and 2007 under alternative A. The robust piping plover data collection under alternative B would alert the Seashore to trends that might portend large declines, and additional management action would be taken to prevent such declines.

The plan/EIS analysis of cumulative impacts from combining the effects of alternative B with effects of other past, present, and future planned actions in and around the Seashore (such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the seashore, and increased interpretative programs as part of the Seashore's long range

interpretive plan), indicate that NPS management actions within the Seashore would act as a driver for overall cumulative impacts. The cumulative impacts were deemed to be moderate adverse in the plan/EIS impact analysis because large declines in population numbers would not result and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore the piping plover impacts would not result in impairment.

Determination of Effect. Under the ESA the actions taken under alternative B may affect / are likely to adversely affect piping plover due to the minor adverse effects from monitoring and surveying and from the moderately adverse impacts from ORV and other recreational use, especially with the high level of non-compliance that could result from buffers that adjust often and unpredictably. Further, the partial night-driving restrictions could contribute to long-term minor to moderate benefits to piping plovers, but could still result in long-term minor adverse impacts during the time when night driving is allowed (until 10:00 p.m. May 1 – September 15 during the piping plover breeding season) under alternative B as plovers are known to forage the shoreline during all hours. These impacts would result in a finding of may affect/ are likely to adversely affect piping plovers under the ESA because the action would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. And while there may be beneficial impacts from monitoring, surveying and management of recreation, the actions under alternative B would also likely result in minor adverse impacts from human presence during monitoring activities.

Under the ESA, the actions taken under alternative B may affect / are likely to adversely affect designated critical habitat for wintering piping plover due to the level of recreational access provided within these critical habitat areas and the impact of that access on the value of the habitat. There would be long-term, minor beneficial effects from closing suitable interior habitats at spits and at Cape Point to all recreational users, as these interior habitats are considered one of the PCEs that comprise the designated critical habitat for wintering piping plover. However, year-round recreational use would continue to occur on the majority of the intertidal sand beaches and spits, which are also PCEs of designated critical habitat. The level of recreational use (through the designation of the majority of the Seashore an ORV route or area year-round) could result in vehicular and pedestrian disturbance to foraging plovers and a reduction of invertebrate prey due to disturbance or destruction of the wrack from vehicles driving in and around the wrack line. There would be some benefit to the critical habitat from the implementation of seasonal night-driving restrictions although these restrictions would only apply between May 1 and November 15, which would not cover the majority of time when the wintering population of piping plover is present at the Seashore. Similarly, the protection of ocean backshore (also a PCE) under alternative B would not be required during the peak wintering period for piping plover and would not be implemented in areas of narrow beach width. Although this alternative would not result in a direct loss of critical habitat, the impacts of recreational use would result in a reduction in the value of the designated critical habitat for wintering plovers.

Implementation of alternative B would result in a finding of may affect / is likely to adversely affect designated critical habitat for wintering piping plover under the ESA because the action would result in direct or indirect impacts to the critical habitat for the species that are not discountable, insignificant, or beneficial. And while there would be beneficial impacts from the protection of suitable interior habitat, there would be adverse effects on the value of the primary constituent elements of critical habitat, due to the majority of spits, intertidal sand beaches, and ocean backshore being open to recreational use during wintering.

Impacts of Alternative C: Seasonal Management

Resources Management Activities

Establishment of Prenesting Closures. Prenesting surveying activities for piping plovers under alternative C would include the survey and evaluation of all potential breeding habitats by Seashore staff by March 1 of each year with piping plover prenesting closures recommendations based on that evaluation.

Alternative C would establish SMAs, which are defined as areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season (details are provided in “Table 10, Species Management Strategies for Action Alternatives” in chapter 2). Under alternative C, all designated breeding SMAs would be posted as prenesting closures using symbolic fencing by March 15 each year. The SMAs would be designated for two different MLs, ML1 or ML2. Under ML1, ORV or pedestrian access would not be allowed while prenesting closures are in effect. Under ML2, once prenesting closures are implemented, a narrow pedestrian access corridor would be established. Under alternative C, Bodie Island Spit, Cape Point, and South Point would be established as SMAs and managed under ML2. The remaining SMAs (and areas outside of SMAs) would be managed under ML1 measures. The prenesting closures, as well as the establishment of SMAs, would have long-term moderate beneficial impacts as closures would be in place to protect migrant piping plovers and birds establishing territories early in the breeding season.

Surveying and Monitoring. From March 15 through July 15, areas within any prenesting closures would be monitored three times per week and areas outside of any prenesting closures would be monitored two times per week, which would be increased to three times per week if birds are detected during monitoring. Seashore staff would look for piping plover nests by conducting “walk throughs” every three days. Once piping plover nests are found they would be observed daily from a distance that does not disturb the birds, based on professional judgment. Nests would be approached once per week to visually inspect the nest and check on the enclosure. Alternative C would include surveying all suitable breeding habitat three times a week to detect adults with an associated scrape area or nest foraging outside of an existing closure, which would allow for potential closures for foraging in the areas near known breeding sites. If breeding adult piping plover are observed foraging outside of an existing closure, the site would be surveyed daily to look for signs of courtship and/or nesting building. If piping plover are observed foraging outside of a closure on two consecutive surveys, a buffer would be either established or expanded using flexible increments based on observed bird behavior to include the entire length of the foraging site. These foraging area closures would be removed if no piping plover foraging is observed for a two-week period during the breeding season, or when any associated breeding activity has concluded. Under alternative C, piping plover nests and/or chicks would be surveyed and those with broods under ML1 management would be observed at least once a day, and broods under ML2 management would be observed daily for at least one hour in the morning and one hour in the afternoon. Monitor(s) would be present during all periods of ORV or pedestrian access. Observations under ML1 and ML2 management would end once chicks have fledged (chicks are considered fledged at 35 days of age or are observed in sustained flight of at least 49 feet [15 meters]). Surveying and monitoring as described above would increase knowledge on how and when piping plover use the Seashore and thereby enabling the NPS to implement adaptive management initiatives, providing a beneficial impact. However, as with all the alternatives, surveying and monitoring would bring people and/or essential vehicles into direct short-term contact with piping plovers and their habitat, and these activities themselves are known risk factors, especially during the more sensitive life stages of early prenesting and territory establishment. Under alternative C, many precautions would be taken by staff to minimize impacts from monitoring such as using high powered scopes and thereby reducing impacts from intrusion by monitors. The impact of the monitoring when these precautions are taken into consideration would be minor. Although there would be adverse impacts such as disturbance to piping plover at various life stages, the protection that would result

from surveying would result in long-term moderate beneficial impacts, as these actions would improve the sustainability of the species at the Seashore.

Buffer/Closure Establishment. Under alternative C, during the breeding season, ML1 measures would be implemented at South Beach, Hatteras Inlet Spit, and North Ocracoke Spit, and ML2 measures would be implemented at Bodie Island Spit, Cape Point, and South Point. Both ML1 and ML2 would provide 75-meter buffers around any piping plover nests, nest scrapes, and around any piping plover exhibiting breeding behavior. ML2 differs from ML1 in that it establishes a narrow pedestrian access corridor. Upon the first observation of breeding activity, the standard buffers would apply, which depending upon the circumstance could close the access corridor. NPS would retain the discretion to expand nest buffers under ML1 and ML2, depending on staffing and bird behavior. In unprotected areas, a buffer would be established immediately when a nest with egg(s) is found. Prior to hatching, vehicles may pass by such areas within designated ORV access corridors that have been established along the outside edge of nesting habitat, provided that buffers adequate to prevent human disturbance are maintained. When nests or chicks occur in the immediate vicinity of paved roads, parking lots, campgrounds, buildings, and other facilities, NPS would retain the discretion to provide resource protection to the maximum extent possible while still allowing those facilities to remain operational. NPS would not reduce buffers to accommodate ORV ramp access under alternative C. Under alternative C, buffers would remain in place for two weeks after a nest is lost to determine if birds would re-nest. Outside of prenesting areas, piping plover buffers would be removed if no breeding activity is seen in the area for two weeks, or two weeks after all chicks have fledged, whichever comes later. For unfledged piping plover chicks, ML1 would provide a 1,000-meter buffer for ORVs and pedestrians, and ML2 would provide a 1,000-meter buffer for ORVs and a 300-meter pedestrian buffer. This buffer would move with the chicks and would extend from the oceanside low water line to the soundside low water line or to the farthest extent of dune habitat if no soundside intertidal habitat exists.

Piping plovers would likely experience long-term moderate benefits from the size of the resource closures under ML1 and ML2 and the fact that buffers would adjust in response to chick mobility, as these actions would be expected to improve the sustainability of the species at the Seashore.

Under alternative C, broods under ML1 would be observed once per day and broods under ML2 would be observed for a minimum of one hour in the morning and one hour in the afternoon, whereas under alternative A broods would be observed continually during daylight hours during the first week and thereafter if the buffer size is 600 meters or less, or daily if the buffer is increased. Under alternative B, a 1,000-meter buffer would be established for the first two weeks after hatching and the brood would be observed for a minimum of one hour in the morning and one hour in the afternoon. If the buffer is reduced to 300 meters after the first two weeks then the brood would be monitored from dawn to dusk until fledging.

In addition to the establishment of prenesting areas, alternative C provides for protection of piping plover nests outside of the SMAs through the use of buffer distances recommended, in part, under the Piping Plover Recovery Plan (USFWS 1996a). Deviation from these recommendations and establishment of a 75-meter buffer around known nests is based on studies that show a greater susceptibility to disturbance in similar environments and Seashore staff observation (see “Elements Common to All Action Alternatives,” in chapter 2). Although the species would be offered protection by these buffers, short-term adverse impacts could result to piping plover if adjustments to a buffer are not made in a timely manner or if nests or acts of deliberate disturbance are missed by NPS staff outside of the SMAs. Therefore, the buffers under alternative C would be expected to have long-term moderate beneficial effects on the species because the benefits would outweigh the adverse effects.

Management conducted during prenesting and nesting life stages would bring people and/or essential vehicles into direct long-term contact with piping plover and their habitat, and these activities themselves are known risk factors, especially during the sensitive, early life stages of prenesting and territory establishment. However, management also results in providing appropriate protection to piping plover during these early stages of the annual nesting cycle that would otherwise expose piping plover to disturbances from a variety of activities that might do them far more harm and/or result in nest abandonment or abandonment of the area by the individual or pair. Hence, management provides long-term minor to moderate beneficial impacts to piping plover.

A systematic review of data, annual reports, and other information would be conducted by Seashore staff every 5 years, after a major hurricane, or if necessitated by a significant change in protected species status (e.g., listing or de-listing), in order to evaluate the effectiveness of management actions in making progress toward the accomplishment of stated objectives. Periodic review could result in changes to the management actions in order to improve effectiveness. When desired future conditions for resources are met or exceeded, periodic review and adaptive management may allow for more flexible management of recreational use, provided adverse impacts of such use are effectively managed and wildlife populations remain stable. Where progress is not being made toward the attainment of desired future conditions, periodic review and adaptive management may provide for additional management including appropriate restrictions on recreational use. Periodic review could result in changes to the management actions in order to improve effectiveness, which would have long-term moderate beneficial impacts.

Management of Wintering/Nonbreeding Populations. During the nonbreeding season, Seashore staff would monitor presence, abundance, and behavior of migrating and wintering shorebirds in all SMAs from July through May using the SECN protocol. These surveys would result in moderate beneficial impacts to plovers by providing Seashore managers with information on the types and location of habitats used by nonbreeding piping plovers, seasonality of plover use of the Seashore, tidal influences on habitat use, and potential threats the habitat may contain. Surveying would increase knowledge on how and when piping plovers use the Seashore and enable adaptive management initiatives.

During the nonbreeding season under alternative C, SMAs would be established at the points and spits based on an annual habitat assessment. In addition, year-round non-ORV areas along the ocean shoreline outside of the villages would be managed as Nonbreeding Shorebird SMAs with recreational activity restrictions such that if staff determines that any single recreational activity or collection of activities is negatively impacting nonbreeding piping plover use of a specific location, NPS may implement additional restrictions on activities. Regarding timing, under alternative C, all SMAs are closed to ORVs from March 15 through October 14, and a pedestrian access corridor is established at Bodie Island Spit, Cape Point, and South Point on March 15 (subject to ML2 actions when breeding activity is observed).

As with management that takes place during prenesting incubation and brood rearing life stages, post-breeding management conducted during the nonbreeding life stages would bring people and/or essential vehicles into direct long-term contact with piping plover and their habitat, and these activities themselves are known to result in disturbance to foraging and resting plovers. However, management also results in providing some protection to piping plover during nonbreeding life history stages that might otherwise expose piping plover to far more disturbances. Although migrant plover can and do utilize the entire shoreline, a large portion of the preferred stopover sites (i.e., Bodie Island Spit and South Point) remain closed to ORVs throughout the period when migrants are observed in the spring and fall and throughout the winter for the small population that overwinters at the Seashore. Hence, nonbreeding management protocols under alternative C provide long-term moderate beneficial impacts to nonbreeding piping plover.

Education and Outreach. Under alternative C, education and outreach activities would be the same as those described under alternative A, with the addition of educational requirements as part of a permit program. This additional education would result in long-term minor to moderate benefits to species as the public is provided with more information regarding this issue.

Overall Impacts of Resources Management Activities. Overall impacts under alternative C from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate beneficial. As with alternative B, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative C, areas of high resource sensitivity (SMAs) and high visitor use would generally be designated as non-ORV areas during the breeding season and peak visitation period (March 15 to October 14). ORV routes would be designated outside of these locations and would be open to ORV use during the same period. Some areas would be open to ORV use during the off-season (October 15 to March 14), while some areas would remain vehicle-free year-round to provide opportunities for non-ORV users to experience the Seashore without the presence of vehicles. The establishment of SMAs and other non-ORV use areas would serve to reduce pressure on the species from recreational uses, as compared to alternatives A and B.

Approximately 27 miles of shoreline would be designated for ORV use year-round, approximately 298 miles would be seasonally designated for ORV use from October 15 through March 14, and approximately 12 miles would be designated as non-ORV year-round. The speed limit would be 15 mph unless otherwise posted, and permits would be required for all ORVs. Three SMAs that are seasonally designated as non-ORV from March 15 to October 14 would be managed under ML2 procedures and would maintain an open pedestrian access corridor along the shoreline to the inlet or point, subject to resource closures.

The seasonal restriction on ORVs and pedestrians in SMAs, the level of monitoring provided, and the size of the buffers under alternative C would reduce the potential of disturbance and nest abandonment from direct short-term contact with people and/or essential vehicles compared to alternatives A and B. In addition, the preclusion of ORV access in the SMAs for the entire breeding season would reduce the level of recreational use in sensitive resource areas. Although these measures should limit adverse impacts to piping plover, compliance with closures may not be absolute, since alternative C still includes pedestrian access to Bodie Island Spit, Cape Point, and South Point during the breeding season, and the areas closed are not expansive or contiguous. Therefore, recreational uses could result in short-term moderate adverse impacts if non-compliance occurs.

Establishment of SMAs and prescribed buffers and exclusion of ORVs from these areas during the breeding season would reduce pressure on the species from recreational uses at the Seashore. Under this alternative, recreational activities would still occur in the vicinity of the species and would still have the potential to impact them, with minor to moderate adverse impacts to piping plover from recreational use, and minor to moderate benefits from the protection offered.

Night-Driving Restrictions. Under alternative C, operation of all nonessential ORV traffic would be prohibited from all areas (other than the soundside) between 7:00 p.m. and 7:00 a.m. from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles holding valid ORV permits. Furthermore, NPS retains the discretion

to limit night driving to certain areas or routes, based on resource protection considerations. Because plovers are known to be active at night (Staine and Burger 1994; Majka and Shaffer 2008), and plover chick and fledgling response to vehicles can increase their vulnerability to ORVs (USFWS 1996a), the high level of protection at night from May 1 to November 15 under alternative C would result in long-term moderate beneficial impacts because it would reduce the potential for disturbance to plovers that could result in mortality.

Commercial Fishing. Commercial fishing vehicle access would be the same as under alternative A and would be managed by the terms and conditions in the commercial fishing special use permit, which includes restriction from entering resource closures. Commercial fisherman would not be required to obtain an ORV permit, but would be regulated under their existing use permit. Under alternative C, commercial fishing vehicles would be authorized to enter non-ORV areas, but would not be allowed to enter resource closures or lifeguarded beaches. Night-driving restrictions, which are applicable to all ORV use, could be modified by up to +/- 2 hours for commercial fishing purposes. Presence of commercial fishing operations would have a long-term negligible adverse impact, with long-term minor to moderate benefits from night-driving restrictions.

Permit/Carrying Capacity. As described above under the night-driving restrictions and education/outreach sections, alternative C would require a permit for ORV use, including night driving. As stated in these sections, as a result of the educational information provided by the permit, there would be long-term minor to moderate benefits to piping plover as ORV users would be more aware of the regulations in place to protect this species, which would likely result in a higher level of compliance with buffer, closures, and other restrictions. ORV carrying capacity established under alternative C would not directly impact piping plover, as ORV use would not be allowed in resource protection areas.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all SMAs from March 15 to October 14 and within all nonbreeding shorebird SMAs that are otherwise open to recreational use; however, compliance would be needed to ensure that this reduces the risks of impacts. In addition, an educational permit would be required for any beach fire year-round, which would inform visitors about species protection issues related to this recreational activity. Camping restrictions would be the same as those under alternative A, with additional requirements for removing unattended beach equipment prior to nightfall. These restrictions would result in long-term minor to moderate benefits to species at the Seashore, further reducing pressure to piping plover from recreational activity.

Overall Impacts from ORV and Other Recreational Use. Overall, impacts to piping plover from ORV and other recreational use would be long-term minor adverse. The establishment of the SMAs, which proactively reduce or preclude recreational use early in the breeding season; ORV permit requirements; seasonal night-driving restrictions; and pet and other recreational activity restrictions would all provide benefits in terms of species protection. As there would still be some opportunity for recreational use to come in contact with and impact piping plovers, and the fact that alternative C would still include some level of pedestrian access to three SMAs during a portion of the breeding season, impacts to piping plover would be long-term minor adverse.

Cumulative Impacts. The same past, present, and future actions discussed under the cumulative impact scenario for alternative A would occur under alternative C. The overall cumulative impact of these past, current, and future actions would be long-term negligible to minor, depending on the intensity and duration of unpredictable factors such as storm events, with long-term moderate beneficial impacts from actions such as increased interpretive programs as part of the long-range interpretive plan and predator management within the Seashore. Many of these actions do not directly impact piping plover habitat in the area, as most of this habitat is located within the Seashore and is affected by NPS management actions more than any of the aforementioned past, present, and future actions. These impacts, combined with the

long-term minor adverse, as well as minor to moderate beneficial impacts of alternative C, would be long-term minor adverse impacts, as actions within the Seashore would act as a driver for overall cumulative impact.

Conclusion. Overall impacts under alternative C from resources management activities would be long-term moderate beneficial. As with alternative B, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of prenesting closures within the SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species. Overall impacts under alternative C from ORV and other recreational use would be long-term minor adverse. The establishment of the SMAs, which proactively reduce or preclude recreational use early in the breeding season; prohibition of ORV use in SMAs between March 15 and October 14; ORV permit requirements; seasonal night-driving restrictions; and restrictions on pets and other recreational activities would all provide benefits in terms of species protection. As there would still be some opportunity for recreational use to come in contact with and impact the species, impacts to piping plovers would be long-term minor adverse.

Cumulative impacts under alternative C would be long-term minor adverse.

Impairment Determination. Implementation of alternative C would not impair piping plover because sufficient population numbers and functional habitat would remain to maintain a sustainable population of piping plover in the Seashore. Under alternative C, the Seashore would establish SMAs, which proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. Under alternative C, ORVs would be prohibited in SMAs between March 15 and October 14. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. SMAs at Bodie Island Spit, Cape Point, and South Point would be closed to ORVs with a narrow pedestrian access corridor. The remaining SMAs and areas outside of SMAs would not allow ORV or pedestrian access while prenesting closures are in effect. Pets would be prohibited within all designated breeding shorebird SMAs from March 15 to October 15. Pets would be prohibited within all nonbreeding shorebird SMAs that are otherwise open to recreational use. From March 15 through July 15, Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting closures two times per week, increasing to three times per week once birds are present.

The plan/EIS impact analysis deemed the management measures for breeding and nonbreeding piping plover, such as 75-meter buffers for nests, nest scrapes, and breeding behavior; 1,000-meter ORV buffers and 300-meter pedestrian buffers for chicks; nonbreeding SMAs; establishment of non-ORV areas; prohibition of night driving between 7:00 p.m. and 7:00 a.m. from May 1 to November 15; and increased monitoring, under alternative C to be minor to moderate beneficial because they would minimize or prevent harassment or injury to individuals and improve the sustainability of the piping plover in the Seashore.

Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. However, alternative C would require a permit for ORV use, which includes an educational component. Because ORV users would be more aware of the regulations in place to protect piping plover, the permit requirement would likely increase

compliance with buffers, closures, and other restrictions. Violations may result in permit revocation, which is expected to increase compliance. Under alternative C, ORVs would bring people into the vicinity of plover areas where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of piping plovers; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance and harm that would occur naturally, but are not expected to result in large declines in population because the Seashore takes management action to protect piping plover from predation. The plan/EIS impact analysis deemed alternative C adverse impacts to piping plover from ORV and other recreational use to be minor because impacts would be detectable, but would not be beyond the level of disturbance or harm that would occur naturally. Some impacts might occur during critical reproductive periods, but would not result in injury or mortality. Sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore.

The plan/EIS analysis of cumulative impacts from combining the effects of alternative C with effects of other past, present, and future planned actions in and around the Seashore (such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the seashore, and increased interpretative programs as part of the Seashore's long range interpretive plan), indicate that NPS management actions within the Seashore would act as a driver for overall cumulative impacts. The cumulative impacts were deemed to be minor adverse in the plan/EIS impact analysis because impacts would be detectable, but would be within natural fluctuations. Some impacts might occur during critical reproductive periods, but would not result in injury or mortality. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore the piping plover impacts would not result in impairment.

Determination of Effect. Under the ESA, the actions taken under alternative C may affect / are likely to adversely affect piping plover due to the minor adverse effects from monitoring and surveying and the minor adverse effects of ORV and other recreational use. Establishment of these SMAs and prenesting closures early in the breeding season would have long-term moderate benefits to piping plover. ORV use and pedestrian access would result in long-term minor adverse impacts as the SMAs and larger buffers would reduce pressure from recreational uses on piping plovers. However, recreational uses would still occur in the vicinity of plovers during breeding season. Restricting ORV use at night from May 1 to November 15 would offer a higher level of protection than alternatives A and B and would have long-term moderate benefits to foraging plovers. These impacts would result in a finding of may affect / are likely to adversely affect piping plovers under the ESA because the action would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. And while there may be beneficial impacts from monitoring, surveying, and management of recreation, the actions under alternative C would also likely result in some adverse effects.

Under the ESA, the actions taken under alternative C may affect / are not likely to adversely affect designated critical habitat for wintering piping plover due to the establishment of SMAs which would result in the closure of approximately 12 miles of shoreline to ORV use year round, which would provide relatively less-disturbed foraging, resting, and roosting areas for migrating and wintering shorebirds. These closures would protect the primary constituent elements of intertidal sand beaches and backshores in these areas. Year-round non-ORV areas along the ocean shoreline would be managed as Nonbreeding Shorebird SMAs with recreational activity restrictions, such that if staff determines that any single recreational activity or collection of activities is negatively impacting nonbreeding piping plover use of a specific location, NPS may implement additional restrictions on activities. Nonbreeding Shorebird SMAs would also be established at the points and spits based on an annual habitat assessment, which would provide protection for interior wintering plover habitat. There would be some benefit to the critical habitat from the implementation of seasonal night-driving restrictions although these restrictions would only

apply between May 1 and November 15, which would not cover the majority of time when the wintering population of piping plover is present at the Seashore.

Although there would be construction of ORV access ramps, parking areas, and interdunal roads, none of these improvements would impact any of the primary constituent elements of designated critical habitat for wintering piping plover.

Implementation of alternative C would result in a finding of may affect / is not likely to adversely affect designated critical habitat for wintering piping plover under the ESA because the action would result in impacts to the critical habitat for the species that are discountable, insignificant, or beneficial. Actions under alternative C would result in greater protection of the primary constituent elements of suitable interior habitat, spits, intertidal sand beaches, and ocean backshore, primarily as a result of the establishment of Nonbreeding Shorebird SMAs and approximately 12 miles of year-round non-ORV areas.

Impacts of Alternative D: Increased Predictability and Simplified Management

Resources Management Activities

Establishment of Prenesting Closures. Prenesting surveying activities for piping plovers under alternative D would be carried out as described under alternative C, which would include the survey and evaluation of all potential breeding habitats by Seashore staff by March 1 of each year with piping plover prenesting closures recommendations based on that evaluation. Under alternative D, all designated breeding SMAs would be posted as prenesting closures using symbolic fencing by March 15 of each year. All SMAs under alternative D would be managed under ML1 procedures, which would prohibit recreational access while the closures are in place, and would provide long-term major benefits to the species.

Surveying and Monitoring. Surveys and monitoring during prenesting, nesting, and chick rearing life stages would be largely similar to alternative C. However, under alternative D, ML1 procedures would be implemented in all SMAs during the breeding season, resulting in a reduction in the frequency of monitoring required compared to alternatives that either do not designate any SMAs or those that employ ML2 procedures and therefore require more frequent monitoring. Under the ML1 procedures in alternative D, all SMAs containing piping plover habitat would be closed to public access throughout the breeding season.

Because the frequency of monitoring would be reduced under alternative D, the impacts from surveying and monitoring, such as disturbance to piping plover at various life stages would also be reduced. Monitoring and surveying would result in minor to moderate, beneficial impacts to piping plover by providing Seashore managers with information on habitats used by breeding and nonbreeding piping plovers and the locations of those habitats, as well as potential threats they may contain. Surveying and monitoring would increase knowledge on how and when piping plover use the Seashore and thereby enabling the NPS to implement adaptive management initiatives, providing a beneficial impact. However, as with all the alternatives, surveying and monitoring would bring people and/or essential vehicles into direct short-term contact with piping plovers and their habitat, and these activities themselves are known risk factors, especially during the more sensitive life stages of early prenesting and territory establishment. Under alternative D, many precautions would be taken by staff to minimize impacts from monitoring such as using high powered scopes and thereby reducing impacts from intrusion by monitors. The impact of the monitoring when these precautions are taken into consideration would be minor. Although there would be adverse impacts such as disturbance to piping plover at various life stages, the protection that would result from surveying would result in long-term moderate beneficial impacts.

Buffer/Closure Establishment. Under alternative D, ML1 procedures would be implemented during the breeding season at all SMAs including Bodie Island Spit, Cape Point, and South Point, which would preclude all public access throughout the breeding season and all ORV use year-round. ML1 procedures measures designate 75-meter buffers around any piping plover nests and scrapes. ML1 procedures provide 1,000-meter buffers for both ORVs and pedestrians around unfledged chicks, as opposed to ML2 procedures in other action alternatives that reduce this to 300-meters for pedestrians. Because buffers under ML1 procedures are larger, there would be less monitoring required resulting in fewer changes in closure fencing by Seashore staff. Piping plovers would likely experience long-term moderate to major benefits from the size and duration of the closures and from the fact that buffers would adjust in response to chick mobility under ML1 procedures.

In addition to the closure of all SMAs to public access during the breeding season, alternative D provides for the protection of piping plover nests through the use of buffer distances recommended, in part, under the Piping Plover Recovery Plan (USFWS 1996a) as described under alternative C. If piping plover breeding activity occurs outside of the SMAs, adverse impacts could result if implementation of or adjustments to a buffer are not made in a timely manner. This outcome may be more likely under the reduced monitoring associated with alternative D and ML1 procedures, or if nests or acts of deliberate disturbance are not detected by Seashore staff.

Under alternative D designated SMAs would be subject to periodic review, as described under alternative C, resulting in long-term moderate beneficial impacts. Overall, the benefit of the preclusion of all public access in SMAs during the breeding season would outweigh the disturbance inherent with species management, and result in long-term moderate to major beneficial impacts from species closures and buffers.

Management of Wintering/Nonbreeding Populations. Management of wintering/nonbreeding populations under alternative D would be the same as those under alternative C, resulting in long-term moderate beneficial impacts.

Education and Outreach. Under alternative D, impacts as a result of education and outreach, including education from a permit system, would be the same as those under alternative C and would result in long-term minor to moderate beneficial impacts.

Overall Impacts of Resources Management Activities. Overall impacts to piping plover from resources management activities (primarily resulting from the effects of surveying and field activities) under alternative D would be long-term moderate to major beneficial. As with all species management activities, minor adverse impacts would occur from human presence during monitoring, but on the whole the implementation of SMAs that prohibit ORV use year-round and only allow pedestrian access outside of the breeding season, establishment of prenesting closures early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate to major beneficial impacts to the species.

ORV and Other Recreational Use

ORV and Pedestrian Access. Alternative D is designed to provide visitors to the Seashore with the maximum amount of predictability regarding routes available for ORV use and vehicle-free areas for pedestrian use, which means establishing year-round ORV route and non-ORV area designations. Under this alternative, year-round vehicle-free areas would include the area in front of villages and lifeguarded beaches, as well as all SMAs, which include the points and spits. Approximately 27 miles of shoreline would be designated for ORV use and approximately 41 miles would be designated as non-ORV year-round. Non-ORV areas would be open to pedestrian access, except for the SMAs during breeding season

and potentially other locations outside the SMAs if breeding activity occurs. There would be no seasonally designated ORV routes. In designated ORV areas, the speed limit would be 15 mph unless otherwise posted, and permits would be required for all ORVs. Other uses would still be allowed in these vehicle-free areas outside of any identified resource closures/SMAs.

Restricted access within large contiguous areas, including all points and spits, under alternative D would provide long-term moderate to major beneficial impacts to the piping plover (as described above under buffer/closure establishment), with greater benefits associated with fewer occurrences of non-compliance that would be expected from restrictions that would essentially eliminate a conduit or access way for ORVs and pedestrians in these sensitive areas. Disturbance from direct short-term contact with people and/or ORVs should be greatly reduced compared to alternatives A, B, and C, because of the amount of Seashore that is designated as non-ORV year-round, including all points and spits, which are the primary breeding and foraging areas for piping plover. Closures to pedestrians in all SMAs during the breeding season would also reduce the potential for disturbance to breeding plovers. As with all alternatives, compliance with closures would be an enforcement issue for the NPS, although with the size/length of the non-ORV areas, non-compliance would be much less likely. It is recognized that compliance would still be less than absolute, with a potential for short-term adverse impacts, but overall alternative D would provide substantial benefits to the species. Adverse impacts from ORV and pedestrian access would be expected to be long-term minor adverse.

Night-Driving Restrictions. Under alternative D, night-driving restrictions would be the same as under alternative C and would result in long-term moderate beneficial impacts as it would further reduce the potential for disturbance to night-foraging plover that could result in mortality, although foraging of piping plover outside of the SMAs is unlikely.

Commercial Fishing. Commercial fishing activities under alternative D would be the same as alternative C and would result in long-term negligible adverse impacts, with long-term minor to moderate benefits from night-driving restrictions.

Permit/Carrying Capacity Requirements. As described above under the night-driving restrictions and education/outreach sections, alternative D would require a permit for ORV use, including night driving. As stated in these sections, as a result of the educational information provided by the permit, there would be long-term minor to moderate benefits to piping plover as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance with buffer, closures, and other restrictions. There would be no impacts related to carrying capacity, as it would not be a requirement under alternative D, other than one-deep vehicle stacking restrictions.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all SMAs year-round. Camping would not be permitted at the Seashore, and beach fires would be regulated with a non-fee educational permit, as described under alternative C. Prohibition of pets within the SMAs year-round and additional education from a beach fire permit would be expected to have long-term minor to moderate beneficial impacts to the species, greater than those under alternative C, provided the level of non-compliance is kept low.

Overall Impacts from ORV and Other Recreational Use. Overall impacts under alternative D from ORV and other recreational use would be long-term minor adverse. The establishment of SMAs that are closed to ORVs year-round and managed under ML1 procedures during the breeding season would proactively preclude recreational use early in the breeding season from large areas of the Seashore, which would reduce the potential for disturbance to plovers during critical life stages. This protection, combined with ORV permit requirements, seasonal night-driving restrictions, and pet and other recreational activities restrictions would all provide benefits in terms of species protection. As there would still be some

opportunity for recreational use to come in contact with and impact the species, impacts would be long-term minor adverse.

Cumulative Impacts. The same past, present, and future actions discussed under the cumulative impact scenario for alternative A would occur under alternative D. The overall cumulative impact of these past, current, and future actions, would be long-term negligible to minor, depending on the intensity and duration of unpredictable factors such as storm events, with long-term moderate beneficial impacts from actions such as increased interpretive programs as part of the long-range interpretive plan and predator management within the Seashore. Many of these actions do not directly impact piping plover habitat in the area, as most of this habitat is located within the Seashore and is impacted by NPS management actions more than any of the aforementioned past, present, and future actions. These impacts, combined with the long-term minor adverse, as well as minor to major beneficial impacts of alternative D, would be long-term minor adverse impacts, as actions within the Seashore would act as a driver for overall cumulative impacts.

Conclusion. Overall impacts to piping plover from resources management activities (primarily resulting from the effects of surveying and field activities) under alternative D would be long-term moderate to major beneficial. As with all species management activities, minor adverse impacts would occur from human presence during monitoring, but on the whole the implementation of SMAs that prohibit ORV use year-round and only allow pedestrian access outside of the breeding season, establishment of prenesting closures early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate to major beneficial impacts to the species. Overall impacts under alternative D from ORV and other recreational use would be long-term minor adverse. The establishment of SMAs that are closed to ORVs year-round and managed under ML1 procedures during the breeding season would proactively preclude recreational use early in the breeding season from large areas of the Seashore, which would reduce the potential for disturbance to plovers during critical life states. This protection, combined with ORV permit requirements, seasonal night-driving restrictions, and pet and other recreational activities restrictions would all provide benefits in terms of species protection. As there would still be some opportunity for recreational use to come in contact with and impact the species, impacts would be long-term minor adverse.

Cumulative impacts would be long-term minor adverse.

Impairment Determination. Implementation of alternative D would not impair piping plovers because sufficient population numbers and functional habitat would remain to maintain a sustainable population of piping plover in the Seashore. Under alternative D, the Seashore would establish SMAs, which proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. Under alternative D, all public access (ORV and pedestrian) would be precluded from all SMAs containing piping plover habitat during the breeding season and from ORV use year-round. Pets would be prohibited in all designated SMAs year-round. From March 15 through July 15, Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting closures two times per week, increasing to three times per week once birds are present.

Under alternative D, management measures for breeding and nonbreeding piping plovers include 75-meter buffers for nests, nest scrapes, and breeding behavior; 1,000-meter buffers that adjust to chick mobility for both ORV and pedestrians; fewer changes in closure fencing; year-round SMAs; establishment of non-ORV areas; prohibition of night driving between 7:00 p.m. and 7:00 a.m. from May 1 to November 15; and increased monitoring. The plan/EIS impact analysis deemed the impacts of the

management measures for breeding and nonbreeding piping plover under alternative D to be between moderate and major beneficial because they would be detectable and could be beyond the level of disturbance or harm that would occur naturally. Protection to key life history stages would minimize or prevent harassment or injury to individuals, may result in notable increases in Seashore population levels, and would improve the sustainability of the piping plover in the Seashore.

Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians and pets may result in harassment, injury or mortality to one or more individuals. However, alternative D would require a permit for ORV use which includes an educational component. Because ORV users would be more aware of the regulations in place to protect piping plover, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Additionally violations may result in permit revocation, which is expected to increase compliance. Under alternative D, ORVs would bring people into the vicinity of plover areas where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of piping plovers; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance and harm that would occur naturally, but is not expected to result in large declines in population because the Seashore takes management action to protect piping plover from predation. The plan/EIS impact analysis of alternative D deemed adverse impacts to piping plover from ORV and other recreational use to be minor because impacts would be detectable, but would not be beyond the level of disturbance or harm that would occur naturally. Some impacts might occur during critical reproductive periods, but would not result in injury or mortality. Sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore.

The plan/EIS analysis of cumulative impacts from combining the effects of alternative D with effects of other past, present, and future planned actions in and around the Seashore (such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the seashore, and increased interpretative programs as part of the Seashore's long range interpretive plan), indicate that NPS management actions within the Seashore would act as a driver for overall cumulative impacts. The cumulative impacts were deemed to be minor adverse in the plan/EIS impact analysis because impacts would be detectable, but would be within natural fluctuations. Some impacts might occur during critical reproductive periods, but would not result in injury or mortality. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the piping plover impacts would not result in impairment.

Determination of Effect. Under the ESA, the actions taken under alternative D may affect / are likely to adversely affect piping plover due to the minor adverse effects from monitoring and surveying and the minor adverse impacts from ORV and other recreational use. Establishment of SMAs with year-round ORV closures and prenesting closures early in the breeding season would have long-term moderate to major benefits to piping plover. ORV use and pedestrian access would result in long-term minor adverse impacts as the SMAs and larger buffers would reduce pressure from recreational uses on plovers. However, recreational uses would still occur in the vicinity of plovers during breeding season. Restricting ORV use at night from May 1 to November 15 would offer a higher level of protection than alternatives A and B and would have long-term moderate benefits to foraging plovers. These impacts would result in a finding of may affect/ are likely to adversely affect piping plovers under ESA because the action would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. And

while there may be beneficial impacts from monitoring, surveying, and management of recreation, the actions under alternative D would also likely cause some adverse effects.

Under the ESA, the actions taken under alternative D may affect / are not likely to adversely affect designated critical habitat for wintering piping plover due to the establishment of SMAs which would result in the closure of approximately 41 miles of shoreline to ORV use year round, including ocean beaches along all of the points and spits. These closures would provide less-disturbed foraging, resting, and roosting areas for migrating and wintering shorebirds and would protect the primary constituent elements of intertidal sand beaches, backshores, and spits. These year-round non-ORV areas along the ocean shoreline would be managed as Nonbreeding Shorebird SMAs with recreational activity restrictions, such that if staff determines that any single recreational activity or collection of activities is negatively impacting nonbreeding piping plover use of a specific location, NPS may implement additional restrictions on activities. Nonbreeding Shorebird SMAs would also be established at the points and spits based on an annual habitat assessment, which would provide protection for interior wintering plover habitat. There would be some benefit to the critical habitat from the implementation of seasonal night-driving restrictions although these restrictions would only apply between May 1 and November 15, which would not cover the majority of time when the wintering population of piping plover is present at the Seashore.

Although there would be construction of ORV access ramps, parking areas, and interdunal roads, none of these improvements would impact any of the primary constituent elements of designated critical habitat for wintering piping plover.

Implementation of alternative D would result in a finding of may affect / is not likely to adversely affect designated critical habitat for wintering piping plover under the ESA because the action would result in impacts to the critical habitat for the species that are discountable, insignificant, or beneficial. Actions under alternative D would result in greater protection of the primary constituent elements of suitable interior habitat, spits, intertidal sand beaches, and ocean backshore, primarily as a result of the establishment of Nonbreeding Shorebird SMAs and 41 miles of year-round non-ORV areas.

Impacts of Alternative E: Variable Access and Maximum Management

Resources Management Activities

Establishment of Prenesting Closures. Prenesting surveying activities for piping plovers under alternative E would be carried out as described under alternative C, which would include the survey and evaluation of all potential breeding habitats by Seashore staff by March 1 of each year with piping plover prenesting closures recommendations based on that evaluation. Under alternative E, all designated breeding SMAs would be posted as prenesting closures using symbolic fencing by March 15 of each year. However, under alternative E, Bodie Island Spit, Cape Point, and South Point would be managed under ML2 procedures, which would include the establishment of an ORV pass-through zone at the start of the breeding season, which would be subject to resource closures if necessary. Establishment of these SMAs and prenesting closures early in the breeding season would have long-term moderate benefits to piping plover.

Surveying and Monitoring. Surveys and monitoring during prenesting, nesting, and chick rearing life stages would be the same as alternative C. Protected species buffers would follow ML1 procedures at most areas of the Seashore, with the exception of Bodie Island Spit, Cape Point, and South Point, where ML2 procedures would apply. Because surveying and monitoring protocols would be the same as alternative C, these protocols would result in long-term moderate beneficial impacts to piping plovers by providing Seashore managers with information on the types and location of habitats used by nonbreeding

pipin plover, seasonality of plover use of the Seashore, tidal influences on habitat use, and potential threats the habitat may contain. Surveying would increase knowledge on how and when pipin plover use the Seashore and enable adaptive management initiatives and contribute to better management.

As with all the alternatives, surveying and monitoring would bring people and/or essential vehicles into direct short-term contact with pipin plover and their habitat, and these activities themselves are known risk factors, especially during the more sensitive life stages of early prenesting and territory establishment. Under alternative E, like alternative C, many precautions would be taken by staff to minimize impacts from monitoring, such as using high powered scopes, thereby reducing impacts from intrusion by monitors. The impact of the monitoring when these precautions are considered would be minor. Although there would be adverse impacts such as disturbance to pipin plover at various life stages, the protection that would result from surveying would result in long-term moderate beneficial impacts.

Buffer Closure/Establishment. Under alternative E, SMAs would be established and the level of species management designated either ML1 or ML2. ML1 procedures would not allow ORV or pedestrian access when prenesting closures are in effect. Bodie Island Spit, Cape Point, and South Point would be managed under ML2 procedures and would include a narrow ORV access corridor at the start of the breeding season that would be subject to resource closures if necessary. ML1 procedures require 75-meter buffers around any pipin plover nests or scrapes. ML1 procedures provide 1,000-meter buffers for both ORVs and pedestrians around unfledged chicks, as opposed to ML2 procedures, which reduce this distance to 300 meters for pedestrians. Because buffers under ML1 procedures are larger, there would be less monitoring required, resulting in fewer changes in closure fencing by Seashore staff. Pipin plover would likely experience moderate long-term benefits from the size and duration of the closures and from the fact that buffers would adjust in response to chick mobility.

Like alternative C, in addition to prenesting areas and the general reduction in recreational pressure provided by the SMAs, alternative E would provide for protection of pipin plover nests outside of the SMAs through the use of buffer distances described under alternative C. Although the species would be offered protection by these buffers, short-term adverse impacts could result to pipin plover if adjustments to a buffer are not made in a timely manner or if nests or acts of deliberate disturbance are missed by Seashore staff outside of the SMAs areas. Therefore, the buffers under alternative E would be expected to have long-term moderate beneficial effects on the species because the benefits outweigh the adverse effects of surveys and monitoring. Alternative E would also include periodic review (as described under alternative C), which would provide additional benefits to the species, as management actions could be altered to provide improved protection for plover.

Management of Wintering/Nonbreeding Populations. Under alternative E, as described under alternatives C and D, SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be established no later than when breeding season closures are removed at the same location(s), resulting in long-term moderate beneficial impacts from this protection.

Nonbreeding resource closures would be established at the spits and Cape Point based on habitat used by wintering pipin plover in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, designated non-ORV areas along the ocean shoreline would provide areas of reduced ORV disturbance for foraging, resting, and roosting areas for migrating and wintering shorebirds.

Education and Outreach. Under alternative E, impacts as a result of education and outreach, including education from a permit system, would be the same as those under alternative C and would result in long-term minor to moderate beneficial impacts to piping plover.

Overall Impacts of Resources Management Activities. Overall impacts under alternative E from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate beneficial. As with all species management activities, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative E, approximately 33 miles of shoreline would be designated for ORV use year-round, approximately 20 miles would be designated for seasonal ORV use from September 1 through March 14, and approximately 15 miles would be designated as non-ORV year-round. The speed limit would be 15 mph unless otherwise posted, and permits would be required for all ORVs. In the SMAs, under ML2 procedures, adjacent to the prenesting area, NPS would provide an ORV corridor with a pass-through zone at the start of the breeding season (March 15). When breeding activity is observed, standard buffers would apply, which depending upon the circumstances could close the access corridor until breeding activity has concluded.

The designation of SMAs and other restrictions under alternative E would reduce the potential of disturbance and nest abandonment from direct short-term contact with people and/or essential vehicles compared to alternatives A and B, but would have greater impacts than alternative C due to the existence of an ORV pass-through at three SMAs, which would create a conduit to the points and spits for ORVs. Alternative E would also reduce the duration of ORV closures in SMAs managed under ML1 procedures by allowing ORV use starting September 1 instead of October 14 (alternative C). Impacts would also be greater under alternative E than alternative D, which has all SMAs closed to ORV and pedestrian use during the breeding season. Although these measures should limit adverse impacts to piping plover, compliance with closures may not be absolute, since alternative E still includes access to some points and spits, which could result in short-term moderate adverse impacts if non-compliance occurs.

Although the SMAs would be beneficial to the species, continued recreational use in this area would still result in potential long-term minor to moderate adverse impacts to the species, which would be greater than those impacts under alternative C because of the increased level of access provided under alternative E and the shorter duration of SMA closures.

Night-Driving Restrictions. Under alternative E, night-driving restrictions would be similar to those in alternative B and would result in long-term minor to moderate beneficial impacts because it would reduce the potential for disturbance to night-foraging birds that could result in mortality. However, ORV use would still be allowed until 10:00 p.m. from May 1 through November 15, which would result in ORVs on the beach after dark and could still result in some level of adverse impact.

Commercial Fishing. Management of commercial fishing under alternative E would be the same as alternative C resulting in long-term negligible adverse impacts from the presence of commercial fishing vehicles, with long-term minor to moderate benefits from night-driving restrictions.

Permit/Carrying Capacity. As described above under the night-driving restrictions and education/outreach sections, alternative E would require a permit for ORV use, including night-driving. As stated in these sections, as a result of the educational information provided by the permit, there would

be long-term minor to moderate benefits to piping plover as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance with buffer, closures, and other restrictions. There would be no impacts to piping plover related to carrying capacity, for reasons described under alternative C.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all SMAs from March 15 to August 31. As with alternative C, an educational permit would be required for any beach fire year-round, which would inform visitors about species protection issues related to this recreational activity.

Camping restrictions would be the same as alternative C; however, park-and-stay permits for overnight beach use would be issued at selected spits and points that are not closed for resource protection. The provision for park-and-stay overnight at some spits and points during portions of the breeding season when resource closures do not preclude access would increase the potential for human disturbance to nesting birds adjacent to those locations.

Pet, camping, and beach fire restrictions would result in long-term minor to moderate benefits to species at the Seashore, further reducing pressure to piping plover from recreational activity, with the potential for long-term minor to moderate adverse impacts from the park-and-stay option, which would occur outside of resource closures.

Overall Impacts from ORV and Other Recreational Use. Overall impacts under alternative E from ORV and other recreational use would be long-term minor to moderate adverse. The establishment of the SMAs which proactively reduce or preclude recreational use early in the breeding season, ORV permit requirements, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. Although there would be benefits from seasonal night-driving restrictions, they would not be as great as other action alternatives because driving after dark (until 10:00 p.m.) would still be occurring, even during seasonal restrictions. The potential for adverse impacts would exist from the park-and-stay option under this alternative. As there would still be some opportunity for recreational use to come in contact with and impact the species, impacts would be long-term minor to moderate adverse.

Cumulative Impacts. The same past, present, and future actions discussed under the cumulative impact scenario for alternative A would occur under alternative E. The overall cumulative impact of these past, current, and future actions, would be long-term negligible to minor, depending on the intensity and duration of unpredictable factors such as storm events, with long-term moderate beneficial impacts from actions such as increased interpretive programs as part of the long-range interpretive plan and predator management within the Seashore. Many of these actions do not directly impact piping plover habitat in the area, as most of this habitat is located within the Seashore and is impacted by NPS management actions more than any of the aforementioned past, present, and future actions. These impacts, combined with the long-term minor to moderate adverse, as well as minor to moderate beneficial impacts of alternative E, would be long-term minor to moderate adverse impacts, as actions within the Seashore would act as a driver for overall cumulative impact.

Conclusion. Overall impacts under alternative E from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate beneficial. As with all species management activities, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species.

Overall impacts under alternative E from ORV and other recreational use would be long-term minor to moderate adverse. The establishment of the SMAs which proactively reduce or preclude recreational use

early in the breeding season, ORV permit requirements, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. Although there would be benefits from seasonal night-driving restrictions, they would not be as great as other action alternatives because driving after dark (until 10:00 p.m.) would still be occurring, even during seasonal restrictions. The potential for adverse impacts would exist from the park-and-stay option under this alternative. As there would still be some opportunity for recreational use to come in contact with and impact the species, impacts would be long-term minor to moderate adverse.

Cumulative impacts under alternative E would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative E would not impair piping plover because sufficient population numbers and functional habitat would remain to maintain a sustainable population of piping plover in the Seashore. Under alternative E, the Seashore would establish SMAs, which proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. Under alternative E, ORVs would be prohibited in SMA from March 15 through August 31, except for Bodie Island Spit, Cape Point, and South Point where an ORV corridor and pass-through zone would be established at the start of the breeding season. The pass-through zone would be in effect during prenesting and incubation periods only and would be subject to resource closures if necessary. The remaining SMAs and prenesting closures outside of SMAs would not allow ORV or pedestrian access while prenesting closures are in effect. Alternative E would prohibit pets within all SMAs from March 15 through August 31. From March 15 through July 15 Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting closures two times per week, increasing to three times per week once birds are present.

The plan/EIS impact analysis deemed the management measures for breeding and nonbreeding piping plover, such as 75-meter buffers for nests, nest scrapes, and breeding behavior; 1,000-meter ORV buffers and 300-meter pedestrian buffers for chicks; nonbreeding SMAs; establishment of non-ORV areas; prohibition of night driving between 10:00 p.m. and 7:00 a.m. from May 1 to November 15; and increased monitoring, under alternative E to be minor to moderate beneficial because they would minimize or prevent harassment or injury to individuals and improve the sustainability of the piping plover in the Seashore.

Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians and pets may result in harassment, injury or mortality to one or more individuals. However, alternative E would require a permit for ORV use which includes an educational component. Because ORV users would be more aware of the regulations in place to protect piping plover, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Violations may result in permit revocation, which is expected to increase compliance. Alternative E would establish a park-and-stay overnight option at some spits and points during portions of the breeding season, when resource closures do not preclude access. It would also promote water taxi service to some points and spits. Alternative E would provide for self-contained vehicle camping from November 1 to March 31 at three of the Seashore's campgrounds. Piping plovers are known to be active at night; alternative E would allow driving after dark, except from May 1 to September 15 (continuing from September 16 to November 15 in some areas), when it would be

prohibited between 10:00 p.m. and 6:00 a.m. Under alternative E, ORVs would bring people into the vicinity of plover areas where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of piping plovers; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance and harm that would occur naturally, but is not expected to result in large declines in population because the Seashore takes management action to protect piping plover from predation. The plan/EIS impact analysis of alternative E deemed adverse impacts to piping plover from ORV and other recreational use to be minor to moderate because impacts would be detectable, and could be beyond the level of disturbance or harm that would occur naturally. Although some impacts might occur during critical reproductive periods or in key habitats in the Seashore and could result in injury or mortality, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

The plan/EIS analysis of cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore (such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the seashore, and increased interpretative programs as part of the Seashore's long range interpretive plan), indicate that NPS management actions within the Seashore would act as a driver for overall cumulative impacts. The cumulative impacts were deemed to be minor to moderate adverse in the plan/EIS impact analysis because large declines in population numbers would not result and sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore. Some negative impacts to feeding, reproduction, resting or other factors affecting local population levels may occur and may result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore the piping plover impacts would not result in impairment.

Determination of Effect. Under the ESA, the actions taken under alternative E may affect / are likely to adversely affect piping plover due to the minor adverse effects from monitoring and surveying and the minor to moderate adverse effects from ORV and pedestrian access. Areas managed under ML2 procedures would accommodate a narrow ORV access corridor at the start of the breeding season. However, under alternative E, most SMAs would be closed to ORV use from March 15 through August 31, except Bodie Island Spit, Cape Point, and South Point which would include an ORV pass-through zone, subject to resource closures. Establishment of these SMAs and prenesting closures early in the breeding season would have long-term moderate benefits to piping plover. However, recreational uses would still occur in the vicinity of plovers during breeding season. All recreational ORV traffic would be prohibited from 10:00 p.m. until 6:00 a.m. from May 1 to September 15. From September 16 to November 15, night-driving permits would be available for authorized nonessential driving between the hours of 10:00 p.m. and 6:00 a.m. These restrictions to night driving would provide long-term minor to moderate benefits to piping plovers but could still result in long-term minor adverse impacts during the time when night driving is allowed by permit. These impacts would result in a finding of may affect/ are likely to adversely affect piping plovers under ESA because the action would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. And while there may be beneficial impacts from monitoring, surveying, and management of recreation, the actions under alternative E would also likely cause some adverse effects.

Under the ESA, the actions taken under alternative E may affect / are not likely to adversely affect designated critical habitat for wintering piping plover due to the establishment of SMAs which would result in the closure of approximately 15 miles of shoreline to ORV use year round. These closures would provide less-disturbed foraging, resting, and roosting areas for migrating and wintering shorebirds and would protect the primary constituent elements of intertidal sand beaches and ocean backshores. These year-round non-ORV areas along the ocean shoreline would be managed as Nonbreeding Shorebird SMAs with recreational activity restrictions, such that if staff determines that any single recreational

activity or collection of activities is negatively impacting nonbreeding piping plover use of a specific location, NPS may implement additional restrictions on activities. Nonbreeding Shorebird SMAs would also be established at the points and spits based on an annual habitat assessment, which would provide protection for interior wintering plover habitat. There would be some benefit to the critical habitat from the implementation of seasonal night-driving restrictions although these restrictions would only apply between May 1 and November 15, which would not cover the majority of time when the wintering population of piping plover is present at the Seashore.

Although there would be construction of ORV access ramps, parking areas, and interdunal roads, none of these improvements would impact any of the primary constituent elements of designated critical habitat for wintering piping plover.

Implementation of alternative E would result in a finding of may affect / is not likely to adversely affect designated critical habitat for wintering piping plover under the ESA because the action would result in impacts to the critical habitat for the species that are discountable, insignificant, or beneficial. Actions under alternative E would result in greater protection of the primary constituent elements of suitable interior habitat, spits, intertidal sand beaches, and ocean backshore, primarily as a result of the establishment of Nonbreeding Shorebird SMAs and approximately 15 miles of year-round non-ORV areas.

Impacts of Alternative F: Management Based on Advisory Committee Input

Resources Management Activities

Establishment of Prenesting Closures. Prenesting surveying activities for piping plovers under alternative F would be carried out as described under alternative C, which would include the survey and evaluation of all potential breeding habitats by Seashore staff by March 1 of each year with piping plover prenesting closures recommendations based on that evaluation. Under alternative F, all designated breeding SMAs would be posted as prenesting closures using symbolic fencing by March 15 of each year. Establishment of these SMAs early in the breeding season would have long-term moderate benefits to piping plover.

Surveying and Monitoring. Surveys and monitoring during prenesting, nesting, and chick-rearing life stages would be the same as alternatives C and E. Surveying and monitoring during all life stages, as described under alternatives C and E, would bring people and/or essential vehicles into direct short-term contact with piping plovers and their habitat, and these activities themselves are known risk factors, especially during the more sensitive life stages of early prenesting and territory establishment. However, many precautions would be taken by staff to minimize impacts, for example, using scopes to watch the birds from a distance, and remaining outside closures to the extent possible. Overall, pre-breeding surveying, post-breeding monitoring, and management actions proposed under alternative F would have a long-term moderate beneficial impact, providing the Seashore with additional data and information that would enable the implementation of adaptive management initiatives and contribute to better management.

Buffer/Closure Establishment. As with alternative C, alternative F establishes SMAs for resource protection. However, under alternative F, SMAs would be closed to ORV use from March 15 through July 31, or two weeks after all the chicks in the area have fledged (whichever comes later), for all seasonal areas, except for 0.5 mile southwest of ramp 68 to 1.2 miles northeast of ramp 70, which would be closed to ORVs through October 31. Unlike alternative C, four SMAs would be closed to ORVs year-round, including Hatteras Inlet Spit and North Ocracoke Spit. Cape Point and South Point would be managed under ML2 procedures, like alternative C, but would include an ORV access corridor in these areas (subject to resource closures) from March 15 to July 31. Within these areas, as well as throughout

other areas of the Seashore not included in an SMA, buffers for species protection would be established as described for alternative C. Piping plovers would likely experience long-term moderate benefits from the size of the resource closures under ML1 and ML2 procedures and the fact that buffers would adjust in response to chick mobility, as these action would be expected to improve the sustainability of the species at the Seashore.

As with alternative C, all designated SMAs would be subject to periodic review, which would have long-term moderate beneficial impacts.

Management of Wintering/Nonbreeding Populations. Management of wintering/nonbreeding populations of piping plover under alternative F would include the measures described under alternative C. In addition, a total of four miles of ocean shoreline would be considered “floating” closures and would be closed to ORVs during the nonbreeding season. These “floating” closures would be determined each year based on the best available habitat for nonbreeding use. These measures would result in long-term moderate beneficial impacts to nonbreeding piping plover that would be greater than those under the other action alternatives.

Education and Outreach. Under alternative F, education and outreach activities would be the same as those described under alternative A, with the addition of educational requirements as part of a permit program. This additional education would result in long-term minor to moderate benefits to species as the public is provided with more information regarding piping plover management issues.

Overall Impacts from Resources Management Activities. Overall impacts under alternative F from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate and beneficial for piping plovers. As with all species management activities, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species. Long-term moderate benefits to nonbreeding populations would be greater under alternative F than under alternatives C or E because of the addition of four miles of nonbreeding closures.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative F, Seashore visitors would be provided with a degree of predictability regarding areas available for ORV use, as well as vehicle-free areas, based largely on the seasonal resource and visitor use characteristics of various areas in the Seashore. Under alternative F, approximately 29 miles of shoreline would be designated for ORV use year-round, approximately 23 miles would be seasonally designated for ORV use from August 1 through March 14 (one area from November 1 through March 14), and approximately 16 miles would be designated as non-ORV year-round. The speed limit would be 15 mph unless otherwise posted, and permits would be required for all ORVs. Two SMAs (managed under ML2 procedures) would have an ORV corridor and one SMA would have a pedestrian corridor, at the start of the breeding season (March 15), subject to resource closures. These corridors, once closed, would reopen July 31 or two weeks after fledging, whichever is later. Establishment of these areas, and other SMAs managed under ML1 procedures, would reduce pressure from recreational activities on piping plover. Under alternative F, this reduction in pressure would be similar to alternative E and greater than alternatives A and B, but less than C and D, which close larger and more contiguous areas of habitat for longer periods of time.

Like alternative E, alternative F would reduce the potential for disturbance and nest abandonment from direct short-term contact with people and/or essential vehicles compared to alternatives A and B, but would have greater impacts than alternative C due to the existence of an ORV corridor in two SMAs

managed under ML2 procedures and a reduction in the length of ORV closure in other SMAs from October 14 under alternative C to July 31 under alternative F. Although the designation of SMAs and the other restrictions under alternative F should limit adverse impacts to piping plover, compliance with closures may not be absolute, since alternative F still includes pedestrian access to Bodie Island Spit and a conduit (ORV corridor) to Cape Point and South Point during the breeding season (all subject to resource closures). Therefore, recreational uses could result in short-term minor to moderate adverse impacts to piping plovers if non-compliance occurs. Since recreational activities would still occur, under alternative F impacts from ORV and pedestrian access to piping plover would be long-term minor to moderate adverse and would be greater than alternative C due to increased access.

Night-Driving Restrictions. Under alternative F, all nonessential ORV traffic would be prohibited from all areas (other than soundside access areas), from one hour after sunset until approximately one-half hour after sunrise from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles with a valid ORV permit. Furthermore, the NPS would retain the discretion to limit night driving to certain areas or routes, based on resource protection considerations. Because plovers are known to be active at night (Staine and Burger 1994; Majka and Shaffer 2008), and plover chick and fledgling response to vehicles can increase their vulnerability to ORVs (USFWS 1996a), the high level of protection at night from May 1 to November 15 under alternative F would result in long-term moderate beneficial impacts because it would reduce the potential for disturbance to plovers that could result in mortality.

Commercial Fishing. Commercial fishing would be managed the same as described under alternative C, with long-term negligible adverse impacts from the presence of commercial fishing operations and long-term minor to moderate benefits from night-driving restrictions.

Permits/Carrying Capacity. As described above under the night-driving restrictions and education/outreach sections, alternative F would require a permit for ORV use, including night driving. As stated in these sections, as a result of the educational information provided by the permit, there would be long-term minor to moderate benefits to piping plover as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance with buffer, closures, and other restrictions. There would be no impacts related to carrying capacity, as described under alternative C.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all SMAs during the breeding season, which would greatly reduce the likelihood of pet disturbance in piping plover breeding areas; however, compliance is needed to ensure that this reduces the risk of impacts. Camping and beach fire restrictions would be the same as those under alternative C, with the addition of restricting beach fires from May 1 to November 15 to Coquina Beach, Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras Village, and Ocracoke Day Use Area. These additional restrictions would result in long-term moderate beneficial impacts to piping plover at the Seashore as recreational pressures are further reduced.

Overall Impacts from ORV and Other Recreational Use. Overall impacts under alternative F from ORV and other recreational use would be long-term minor to moderate adverse. The establishment of the SMAs which proactively reduce or preclude recreational use early in the breeding season, ORV permit requirements, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. As alternative F would provide for more flexible access to various areas of the Seashore, the potential for disturbance to piping plover is increased over alternatives C and D, resulting in long-term minor to moderate adverse impacts.

Cumulative Impacts. The same past, present, and future actions discussed under the cumulative impact scenario for alternative A would occur under alternative F. The overall cumulative impact of these past,

current, and future actions, would be long-term negligible to minor, depending on the intensity and duration of unpredictable factors such as storm events, with long-term moderate beneficial impacts from actions such as increased interpretive programs as part of the long-range interpretive plan and predator management within the Seashore. Many of these actions do not directly impact piping plover habitat in the area, as most of this habitat is located within the Seashore and is impacted by NPS management actions more than any of the aforementioned past, present, and future actions. These impacts, combined with the long-term minor to moderate adverse, as well as minor to moderate beneficial impacts of alternative F, would be long-term minor to moderate adverse impacts, as actions within the Seashore would act as a driver for overall cumulative impact.

Conclusion. Overall impacts under alternative F from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate and beneficial for piping plovers. As with all species management activities, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species. Long-term moderate benefits to nonbreeding populations would be greater under alternative F than under alternatives C or E because of the addition of four miles of nonbreeding areas closed to ORV use. Overall impacts under alternative F from ORV and other recreational use would be long-term minor to moderate adverse. The establishment of the SMAs which proactively reduce or preclude recreational use early in the breeding season, ORV permit requirements, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. As alternative F would provide for more flexible access to various areas of the Seashore, the potential for disturbance to piping plover is increased over alternatives C and D, resulting in long-term minor to moderate adverse impacts.

Cumulative impacts would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative F would not impair piping plover because sufficient population numbers and functional habitat would remain to maintain a sustainable population of piping plover in the Seashore. Under alternative F, the Seashore would establish SMAs, which proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. Under alternative F, ORVs would be prohibited in SMAs from March 15 through July 31, or two weeks after all chicks in the area have fledged (whichever comes later), for all seasonal areas except for 0.5 mile southwest of ramp 68 to 1.2 miles northeast of ramp 70, which would be closed to ORVs through October 31, and except at Cape Point and South Point where an ORV corridor would be established (subject to standard resource protection buffers and subject to resource closures) from March 15 through July 31. Four SMAs, including Hatteras Inlet Spit and North Ocracoke Spit would be closed to ORVs year-round. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. The remaining SMAs and prenesting closures outside of SMAs would not allow ORV or pedestrian access while prenesting closures are in effect. Alternative F would prohibit pets in all designated breeding shorebird SMAs from March 15 to July 31, or 2 weeks after all shorebird breeding activities have ceased or all chicks in the area have fledged, whichever comes later. In addition to nonbreeding shorebird SMAs, under alternative F, an additional four miles of ocean shoreline would be considered “floating” closures and would be closed to ORVs during the nonbreeding season. From March 15 through July 15, Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting closures two times per week, increasing to three times per week once birds are present.

The plan/EIS impact analysis deemed the management measures for breeding and nonbreeding piping plover (such as 75-meter buffers for nests, nest scrapes, and breeding behavior; 1,000-meter ORV buffers

and 300-meter pedestrian buffers for chicks; nonbreeding SMAs and floating closures; establishment of non-ORV areas; prohibition of night driving between an hour after sunset to approximately one-half hour after sunrise from May 1 to November 15; and increased monitoring) to be moderate beneficial. Beneficial impacts would be detectable and could be beyond the level of disturbance or harm that would occur naturally. Protection to key life history stages would minimize or prevent harassment or injury to individuals and improve the sustainability of the piping plover in the Seashore.

Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. However, alternative F would require a permit for ORV use, which includes an educational component. Because ORV users would be more aware of the regulations in place to protect piping plover, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Violations may result in permit revocation, which is expected to increase compliance. Alternative F would also establish a new voluntary resource education program targeted toward non-ORV beach users. Under alternative F, ORVs would bring people into the vicinity of plover areas where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of piping plovers; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance and harm that would occur naturally, but is not expected to result in large declines in population because the Seashore takes management action to protect piping plover from predation. The plan/EIS impact analysis of alternative F deemed adverse impacts to piping plover from ORV and other recreational use to be minor to moderate because impacts would be detectable, and could be beyond the level of disturbance or harm that would occur naturally. Although some impacts might occur during critical reproductive periods or in key habitats in the Seashore and could result in injury or mortality, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

The plan/EIS analysis of cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore (such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the seashore, and increased interpretative programs as part of the Seashore's long range interpretive plan) indicate that NPS management actions within the Seashore would act as a driver for overall cumulative impacts. The cumulative impacts were deemed to be minor to moderate adverse in the plan/EIS impact analysis because large declines in population numbers would not result and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Some negative impacts to feeding, reproduction, resting or other factors affecting local population levels may occur and may result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the piping plover impacts would not result in impairment.

Determination of Effect. Under the ESA, the actions taken under alternative F may affect / are likely to adversely affect piping plover due to the minor adverse effects from monitoring and surveying and the minor to moderate impacts from ORV and other recreational use. Under alternative F, SMAs would be closed to ORV use from March 15 through July 31 for all seasonally designated ORV use areas, except for 0.5 mile southwest of ramp 68 to 1.2 miles northeast of ramp 70, which would be closed to October 31. Establishment of these SMAs early in the breeding season would have long-term moderate benefits to piping plover as SMAs would provide protection for migrating piping plover and plover establishing territories early in the season. However, recreational uses would still occur in the vicinity of plovers

during breeding season. Under alternative F, nonessential ORV traffic would be prohibited from all areas (other than the soundside access areas), from one hour after sunset until approximately one-half hour after sunrise from May 1 to November 15. From November 16 to April 30, ORV access would be allowed 24 hours per day in designated ORV routes for vehicles displaying a valid ORV permit. The NPS retains the discretion to limit night driving to certain areas or routes, based on resource protection considerations. These restrictions to night driving would provide long-term minor to moderate benefits to piping plovers but could still result in long-term minor adverse impacts during the time when night driving is allowed by permit. These impacts would result in a finding of may affect / are likely to adversely affect piping plovers under the ESA because the action would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. And while there may be beneficial impacts from surveys and monitoring, and management of recreation, the actions under alternative F would also likely cause some adverse effects.

Under the ESA, the actions taken under alternative F may affect / are not likely to adversely affect designated critical habitat for wintering piping plover due to the establishment of SMAs which would result in the closure of approximately 16 miles of shoreline to ORV use year round. These closures would provide less-disturbed foraging, resting, and roosting areas for migrating and wintering shorebirds and would protect the primary constituent elements of intertidal sand beaches and ocean backshores. These year-round non-ORV areas along the ocean shoreline would be managed as Nonbreeding Shorebird SMAs with recreational activity restrictions, such that if staff determines that any single recreational activity or collection of activities is negatively impacting nonbreeding piping plover use of a specific location, NPS may implement additional restrictions on activities. Nonbreeding Shorebird SMAs would also be established at the points and spits based on an annual habitat assessment, which would provide protection for interior wintering plover habitat. Alternative F would also involve the implementation of four miles of additional “floating” non-ORV areas which would protect the ocean shoreline habitat along three stretches of beach during the non-breeding season. There would be some benefit to the critical habitat from the implementation of seasonal night-driving restrictions although these restrictions would only apply between May 1 and November 15, which would not cover the majority of time when the wintering population of piping plover is present at the Seashore.

Although there would be construction of ORV access ramps, parking areas, and interdunal roads, none of these improvements would impact any of the primary constituent elements of designated critical habitat for wintering piping plover.

Implementation of alternative F would result in a finding of may affect / is not likely to adversely affect designated critical habitat for wintering piping plover under the ESA because the action would result in impacts to the critical habitat for the species that are discountable, insignificant, or beneficial. Actions under alternative F would result in greater protection of the primary constituent elements of suitable interior habitat, spits, intertidal sand beaches, and ocean backshore, primarily as a result of the establishment of Nonbreeding Shorebird SMAs, four additional miles protected shoreline during the nonbreeding season, and approximately 16 miles of year-round non-ORV areas.

TABLE 52. SUMMARY OF IMPACTS TO PIPING PLOVER UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Resources Management Activities					
Establishment of Prenesting Closures					
Long-term minor to moderate adverse impacts would occur to piping plovers arriving before the April 1 prenesting closures due to the sensitivity of the species during this life stage, with long-term moderate benefits to those arriving after the prenesting closure is in place.	Long-term moderate benefits would occur as closures would be in place earlier to provide protection for migratory piping plovers and breeding plovers establishing territories.	Long-term moderate benefits would occur as closures would be in place to provide protection for migratory piping plovers and breeding plovers establishing territories early in the breeding season.	Long-term moderate benefits would occur as closures would be in place to provide protection for migratory piping plovers and breeding plovers establishing territories early in the breeding season.	Long-term moderate benefits would occur as closures would be in place to provide protection for migratory piping plovers and breeding plovers establishing territories early in the breeding season.	Long-term moderate benefits would occur as SMAs would establish closures by March 15 and would be in place to provide protection for migratory piping plovers and breeding plovers establishing territories.
Surveying and Monitoring					
Best management practices would be implemented to reduce disturbance during surveying, resulting in long-term minor to moderate benefits to the species as surveying and monitoring would lead to the necessary management measures.	Intensive surveys and monitoring would be expected to have long-term moderate beneficial impacts, as any changes in species behavior would be detected and appropriate management measures implemented.	Surveys and monitoring would be expected to have long-term moderate beneficial impacts, as these actions would improve the sustainability of the species at the Seashore.	Surveys and monitoring would be expected to have long-term moderate beneficial impacts, as these actions would improve the sustainability of the species at the Seashore.	Surveys and monitoring would be expected to have long-term moderate beneficial impacts, as these actions would improve the sustainability of the species at the Seashore.	Surveys and monitoring would be expected to have long-term moderate beneficial impacts, as these actions would improve the sustainability of the species at the Seashore.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Buffer/Closure Establishment					
Piping plovers would likely experience minor long-term benefits from the size of resource closures and observation intensity would adjust in response to chick behavior. Long-term moderate adverse impacts may occur as frequent adjustment of the buffers may result in additional disturbance to piping plover, and buffers that are not adjusted in a timely manner could result in less than optimal protection for the species.	The larger and more responsive buffers under alternative B would be expected to have long-term minor to moderate beneficial effects to piping plover.	Establishment of SMAs and prescribed buffers, along with periodic review to ensure effective management would have long-term moderate beneficial impacts.	SMAs would be closed to public access during the breeding season and closed to ORVs year-round, resulting in long-term moderate to major beneficial impacts from species closures and buffers. Benefits would also occur from a system of periodic review that would evaluate the SMAs for effectiveness.	Establishment of SMAs and prescribed buffers, along with periodic review to ensure management is effective, would have long-term moderate beneficial impacts.	Establishment of SMAs and prescribed buffers along with periodic review to ensure management is effective, would have long-term moderate beneficial impacts.
Management of Wintering/Nonbreeding Populations					
Suitable interior habitats at spits and at Cape Point would be closed year-round to all recreational users and would provide for resting and foraging for all species, resulting in long-term minor beneficial impacts as this would represent a improvement to habitat during key life stages of the species.	Closing suitable interior habitats year-round at spits and Cape Point, as well as implementation of SECN survey protocol, would have long-term moderate beneficial impacts for piping plover.	Annual habitat assessment and establishment of nonbreeding SMAs would result in long-term moderate beneficial impacts.	Annual habitat assessment and establishment of nonbreeding SMAs would result in long-term moderate beneficial impacts.	Annual habitat assessment and establishment of nonbreeding SMAs would result in long-term moderate beneficial impacts.	Annual habitat assessment and establishment of nonbreeding SMAs would result in long-term moderate beneficial impacts. Long-term moderate benefits to nonbreeding populations would be greater under alternative F than alternatives C or E because of the addition of four miles of "floating" closures that would be closed to ORV use during the nonbreeding season.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Education and Outreach					
Education and outreach efforts under alternative A would aim to reduce non-compliance and further protect the species, resulting in long-term minor beneficial impacts.	Public outreach as part of species management would have long-term minor beneficial impacts, with the expanded outreach having greater impacts than alternative A.	Additional education would result in long-term minor to moderate benefits to species as the public is provided with more information regarding this issue.	Additional education would result in long-term minor to moderate benefits to species as the public is provided with more information regarding this issue.	Additional education would result in long-term minor to moderate benefits to species as the public is provided with more information regarding this issue.	Additional education would result in long-term minor to moderate benefits to species as the public is provided with more information regarding this issue.
Overall Impacts from Resources Management Activities					
Overall, impacts to piping plover from resource management activities (primarily as a result of surveys and field activities) would be long-term minor to moderate adverse. Although the management of the species would provide a certain level of benefit, the manner in which buffers would be established, along with the need to adjust buffers frequently would have an adverse impact on the species.	Overall, impacts under alternative B from resource management activities (primarily resulting from the effects of surveying and field activities) would be long-term minor to moderate beneficial. Buffers for piping plover would be larger and provide more protection compared to buffers under alternative A. Minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of prenesting closures early in the breeding season, monitoring activities, education and outreach efforts, and establishment of prescribed buffers would provide long-term minor to moderate beneficial impacts to the species.	Overall impacts under alternative C from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate beneficial. As with alternative B, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species.	Overall impacts to piping plover from resources management activities (primarily resulting from the effects of surveying and field activities) under alternative D would be long-term moderate to major beneficial. As with all species management activities, minor adverse impacts would occur from human presence during monitoring, but on the whole the implementation of SMAs that prohibit ORV use year-round and only allow pedestrian access outside of the breeding season, establishment of prenesting closures early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate to major beneficial impacts to the species.	Overall impacts under alternative E from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate beneficial. As with all species management activities, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species.	Overall impacts under alternative F from resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term moderate beneficial for piping plovers. As with all species management activities, minor adverse impacts would occur from human presence during monitoring activities, but on the whole the establishment of SMAs early in the breeding season, monitoring activities, and establishment of prescribed buffers would provide long-term moderate beneficial impacts to the species. Long-term moderate benefits to nonbreeding populations would be greater under alternative F than under alternatives C or E because of the addition of four miles of nonbreeding areas closed to ORV use.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
ORV And Other Recreational Use					
ORV and Pedestrian Access					
A lack of compliance with closures, including non-compliance (either intentional or unintentional) due to variable buffer sizes, could result in short-term moderate to major adverse impacts at a particular location, and would result in long-term moderate to major adverse impacts if there is a chronic lack of compliance.	Increased monitoring at key piping plover breeding areas and larger buffers for piping plover chicks would offer more protection from ORV and pedestrian access. However, because all Seashore beaches would be open to ORV access, the potential for impacts to piping plover from recreational use would still exist, resulting in long-term moderate adverse impacts.	Establishment of SMAs and prescribed buffer areas and exclusion of ORVs from these areas during the breeding season would reduce pressure on the species from recreational uses at the Seashore. Under this alternative, recreational activities would still occur in the vicinity of the species and would still have the potential to impact them, with long-term minor to moderate adverse impacts to piping plover from recreational use, and minor to moderate benefits from the protection offered.	Due to the restrictions on recreational activities in SMAs (ORVs prohibited year-round; pedestrians prohibited during breeding season), adverse impacts from recreational use would be expected to be long-term minor adverse.	Although the large SMAs would be beneficial to the species, continued recreation use in this area would still result in potential long-term minor to moderate adverse impacts to the species, which would be greater than those impacts under alternative C because of the increased access from ORV pass-throughs and shorter duration of closures within SMAs.	Although the large SMAs would be beneficial to the species, continued recreation use in this area would still result in potential long-term minor to moderate adverse impacts to the species, which would be greater than those impacts under alternative C because of the increased access to some SMAs by the establishment of pedestrian and ORV access corridors and shorter duration of closures within SMAs.
Night-Driving Restrictions					
Allowing unrestricted night driving would result in long-term moderate adverse impacts, as plovers are known to forage along the shoreline at all times of the day.	Restrictions on night driving would be provide long-term minor to moderate benefits to piping plovers; however, could still result in long-term minor adverse impacts during the time when night driving is allowed (until 10:00 p.m. during much of the breeding season).	The high level of protection at night from May 1 to November 15 would result in long-term moderate beneficial impacts because it would reduce the potential for disturbance to plovers that could result in mortality.	The high level of protection at night from May 1 to November 15 would result in long-term moderate beneficial impacts because it would reduce the potential for disturbance to plovers that could result in mortality.	Night-driving restrictions under alternative E would result in long-term minor to moderate beneficial impacts because it would reduce the potential for disturbance to plovers that could result in mortality, but would still allow some level of night driving after dark (until 10:00 p.m. between May 1 and November 15).	Alternative F would result in long-term moderate beneficial impacts because it would reduce the potential for disturbance to plovers that could result in mortality.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Commercial Fishing					
There would be long-term negligible adverse impacts from commercial fishing.	Presence of commercial fishing operations would have a long-term negligible adverse impact, with long-term minor to moderate beneficial impacts from night-driving restrictions.	Presence of commercial fishing operations would have a long-term negligible adverse impact, with long-term minor to moderate benefits from night-driving restrictions.	Presence of commercial fishing operations would have a long-term negligible adverse impact, with long-term minor to moderate benefits from night-driving restrictions.	Presence of commercial fishing operations would have a long-term negligible adverse impact, with long-term minor to moderate benefits from night-driving restrictions.	Presence of commercial fishing operations would have a long-term negligible adverse impact, with long-term minor to moderate benefits from night-driving restrictions.
Permit/Carrying Capacity Requirements					
Lack of a permit system would have long-term moderate adverse impacts. Lack of a carrying capacity is not expected to impact piping plover.	There would be no impacts related to carrying capacity, as it would not be a requirement under this alternative.	ORV permit requirements would result in long-term minor to moderate benefits due to the species protection resulting from the educational component of the permit. There would be no impacts related to carrying capacity.	ORV permit requirements would result in long-term minor to moderate benefits due to species protection resulting from the educational component of the permit. There would be no impacts related to carrying capacity.	ORV permit requirements would result in long-term minor to moderate benefits due to species protection resulting from the educational component of the permit. There would be no impacts related to carrying capacity.	ORV permit requirements would result in long-term minor to moderate benefits due to species protection resulting from the educational component of the permit. There would be no impacts related to carrying capacity.
Pet/Other Recreational Activity Restrictions					
Long-term minor benefits from camping and nighttime beach fire restrictions. Long-term minor to moderate adverse impacts from presence of pets at the Seashore during breeding season.	Long-term minor benefits from camping and nighttime beach fire restrictions. Long-term minor to moderate adverse impacts from presence of pets at the Seashore during breeding season.	Restrictions on pets, camping, and beach fires and additional education from a beach fire permit, would be expected to have long-term minor to moderate benefits to species at the Seashore, further reducing pressure to piping plover from recreational activity.	Prohibition of pets within the SMAs year-round and additional education from a beach fire permit would be expected to have long-term minor to moderate beneficial impacts to the species, greater than those under alternative C, provided the level of non-compliance is kept low.	These restrictions would result in long-term minor to moderate benefits to species at the Seashore, further reducing pressure to piping plover from recreational activity, with the potential for long-term minor to moderate adverse impacts from the park-and-stay option.	Additional beach fire restrictions and prohibition of pets in SMAs during the breeding season would result in long-term moderate beneficial impacts to species at the Seashore as recreational pressures are further reduced.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Overall Impact from ORV and Other Recreational Use					
Overall, impacts to piping plover from ORV and other recreational use would be long-term moderate to major adverse as much of the Seashore would be open to recreational use, with an increased potential that piping plover could be impacted due to disturbance from ORV use and other recreational activities. Lack of a permit system for education and law enforcement, no night-driving restrictions, and lack of compliance with pet leash requirements would contribute substantially to these adverse impacts.	Overall, impacts to piping plover from ORV and other recreational use would be long-term moderate adverse. While some buffers would be increased in an attempt to separate recreational uses from piping plover, access up to these buffers would be provided at all Seashore beaches and could result in intentional or unintentional non-compliance (i.e., when signs are washed out), which would impact the species. Adverse impacts would also occur due to limited prenesting protection outside of the points and spits, and the potential for protective buffers to be reduced during critical life stages of plover chicks.	Overall, impacts to piping plover from ORV and other recreational use would be long-term minor adverse. The establishment of the SMAs which proactively reduce or preclude recreational use early in the breeding season, ORV permit requirements, seasonal night-driving restrictions, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. As there would still be some opportunity for recreational use to come in contact with and impact piping plovers, and the fact that alternative C would still include some level of pedestrian access to three SMAs during a portion of the breeding season, impacts to piping plover would be long-term minor adverse.	Overall impacts from ORV and other recreational use would be long-term minor adverse. The establishment of SMAs that are closed to ORVs year-round and managed under ML1 procedures during the breeding season would proactively preclude recreational use early in the breeding season from large areas of the Seashore, which would reduce the potential for disturbance to plovers during critical life stages. This protection, combined with ORV permit requirements, seasonal night-driving restrictions, and pet and other recreational activities restrictions would all provide benefits in terms of species protection. As there would still be some opportunity for recreational use to come in contact with and impact the species, impacts would be long-term minor adverse.	Overall impacts from ORV and other recreational use would be long-term minor to moderate adverse. The establishment of the SMAs which proactively reduce or preclude recreational use early in the breeding season, ORV permit requirements, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. Although there would be benefits from seasonal night-driving restrictions, they would not be as great as other action alternatives because driving after dark (until 10:00 p.m.) would still be occurring, even during seasonal restrictions. The potential for adverse impacts would exist from the park-and-stay option under this alternative. As there would still be some opportunity for recreational use to come in contact with and impact the species, impacts would be long-term minor to moderate adverse.	Overall impacts under alternative F from ORV and other recreational use would be long-term minor to moderate adverse. The establishment of the SMAs which proactively reduce or preclude recreational use early in the breeding season, ORV permit requirements, and pet and other recreational activity restrictions would all provide benefits in terms of species protection. As alternative F would provide for more flexible access to various areas of the Seashore, the potential for disturbance to piping plover is increased over alternatives C and D, resulting in long-term minor to moderate adverse impacts.

SEA TURTLES

Species-specific Methodology and Assumptions

Potential impacts on federally listed sea turtle populations and their habitat within the Seashore were evaluated based on the species' known interactions with humans, domestic pets, recreational and nighttime activities, predators, artificial lighting, and ORVs, as well as past and present occurrence at the Seashore. Information about habitat and species occurrence within the Seashore and potential impacts on sea turtles from recreation and other activities was acquired from staff at Cape Hatteras National Seashore, the USFWS, the NCWRC, and available literature.

Although five threatened or endangered sea turtle species occur in the waters of North Carolina, only three species, the loggerhead, green, and leatherback, are known to nest at the Seashore. The other two species, Kemp's ridley and hawksbill, are only known to occur at the Seashore through occasional stranding, usually due to either prior death or incapacitation from hypothermia. Therefore, the analysis focuses only on the three species that nest at the Seashore. For these three species, the analysis focuses on effects to sea turtles from a variety of human recreation and other activities, as well as impacts incurred as a result of surveying and management activities. Except for the timing of nest laying activities, the nesting habits for loggerhead, green, and leatherback sea turtles at the Seashore are similar. Therefore, the analysis generally discusses the impacts on the sea turtles as a group. Impacts to a specific species are noted where they differ from impacts to the other sea turtle species. Sea turtle nesting habitat overlap protected bird species and seabeach amaranth habitat seaward of the primary dune line. Consequently, management of these species could also benefit nesting sea turtles and is included in the analysis. However, the extent to which the bird and seabeach amaranth closures are beneficial to the turtles depends on the location, size, and duration of the closures. In the analysis, it is assumed that compliance with closures and other regulations such as leash requirements, disposal of bait and fish carcasses, etc., would increase from current levels where alternatives increase the natural resource and law enforcement staff.

When examining the impacts of artificial light on sea turtles, the lighting zones (see "Visitor Use and Experience")—developed for the Seashore by the NPS Night Skies Team—were considered. In these zones, special consideration is given to areas with sensitive wildlife, and alternate guidance is provided to enhance the protection of nocturnal habitat. These special lighting zones represent the conditions that should be present at the Seashore, not necessarily actual current conditions, and create a buffer when two varying zones abut each other.

In general, direct and indirect impacts to sea turtles, their nests, eggs, and hatchlings would primarily occur during the sea turtle nesting and hatching seasons from May 1 to November 15 and during summer and fall storm events when post-hatchlings may wash ashore. Direct impacts to live stranded turtles may occur year-round.

The information contained in this analysis was obtained through best professional judgment of Seashore staff and experts in the field, and by reviewing applicable scientific literature.

Sea Turtle Impact Thresholds

A summary of sea turtle impacts under all alternatives is provided in table 53 at the end of this section. The following thresholds for evaluating impacts to sea turtles were defined.

- Negligible:* There would be no observable or measurable impacts to sea turtles, their habitats, or the natural processes sustaining them. Impacts would be well within the natural range of variability.
- Minor Adverse:* Impacts to sea turtles, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Disturbance to some nesting females could be expected to occur, but would be infrequent. Complete or partial nest loss due to human activities would occur infrequently. Occurrences of disorientation/disruption of hatchling movement would occur infrequently (less than 10% of all hatchling emergence events). Direct hatchling mortality from human activities would be rare.
- Minor Beneficial:* Impacts on sea turtles, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Improvements to key characteristics of habitat and/or protection to key life history stages in the Seashore would sustain or slightly improve existing population levels, population structure, or other factors and maintain a sustainable population in the Seashore.
- Moderate Adverse:* Impacts to sea turtles their habitats or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Occasional disturbance to some nesting females could be expected, with negative impacts to reproduction affecting local population levels. Complete or partial nest loss due to human activities would occur occasionally. Occurrences of disorientation/disruption of hatchling movement would occur occasionally (more than 10% and less than 30% of all hatchling emergence events). Direct hatchling mortality from human activities would occasionally occur. However, sufficient population numbers and habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.
- Moderate Beneficial:* Impacts on sea turtles, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Changes to key characteristics of habitat in the Seashore and/or protection to key life history stages would minimize or prevent harassment or injury to individuals and improve the sustainability of the species in the Seashore.
- Major Adverse:* Impacts to sea turtles, their habitats, or the natural processes sustaining them would be detectable and would be expected to be outside the natural range of variability. Frequent disturbance to nesting females would be expected, with negative impacts to reproduction, or other factors resulting in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Impacts could include in direct mortality to one or more nesting females. Complete or partial nest loss due to human activities would occur frequently. Occurrences of disorientation/disruption of hatchling movement would occur frequently (more than 30% of all hatchling emergence events). Direct hatchling mortality from human activities would frequently occur. Local population numbers, population structure, and other demographic factors might experience large declines.

Major Beneficial: Impacts on sea turtles, their habitats in the Seashore, or the natural processes sustaining them during key life history stages would be detectable and would be expected to be outside the natural range of variability. Changes to key characteristics of habitat in the Seashore and/or protection to key life history stages would substantially lessen mortality or loss of habitat and would result in notable increases in Seashore population levels.

Duration: Short-term effects would last up to two seasons.

Long-term effects would be continued beyond two seasons.

Study Area

The study area for assessment of the various alternatives is the Seashore. Based on the fact that the loggerhead sea turtle is the primary nester within the Seashore (94% of all nests [NPS 2007e, 2008a; Baker pers. comm. 2009a]) and is the only sea turtle for which recovery criteria are designated for the state of North Carolina in its recovery plan (NMFS and USFWS 2008, 1992a, 1992b 1991), the study area for the cumulative impacts analysis is the state of North Carolina.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Resources Management Activities. Under alternative A, Seashore staff would survey the entire Seashore daily for turtle crawls and nests from May 1 to September 15. Daily surveys would be conducted in the morning prior to the onset of heavy public ORV use. This period encompasses the nesting season for loggerhead sea turtles (mid-May to mid-August), the most prevalent nesters at the Seashore, and the vast majority of the nesting season for the green and leatherback sea turtles, which are infrequent nesters at the Seashore. Prior to May 1, the leatherback sea turtle is the only species likely to nest at the Seashore. Although turtle surveying would not occur prior to May 1, turtle crawls may be detected by bird monitors as evidenced by single leatherback nests being detected in April during two previous years (NPS 2001c, 2008a). Additionally, turtle crawls were often detected by bird monitors in May during years when daily turtle surveys did not begin until June 1 (Murray pers. comm. 2008).

From September 16 to November 15, Seashore staff would conduct periodic monitoring (e.g., every two to three days) for hatchlings emerging from previously undetected nests, especially in areas of high visitation. Between 1998 and 2009, 4 nests have been found after August 31, three of which were found on September 15 or later. However, prior to 2007, morning nest surveys ended on August 31, so any nests laid after that time were unlikely to be located and protected. Since 2007, nest surveys have continued to September 15 (Baker pers. comm. 2009b). Although regular monitoring occurs, some nests on a rare occasion may be missed due to human error or from evidence of the nest being covered up by nighttime ORV use (NPS 2005c, 2004d). Nests that go undetected would not be subject to management by the Seashore staff and would result in long-term minor to moderate adverse impacts because the nests would be subject to multiple potential threats such as being run over by ORVs, depredation by foxes or other predators, and loss due to erosion or frequent flooding. Hatchlings emerging from unprotected nests would be at a greater risk from light pollution because there would be no light management measures enacted. If an undetected nest were located in an ORV or day use area, hatchlings would be subjected to impacts associated with tire tracks and footprints because these would not be raked smooth by Seashore staff. If tracks are not raked smooth, hatchlings can become easily trapped and disoriented in the ruts/footprints, leading to an increased risk of death by predation, being run over by subsequent ORV traffic, or exhaustion prior to reaching the ocean.

Seashore staff would use ATVs/UTVs and occasionally ORVs to survey for turtle crawls and nests. Throughout the Seashore, essential vehicle use would not exceed 10 mph and would avoid driving within turtle nest closures. The use of ATVs/UTVs and ORVs during turtle surveys would provide long-term moderate benefits by allowing Seashore staff to cover the entire length of the shoreline each morning in search of turtle crawls and nests prior to the onset of heavy public use during the daytime hours. Without the use of these vehicles, staff would not be able to cover the entire Seashore or bring the necessary supplies with them to install closures around located nests. NPS staff using vehicles would not leave tire ruts behind in nesting areas. Using ATVs/UTVs and ORVs during surveys would cause a slight risk of crushing a nest or hatchlings or disturbing nesting turtles, potentially causing long-term minor to moderate adverse impacts. However, these risks would be minimized by the fact that surveys would occur during the morning, while nesting and hatching typically occur at night, as well as the precautions taken by the experienced staff conducting the surveys. On the rare occasion when nesting or hatching activities occur during daylight hours, as happened in 2005 (Sayles pers. comm. 2005), abiding by the speed and closure limits would allow observers to see and avoid impacting the turtles and their nests.

Daily surveys for nests would provide long-term minor to moderate beneficial impacts. It would allow the timely detection of closure violations and repair of damage (e.g., broken signs or string) caused by ORVs or pedestrians and allow for an assessment of whether any damage to a nest occurred. Tracks left behind by ORVs and/or pedestrians that are detected would be raked smooth. Predator activity and hatching events would also be detected. In the case of predator activity, daily surveys would allow staff to protect those nests with predator exclosures.

During periods following severe storm events or when large quantities of seaweed are washed ashore, monitoring for post-hatchling washbacks would occur. This monitoring would provide long-term minor benefits to hatchlings washed ashore by helping prevent them from being run over by vehicles or disturbed by pedestrians or their pets and by protecting them from potential predation.

Under alternative A, the Seashore would install a 30-foot (9.1-meter) by 30-foot (9.1-meter) buffer around each turtle nest found. This buffer would continue to help protect turtle nests from being run over by ORVs or disturbed by pedestrians or pets. The buffers would also protect the nests from potential erosion impacts caused by multiple ORV passes. After approximately 50 to 55 days, the turtle closure would be expanded to the surf line, with varying widths based on the level and type of recreational use in the area. In vehicle-free areas with little or no pedestrian traffic, the total width would be 75 feet (22.9 meters); on village beaches or other areas with high levels of pedestrian and other non-ORV use, the total width would be 150 feet (45.7 meters); and in ORV traffic areas, the total width would be 350 feet (106.7 meters). Additionally, the closed area would be expanded by 30 feet (9.1 meters) to 50 feet (15.2 meters) on the landward side of the nest. By protecting all of the detected turtle nests in the Seashore during the incubation and hatching periods, these buffers would provide long-term moderate to major beneficial impacts to the sea turtles.

As nests near their hatching date, Seashore staff would continue to install U-shaped light-filter fencing around the nests, with the open face of the “U” oriented toward the water to block light pollution from the villages, beach fires, any vehicles operating on the beach after dark, or other sources of light pollution. Filter fencing requires high maintenance because it is often washed out by incoming tides, buried by winds, and/or completely uprooted by storm activity. If not properly maintained, hatchlings may become entangled in the fencing. However, since 2005 when filter fencing was first employed for all turtle nests, no occurrences of hatchlings becoming entangled in fencing have been recorded (NPS 2007e, 2008a, 2009c). Although it does not eliminate light impacts completely, the installation of filter fencing would provide long-term moderate to major beneficial impacts to sea turtles.

If it is determined that expanding the buffer around a nest prior to hatching would disrupt ORV access along the beach, the Seashore staff would immediately determine if an alternate route is available or if a reasonable bypass route could be established during the hatch window. The use of bypasses or alternate routes around sea turtle nests would protect the nests and hatchlings by diverting recreation-users away from the sensitive area and result in long-term minor beneficial impacts. Relocation of nests solely to resolve recreational access issues would not be considered.

In accordance with NCWRC guidelines, relocation for environmental reasons would be considered as a last resort since relocation carries the risk of either damaging the eggs or the embryonic development process. When a nest is found, under alternative A, staff would assess the need to relocate the nest away from areas prone to erosion or frequent flooding. If relocation is necessary, procedures for relocating nests provided in the NCWRC handbook (NCWRC 2006) would continue to be followed. Relocating nests would have both beneficial and adverse impacts. Historically, the single greatest impact on hatching success has been weather-related events, such as hurricanes or other storms, which can uncover nests through erosion, frequently flood and inundate nests, or bury nests under feet of sand (NPS 2009c, 2008a, 2007e, 2005c, 2004d, 2003e, 2002c, 2001c, 2000b). Relocating nests prone to these events to areas higher on the beach increases the likelihood that these nests would not be lost, resulting in long-term moderate to major beneficial impacts. However, relocation does have some negative impacts that would result in long-term minor to moderate adverse impacts. Six hours after deposition, the egg embryo becomes attached to the top of the eggshell. After this time, the embryo becomes very sensitive to movement and can be dislodged if the egg is rotated. This would result in the death of the embryo. In addition, relocating nests higher on the beach could alter the natural sex ratio of the nest by altering the incubation temperature. Temperatures warmer than 84.6°F produce more females, while colder temperatures produce more males. Because North Carolina is near the northern limit of loggerhead nesting, it is believed that North Carolina contributes more males to the population (Mrosovsky 1988). However, there are currently not enough temperature or sex ratio data to determine if sex ratios are being altered due to relocation efforts.

Sea turtles would continue to experience long-term minor benefits from periodic night patrols by law enforcement for the purpose of enforcing compliance with regulations and closures. Night patrol rangers have been known to place make-shift fencing around nests to protect them until turtle observers arrive in the morning (Meekins pers. comm. 2005). However, night patrols would be conducted using ORVs and could contribute to the number of false crawls that exist at the Seashore, resulting in long-term minor to moderate adverse impacts (see discussion of night driving and false crawls below under “ORV and Other Recreational Use”).

Under alternative A, the Seashore would use turtle-friendly lighting for all Seashore structures and would continue to encourage all concessionaires to install turtle-friendly lighting as well. These actions would provide long-term minor benefits to sea turtles by reducing the amount of light pollution on the beaches that could disorient emerging hatchlings or cause nesting females to abort their nesting attempts.

Under alternative A, the public would continue to receive information at the visitor centers about nesting sea turtles and the measures the Seashore is taking to protect the nests and hatchlings. The public would also continue to be notified about temporary closures that would limit ORV traffic, as well as when the closures are removed. Such public outreach is beneficial to the species because it educates the public about the specific needs of the species and alerts the public ahead of time to areas where they cannot drive due to potential impacts to the species. Therefore, public outreach under alternative A would have long-term minor beneficial impacts.

To help better understand the biology of sea turtles under alternative A, the Seashore would support research efforts studying the sex ratio of sea turtles at the Seashore. Depending upon the methodology used in conducting the research, there could be a slight risk of disturbing or injuring hatchlings or eggs.

However, Seashore staff would take precautions to minimize disturbance, and information obtained from the research would be beneficial in making long-term decisions regarding nest relocation policies. Overall, sea turtle research would have long-term minor beneficial impacts.

Overall, resources management activities under alternative A would have long-term moderate benefits due to the protection provided to sea turtles.

ORV and Other Recreational Use. Under alternative A, the Seashore would continue to provide sea turtles with protection from human disturbance, although there would be no restriction on night driving. Although all of the species management actions would provide some measure of protection to sea turtles, there would still be a risk of disturbance or injury to adult nesting females, hatchlings, and live stranded sea turtles due to ORV use and other activities (i.e., pedestrian use, pets). Sea turtles nest along all of the Seashore ocean beaches. Although the process of nest site selection is not well understood, and there is a lack of data describing the characteristics of nesting sites at the Seashore, 24-hour-per-day ORV use may affect the beach profile and substrate characteristics in a way that reduces suitability for nesting and hatching success (Cohen et al. in press). Vehicle traffic on beaches contributes to erosion, especially during high tides or on narrow beaches, where driving is concentrated higher on the beach, which may make some areas unsuitable for nesting (NMFS and USFWS 2008). Vehicle driving also compacts the sand, making it more difficult for females to dig their nest cavities. Although the ORV corridor protects some of the beach from ORV use, the protected area is fairly narrow, and it is unknown if the protected areas are more suitable for nesting than the unprotected areas, or what percentage of historical nests are located within the protected area as compared to unprotected areas. Vehicles also leave ruts in the sand, and although these ruts would be raked smooth approximately 50 to 55 days into the incubation period when nest closures are expanded, closure violations do occur, leaving ruts, which can trap hatchlings attempting to reach the ocean (Hosier et al. 1981). Over the years, closure violations and vandalism of closures and nests has continued to occur (NPS 2009c, 2008a, 2007e, 2005c, 2004d, 2003e, 2002c, 2001c, 2000b), and with no increase in law enforcement or resource staffing levels under alternative A, the closure violations and vandalism would be expected to continue. Under alternative A, ORVs would have long-term minor to moderate adverse impacts because of these potential disturbances.

Recreational driving, commercial fishing vehicles, and beach fires would continue to be allowed at night within the Seashore under alternative A, resulting in long-term moderate to major adverse impacts. The presence of ORVs on the beach at night during the sea turtle nesting season could have adverse impacts by disrupting the nesting process and causing nesting attempts to be aborted. Because visibility is reduced at night, there is also the potential for nesting, live stranded, or hatchling turtles to be hit by ORVs operating at night. (NMFS and USFWS 1993; Cohen et al. in press). Cape Hatteras and Cape Lookout national seashores are listed in the USFWS Loggerhead Recovery Plan as the only federal agencies within the nesting range allowing nighttime driving on beaches. Though actual vehicle counts are scant, patrol rangers noted substantial vehicle driving on the beaches at night in 2005 when there were no night-driving restrictions (Henson pers. comm. 2005). Night driving and heavy pedestrian use at night may also obscure turtle crawls prior to the morning turtle patrol, causing the Seashore staff to miss a turtle nest and therefore not protect it (NPS 2007e, 2004d, 2003e). Impacts to unprotected nests would be the same as discussed above under “Resources Management Activities,” resulting in long-term major adverse impacts.

False crawls (aborted turtle crawls that do not result in a nest, also often referred to as non-nesting crawls) can be detrimental to sea turtles and can be caused by, among other things, suboptimal sand conditions; encounters with roots, debris, or rocks while digging a nest; encounters with obstacles while crawling up a beach; disturbance from lights, noise, or other unusual activities; or other reasons that are not known. If too many false crawls occur for one individual, turtles can shed their eggs in the water and, thus, those eggs would be lost. Although turtles may attempt to nest again that same night or on subsequent nights,

causing a turtle to abort a nesting attempt is considered an incidental take under Section 7 of the ESA, and it may cause the turtle to nest in another location that is less optimal.

Under normal, undisturbed conditions, there is generally a one to one ratio between the number of nests and the number of false crawls in a given area (Godfrey pers. comm. 2005a). Based on numbers contained in the 2000–2008 sea turtle annual reports provided by the Seashore, since 2000, an average of 49.1% of all turtle activity at the Seashore each year was false crawls, with individual years ranging from 35.5% to as high as 64.5%. Although it is not known how many false crawls have been caused directly by ORVs, specific incidents have been documented where it was known that an ORV caused the false crawl (NPS 2006e). However, it is important to note that many different factors can contribute to false crawls, and no definitive assessment exists of how the level of ORV use, or any other recreational use, may influence sea turtle nesting activity. For example, within areas open to ORV use on Hatteras Island during 2008, false crawls made up 47.5% of the total known nesting activity (19 false crawls versus 21 nests) (NPS 2009c).

The sea-finding mechanisms in emerging hatchlings are complex and involve cues from both brightness and shape. However, studies indicate that strong brightness stimuli can override competing cues (Witherington and Martin 1996). Hatchlings tend to orient toward the brightest direction over a broad horizontal direction, which on an undeveloped beach is often toward the open horizon of the ocean. However, light pollution, such as that from ORV headlights, beach fires, or lights from nearby residences or other developments, can cause emerging hatchlings to become disoriented (meander or circle) or misoriented (led in the wrong direction). Depending on the location of the artificial lights with respect to a hatching nest, hatchlings may move toward the artificial light in a direction that is away from or parallel to the ocean. This can result in the hatchlings never finding their way to the ocean. It can also cause the hatchlings to expend more energy than necessary to find the ocean, leading to exhaustion and an increased risk of predation or desiccation. Installing light filter fencing approximately 50 to 55 days into the incubation period decreases this impact somewhat by helping to shelter the emerging hatchlings from light emanating from ORV headlights, beach fires, or nearby development, but it does not eliminate the impact completely.

Beach fires are also associated with the presence of ORVs and nighttime use at the Seashore (Meekins pers. comm. 2005). As a result, both adult nesting turtles and hatchlings would be subject to long-term moderate to major adverse impacts associated with light pollution from beach fires. In 2006, a turtle crawl was discovered going into the coals of a beach fire (NPS 2007e), and in 2007, a nest was discovered two feet from a beach fire. In this instance, visitors relayed to Seashore staff that they extinguished the fire when they saw an adult turtle crawling towards the fire (NPS 2008a). In 2008, hatchlings emerging from a nest crawled approximately 984 feet (300 meters) into a campfire to the south of the nest (NPS 2009c).

Overall, ORV and other recreational use under alternative A would result in long-term major adverse impacts to sea turtles due to the amount of Seashore available for ORV use and the lack of night-driving restrictions.

Cumulative Impacts. Other past, present, and future planned actions within and around the Seashore have the potential to impact the population of all three species of sea turtles that nest at the Seashore. Past storms such as hurricanes and other weather events during the turtle nesting and hatching season (April–November) have substantially impacted turtle nesting success within the Seashore and throughout the state of North Carolina and would continue to have long-term moderate to major adverse impacts. Storms, depending upon their intensity, can result in partial or complete nest loss due to flooding of nests, exposing nests due to erosion, or burying nests under feet of sand. Sea turtles have developed nesting strategies (e.g., laying lots of eggs and nesting several times during a season) to compensate for catastrophic natural events. Storms also have altered the beachscape in both positive and negative manners. In some areas, storms cause beach erosion, which has made those areas less optimal for nesting,

while in other areas, storms have caused sand accretions that creates new nesting habitat. Weather events such as cold fronts can also cause sudden drops in ocean and soundside water temperatures that can cause hypothermia, which can kill sea turtles. Hurricanes can also indirectly affect sea turtles because of their impact on staff resources. Recovery efforts that detract staff from surveying/monitoring activities during sea turtle nesting and hatchling season can have long-term minor adverse impacts by causing nests to be missed due to inability to survey.

The dredging of the federally authorized navigation channel at Oregon Inlet and disposing of material on Pea Island has occurred in the past and would continue to occur on an annual basis in the future with long-term minor to moderate adverse impacts. Dredging is typically done by hydraulic pipeline dredge with work generally performed during the fall and winter months (USACE 2002). Maintenance of the navigation channels with pipeline dredges should not affect turtle species because pipeline dredges are not known to take sea turtles. Hopper dredging, which is known to take sea turtles, is currently performed under a Regional Biological Opinion (RBO) issued by the NMFS for hopper dredging in the southeastern United States. All provisions of this RBO, or any issued subsequently, are strictly followed. No sea turtles have ever been taken by hopper dredges at Oregon Inlet, and under the recommended plan, the use of a hopper dredge to construct and maintain the navigation channel would be extremely rare (USACE 2002). Nests laid in the area are currently relocated by Refuge personnel because of the severely eroded nature of some beach areas and the possibility of nest overwash by high tides. However, because encroachment into the nesting season during dredging and disposal events could occasionally occur, and because of the possibility of missing a sea turtle nest during the nest surveys or inadvertently breaking eggs during relocation, it has been determined that the recommended project may affect both the loggerhead and green sea turtles that nest on Pea Island (USACE 2002). Dredging occurs during the turtle nesting season, and occasionally a hopper dredge is used, which has been known to be responsible for incidental takes of sea turtles. Heavy construction equipment may also be used during the deposition of the dredged material, which is typically placed on Pea Island. Heavy equipment use could lead to increased erosion or soil compaction, making the habitat less suitable for nesting.

Several local and NPS past, current, and future planning efforts can also affect sea turtles. For example, new development might result from the County Land Use Development Plan for Dare and Hyde counties. Although the details are lacking, additional development within the Seashore's boundaries that may result from implementing the land use plan may have long-term minor to moderate adverse impacts by increasing the amount of light pollution on the beaches causing adult turtles to abort nesting attempts and hatchlings to be disoriented when trying to make their way to the sea. Development might also increase the recreational use of the beaches and the impacts that recreation has on sea turtles.

The educational aspect of the Seashore's Long-range Interpretive Plan would provide long-term minor benefits to the sea turtles because it would help to educate visitors about the sea turtles that inhabit the Seashore and the protection measures that are put in place to help protect them. The Predator Management Plan would also provide long-term minor benefits to the sea turtles by helping to control mammalian predators, such as fox and raccoon, which prey upon sea turtle eggs and hatchlings. However, there could be a slight chance that predator trapping would result in disturbance to females or hatchlings, or result in nest or hatchling loss if trappers are not cognizant of nest locations, resulting in long-term minor to moderate adverse impacts.

The Cape Lookout National Park Interim Protected Species Management Plan provides long-term moderate beneficial impacts to all three species of nesting sea turtles at the Seashore through the management policies that it employs. The outcome of the Cape Lookout National Seashore ORV Management Plan/EIS would also have direct long-term impacts on the nesting sea turtle populations within the Seashore, as well as within the state of North Carolina. Specifically, it would have an impact on the state's goal of achieving 2,000 loggerhead nests annually within the state per the Loggerhead

Recovery Plan (NMFS and USFWS 2008). However, whether the impact of the ORV plan would be beneficial or adverse to sea turtles would depend upon the management decisions that are made and ultimately implemented.

During the replacement of the Herbert C. Bonner Bridge, construction noise and lighting may adversely impact nesting females, and dredging in Pamlico Sound could impact waterborne turtles, resulting in long-term minor to moderate adverse impacts. The presence of shading from the bridge and pilings driven into the substrate may also alter the optimal suitability of the beach surrounding the bridge for turtle nesting. However, the new bridge would also provide some long-term minor benefits by allowing barrier island processes to occur more naturally than with the present bridge. The new bridge would allow the natural formation of new habitats such as overwash fans, new inlets, and low sloping beaches that could provide suitable habitat for nesting turtles. The EIS for this project found that the proposed replacement of the Bonner Bridge, and subsequent phases of elevating portions of NC-12 onto bridges is not likely to jeopardize the continued existence of listed sea turtles (FHWA 2007).

The overall cumulative impact of these past, current, and future actions—added to the effects of actions under alternative A—would result in long-term moderate to major adverse cumulative impacts.

Conclusion. Through the protection of adult and hatchling sea turtles, surveys and management activities would provide long-term moderate beneficial impacts. Because alternative A lacks night-driving restrictions during sea turtle breeding season, adult turtles may be killed or caused to abort nesting attempts, nests may be run over or disturbed, and hatchlings may be run over or disoriented by light pollution from vehicles and associated activities, such as recreational and commercial fishing. Therefore, ORV and other recreational use occurring under alternative A would have long-term major adverse impacts.

Past, present, and future activities both inside the Seashore and within the state of North Carolina—when combined with the impacts of ORV use and level of resource management expected under this alternative would continue to result in long-term moderate to major adverse cumulative impacts.

Impairment Determination. Implementation of alternative A has the potential for impairment to sea turtles because it may result in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Implementation of alternative A would permit year-round unrestricted night driving on the beach and would designate all of the ocean beach as an ORV route. Complete or partial nest loss from causes related to human activities would be expected to occur frequently for the following reasons. Unrestricted nighttime or very early morning ORV use may cover evidence of the nest so that it is not found by the morning sea turtle patrol. Undetected nests are not managed by Seashore staff. Unmanaged nests are subject to being run over by ORVs, depredation, loss due to erosion or frequent flooding, and greater risks of hatchling disorientation or misorientation from light pollution. Hatchlings from unmanaged nests may become trapped and disoriented in tire ruts or footprints, leading to an increased risk of death by predation, being run over by subsequent ORV traffic, dessication, or exhaustion before reaching the ocean. Disoriented/misoriented hatchlings may never reach the ocean. Detected nests are protected by a symbolically fenced closure until the hatch window, however, implementation of alternative A continues law enforcement and resource staffing at a level where closure violations and vandalism of nests would be expected to continue at the same level or at an increased level as visitation increases.

Seashore staff erect light filter fencing at managed nests during the hatch window, which lessens, but does not eliminate, impacts from vehicle headlights, lanterns, beach campfires and other sources of light pollution that result in hatchling disorientation. There are no restrictions on use of lanterns or other auxiliary light sources on the beach at night. In addition to the direct effects of ORVs on the beach at

night, unrestricted night driving also increases the potential for disturbance by people and pets carried to more distant locations by vehicles. Beach fires are also associated with the presence of ORVs and nighttime use at the Seashore. Hatchlings have been disoriented by and crawled into beach fires.

In addition to the impacts to nests and hatchlings, the presence of ORVs on the beach at night can disrupt the nesting process and cause nesting attempts to be aborted. Repeated aborted nesting attempts by the same individual can lead to the eggs being shed in the water. Sea turtles nest along all of the Seashore's ocean beaches. Although management under alternative A would provide some protection to detected sea turtle nests and hatchlings, there would continue to be risk of disturbance to adult nesting females, undetected nests, hatchlings, and live stranded sea turtle due to ORV use and associated pedestrian and pet use. Reduced visibility at night increases the potential for nesting, live stranded, or hatchling turtles to be hit by ORVs operating at night. Additionally 24-hour-per-day ORV use may affect the beach profile and substrate. Vehicle driving also compacts the sand, making it more difficult for females to dig their nest cavities. Cumulative impacts from combining the effects of alternative A with effects of other past, present, and future planned actions in and around the Seashore would likely result in adverse effects that are beyond the level of disturbance or harm that would occur naturally, and may include changes in population structure and declines in local population numbers. Therefore, implementation of alternative A has the potential to impair sea turtles.

Determination of Effect. Under alternative A, resources management activities would result in long-term moderate benefits due to the protection provided to sea turtles from daily surveys for nests during the sea turtle nesting season (May 1 – September 15) and installing closures around each nest found, expanding the closures and installing light filter fencing around the nests during the hatch window, relocating nests from areas prone to erosion or frequent flooding, conducting periodic night patrols to enforce compliance regulations, and installing turtle friendly lighting on the Seashore.

ORV and other recreational use would have long-term major adverse impacts on sea turtles due to the amount of Seashore available for ORV use and by allowing nighttime driving on the beach. ORV and other recreational use would have impacts on sea turtles by affecting the beach profile and substrate characteristics in ways that reduce suitability for nesting and hatching success, likely continued closure violations and vandalism, and impacts caused by night driving and beach fires. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect sea turtles because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative A would also likely cause adverse effects.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Resources Management Activities. Surveys for sea turtle nests/crawls and monitoring for evidence of hatching under alternative B and the impacts of these activities would be the same as under alternative A.

Other management activities and impacts under alternative B would be similar to alternative A with several exceptions included in this alternative that would enhance the protection of sea turtles and their habitat. As under alternative A, Seashore staff would continue to install a 30-foot (9.1-meter) by 30-foot (9.1-meter) buffer around each turtle nest found, and after approximately 50 to 55 days, when the nest is approaching its hatch window, the turtle closure would be expanded to the surf line with varying widths based on the level and type of recreational use in the area. The widths would be the same as alternative A; however, under alternative B, full beach closures would be enacted after September 15 when a nest enters its "hatch window" (50 to 55 days). These full beach closures would be put into place to mitigate impacts to hatchlings from night driving. By protecting all of the detected turtle nests in the Seashore during the

incubation and hatching periods, these buffers would provide long-term moderate to major beneficial impacts to the sea turtles.

In accordance with the consent decree, under alternative B, if a deliberate act of vandalism occurs to a resource closure, the buffers would be expanded by 150 feet for the first violation, 300 feet for a second violation, and 1,500 feet or more for a third violation. During 2009, two violations occurred to turtle closures that were deemed deliberate and resulted in the expansion of buffers by 150 feet (NPS 2009d). One violation occurred in an area open to ORVs, and the other was in an area open to pedestrians only. Expanding buffers in response to violations would be used as a deterrent to future deliberate acts of vandalism to protect turtle nests and hatchlings. Although some violations may still occur, as evidenced by the violations occurring in 2009, it is assumed that as a result of the impacts that expanded buffers would have on ORV and pedestrian use of the beaches, the number of violations in the future should decrease. Therefore, expanding buffers as a result of violation would have a long-term minor to moderate beneficial impact. These impacts would be the same prior to and after the June 2009 modifications to the consent decree.

If it is determined that expanding the buffer around a nest prior to hatching would disrupt ORV access along the beach, the Seashore staff would immediately assess if an alternate route is available or if a reasonable bypass route could be established at hatching time. The use of bypasses or alternate routes around sea turtle nests would protect the nests and hatchlings by diverting ORVs and pedestrians away from the sensitive area and result in long-term minor beneficial impacts. Relocation of nests solely to resolve recreational access issues would not be considered.

Overall, resource management activities under alternative B would have long-term moderate benefits due to the protection provided to sea turtles.

ORV and Other Recreational Use. In general, management of ORV and other recreational use under alternative B would be the similar to alternative A, but would involve several changes that would result in additional protection of sea turtles and hatchlings.

ORV use on beaches can impact the beach profile and substrate characteristics in a way that may deteriorate the quality and quantity of suitable turtle nesting habitat. Under alternative B, in all locations open to ORV use that are not in front of villages, a 10-meter (30-foot) wide ORV-free zone would be created in the ocean backshore wherever there is sufficient beach width to allow an ORV corridor of at least 20 meters (60 foot) above the mean high tide line. This ORV-free corridor would protect some of the beach from ORV use and reduce impacts that may eventually alter the suitability of turtle nesting habitat. However, the area would be fairly narrow, and it is unknown if the areas to be protected are more suitable for turtle nesting than the unprotected areas, or what percentage of historical nests are located within the protected area as compared to unprotected area. Because of the relatively narrow section of beach being protected from ORV use impacts, the impacts would be long-term minor beneficial. Speed limits under alternative B would be 15 mph, unless otherwise posted, from May 15 through September 15; and 25 mph, unless otherwise posted, from September 15 to May 15. The 15 mph speed limit during the majority of the turtle nesting season is slower than the general 25 mph speed limit under alternative A (except where an ORV corridor is less than 100 feet wide when the speed limit under alternative A is 10 mph). This slower speed limit would likely help ORV operators better see and potentially avoid turtles and hatchlings as they are driving, resulting in long-term negligible beneficial impacts.

Under alternative B, all potential sea turtle nesting habitat (ocean intertidal, ocean backshore, and dunes) would be closed to all nonessential ORV use, including commercial fishermen, from 10:00 p.m. until 6:00 a.m. (5:00 a.m. for commercial fishermen) from May 1 to September 15. For the period from September 16 through November 15, night driving would be allowed with a permit, although there would

be no restriction on the number of permits issued. A permit could be revoked, however, for violation of applicable Seashore regulations or terms and conditions of the permit. Turtle nesting and hatching occurs mostly during nighttime hours. Only on rare occasions do these events take place during daylight hours (NPS 2005c). Therefore, prohibiting driving during the majority of the nighttime during the turtle nesting and hatching season would provide additional protection from ORV impacts, such as causing false crawls, disorienting or misorienting nesting turtles and hatchlings, running over hatchlings and/or nests, leaving behind tire ruts that can trap hatchlings, or running over turtle crawls and obscuring the tracks that help the Seashore staff identify and protect nests. While this would provide some long-term beneficial impacts to turtles, adverse impacts from night driving could still occur between the hours of sunset and 10:00 p.m.; therefore, overall, the impacts would be long-term minor to moderate adverse.

Although additional restrictions and regulations would help lessen some of the impacts from ORV and other recreational use, overall, the impacts would be long-term moderate adverse.

Cumulative Impacts. Cumulative impacts to sea turtles under alternative B would be very similar to those described for alternative A. Although alternative B would provide some additional protection, the adverse effects on sea turtles from other actions occurring in the region would still exist and would not be greatly offset by the additional protection afforded under alternative B. Therefore, the effects of these other actions—added to the effects of actions under alternative B—would result in long-term moderate adverse cumulative impacts.

Conclusion. Through early morning surveys and monitoring activities, the protection of nests and hatchling sea turtles, and restrictions on night driving during the sea turtle nesting season, alternative B would provide long-term moderate beneficial impacts. Because ORVs would be restricted between the hours of 10:00 p.m. and 6:00 a.m. during sea turtle breeding season, the chances are reduced that (1) adult turtles may be killed or caused to abort nesting attempts; (2) nests may be run over or disturbed; and (3) hatchlings may be killed or disoriented by light pollution from vehicles and associated recreational activities. ORV and other recreational use occurring under alternative B would have long-term moderate adverse impacts. Past, present, and future activities both inside the Seashore and within the state of North Carolina—when combined with the impacts of surveys and management activities, ORV use, and other recreational activities expected under this alternative—would continue to result in long-term moderate adverse cumulative impacts.

Impairment Determination. Implementation of alternative B would not result in impairment to sea turtles because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. From March 15 to November 30, in all locations not in front of the villages, outside of the avian prenesting areas and open to ORV use, alternative B would close to ORVs a linear strip of potential turtle nesting habitat (ocean intertidal zone, ocean backshore, and dunes) in the ocean backshore zone at least 10 meters wide, if sufficient beach width is available to allow at least a 20-meter ORV corridor above the mean high tide. This would provide a protected area for nesting turtles, birds, and seabeach amaranth. The NPS would provide a 24-hour phone line for citizens to report illegal activity and unsafe conditions on the beach, educational information about protected species at all ORV access points, and a beach driving brochure to concisely communicate regulations and potential penalties for violations. Night driving would be prohibited between 10:00 p.m. and 6:00 a.m. from May 1 to September 15 and allowed with a permit that has an educational component and restrictions on light use between September 16 and November 15. The night driving allowed between sunset and 10:00 p.m. during turtle nesting season would be expected to occasionally result in aborted nesting attempts, hatchling disorientation or misorientation, running over hatchlings or nests, and obscuring turtle crawl tracks that Seashore staff use to locate newly laid nests so that the undetected nests would not be managed. These adverse effects on sea turtles of allowable hours of night driving, erosion and sand compaction, and other adverse effects related to ORV and other recreational use were deemed to be

moderate in the plan/EIS analysis because although occasional disturbance and harm to sea turtles or their habitat would be expected that are beyond the level of disturbance or harm that would occur naturally, the Seashore would be expected to maintain a sustainable sea turtle population.

Cumulative impacts from combining the effects of alternative B with effects of other past, present, and future planned actions in and around the Seashore would likely result in occasional occurrences of disturbance to some nesting females with negative effects to reproduction affecting local population levels, occasional complete or partial nest loss due to human activities, and occasional disorientation or disruption of hatchling movement or direct hatchling mortality from human activities. Even with these adverse effects, large declines in populations numbers would not result, and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the sea turtle impacts would not result in impairment.

Determination of Effect. Under alternative B, resources management activities would result in long-term moderate benefits due to the protection provided to sea turtles from daily surveys for nests during the sea turtle nesting season (May 1 – September 15) and installation of closures around each nest found, expanding the closures and installing light filter fencing around the nests during the hatch window, relocating nests from areas prone to erosion or frequent flooding, and installing turtle friendly lighting on the Seashore.

ORV and other recreational use would have long-term moderate adverse impacts on sea turtles by affecting the beach profile and substrate characteristics in ways that reduce suitability for nesting and hatching success and likely continued closure violations and vandalism. While there would still be some impacts caused by night driving, these impacts would be lessened by restricting night driving between the hours of 10:00 p.m. and 6:00 a.m. (5:00 a.m. for commercial fisherman) from May 1 to September 15 and requiring night-driving permits from September 16 through November 15. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect sea turtles because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities and restrictions on nonessential ORV nighttime driving, the actions under alternative B would also likely cause adverse effects.

Impacts of Alternative C: Seasonal Management

Resources Management Activities. Under alternative C, the Seashore staff would begin surveying the entire park daily for turtle crawls and nests on May 1 and continue until September 15 or 2 weeks after the last sea turtle nest or crawl is found, whichever is later. Surveys would be conducted in the morning using ATVs/UTVs and possibly ORVs prior to the onset of heavy public ORV use. Similar to alternatives A and B, the daily monitoring period would encompass the nesting season for the loggerhead sea turtle (mid-May to mid-August), the most prevalent nester at the Seashore, and the vast majority of the green and leatherback sea turtles' nesting seasons. Prior to May 1, the leatherback is the only species likely to nest at the Seashore, and their nests are often detected by the Seashore staff conducting bird monitoring, which would begin March 15. If a leatherback turtle nest has been reported in the state of North Carolina prior to May 1, the Seashore would follow the direction of NCWRC regarding the start of turtle patrols. From the date that daily monitoring ends to November 15, periodic monitoring (e.g., every two to three days) for nesting and emerging hatchlings would continue.

Conducting daily and periodic surveys for turtle crawls and nests during these time frames would provide long-term minor to moderate beneficial impacts because similar to alternatives A and B, they would allow nests to be identified for protection; closure violation and damage caused by ORVs or pedestrians would be detected and repaired in a timely manner and an assessment made as to whether or not any damage

was done directly to a nest; tracks left behind by ORVs and/or pedestrians that are detected would be raked smooth in expanded closures; predator activity would be detected and nests protected with predator exclosures as necessary; and during periods following severe storm events or when large quantities of seaweed are washed ashore, monitoring for post-hatchling washbacks would help protect them from being run over by vehicles, disturbance from pedestrians or their pets, and potential predation. Precautions would be taken by Seashore staff to avoid potential impacts to sea turtles as described under alternative A.

Under alternative C, turtle nest closures would be the same as for alternatives A and B with 30-foot (9.1-meter) by 30-foot (9.1-meter) closures around each turtle nest found. This closure would help protect nests from being run over by ORVs or disturbed by pedestrians and/or their pets, and against erosion impacts caused by multiple ORV passes. After approximately 50 to 55 days, the turtle closure would be expanded to the surf line, with varying widths based on the level and type of recreational use in the area. In vehicle-free areas with little or no pedestrian traffic, the total width would be 75 feet (22.9 meters); on village beaches or other areas with high levels of pedestrian and other non-ORV use, the total width would be 150 feet (45.7 meters); and in ORV traffic areas the total width would be 350 feet (106.7 meters). Additionally, the closed area on the landward side of the nest would be expanded from 30 feet (9.1 meters) to 50 feet (15.2 meters). A difference under alternative C from alternatives A and B is that if multiple nests are located near each other (within 150 feet [45.7 meters]) and have similar hatch dates (within 14 days of each other), the closures would encompass all nests and would not be removed until all nests within the closure have hatched. By protecting all of the detected turtle nests in the Seashore during the incubation and hatching periods, these buffers would provide long-term moderate to major beneficial impacts to the sea turtles.

Similar to alternatives A and B, when a nest is found under alternative C, Seashore staff would determine if the nest should be relocated out of areas that are prone to erosion or frequent flooding. If relocation is necessary, procedures for relocating nests provided in the NCWRC handbook (NCWRC 2006) would be followed. A difference under alternative C from alternatives A and B is that prior to the turtle nesting season, areas in the Seashore deemed unsuitable for turtle nests (i.e., high erosion areas) would be identified by April 15, with maps and descriptions of the areas analyzed by NCWRC. This process would expedite decisions about relocating nests, which would be beneficial in making sure that all morning survey activities are completed in a timely manner. As indicated under alternative A, relocating nests results in long-term moderate to major beneficial impacts by increasing the likelihood that the nests will hatch successfully instead of being lost to storm or erosion related events. However, similar to alternatives A and B, relocating nests does have some adverse impacts including possibly altering the natural sex ratio of the nest by altering the incubation temperature, killing the embryo by dislodging it during movement, or potentially decreasing the successful hatch rate of the nest by improperly constructing the nest pit. These negative impacts would result in long-term minor to moderate adverse impacts.

Similar to alternatives A and B, as nests near their hatching date, the Seashore staff would install U-shaped light filter fencing around the nests, with the open face of the “U” oriented toward the water, to block light pollution from the villages, beach fires, any vehicles operating on the beach after dark, or other sources of light pollution. Although it would not eliminate light impacts completely, installing filter fencing would provide long-term moderate to major beneficial impacts to sea turtles.

Under alternative C, by May 1, 2012, the Seashore would install turtle friendly lighting fixtures on all the Seashore structures visible from the ocean beach except where prevented by overriding lighting requirements, such as lighthouses and fishing piers operated by NPS concessionaires. These actions would provide long-term minor benefits to sea turtles by reducing the amount of light pollution on the beaches that could disorient emerging hatchlings or cause nesting females to abort their nesting attempts. The Seashore would also work with the USFWS, the NCWRC, and Dare County to encourage the

development of a turtle friendly lighting educational program or a turtle friendly lighting ordinance for villages within the Seashore on Hatteras Island. If the Seashore is able to work with these agencies to enact a turtle friendly educational program or lighting ordinance in the villages, this would result in long-term moderate to major beneficial impacts because lighting on beaches from the villages may deter turtles from coming ashore and nesting on beaches of their first choice, forcing them to lay eggs at a less optimal site. In addition, hatchlings can become disoriented by the lights and move inland toward the villages and away from the beach, resulting in mortality (NPS 2008a, 2009c).

Besides management activities targeted toward turtles, management activities targeted toward birds and seabeach amaranth under alternative C at the Seashore would also protect turtles and their nesting habitat because their habitats overlap in areas seaward of the primary dune line. Under alternative C, through the establishment of SMAs for birds and seabeach amaranth, combined with other areas that would be closed to ORVs use such as the village beaches, would close approximately 41 miles of beach to ORV use from March 15 to October 14, which encompasses the turtle nesting season. Although some of these closed areas are not historically popular turtle nesting sites (e.g., Bodie Island Spit), other areas such as Cape Point are. Closing approximately 41 miles of beach to ORV use during this period would minimize potential impacts to sea turtles and would result in long-term moderate to major beneficial impacts. The extent of the benefits would depend on the location and size of the closures, which would be reevaluated and re-designated every five years or after major hurricanes.

Under alternative C, and similar to alternatives A and B, the public would continue to receive information at the visitor centers about nesting sea turtles and the measures the Seashore is taking to protect nests and hatchlings. The public would also be notified about temporary closures that would limit ORV traffic, as well as when these closures reopen. Such public outreach is beneficial to sea turtles because it educates the public on the specific needs of the species and alerts the public ahead of time to areas where they can and cannot go due to potential impacts to species. Similar to alternatives A and B, this aspect of public education would have a long-term minor beneficial impact. In addition, under alternative C, ORV users would be required to obtain an annual ORV users permit valid for 12 months from the date of purchase. To obtain the permit, an ORV user would need to complete a short educational program and pass a basic knowledge test showing that the person understands the rules and regulations governing ORV use at the Seashore. The permit may be revoked for violation of applicable Seashore regulations or terms and conditions of the permit. This educational requirement, with the potential deterrent of losing driving privileges on the Seashore, would have an additional long-term minor to moderate beneficial impacts, with the extent of the impacts based on the ability to enforce the regulations and apprehend violators.

To help better understand the biology of sea turtles or improve resource protection within the Seashore, under alternative C, the Seashore may authorize qualified researchers associated with recognized academic or research institutions to conduct additional scientific research on turtle species. Depending upon the methodology used in conducting the research, there could be a slight risk of disturbing, injuring, killing, or destroying turtles, hatchlings, or eggs. However, the information obtained from the research would be beneficial to the long-term survivability of the individual sea turtle species and in making long-term decisions regarding their protection within the Seashore and in other areas. Research would provide long-term minor to moderate beneficial impacts to nesting sea turtles at the Seashore.

Overall, resource management activities under alternative C would have long-term moderate to major beneficial impacts due to the added protection provided to sea turtles.

ORV and Other Recreational Use. Under alternative C, the overall impact on sea turtles due to ORV use would be substantially reduced when compared to the no-action alternatives by closing approximately 41 miles of beach to ORV use during the nesting season and by closing ORV routes in potential sea turtle

nesting habitat (ocean intertidal zone, ocean backshore, and dunes) to nonessential recreational ORV use from 7:00 p.m. to 7:00 a.m. between the dates of May 1 and November 15.

As described under alternative A, vehicle traffic on beaches contributes to erosion, which may eventually deteriorate the quality and quantity of nesting habitat, especially during high tides or on narrow beaches where driving is concentrated higher up on the beach. Vehicle traffic also compacts the sand, making it more difficult for females to dig their nest cavities, forcing them to expend more energy, or even causing them to abort the nesting attempt. Under alternative C, these impacts would be eliminated in some areas by closing approximately 12 miles of beach year-round (approximately 29 miles closed during the nesting season only), although not all of this area is necessarily optimal nesting habitat.

Vehicles also leave ruts in the sand and pedestrians leave footprints, and although these ruts and footprints would be raked smooth approximately 50 to 55 days into the incubation period when nests closures are expanded, closure violations do occur, leaving ruts and footprints that can trap hatchlings attempting to reach the ocean (Hosier et al. 1981; NPS 2007e, 2008a, 2009c). However, with increased education through an ORV permit program and the threat of having the permit revoked as a result of violating the Seashore's rules and regulations, it is assumed that the number of violations occurring under alternative C would decrease. While the existing level of impacts from ORVs would be expected to decrease under alternative C because there would still be adverse impacts, the above impacts from ORV use would have long-term minor to moderate adverse impacts.

As described under alternative A, turtle nesting and hatching occurs mostly during nighttime hours, and this activity can be impacted by ORVs through disorientation by light or direct mortality (NPS 2005c, 2008a). Prohibiting nonessential recreational ORV nighttime driving during turtle nesting season would virtually eliminate these potential impacts, creating long-term moderate to major beneficial impacts. However, some risk of long-term minor adverse impacts would still exist from the use of essential vehicles at night, as well as allowing night driving in area outside of existing resource closures by commercial fishermen who are actively engaged in authorized commercial fishing activities.

As described under alternative A, both nesting turtles and hatchlings are impacted by light pollution from beach fires, and many beach fires are associated with the presence of ORVs (Meekins pers. comm. 2005). Although beach fires would not be prohibited under alternative C, prohibiting ORV use during nighttime hours would likely greatly reduce the number of beach fires that occur at the Seashore, providing long-term minor to moderate beneficial impacts. Without nonessential ORV use at night, any beach fires would likely be limited to those areas in front of the villages to which people can more easily carry firewood. Even though the ability to have beach fires would require a non-fee educational permit, allowing these beach fires would impact (misorientation, disorientation, injury, and death) nesting turtles and hatchlings, resulting in long-term minor to moderate adverse impacts.

Under alternative C, portable lanterns, auxiliary lights, and powered fixed lights of any kind shining for more than 5 minutes at a time would be prohibited on the Seashore's ocean beaches. This would help eliminate point sources of light that provide additional light pollution on the beaches and minimize impacts to turtles and hatchlings, resulting in long-term minor to moderate beneficial impacts.

Restrictions placed on nonessential, recreational ORV use under alternative C would provide substantial long-term benefits to sea turtles, including seasonal night-driving restrictions that close the beach before dark (7:00 p.m.), some adverse impacts would still occur in areas where their use is allowed. Therefore, overall, ORV and other recreational use would have long-term minor adverse impacts.

Cumulative Impacts. Cumulative impacts to sea turtles under alternative C would be very similar to those described for alternative A. Although alternative C would provide additional protection that would

be beneficial to the regional sea turtle population, the adverse effects on sea turtles from other actions occurring in the region would still exist. Therefore, the overall cumulative impact of these past, current, and futures actions—added to the effects of actions under alternative C—would result in long-term minor to moderate adverse cumulative impacts.

Conclusion. Through surveys and monitoring activities, the protection of nests and hatchling sea turtles, restrictions on night driving during the sea turtle nesting season, and limiting of ORVs to designated use areas, alternative C would provide long-term moderate to major beneficial impacts. Because ORV use would be restricted between the hours of 7:00 p.m. and 7:00 a.m. during sea turtle nesting season, the chances are reduced that (1) adult turtles may be killed or caused to abort nesting attempts; (2) nests may be run over or disturbed; and (3) hatchlings may be killed or disoriented by light pollution from vehicles and associated recreational activities. ORV and other recreational uses occurring under alternative C would have long-term minor adverse impacts.

Past, present, and future activities both inside the Seashore and within the state of North Carolina—when combined with the impacts of ORV use, surveys and management of species expected under this alternative—would continue to result in long-term minor to moderate adverse cumulative impacts.

Impairment Determination. Implementation of alternative C would not result in impairment to sea turtles because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Beach fires would be prohibited from midnight to 6:00 a.m. year-round. A permit would be required for all beach fires to ensure that users are informed of basic safety and resource protection measures. Where fires are permitted, they would be prohibited within 100 yards of turtle nest protection areas. From May 1 through November 15, portable lanterns, auxiliary lights, and powered fixed lights of any kind shining for more than 5 minutes at a time would be prohibited on Seashore ocean beaches.

By May 1, 2012, turtle-friendly lighting fixtures would be installed on all Seashore structures visible from the ocean beach (except where prevented by other overriding lighting requirements, such as lighthouses, which serve as aids to navigation) and fishing piers operated by NPS concessioners. The Seashore would provide information about and encourage the use of turtle friendly lighting. Educational material would be developed to inform visitors about their impact on the success of sea turtle nests. The Seashore would work with the USFWS, the NCWRC, and Dare County to encourage development of a turtle-friendly lighting education program for villages within the Seashore on Hatteras Island.

Unattended beach equipment (chairs, canopies, volleyball nets, watersports gear, etc.) would be prohibited on the Seashore at night. Turtle patrol and law enforcement would tag equipment found at night. Owners would have 24 hours to remove equipment before it would be removed by NPS staff. The Seashore would work with local organizations and businesses, including real estate rental agencies and hotels/motels, to ensure wider distribution of ORV and resource protection educational information. This would include encouraging these businesses to provide information about removal of beach equipment from the beaches at night.

The Seashore would implement a Nest Watch Program. A cadre of trained volunteers would be established to watch nests that have reached their hatch windows to monitor hatchling emergence success and success reaching the water, and to minimize negative impacts from artificial lighting, predation, and human disturbance. Depending on the number of nests that may be ready to hatch and the availability of volunteers, it may be necessary for NPS turtle staff to prioritize which nests are watched on any particular night. Priority would be given to watching the nests that are most likely to be negatively impacted by manageable factors.

During nesting season approximately 41 miles of ocean beach would be closed to ORV use, and night driving on the rest of the ocean beach on designated ORV routes would be prohibited between 7:00 p.m. and 7:00 a.m. between May 1 and November 15. Implementation of alternative C would infrequently result in aborted nesting attempts, hatchling disorientation or misorientation, running over hatchlings or nests, or complete or partial nest loss due to human activities. Because of the educational component of the ORV permit program, the consequence of permit revocation for ORV closure violations, the restriction of night driving and the provision of areas where ORV routes would not be designated, implementation of alternative C would be expected to result in a decrease of sea turtle closure violations. The approximately 12 miles of beach that would be closed to ORVs year-round and the approximately 29 miles closed seasonally would be protected from vehicle effects on erosion and sand compaction. The adverse effects on sea turtles of allowable hours of night driving, erosion and sand compaction, and other adverse effects related to ORV and other recreational use were deemed to be minor in the plan/EIS analysis because occasional disturbance and harm to sea turtles or their habitat would not be expected to be beyond the level of disturbance and harm that occur naturally and the Seashore would be expected to maintain a sustainable sea turtle population.

Cumulative impacts from combining the effects of alternative C with effects of other past, present, and future planned actions in and around the Seashore would likely result in infrequent or occasional occurrences of disturbance to some nesting females with negative effects to reproduction affecting local population levels; infrequent or occasional complete or partial nest loss due to human activities; and occasional disorientation or disruption of hatchling movement; or occasional direct hatchling mortality from human activities. These impacts would not result in large declines in populations numbers and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the sea turtle impacts would not result in impairment.

Determination of Effect. Under alternative C, resources management activities would result in long-term moderate to major benefits due to the protection provided to sea turtles from daily surveying for nests during the sea turtle nesting season (May 1 – September 15) and installing closures around each nest found, expanding the closures and installing light filter fencing around the nests during the hatching window, relocating nests from areas prone to erosion or frequent flooding, installing turtle friendly lighting on the Seashore and working with the USFWS, NCWRC and Dare County to encourage the development of a turtle friendly lighting educational program or a turtle friendly lighting ordinance. Establishing SMAs for birds and seabeach amaranth, combined with other areas that would be closed to ORV use such as the village beaches, would close approximately 41 miles of beach to ORV use from March 15 through October 14. These closures would minimize the potential for impacts to nesting turtles, turtle nests, and turtle hatchlings in these areas.

ORV and other recreational use would have long-term minor adverse impacts on sea turtles by affecting the beach profile and substrate characteristics in ways that reduce suitability for nesting and hatching success and likely continued closure violations and vandalism. Prohibiting nonessential recreational ORV nighttime driving from 7:00 p.m. to 7:00 a.m. between the dates of May 1 and November 15 would virtually eliminate potential impacts to adult and hatchling turtles caused by night driving. Beach fires would still be allowed, and though they would likely only occur in front of the villages due to the night-driving restrictions, they would still cause adverse impacts to turtles through light pollution. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect sea turtles because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities and the prohibition on nonessential recreational ORV nighttime driving during the turtle nesting season, the actions under alternative C would also likely cause adverse effects.

Impacts of Alternative D: Increased Predictability and Simplified Management

Resources Management Activities. Surveying activities for sea turtles under alternative D would be the same as under alternative C, resulting in long-term minor to moderate beneficial impacts.

Other management activities for sea turtles under alternative D would be the same as under alternative C with one exception that would enhance the protection of the sea turtle habitat. Under alternative D, SMAs for bird species and seabeach amaranth would be designated as non-ORV areas year-round, instead of just seasonally from March 15 through October 14 as under alternative C, and would be managed under ML1 procedures during the breeding season. This, along with all village beaches being designated as non-ORV year-round, would protect approximately 41 miles of the Seashore beach habitat from ORVs year-round. Prohibiting ORV use in these areas for the additional time from October 15 through March 14 would protect this habitat from additional erosion and sand compaction impacts that could eventually deteriorate the quality and quantity of turtle nesting habitat in these areas, resulting in long-term moderate to major beneficial impacts. The extent of the impact would depend on the location and size of the SMAs, which would be reevaluated and re-designated every five years, or after major hurricanes.

Overall, similar to alternative C, management activities under alternative D would result in long-term moderate to major beneficial impacts.

ORV and Other Recreational Use. Impacts under alternative D would be similar to those under alternative C, with the overall impact on sea turtles lessened due to the closure of approximately 41 miles of the Seashore beach to ORV use year-round. As under alternative C, alternative D would close ORV routes in potential sea turtle nesting habitat to recreational ORV use from 7:00 p.m. to 7:00 a.m. between the dates of May 1 and November 15.

While restrictions placed on ORV use under alternative D would provide long-term moderate to major beneficial impacts, similar to alternative C, there would still be some level of adverse impact to sea turtles in areas where ORV use and beach fires are allowed; therefore, overall impacts from ORV and other recreational use would be long-term minor adverse.

Cumulative Impacts. Cumulative impacts to sea turtles under alternative D would be very similar to those described for alternative A. Although alternative D would provide additional protection that would be beneficial to the regional sea turtle population, the adverse effects on sea turtles from other actions occurring in the region would still exist. Therefore, the overall cumulative impact of these past, current, and futures actions—added to the effects of actions under alternative D—would result in long-term minor adverse cumulative impacts.

Conclusion. Through the protection of adult and hatchling sea turtles, surveys and management activities, limiting ORVs to designated use areas, and restricting night driving therein during the sea turtle nesting season, alternative D would provide long-term moderate to major beneficial impacts. Because beach driving would be prohibited in designated ORV use areas between 7:00 p.m. and 7:00 a.m. during the sea turtle nesting season, the chances are greatly reduced that (1) adult turtles may be killed or caused to abort nesting attempts; (2) nests may be run over or disturbed; and (3) hatchlings may be killed or disoriented by light pollution from vehicles and associated recreational activities. Year-round ORV closures in SMAs would reduce erosion and compaction of beaches in these areas, providing benefits to sea turtle habitat. ORV activities occurring under alternative D would have long-term minor adverse impacts.

Past, present, and future activities both inside the Seashore and within the state of North Carolina—when combined with the impacts of ORV use, surveys and management of species expected under this alternative would have long-term minor adverse cumulative impacts.

Impairment Determination. Implementation of alternative D would not result in impairment to sea turtles because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Beach fires would be prohibited from midnight to 6:00 a.m. year-round. A permit would be required for all beach fires to ensure that users are informed of basic safety and resource protection measures. Where fires are permitted, they would be prohibited within 100 yards of turtle nest protection areas. From May 1 through November 15, portable lanterns, auxiliary lights, and powered fixed lights of any kind shining for more than 5 minutes at a time would be prohibited on Seashore ocean beaches.

By May 1, 2012, turtle-friendly lighting fixtures would be installed on all Seashore structures visible from the ocean beach (except where prevented by other overriding lighting requirements, such as lighthouses, which serve as aids to navigation) and fishing piers operated by NPS concessioners. The Seashore would provide information about and encourage the use of turtle friendly lighting. Educational material would be developed to inform visitors about their impact on the success of sea turtle nests. The Seashore would work with the USFWS, the NCWRC, and Dare County to encourage development of a turtle-friendly lighting education program for villages within the Seashore on Hatteras Island.

Unattended beach equipment (chairs, canopies, volleyball nets, watersports gear, etc.) would be prohibited on the Seashore at night. Turtle patrol and law enforcement would tag equipment found at night. Owners would have 24 hours to remove equipment before it would be removed by NPS staff. The Seashore would work with local organizations and businesses, including real estate rental agencies and hotels/motels, to ensure wider distribution of ORV and resource protection educational information. This would include encouraging these businesses to provide information about removal of beach equipment from the beaches at night.

The Seashore would implement a Nest Watch Program. A cadre of trained volunteers would be established to watch nests that have reached their hatch windows to monitor hatchling emergence success and success reaching the water, and to minimize negative impacts from artificial lighting, predation, and human disturbance. Depending on the number of nests that may be ready to hatch and the availability of volunteers, it may be necessary for NPS turtle staff to prioritize which nests are watched on any particular night. Priority would be given to watching the nests that are most likely to be negatively impacted by manageable factors.

Approximately 41 miles of ocean beach would be closed to ORV use, and night driving on the rest of the ocean beach on designated ORV routes would be prohibited between 7:00 p.m. and 7:00 a.m. between May 1 and November 15. Year-round protection of 41 miles of ocean shoreline from beach driving would protect this habitat from additional erosion and sand compaction impacts that could eventually deteriorate the quality and quantity of turtle nest habitat in these areas. Implementation of alternative D would infrequently result in aborted nesting attempts, hatchling disorientation or misorientation, or running over hatchlings or nests. Implementation of alternative D would be expected to result only infrequently in complete or partial nest loss due to human activities. Because of the educational component of the ORV permit program, the consequence of permit revocation for ORV closure violations, the restriction of night driving, and the provision of areas where ORV routes would not be designated, implementation of alternative D would be expected to result in a decrease in sea turtle closure violations. Impacts to sea turtles and their habitat would be detectable, but likely would not be beyond the level of disturbance or harm that would occur naturally and the Seashore would be expected to maintain a sustainable sea turtle population.

Cumulative impacts from combining the effects of alternative D with effects of other past, present, and future planned actions in and around the Seashore would likely result in detectable adverse effects to sea turtles, but overall the effects would not result and large declines in populations numbers and sufficient

population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the sea turtle impacts would not result in impairment.

Determination of Effect. Under alternative D, resources management activities would result in long-term moderate to major benefits due to the protection provided to sea turtles from daily surveying for nests during the sea turtle nesting season (May 1 – September 15) and installation of closures around each nest found, expanding the closures and installing light filter fencing around the nests during the hatch window, relocating nests from areas prone to erosion or frequent flooding, installing turtle friendly lighting on the Seashore and working with the USFWS, the NCWRC and Dare County to encourage the development of a turtle friendly lighting educational program or a turtle friendly lighting ordinance. Establishing SMAs for birds and seabeach amaranth, combined with other areas such as the village beaches that would be designated as non-ORV, would close approximately 41 miles of Seashore beach to ORV use year-round. These closures would minimize potential impacts to nesting turtles, turtle nests, and turtle hatchlings in these areas.

ORV and other recreational use would have long-term minor adverse impacts on sea turtles by affecting the beach profile and substrate characteristics in ways that reduce suitability for nesting and hatching success and likely continued closure violations and vandalism. Prohibiting recreational ORV use from 7:00 p.m. to 7:00 a.m. between the dates of May 1 and November 15 would virtually eliminate potential impacts to adult and hatchling turtles caused by night driving. Beach fires would still be allowed, and though they would likely only occur in front of the villages due to the night-driving restrictions, they would still cause adverse impacts to turtles through light pollution. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect to sea turtles because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities and the prohibition on recreational night driving during the turtle nesting season, the actions under alternative D would also likely cause adverse effects.

Impacts of Alternative E: Variable Access and Maximum Management

Resources Management Activities. Surveying activities for sea turtles under alternative E would be the same as under alternatives C and D, resulting in long-term minor to moderate beneficial impacts.

Other management activities for sea turtles under alternative E would be the same as under alternatives C and D with the exception that SMAs would be closed to ORV use for 5.5 months from March 15 through August 31, and SMAs under ML2 procedures at Bodie Island Spit, Cape Point, and South Point would have ORV pass-through corridors, subject to resource closures. While not all closed areas are necessarily historically popular nesting sites, the SMAs, combined with other areas that would be closed to ORV use such as the village beaches, would protect approximately 35 miles of the Seashore from ORV use during the majority of the sea turtle nesting season and provide long-term moderate to major beneficial impacts. The extent of the impact would depend on the location and size of the closures, which would be reevaluated and redesigned every 5 years or after major hurricanes. The beneficial impacts in SMAs under ML2 procedures would be tempered slightly with pass-through corridors subject to potential deterioration of nesting habitat due to the compaction of sand and contributing factors to erosion that result from ORV use. While SMAs would reopen after August 31, this would have only negligible to minor adverse impacts directly on nesting sea turtles, because since 1998, there has been minimal nesting activity at the Seashore after August 31, with only two nests and no false crawls recorded (NPS 2006e, 2007e, 2008a, 2009c).

Management activities would provide long-term moderate to major beneficial impacts to sea turtles.

ORV and Other Recreational Use. The majority of impacts under alternative E would be the same as those under alternatives C and D with the following exceptions, due to differences in night-driving restrictions and provisions for overnight ORV use via a park-and-stay option.

Under alternative E, designated ORV routes in potential sea turtle nesting habitat (ocean intertidal zone, ocean backshore, and dunes) would be closed to nonessential ORV use from 10:00 p.m. to 6:00 a.m. from May 1 through November 15. For the period from September 16 through November 15, selected ORV routes with no or a low density of turtle nests would reopen to ORV use between 10:00 p.m. and 6:00 a.m., subject to terms and conditions of a permit. Turtle nesting and hatching occurs mostly during nighttime hours. Only on rare occasions do these events take place during daylight hours (NPS 2005c). Therefore, prohibiting driving during the majority of the nighttime during the turtle nesting and hatching season would provide additional protection from ORV impacts such as causing false crawls, misorienting or disorienting nesting turtles and hatchlings, running over hatchlings and/or nests, leaving behind tire ruts that can trap hatchlings, or running over turtle crawls and obscuring the tracks that help Seashore staff identify and protect nests. Although this would provide some long-term beneficial impacts to turtles, adverse impacts from night driving could still occur between the hours of sunset and 10:00 p.m. Additionally, in those areas reopened to ORV use at night after September 15, hatchlings would be subjected to nighttime impacts from ORVs, but the potential for adverse impacts would be reduced by limiting it to areas where there are no nests or a very low density of nests. Therefore, while some beneficial impacts from limiting night driving would occur, night-driving impacts under alternative E would be long-term minor to moderate adverse. These impacts would be less than alternatives A and B, but more than alternatives C and D.

In addition, allowing night driving until 10:00 p.m. would likely increase the number of beach fires that occur throughout the Seashore as compared to alternatives C and D because the ability to easily carry firewood would not be restricted to areas in front of the villages. Therefore, impacts from light pollution resulting from beach fires would be more widespread under alternative E, similar to alternatives A and B, resulting in long-term minor to moderate adverse impacts.

Under alternative E, a limited number of ORVs would be allowed to park-and-stay overnight with a permit at selected spits and points, if not otherwise closed to protect resources. Fifteen vehicles would be allowed to stay at each inlet spit, while 25 vehicles would be allowed to stay overnight at Cape Point and South Point. Limitations on night-driving and lighting restrictions (i.e., portable lanterns, auxiliary lights, and powered fixed lights of any kind shining for more than 5 minutes at a time would be prohibited, similar to all action alternatives) would help limit the amount of impacts created by these park-and-stay vehicles; however, they would still pose potential obstacles to turtles coming ashore to nest, possibly causing false crawls and turtles to expend more energy to find another nesting location that may be less optimal. This would result in long-term minor adverse impacts.

Under alternative E, a 10-meter (30-foot) wide ORV-free zone would be designated in the ocean backshore wherever there was sufficient beach width to allow an ORV corridor of at least 30 meters (90 feet) above the mean high tide line. This ORV-free zone would protect some turtle nesting habitat from ORV use; however, the area is fairly narrow, and it is unknown if the areas to be protected are more suitable for turtle nesting than the unprotected areas, or what percentage of historic nests are located within the protected area as compared to unprotected area. Because of the relative narrow portion of habitat protected, the impacts would be long-term minor beneficial.

While additional restrictions and regulations would help lessen some of the impacts from ORV use and other recreational activities, overall, the impacts would be long-term moderate adverse from allowing night driving until 10:00 p.m., and due to increased recreational access throughout the Seashore during the turtle nesting season, including a park-and-stay option for ORVs at selected points and spits.

Cumulative Impacts. Cumulative impacts to sea turtles under alternative E would be very similar to those described for alternative A. Although alternative E would provide additional protection that would be beneficial to the regional sea turtle population, the adverse effects on sea turtles from other actions occurring in the region would still exist. Therefore, the overall cumulative impact of these past, current, and futures actions—added to the effects of actions under alternative E—would result in long-term moderate adverse cumulative impacts.

Conclusion. Through the protection of adult and hatchling sea turtles, daily surveys and management activities, limiting ORVs to designated use areas and restricting night driving therein during the sea turtle nesting season, alternative E would provide long-term moderate to major beneficial impacts. Because ORVs would be restricted between the hours of 10:00 p.m. and 6:00 a.m. during the sea turtle nesting season, the chances are reduced that (1) adult turtles may be killed or caused to abort nesting attempts; (2) nests may be run over or disturbed; and (3) hatchlings may be killed or disoriented by light pollution from vehicles and associated recreational activities. However, the chances for impacts to turtles under alternative E would be greater than under alternatives C or D due to ORV and other recreational use allowed between sunset and 10:00 p.m. and over night under the park-and-stay provision. Therefore, the implementation of alternative E would result in long-term moderate adverse impacts to sea turtles.

Past, present, and future activities both inside the Seashore and within the state of North Carolina—when combined with the impacts of surveys and management activities, ORV use, and other recreational activities expected under this alternative—would continue to result in long-term moderate adverse cumulative impacts.

Impairment Determination. Implementation of alternative E would not result in impairment to sea turtles because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Beach fires would be prohibited from midnight to 6:00 a.m. year-round. A permit would be required for all beach fires to ensure that users are informed of basic safety and resource protection measures. Where fires are permitted, they would be prohibited within 100 yards of turtle nest protection areas. From May 1 through November 15, portable lanterns, auxiliary lights, and powered fixed lights of any kind shining for more than 5 minutes at a time would be prohibited on Seashore ocean beaches.

By May 1, 2012, turtle-friendly lighting fixtures would be installed on all Seashore structures visible from the ocean beach (except where prevented by other overriding lighting requirements, such as lighthouses, which serve as aids to navigation) and fishing piers operated by NPS concessioners. The Seashore would provide information about and encourage the use of turtle friendly lighting. Educational material would be developed to inform visitors about their impact on the success of sea turtle nests. The Seashore would work with the USFWS, the NCWRC, and Dare County to encourage development of a turtle-friendly lighting education program for villages within the Seashore on Hatteras Island.

Unattended beach equipment (chairs, canopies, volleyball nets, watersports gear, etc.) would be prohibited on the Seashore at night. Turtle patrol and law enforcement would tag equipment found at night. Owners would have 24 hours to remove equipment before it would be removed by NPS staff. The Seashore would work with local organizations and businesses, including real estate rental agencies and hotels/motels, to ensure wider distribution of ORV and resource protection educational information. This would include encouraging these businesses to provide information about removal of beach equipment from the beaches at night.

The Seashore would implement a Nest Watch Program. A cadre of trained volunteers would be established to watch nests that have reached their hatch windows to monitor hatchling emergence success and success reaching the water, and to minimize negative impacts from artificial lighting, predation, and

human disturbance. Depending on the number of nests that may be ready to hatch and the availability of volunteers, it may be necessary for NPS turtle staff to prioritize which nests are watched on any particular night. Priority would be given to watching the nests that are most likely to be negatively impacted by manageable factors.

During most of the nesting season approximately 35 miles of ocean beach would be closed to ORV use, although where resource conditions permit, ORV pass-through corridors through closed areas would be provided at Bodie Island Spit, Cape Point, and South Point. Between May 1 and November 15, night driving on designated ORV routes would be prohibited between 10:00 p.m. and 6:00 a.m. However, from September 16 through November 15, selected ORV routes with no or a low density of turtle nests would allow night driving, subject to terms and conditions of a permit. The night driving allowed between sunset and 10:00 p.m. during turtle nesting season; the night driving on selected routes from September 16 through November 16; the nighttime human activity associated with the overnight park-and-stay at the inlet spits, Cape Point and South Point; erosion and sand compaction; and other adverse effects related to ORV and other recreational use would be expected to occasionally result in aborted nesting attempts, hatchling disorientation or misorientation, running over hatchlings or nests, complete or partial nest loss due to human activities, and obscuring turtle crawl tracks that Seashore staff use to locate newly laid nests so that the undetected nests are not managed. These adverse effects on sea turtles were deemed to be moderate in the plan/EIS analysis because although there would be occasional disturbance and harm to sea turtles or their habitat (beyond the level of disturbance and harm that occur naturally), the Seashore would be expected to maintain a sustainable sea turtle population.

Because of the educational component of the ORV permit program, the consequence of permit revocation for ORV closure violations, some restriction of night driving and the provision of areas where ORV routes would not be designated, implementation of alternative E would be expected to result in a decrease in sea turtle closure violations.

Cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore would likely result in occasional occurrences of disturbance to some nesting females with negative effects to reproduction affecting local population levels, occasional complete or partial nest loss due to human activities and occasional disorientation or disruption of hatchling movement or direct hatchling mortality from human activities. Even with these adverse effects, large declines in population numbers would not result, and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the sea turtle impacts would not result in impairment.

Determination of Effect. Under alternative E, resources management activities would result in long-term moderate to major benefits due to the protection provided to sea turtles from daily surveying for nests during the sea turtle nesting season (May 1 – September 15) and installing closures around each nest found, expanding the closures and installing light filter fencing around the nests during the hatching window, relocating nests from areas prone to erosion or frequent flooding, installing turtle friendly lighting on the Seashore and working with the USFWS, the NCWRC and Dare County to encourage the development of a turtle friendly lighting educational program or a turtle friendly lighting ordinance. The benefits of establishing SMAs for birds and seabeach amaranth closures and SMAs under ML2 procedures at Bodie Island Spit, Cape Point, and South Point, combined with other areas that would be closed to ORV use such as the village beaches, would close approximately 35 miles of Seashore beach to ORV use during the majority of the sea turtle nesting season. These closures would minimize potential impacts turtles, turtle nests, and turtle hatchlings in these areas; however, the benefits would be tempered somewhat by the fact that the SMAs would only be closed to ORV use from March 15 through August 31 which does not encompass the entire turtle nesting season and ORV pass-through corridors would be provided for the SMAs operating under ML2 procedures.

ORV and other recreational use would have long-term moderate adverse impacts resulting from some level of nighttime driving and due to increased recreational access throughout the Seashore, including a limited number of ORVs allowed overnight at selected points and spits. ORV and other recreational use would have adverse impacts on sea turtles by affecting the beach profile and substrate characteristics in ways that reduce suitability for nesting and hatching success and likely continued closure violations and vandalism. While there would still be some impacts caused by night driving, these impacts would be lessened by prohibiting night driving between the hours of 10:00 p.m. and 6:00 a.m. from May 1 to November 15. Opening select ORV routes with no or a low density of turtle nests from September 16 through November 15, subject to terms and conditions of a permit could impact turtles in those areas. Beach fires would still be allowed, and due to night driving being allowed until 10:00 p.m., beach fires would likely occur in areas throughout the Seashore besides just in front of the villages and therefore could still cause adverse impacts to adult and hatchling turtles through light pollution. Under the ESA, these impacts would result in a finding of may affect/are likely to adversely affect sea turtles because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities and restrictions on nonessential recreational ORV nighttime driving, the actions under alternative E would also likely cause adverse effects.

Impacts of Alternative F: Management Based on Advisory Committee Input

Resources Management Activities. Surveying activities for sea turtles under alternative F would be the same as under alternatives C, D, and E, resulting in long-term minor to moderate beneficial impacts to sea turtles.

Other species management activities for sea turtles under alternative F would be the same as under alternatives C, D, and E, with the exception that SMAs would be closed to ORV use generally for only 4.5 months from March 15 through July 31 or the end of fledging. Also, under alternative F, areas managed using ML2 procedures during the breeding season at Cape Point and South Point would have ORV access corridors at the start of the shorebird breeding season, subject to resource closures, while Bodie Island Spit (also managed under ML2 procedures) would have a pedestrian corridor. Some SMAs would be closed year-round to ORVs (and managed under ML1 procedures during the breeding season), including Hatteras Inlet Spit and North Ocracoke Spit. While not all closed areas are necessarily historically popular nesting sites, the SMAs, combined with other areas that are closed to ORV use such as the village beaches, would protect approximately 39 miles of the Seashore during a portion of the sea turtle nesting season. However, some of these areas could be re-opened to ORV use after about July 31 (when sea turtle nesting is still ongoing), reducing the overall beneficial impacts that SMAs provide to turtles to long-term minor to moderate. The extent of the impacts would depend on the location and size of the closures, which would be reevaluated and re-designated every 5 years, or after major hurricanes. During the closures, the beneficial impacts in the Cape Point and South Point areas, under ML2 management would also be tempered slightly because pass-through corridors would be subject to potential deterioration of nesting habitat due to the compaction of sand and contributing factors to erosion that result from ORV use.

Overall, resource management activities would provide long-term moderate to major beneficial impacts to sea turtles

ORV and Other Recreational Use. The majority of impacts under alternative F would be the same as under alternative E, except that there would be no impacts from park-and-stay vehicles under alternative F since this activity would be prohibited. In addition, greater beneficial impacts would be realized under alternative F due to the decreased hours night time driving allowed, as restrictions would begin earlier in the evening than under alternative E.

Under alternative F, designated ORV routes in potential sea turtle nesting habitat (ocean intertidal zone, ocean backshore, and dunes) would be closed to nonessential ORV use from one hour after sunset until turtle patrol has surveyed the beaches in the morning, which would be approximately one-half hour after sunrise. Similar to alternative E, select ORV routes with no or a low density of turtle nests remaining would reopen for night driving between September 16 and November 15, subject to terms and conditions of an ORV permit. Turtle nesting and hatching occurs mostly during nighttime hours. Only on rare occasions do these events take place during daylight hours (NPS 2005c). Prohibiting nonessential recreational ORV nighttime driving would virtually eliminate all potential impacts to nesting turtles and hatchlings throughout the Seashore, creating long-term moderate to major beneficial impacts. In addition, by not opening beaches to ORV use in the morning until the Seashore staff have surveyed a beach, the possibility that crawls would be obscured by ORV tracks—causing nests to be missed and therefore not protected as has occurred in the past—would be eliminated. However, some risk of long-term minor to moderate adverse impacts would still exist from using essential vehicles at night and allowing possible night driving in areas outside of existing resource closures by commercial fisherman, who are actively engaged in authorized commercial fishing activities.

Similar to alternative E, those areas reopened to ORV use at night after September 15 would subject hatchlings to nighttime impacts from ORVs, although the potential for adverse impacts would be reduced by limiting it to areas where there are no nests or a very low density of nests. Therefore, while restricting night driving would result in significant beneficial impacts, because some adverse impacts could occur after September 15, night-driving impacts under alternative F would be long-term minor to moderate adverse. These impacts would be significantly less than alternatives A, B, and E, but only slightly more than alternatives C and D.

Beach fires would not be prohibited under alternative F, but they would be restricted to the areas in front of Coquina Beach, Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras Village, and the Ocracoke Day Use Area during the sea turtle nesting season. Even though the ability to have beach fires would require a non-fee educational permit, allowing these beach fires would cause impacts (misorientation, disorientation, injury, and death) to nesting turtles and hatchlings, resulting in long-term minor to moderate adverse impacts; however, these impacts would not potentially be Seashore wide and would be restricted to the few areas where they would be allowed.

Similar to alternative E, under alternative F, a 10-meter (30-foot) wide ORV-free zone would be designated in the ocean backshore wherever there was sufficient beach width to allow an ORV corridor of at least 30 meters (90 feet) above the mean high tide line. However, unlike alternative E, this ORV-free zone would be a year-round closure under alternative F. This ORV-free corridor would protect some turtle nesting habitat from ORV use; however, the area is fairly narrow and it is unknown if the areas to be protected are more suitable for turtle nesting than the unprotected areas, or what percentage of historical nests are located within the protected area as compared to unprotected areas. Because of the relative narrow portion of habitat protected, the impacts would be long-term minor beneficial.

While additional restrictions and regulations would help lessen some of the impacts from ORV and other recreational use, overall, the impacts would be long-term minor to moderate adverse, due to the earlier re-opening of SMAs (after shorebird breeding activity has concluded), resulting in increased recreational access throughout the Seashore during the sea turtle nesting season.

Cumulative Impacts. Cumulative impacts to sea turtles under alternative F would be very similar to those described for alternative A. Although alternative F would provide additional protection that would be beneficial to the regional sea turtle population, the adverse effects on sea turtles from other actions occurring in the region would still exist. Therefore, the overall cumulative impact of these past, current,

and future actions—added to the effects of actions under alternative F—would result in long-term minor to moderate adverse cumulative impacts.

Conclusion. Through the protection of adult and hatchling sea turtles, surveys and management activities, limiting ORVs to designated use areas and restricting night driving therein during the sea turtle nesting season, alternative F would provide long-term moderate to major beneficial impacts. Because ORVs would be restricted between the hours of 1 hour after sunset until turtle patrol has checked the beach in the morning (approximately one-half hour after sunrise), the chances are greatly reduced that adult turtles (1) may be killed or caused to abort nesting attempts; (2) nests may be run over or disturbed; and (3) hatchlings may be killed or disoriented by light pollution from vehicles and associated recreational activities, ORV use and other recreational activities occurring under alternative E would have long-term minor to moderate adverse impacts.

Past, present, and future activities both inside the Seashore and within the state of North Carolina—when combined with the impacts of surveying and management activities, ORV use, and other recreational activities expected under this alternative—would continue to result in long-term minor to moderate adverse cumulative impacts.

Impairment Determination. Implementation of alternative F would not result in impairment to sea turtles because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Beach fires would be prohibited from midnight to 6:00 a.m. year-round. A permit would be required for all beach fires to ensure that users are informed of basic safety and resource protection measures. Beach fires would be restricted to areas in front of the villages and Coquina Beach and the Ocracoke Day Use Area during the sea turtle nesting season, reducing the areas of the Seashore subject to light pollution from beach fires. Where fires are permitted, they would be prohibited within 100 yards of turtle nest protection areas. From May 1 through November 15 portable lanterns, auxiliary lights, and powered fixed lights of any kind shining for more than 5 minutes at a time would be prohibited on Seashore ocean beaches.

By May 1, 2012, turtle-friendly lighting fixtures would be installed on all Seashore structures visible from the ocean beach (except where prevented by other overriding lighting requirements, such as lighthouses, which serve as aids to navigation) and fishing piers operated by NPS concessioners. The Seashore would provide information about and encourage the use of turtle friendly lighting. Educational material would be developed to inform visitors about their impact on the success of sea turtle nests. The Seashore would work with the USFWS, the NCWRC, and Dare County to encourage development of a turtle-friendly lighting education program for villages within the Seashore on Hatteras Island.

Unattended beach equipment (chairs, canopies, volleyball nets, watersports gear, etc.) would be prohibited on the Seashore at night. Turtle patrol and law enforcement would tag equipment found at night. Owners would have 24 hours to remove equipment before it would be removed by NPS staff. The Seashore would work with local organizations and businesses, including real estate rental agencies and hotels/motels, to ensure wider distribution of ORV and resource protection educational information. This would include encouraging these businesses to provide information about removal of beach equipment from the beaches at night.

The Seashore would implement a Nest Watch Program. A cadre of trained volunteers would be established to watch nests that have reached their hatch windows to monitor hatchling emergence success and success reaching the water, and to minimize negative impacts from artificial lighting, predation, and human disturbance. Depending on the number of nests that may be ready to hatch and the availability of volunteers, it may be necessary for NPS turtle staff to prioritize which nests are watched on any particular

night. Priority would be given to watching the nests that are most likely to be negatively impacted by manageable factors.

During part of the nesting season approximately 39 miles of ocean beach would be closed to ORV use, although where resource conditions permit an ORV corridor would be provided at Cape Point and South Point and a pass-through corridor would be provided at Bodie Island Spit through closed areas. Between May 1 and November 15 night driving on designated ORV routes would be prohibited between one hour after sunset until turtle patrol has surveyed the beaches in the morning, approximately one-half hour after sunrise. However, from September 16 through November 15, selected ORV routes with no or a low density of turtle nests would allow night driving, subject to terms and conditions of a permit. Night driving on selected routes from September 16 through November 16, erosion and sand compaction; and other adverse effects related to ORV and other recreational use would be expected to occasionally result in aborted nesting attempts, hatchling disorientation or misorientation, running over hatchlings or nests, complete or partial nest loss due to human activities, and obscuring turtle crawl tracks that Seashore staff use to locate newly laid nests so that the undetected nests are not managed. These adverse effects on sea turtles were deemed to be minor to moderate in the plan/EIS analysis because, although there would be occasional disturbance and harm to sea turtles or their habitat (beyond the level of disturbance and harm that occur naturally), the Seashore would be expected to maintain a sustainable sea turtle population.

Cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore would likely result in infrequent or occasional occurrences of disturbance to some nesting females with negative effects to reproduction affecting local population levels, infrequent or occasional complete or partial nest loss due to human activities, and occasional disorientation or disruption of hatchling movement or direct hatchling mortality from human activities. Even with these adverse effects, large declines in population numbers would not result and sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore the sea turtle impacts would not result in impairment.

Determination of Effect. Under alternative F, resources management activities would result in long-term moderate to major benefits due to the protection provided to sea turtles from daily surveys for nests during the sea turtle nesting season (May 1 – September 15) and installation of closures around each nest found, expanding the closures and installing light filter fencing around the nests during the hatch window, relocating nests from areas prone to erosion or frequent flooding, installing turtle friendly lighting on the Seashore and working with the USFWS, the NCWRC, and Dare County to encourage the development of a turtle friendly lighting educational program or a turtle friendly lighting ordinance. The benefits of establishing SMAs for birds and seabeach amaranth closures and SMAs under either ML1 or ML2 procedures, combined with other areas that are closed to ORVs use such as the village beaches, would close approximately 39 miles of Seashore beach to ORV use during the breeding season. These closures would minimize potential impacts to nesting turtles, turtle nests and turtle hatchlings in these areas; however, the benefits would be tempered somewhat by the fact that the SMAs would only be closed to ORV use from March 15 through July 31, which does not encompass the entire turtle nesting season and ORV pass-through corridors would be provided for the SMAs operating under ML2 procedures at Cape Point and South Point.

ORV and other recreational use would have long-term minor to moderate adverse impacts due to the earlier re-opening of SMAs (after shorebird breeding activity has concluded), resulting in increased recreational access throughout the Seashore during the sea turtle nesting season. ORV and other recreational use would have impacts on sea turtles by affecting the beach profile and substrate characteristics in ways that reduce suitability for nesting and hatching success and likely continued closure violations and vandalism. Prohibiting recreational ORV use from one hour after sunset until turtle patrol has surveyed the beaches in the morning, which would be approximately one-half hour after

sunrise, would virtually eliminate potential impacts to adult and hatchling turtles caused by night driving. Opening select ORV routes with no or a low density of turtle nests from September 16 through November 15, subject to terms and conditions of a permit, however, could impact turtles in those select ORV route areas. Beach fires would still be allowed, but would be restricted to areas in front of Coquina Beach and Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras Village, and the Ocracoke day use areas. While a permit would be required to have a beach fire, allowing beach fires would still cause adverse impacts to adult and hatchling turtles through light pollution. Under the ESA these impacts would result in a finding of may affect/are likely to adversely affect sea turtles because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. Though there would be beneficial impacts from resources management activities and restrictions on nonessential recreational ORV nighttime driving, the actions under alternative F would also likely cause adverse effects.

TABLE 53. SUMMARY OF IMPACTS TO SEA TURTLES UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Resources Management Activities					
Overall, resources management activities under alternative A would have long-term moderate benefits due to the protection provided to sea turtles.	Overall, resource management activities under alternative B would have long-term moderate benefits due to the protection provided to sea turtles.	Overall, resource management activities under alternative C would have long-term moderate to major beneficial impacts due to the added protection provided to sea turtles.	Overall, similar to alternative C, management activities under alternative D would result in long-term moderate to major beneficial impacts.	Management activities would provide long-term moderate to major beneficial impacts to sea turtles.	Overall, resource management activities would provide long-term moderate to major beneficial impacts to sea turtles.
ORV And Other Recreational Use					
Overall, ORV and other recreational use under alternative A would result in long-term major adverse impacts to sea turtles due to the amount of Seashore available for ORV use and the lack of night-driving restrictions.	Although additional restrictions and regulations would help lessen some of the impacts from ORV use and other recreational activities, overall, the impacts would be long-term moderate adverse.	Restrictions placed on nonessential, recreational ORV use under alternative C would provide substantial long-term benefits to sea turtles, including seasonal night-driving restrictions that close the beach before dark (7:00 p.m.), some adverse impacts would still occur in areas where their use is allowed. Therefore, overall, ORV and other recreational use would have long-term minor adverse impacts.	While restrictions placed on ORV use under alternative D would provide long-term moderate to major beneficial impacts, similar to alternative C, there would still be some level of adverse impact to sea turtles in areas where ORV use and beach fires are allowed; therefore, overall impacts from ORV and other recreational use would be long-term minor adverse.	While additional restrictions and regulations would help lessen some of the impacts from ORV use and other recreational activities, overall, the impacts would be long-term moderate adverse from allowing night driving until 10:00 p.m., and due to increased recreational access throughout the Seashore during the turtle nesting season, including a park-and-stay option for ORVs at selected points and spits.	While additional restrictions and regulations would help lessen some of the impacts from ORV and other recreational use, overall, the impacts would be long-term minor to moderate adverse, due to the earlier re-opening of SMAs (after shorebird breeding activity has concluded), resulting in increased recreational access throughout the Seashore during the sea turtle nesting season.

SEABEACH AMARANTH

Species-Specific Methodology and Assumptions

Potential impacts to seabeach amaranth populations and habitat at the Seashore were evaluated based on the species life history, its past and present occurrence at the Seashore, as well as known effects on the species from activities relating to humans, pets, predators, and ORVs. Information about habitat and other existing data were acquired from staff at Cape Hatteras National Seashore, the USFWS, and available literature.

The analysis focuses on impacts to seabeach amaranth from a variety of human recreational and other activities, as well as impacts incurred as a result of surveying and management activities. Seabeach amaranth often grows in habitat areas used by other protected species within the Seashore such as plovers, oystercatchers, colonial waterbirds, and sea turtles. Therefore, any ORV-related closures established to protect the habitat or nests of these species would also benefit seabeach amaranth, although the extent of the benefit would depend upon the actual location, size, and duration of the closures. It is also assumed that increases in natural resource and law enforcement staffing at the Seashore would increase public compliance with closures and other Seashore regulations (e.g., leash laws) from that which currently exists.

Primary steps in assessing impacts to seabeach amaranth at the Seashore were to determine (1) occurrence and location of seabeach amaranth in areas likely to be affected by management actions described in the alternatives; (2) current and future use and distribution of ORV by alternative; (3) habitat impact or alteration caused by the alternatives; and (4) disturbance potential of the actions and the potential to directly or indirectly affect seabeach amaranth as a result of ORV use. The information contained in this analysis was obtained through best professional judgment of staff and experts in the field and by reviewing applicable scientific literature.

Seabeach amaranth is a fugitive annual, or a species adapted to inhabit newly disturbed habitats yearly, whose seeds are viable for long periods of time and can be dispersed long distances by wind and water, allowing it to occupy newly created habitat. Seeds may also just accumulate around the base of a plant when it dies, allowing it to continue to occupy currently available habitat. As an example of its fugitive nature, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years prior to plants being discovered in 1990, 1991, and again in 1992 (LIBS 1992), though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks (USFWS 1996b). The plant was also found in New Jersey in 2000 after not being reported from the state since 1913; it was rediscovered in Delaware in 2000 after a 125-year absence; and in 1998, it was rediscovered in Maryland on Assateague Island after 31 years of not being reported, while on the Virginia side of Assateague Island it was rediscovered in 2001 (USFWS 2007d).

At the Seashore, seabeach amaranth populations have fluctuated greatly since surveys began in 1985; however, no plants have been found since 2005. In 2005, two plants were found—one located on Bodie Island Spit and one on Ocracoke Island. In 2004, only one plant was found; it was located on Bodie Island Spit. The area on Bodie Island Spit where the plants were located has been continuously protected through summer and winter resources management closures. At Cape Point, a portion of the area where seabeach amaranth was historically found has also been continuously protected through summer and winter resource closures. However, no plants have been found in these protected areas. Additionally, large portions of the plant's historical range at Hatteras Inlet where plants were found from 2001 to 2003 are no longer present due to continued erosion and retreat of the shoreline (NPS 2009e). While it is thought that the plant may possibly be extirpated from the Seashore (NPS 2009e), it should be noted that since plants are not evident every year, but may survive in the seed bank, populations of seabeach amaranth may still

be present even though plants are not visible for several years (USFWS 2007d). Despite the fact that seabeach amaranth has not been found in the Seashore since 2005, it is still necessary to protect potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants and currently occupied habitat (Jolls et al. 2004).

Impact Thresholds

A summary of seabeach amaranth impacts under all alternatives is provided in table 54 at the end of this section.

The following thresholds for evaluating impacts to seabeach amaranth were defined.

Negligible: There would be no observable or measurable impacts to seabeach amaranth, its habitats, or the natural processes sustaining it. Impacts to the plant community would be well within natural fluctuations.

Minor Adverse: Impacts on seabeach amaranth would be measurable or perceptible, but would not be outside the natural range of variability and would be localized within a small area. Small changes to local population numbers, population structure, and other demographic factors might occur, but the natural function and character of the seabeach amaranth community would not be affected. Sufficient habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Minor Beneficial: Impacts on seabeach amaranth, its habitats, or the natural processes sustaining it would be detectable, but would not be outside the natural range of variability. Improvements to key characteristics of habitat and/or protection to key propagation stages in the Seashore would sustain or slightly improve existing population levels, population structure, or other factors and maintain a sustainable population in the Seashore.

Moderate Adverse: Impacts on seabeach amaranth, its habitats, or the natural processes sustaining it would be measurable or perceptible and could be outside the natural range of variability. A change would occur in the natural function and character of the seabeach amaranth community in terms of basic properties (e.g., abundance, distribution, quantity, and quality) but not to the extent that the basic properties of the community change. Sufficient population numbers and habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Moderate Beneficial: Impacts on seabeach amaranth, its habitats, or the natural processes sustaining it would be detectable and could be outside the natural range of variability. Changes to key characteristics of habitat in the Seashore and/or protection to key propagation stages would minimize or prevent injury to individual plants and improve the sustainability of the species in the Seashore.

Major Adverse: Impacts on seabeach amaranth, its habitats, or the natural processes sustaining it would be measurable or perceptible and would be expected to be outside the natural range of variability. Frequent disturbance to individual plants would be expected, with negative impacts that would result in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Impacts would occur during critical periods of propagation and result in direct mortality or loss of habitat. Local population numbers, population structure, and other demographic factors might experience large declines.

Major Beneficial: Impacts on seabeach amaranth, its habitats in the Seashore, or the natural processes sustaining it during key life history stages would be detectable and would be expected to be outside the natural range of variability. Changes to key characteristics of habitat in the Seashore and/or protection to key propagation stages would substantially lessen mortality or loss of habitat and would result in notable increases in Seashore population levels.

Duration: Short-term effects would be up to two reproductive seasons for seabeach amaranth.

Long-term effects would be anything beyond two reproductive seasons for seabeach amaranth.

Study Area

The study area for assessment of the various alternatives is the Seashore. The study area for the cumulative impacts analysis is the state of North Carolina.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Species Management Activities. Under alternative A, during August, when plants are large enough to be easily detected, an annual survey would be conducted of all potential seabeach amaranth habitat to locate and document plants. When a seabeach amaranth plant is found outside of an existing closure (i.e., bird or turtle closure) staff would install a 30-foot (9.1-meter) by 30-foot (9.1-meter) closure around the plant(s) and mark it with signs to prevent trampling of the plants. The closures would not be removed until the plants have died in late autumn or early winter. Providing a closure of this size until the plant dies would provide long-term minor to moderate benefits by helping to protect plants from being run over by ORVs or trampled by people and from erosion caused by multiple passes of ORVs in high use areas.

Prior to the annual August survey, seabeach amaranth would be subject only to ancillary surveys by bird and turtle monitors while they conduct their primary duties. Seabeach amaranth seedlings are typically first visible beginning in June. With only ancillary observations being made during routine bird and turtle surveys, plants germinating outside of an established bird closure or other area where vehicles are prohibited would likely not be detected, resulting in long-term minor to moderate adverse impacts. Any plants that are not detected and subsequently protected may be destroyed by ORVs or other human activities, including Seashore staff using vehicles to conduct bird and turtle surveys. Any plants that are destroyed would not be detected and accounted for during the August survey.

Historically, most areas where seabeach amaranth has been found at the Seashore were either in established bird closures or other areas closed to vehicular traffic (NPS 2009e). The primary habitat of seabeach amaranth consists of overwash flats at accreting ends of islands and the sparsely vegetated zone between the high tide line and the toe of the primary dune. Much of this habitat corresponds with that of

pipin plover, American oystercatcher, and other protected bird species at the Seashore. Therefore, when prenesting closures are installed beginning in March and then subsequently expanded to protect nesting birds and unfledged chicks, seabeach amaranth plants and those portions of its habitat that overlap with the closures would be protected during its growing season, resulting in long-term minor to moderate beneficial impacts. However, protection afforded to seabeach amaranth by closures for other protected species would vary annually and depend upon the location, size, and duration of the other species closures. Because seabeach amaranth must recruit annually and its seeds can be dispersed long distances via wind and water, closures for other species that overlap seabeach amaranth habitat and the 30-foot (9.1-meter) by 30-foot (9.1-meter) buffers installed around plants would not likely protect all areas in the Seashore where seeds exist and could potentially germinate in areas of ORV traffic. Unprotected seedlings or plants in areas open to ORV use would likely be crushed and go completely undocumented and seeds may be pulverized or buried. Because ATVs/UTVs and/or ORVs are used to conduct bird and turtle surveys and monitoring, there would also be a small probability of essential vehicle impacts on plants and seeds due to crushing and burial, respectively, causing long-term minor adverse impacts.

Under alternative A, bird and turtle closures would be surveyed for seabeach amaranth prior to reopening them to ORV traffic when the closures are no longer required to protect nesting birds and their chicks and turtle nests and hatchlings. If any plants are detected, buffers around the plants would be established while other areas of the closures where there are no plants would be reopened to ORV traffic. Areas identified as potential alternate/bypass ORV routes around bird and turtle closures would also be surveyed for seabeach amaranth, and buffers around plants would be established prior to using the routes. These actions would protect any plants and/or seeds that exist within these areas and result in long-term minor to moderate beneficial impacts.

Under alternative A, the Seashore would continue to place interpretive signs at all ORV entry points and at Seashore kiosks describing the effects and susceptibility of seabeach amaranth to pedestrian and ORV use. The Seashore would also continue to notify the public of all resource closures and openings. These actions would be beneficial for helping to protect seabeach amaranth. Therefore, outreach measures would have long-term minor beneficial impacts.

Overall, because of the protection of seabeach amaranth habitat and plants under alternative A, surveys conducted for amaranth plants and protection measures taken when plants are detected would have long-term minor to moderate beneficial impacts to amaranth habitat and plants when they occur.

ORV and Other Recreational Use. Under alternative A, ORV use would be restricted to a corridor 100 feet wide above the mean high tide line in breeding areas of protected bird species from April 1 to August 31. While this corridor would protect a small strip of potential seabeach amaranth habitat near the toe of the dunes, much of the corridor, especially located near and on the spits and Cape Point, would lie within primary seabeach amaranth habitat and would expose any seeds or germinating plants to direct and indirect impacts from ORVs. Stems of the plant are easily broken or crushed by foot traffic and tires; thus, even limited traffic can be detrimental during the growing season (USFWS 1993). Besides damaging plants, ORVs can also pulverize seeds and bury them to depths beyond which they can germinate. In areas of the Seashore where beach widths are greatly reduced, the 100-foot-wide corridor could encroach on the toe of the dunes, increasing the likelihood for impacting seeds and/or seedlings, resulting in long-term minor to moderate adverse impacts.

During the seabeach amaranth's dormant season (December to April), there are fewer closures for protected birds. Only those suitable interior habitats at the spits and at Cape Point used by nonbreeding and wintering piping plovers are closed year-round to ORV and pedestrian traffic. Therefore, more seabeach amaranth habitat would be open to impacts from ORV use. Although there are no plants that can be damaged by ORVs during the plant's dormant period, ORV traffic can still have an adverse impact on

seabeach amaranth by either pulverizing or burying the plant's seeds when driving over them (USFWS 1996b), resulting in long-term moderate adverse impacts.

While off-season ORV traffic can adversely affect seabeach amaranth through its impacts on seeds, it may also provide some benefits to the plant through the disturbance of perennial grasses and shrubs (USFWS 1996b). Seabeach amaranth is intolerant of competition from other plants. If left undisturbed, many areas within the Seashore would naturally progress through successional stages whereby perennial grasses and shrubs would become established, thus rendering the habitat unsuitable for seabeach amaranth. By using areas in late fall and winter that were previously closed to ORV traffic, ORV use helps prevent the establishment of perennial grasses and shrubs. Where this disturbance overlaps with potential seabeach amaranth habitat, it helps to maintain that habitat as potentially suitable for seabeach amaranth, resulting in long-term minor beneficial impacts.

Pedestrians would continue to be prohibited from seabeach amaranth closures under alternative A. Pedestrian use of beaches typically does not overlap heavily with the habitat of seabeach amaranth because joggers prefer wet sand and sunbathers prefer to be closer to the water. Pedestrian traffic during the plants' dormant season is much less than during its growing season and would not likely have any impacts on the species. Even during the growing season, pedestrian traffic would generally have little effect on seabeach amaranth populations because many beaches with daily use by thousands of sunbathers, joggers, and other recreation enthusiasts have substantial and apparently healthy populations of seabeach amaranth (USFWS 1996b). However, some undetected seedlings/plants could still be trampled by pedestrians and/or their pets, resulting in long-term minor to moderate adverse impacts.

Overall, ORV and other recreational use under alternative A would have long-term moderate adverse impacts as plants may go undetected, and would therefore be unprotected from this use.

Cumulative Impacts. Other past, present, and future planned actions within and around the Seashore have the potential to impact seabeach amaranth. Hurricanes and other weather events can have both long-term moderate to major adverse and beneficial impacts on seabeach amaranth within the Seashore and throughout the plant's range. Seabeach amaranth is extremely susceptible to overwash, and strong storms can cause overwash in areas even at the toe of the dunes. If a storm occurs early enough in the growing season, it can destroy plants before they set seed. Storms can also bury seeds so deep that they cannot germinate. However, storms can also uncover previously buried seed banks, bringing them back to a depth where they can then germinate. Storms also play a major role in dispersing seeds through both wind and water, and can reestablish populations in areas that had become devoid of plants. Storms can destroy habitat through erosion or create new habitat by creating overwash areas. Hurricanes can also indirectly affect seabeach amaranth because of their impact on staff resources. Hurricane recovery efforts that pull staff from resources management (and presumably surveying) activities would have long-term minor to moderate adverse impacts by causing plants to be missed and therefore go unprotected.

The dredging of the federally authorized navigation channel at Oregon Inlet has occurred in the past and major dredging events would continue to occur about every four years. The actual dredging does not directly impact seabeach amaranth; however, heavy construction equipment use at the deposition site, usually Pea Island (USACE 2002), could result in long-term minor adverse impacts by pulverizing or burying seeds or running over undetected seedlings or plants. Dredging of channels in and around barrier islands occurs throughout the seabeach amaranth's habitat in North Carolina and would have the same impact, depending upon the level of protection afforded the plant.

Several of the local and NPS past, current, and future planning efforts can also affect the seabeach amaranth. For example, new development might result from the County Land Use Development Plan for Dare and Hyde counties. Though the details are lacking, if additional development results from

implementing the land use plan, the amount of recreation on the area beaches would also likely increase, resulting in potential long-term minor to moderate adverse impacts. Other potential impacts from development are indeterminate at this time. The education aspect of the Seashore's Long-Range Interpretive Plan would provide long-term minor benefits to seabeach amaranth because it would help to educate visitors about the plant and the protection measures that are put in place at the Seashore to help protect it. Under the Predator Management Plan, there is a slight chance that trappers hunting fox and other mammalian predators would trample seabeach amaranth plants during their trapping efforts, resulting in long-term minor to moderate adverse impacts.

The outcome of the current action to develop a Cape Lookout National Seashore ORV Management Plan/EIS could have long-term minor to moderate beneficial impacts on seabeach amaranth populations within Cape Hatteras National Seashore and throughout the rest of the plant's habitat in North Carolina. Populations of seabeach amaranth in the south are probably sources of long distance seed dispersal due to the fact that storms move northward along the U.S. Atlantic seacoast; thus, Cape Lookout National Seashore could be a potential seed source for suitable habitat in Cape Hatteras National Seashore and northward. However, whether the impacts of the long-term ORV plan would be beneficial or adverse depends upon the policies developed with regard to where within the Seashore ORVs would be allowed to go and during what time of year.

The replacement of the Herbert C. Bonner Bridge would result in both long-term minor to moderate adverse and beneficial impacts, with the EIS for this project noting that seabeach amaranth has not been found since 2004, and if suitable habitat were found, a survey for this species would be conducted. The area near the bridge is suitable habitat for seabeach amaranth as evidenced by the presence of the only plant located within the Seashore in 2004. While construction activities could impact seabeach amaranth through direct disturbance of plants or the burying of seeds, surveying for plants prior to construction activities would help minimize this impact. However, the replacement of the bridge would allow the formation of ephemeral habitats to occur more naturally, including overwash fans, increasing the amount of habitat suitable for colonization by seabeach amaranth.

The overall impacts of these past, current, and future actions, in combination with the effects of alternative A, would result in long-term moderate adverse cumulative impacts to seabeach amaranth within the Cape Hatteras National Seashore and throughout the plant's habitat range in North Carolina.

Conclusion. Although there would be some level of impact during surveys and implementation of protection measures due to a risk of disturbing plants, use of experienced staff in areas of known occurrence or habitat would minimize this risk. Overall, species management activities would reduce potential impacts from ORV and other recreational use and would have minor to moderate beneficial impacts. Because ORV and other recreational use could result in plants being run over/trampled and seeds being pulverized or buried to a depth where they cannot germinate, alternative A would have long-term moderate adverse impacts.

Past, present, and future activities both inside the Seashore and within the plant's historic range in North Carolina, when combined with the impacts of ORVs, other recreational use, and resources management activities for this species, would result in long-term moderate adverse cumulative impacts.

Impairment Determination. Seabeach amaranth has not been found in the Seashore since 2005, and for reasons discussed in the seabeach amaranth impact analysis in the plan/EIS, it is thought that the species may possibly be extirpated from the Seashore, thus creating a potential impairment before the no-action alternatives A and B were implemented. However, as noted in the USFWS 5-year review of the plant species, populations of seabeach amaranth may still be present, existing in the seed bank, even though plants are not visible for several years. NPS Management Policy 1.4.7 (NPS 2006c) provides that if there

is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within NPS authorities and available resources, to eliminate the impairment. Although developing a specific plan to remedy the potential impairment is outside the scope of this plan/EIS, the desired future conditions for seabeach amaranth described in chapter 1 of this plan/EIS state that the Seashore will develop a seabeach amaranth restoration plan for four suitable sites. A restoration plan would be consistent with NPS Management Policy 4.4.2.2, which provides that NPS will strive to restore extirpated native plant and animal species to parks whenever certain criteria are met. Although unmanaged or poorly managed beach driving can constitute an important threat to the species, it can be mitigated by using vehicle corridors, closures, and buffers to protect the plants and seeds. The relative contribution of various factors, both human and natural, to the possible extirpation of the species from the Seashore is unknown. However, the action alternatives in this plan/EIS have been developed to manage beach driving so that its effects are at a sufficiently low intensity to not preclude restoration of seabeach amaranth to the Seashore. Moreover, seabeach amaranth has been known to reoccur on its own in areas where it has not occurred for many years. For example, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years before plants were discovered in 1990, 1991, and again in 1992, though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks. Therefore, this impairment determination focuses on how alternative A protects potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants, if discovered or reintroduced.

Implementation of alternative A would not impair seabeach amaranth because the adverse impacts to seabeach amaranth habitat are low enough that sufficient functional habitat would remain to maintain a sustainable population in the Seashore, if the species reappears or is reintroduced to the Seashore. Historically, most areas where seabeach amaranth has been found at the Seashore were either in established bird closures or other areas closed to vehicular traffic. Under alternative A, each year the Seashore staff would identify those areas that would be closed to vehicular traffic for species management. Some other areas would also be closed to ORVs for administrative and safety reasons. If plants are found outside an existing closure, the Seashore would install 30-foot (9.1-meter) by 30-foot (9.1-meter) closures around them for protection from vehicle or foot traffic. Before bird or turtle closures are reopened to ORV traffic or alternative/bypass ORV routes located around bird or turtle closures, the areas would be surveyed for seabeach amaranth plants. If found, the plants would be protected by a 30-foot (9.1-meter) by 30-foot (9.1-meter) closure. The potential for undetected plants outside closures to be crushed and seeds pulverized or buried to a depth where they cannot germinate was deemed to constitute a moderate adverse impact in the plan/EIS analysis because sufficient habitat inside closures is protected to maintain a sustainable population of seabeach amaranth, if rediscovered or reintroduced.

Cumulative impacts from combining the effects of alternative A with effects of other past, present, and future planned actions in the state of North Carolina would likely result in measurable or perceptible adverse effects (beyond the level of disturbance or harm that would occur naturally) and result in a change in the abundance and distribution of plants or quantity and quality of available habitat over the long term, but the magnitude would be low enough to allow sufficient population numbers and functional habitat to remain to maintain a sustainable population in the Seashore, if plants reappear.

Determination of Effect. Under alternative A, resources management activities would result in long-term minor to moderate benefits to seabeach amaranth if plants are detected in the Seashore. Benefits would be due to the protection provided by installing closures around plants that are detected, surveying for plants in August when they are visible, installing prenesting and other closures for nesting bird species that overlap seabeach amaranth habitat, and surveying bird and turtle closures for plants prior to reopening these closures to ORV and other recreation use.

ORV and other recreational use would have long-term moderate adverse impacts on seabeach amaranth as plants may go undetected and therefore unprotected from recreational use of the Seashore. While ORV use would be restricted to a corridor 100 feet wide above the mean high tide line in breeding areas of protected bird species from April 1 to August 31, much of the corridor, especially located near and on the spits and Cape Point would lie within primary seabeach amaranth habitat and would expose any seeds or germinating plants to impacts from ORV use and other recreation use. During seabeach amaranth's dormant season more areas of the Seashore are open to ORV use, and while there would be no plants to be impacted, seeds of the plant could be either pulverized or buried by ORVs driving over them. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect seabeach amaranth because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative A would also likely cause adverse effects.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Species Management Activities. Surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected under alternative B would be the same as under alternative A, resulting in long-term minor to moderate beneficial impacts to seabeach amaranth.

Management activities under alternative B would be the same as under alternative A except for the following management changes for bird species habitat that would also benefit seabeach amaranth. Under the consent decree issued in 2008, the Seashore would establish prenesting areas on Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point, and these areas would not be reduced to accommodate an ORV corridor. The prenesting areas would remain in place until the later of July 15 or two weeks after the last tern, black skimmer, American oystercatcher, piping plover, or Wilson's plover chick within the area has fledged. In subsequent years, the Seashore would establish prenesting closures that incorporate to the maximum extent possible the areas delineated in 2008. Because these areas overlap seabeach amaranth habitat, they would protect potential habitat for seabeach amaranth where it could possibly re-establish itself in the Seashore, and if it does, to potentially continue to survive at in the Seashore. The total amount of potential habitat protected each year would be dependent on the dynamic nature of the Seashore and the amount of breeding habitat used by during the previous three years since that is what the prenesting closures are based on. These prenesting closures would provide long-term moderate beneficial impacts to seabeach amaranth and would be the same as before the June 2009 amendment to the consent decree.

Additional closures for unfledged chicks would not provide a substantial benefit to seabeach amaranth, because the additional areas to be closed would have already been open to ORV and pedestrian use, and they are readily adjusted to accommodate the movement of the chicks. Therefore, they would not provide a sufficient amount of time for seabeach amaranth seeds to germinate and exist without potential impacts from ORVs and/or pedestrians. However, because these areas would still be surveyed prior to reopening them, they would provide long-term minor beneficial impacts to seabeach amaranth.

Overall, surveys conducted for seabeach amaranth plants and the protection measures implemented when plants are detected would result in long-term minor to moderate beneficial impacts. Although plants are scarce and would be difficult to detect, they would be provided protection once detected.

ORV and Other Recreational Use. Under alternative B, the impacts from ORV and other recreational use would be the same as under alternative A, except with additional measures that would slightly reduce adverse impacts to seabeach amaranth. Under alternative B, in all locations open to ORV use that are not in front of villages, a 32.8-foot (10-meter) wide ORV-free zone would be created in the ocean backshore

wherever there is sufficient beach width to allow an ORV corridor of at least 65.6 feet (20 meters) above the mean high tide line. This ORV-free corridor would protect some of the beach from ORV use and reduce impacts on seabeach amaranth plants and habitat. However, the area would be fairly narrow, and it is unknown if the areas to be protected are more suitable for seabeach amaranth than the unprotected areas. Also, under alternative B, shorebird breeding closures would be larger and longer-lasting, providing some additional protection to seabeach amaranth compared to alternative A.

Overall, ORV and other recreational use would result in long-term moderate adverse impacts. Slightly more protection would be provided for the species when compared to alternative A due to shorebird breeding closures being larger and lasting longer and the establishment of backshore closures. However, plants may still go undetected, and would therefore be unprotected from recreational disturbance.

Cumulative Impacts. Cumulative impacts to seabeach amaranth under alternative B would be the same as those described under alternative A. Although alternative B would provide some additional benefits to the plant, the adverse effects on seabeach amaranth from other actions occurring in North Carolina would still exist and would not be greatly offset by the additional protection afforded under alternative B. Therefore, the effects of these other actions, added to the effects of actions under alternative B would result in long-term moderate adverse cumulative impacts to seabeach amaranth in the Seashore and throughout the plant's habitat range in North Carolina.

Conclusion. Overall surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected would reduce potential impacts from ORV and other recreational use, resulting in long-term minor to moderate beneficial impacts. Because ORV and other recreational use could result in plants being run over/trampled and seeds being pulverized or buried to a depth where they cannot germinate, alternative B would have long-term moderate adverse impacts.

Past, present, and future activities both inside the Seashore and within the plant's historical range in North Carolina, when combined with the impacts of ORVs, other recreational use, and resources management activities for this species, would result in long-term moderate adverse cumulative impacts.

Impairment Determination. Seabeach amaranth has not been found in the Seashore since 2005, and for reasons discussed in the seabeach amaranth impact analysis in the plan/EIS, it is thought that the species may possibly be extirpated from the Seashore, thus creating a potential impairment before the no-action alternatives A and B were implemented. However, as noted in the USFWS 5-year review of the plant species, populations of seabeach amaranth may still be present, existing in the seed bank, even though plants are not visible for several years. NPS Management Policy 1.4.7 (NPS 2006c) provides that if there is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within NPS authorities and available resources, to eliminate the impairment. Although developing a specific plan to remedy the potential impairment is outside the scope of this plan/EIS, the desired future conditions for seabeach amaranth described in chapter 1 of this plan/EIS state that the Seashore will develop a seabeach amaranth restoration plan for four suitable sites. A restoration plan would be consistent with NPS Management Policy 4.4.2.2, which provides that NPS will strive to restore extirpated native plant and animal species to parks whenever certain criteria are met. Although unmanaged or poorly managed beach driving can constitute an important threat to the species, it can be mitigated by using vehicle corridors, and closures and buffers to protect the plants and seeds. The relative contribution of various factors, both human and natural, to the possible extirpation of the species from the Seashore is unknown. However, the action alternatives in this plan/EIS have been developed to manage beach driving so that its effects are at a sufficiently low intensity to not preclude restoration of seabeach amaranth to the Seashore. Moreover, seabeach amaranth has been known to reoccur on its own in areas where it has not occurred for many years. For example, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years before plants were discovered in 1990, 1991, and again in 1992,

though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks. Therefore, this impairment determination focuses on how alternative B protects potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants, if discovered or reintroduced.

Implementation of alternative B would not impair seabeach amaranth because the magnitude of adverse impacts to seabeach amaranth habitat are low enough that sufficient functional habitat in the Seashore would remain to maintain a sustainable population in the Seashore, if the species reappears or is reintroduced to the Seashore. Historically, most areas where seabeach amaranth has been found at the Seashore were either in established bird closures or other areas closed to vehicular traffic. Under alternative B, each year the Seashore staff would identify those areas that would to be closed to vehicular traffic for species management. The additional prenesting closures and the 10-meter-wide backshore zone that would be closed to ORVs wherever there is sufficient beach width to allow an ORV corridor of at least 30 meters above the mean high tide line would protect some additional habitat. Some other areas would also be closed to ORVs for administrative and safety reasons. If plants are found outside an existing closure, the Seashore would install 30-foot (9.1-meter) by 30-foot (9.1-meter) closures around them for protection from vehicle or foot traffic. Before bird or turtle closures are reopened to ORV traffic, the areas would be surveyed for seabeach amaranth plants. If found, the plants would be protected by a 30-foot (9.1-meter) by 30-foot (9.1-meter) closure. The potential for undetected plants outside closures to be crushed and seeds pulverized or buried to a depth where they cannot germinate was deemed to constitute a moderate adverse impact in the plan/EIS analysis because sufficient habitat inside closures is protected to maintain a sustainable population of seabeach amaranth, if rediscovered or reintroduced.

Cumulative impacts from combining the effects of alternative B with effects of other past, present, and future planned actions in the state of North Carolina would likely result in measurable or perceptible adverse effects (beyond the level of disturbance or harm that would occur naturally) and result in a change in the abundance and distribution of plants or quantity and quality of available habitat over the long-term, but the magnitude would be low enough to allow sufficient population numbers and functional habitat to remain to maintain a sustainable population in the Seashore, if plants reappear or are reintroduced. Therefore, the seabeach amaranth impacts would not result in impairment.

Determination of Effect. Under alternative B, resources management activities would result in long-term minor to moderate benefits to seabeach amaranth if plants are detected on the Seashore. Benefits would be due to the protection provided by installing closures around plants that are detected, surveying for plants in August when they are visible, installing prenesting and other closures for nesting bird species that overlap seabeach amaranth habitat, and surveying bird and turtle closures for plants prior to reopening these closures to ORV and other recreational use.

ORV and other recreational use would have long-term moderate adverse impacts on seabeach amaranth as plants may go undetected and therefore would be unprotected from recreation use of the Seashore. While ORV use would be restricted to a corridor 100 feet wide above the mean high tide line in breeding areas of protected bird species from April 1 to August 31, much of the corridor, especially located near and on the spits and Cape Point would lie within primary seabeach amaranth habitat and would expose any seeds or germinating plants. Some additional seabeach amaranth habitat would be protected in all areas open to ORV use that are not in front of villages, a 32.8-foot (10-meter) wide ORV-free zone would be created in the ocean backshore wherever there is sufficient beach width to allow an ORV corridor of at least 65.6 feet (20 meters) above the mean high tide line. During seabeach amaranth's dormant season more areas of the Seashore are open to ORV use, and while there would be no plants to be impacted, seeds of the plant could be either pulverized or buried by ORVs driving over them. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect seabeach amaranth because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or

beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative B would also likely cause adverse effects.

Impacts of Alternative C: Seasonal Management

Species Management Activities. Surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected under alternative C would be the same as under alternatives A and B, resulting in long-term minor to moderate beneficial impacts.

Management activities under alternative C would be the same as under alternative B, except for the following management changes that would provide additional protection of seabeach amaranth habitat.

Under alternative C, the NPS would identify suitable seabeach amaranth habitat at the spits and Cape Point where plants have been observed in more than one (i.e., two or more) of the past five years prior to June 1 and would delineate these areas with symbolic fencing by June 1 if such areas are not already protected within existing shorebird resource closure(s). The SMAs for protected species would be re-evaluated and re-designated every five years, or after major hurricanes. Though no areas would currently be protected because there have not been plants observed in two or more of the past five years, the establishment of these SMAs would protect any plants that do become established in the future and would provide long-term moderate beneficial impacts. These SMAs, however, would not be year-round closures and would be reopened to ORV and pedestrian use (as long as there are no overlapping bird or turtle resource closures) by September 1 if no plants are present, or if plants are present, the closures would remain until the plant dies.

Additionally, SMAs for shorebirds would be established and closed to ORV use from March 15 to October 14. While there would currently be no seabeach amaranth SMAs established under alternative C for reasons stated above, the establishment of the shorebird SMAs and other year-round ORV closures would result in approximately 41 miles of beach that would be closed seasonally to ORV use. Closing this amount of beach to ORV use would minimize potential impacts to seabeach amaranth and its habitat and would result in long-term moderate beneficial impacts. Bodie Island Spit, Cape Point, and South Point would be managed under ML2 procedures and would have pedestrian access corridors, unless closed by shorebird breeding behavior buffers, which would result in some adverse impacts to seabeach amaranth, slightly reducing the overall benefits in these areas. Overall, the extent of the benefits from SMAs would depend on the location and size of the closures, which would be re-evaluated and re-designated every five years or after major hurricanes, but would be more than alternatives A and B.

In addition to public education on seabeach amaranth described under alternative A, additional information about the plant and the Seashore's rules and regulations would be provided via the ORV permit that users would need to obtain. With the threat of permit revocation if a user violates the Seashore's regulations or terms of the permit, it is assumed that greater compliance with closures would occur, resulting in additional long-term minor to moderate beneficial impacts, with the extent of the impacts based on the ability to enforce the regulations and apprehend violators.

Overall, because of the protection of seabeach amaranth habitat and plants under alternative C, resource management activities would have long-term moderate beneficial impacts to seabeach amaranth as the establishment of SMAs and increased protection for the species would occur compared to alternatives A and B.

ORV and Other Recreational Use. Under alternative C, the impacts from ORV and other recreational use would be less than under alternative B due to the seasonal restrictions on ORV use at most locations where seabeach amaranth has historically been found. In addition, six new beach access ramps would be

constructed. This would eliminate some potential seabeach amaranth habitat; however, the amount of habitat impacted is small when compared to the available habitat in the Seashore. Therefore, the new ramps would have long-term negligible to minor adverse impacts.

Overall, ORV and other recreational use would result in long-term minor to moderate adverse impacts. Because of the establishment of SMAs and protection of approximately 41 miles of beach from March 15 to October 14, the adverse impacts under alternative C would likely be less than those under alternative B, but exactly how much less would be dependent on the size, location, and duration of the SMA closures.

Cumulative Impacts. Cumulative impacts to seabeach amaranth under alternative C would be the same as those described under alternative A. Although alternative C would provide some additional benefits to the plant, the adverse effects on seabeach amaranth from other actions occurring in North Carolina would still exist and would not be greatly offset by the additional protection afforded under alternative C. Therefore, the effects of these other actions, added to the effects of actions under alternative C, would result in long-term minor to moderate adverse cumulative impacts.

Conclusion. Surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected would reduce potential impacts from ORV and other recreational use (i.e., pedestrian use and pets), resulting in long-term moderate beneficial impacts. Because the amount of beach habitat seasonally protected from ORV and other recreational use under alternative C, the chance of plants being run over/trampled and seeds being pulverized or buried to a depth where they cannot germinate would be reduced, when compared to alternatives A and B. Alternative C would have long-term minor to moderate adverse impacts to seabeach amaranth.

Past, present, and future activities both inside the Seashore and within the plant's historical range in North Carolina, when combined with the impacts of ORVs, other recreational use, and resources management activities for this species, would result in long-term minor to moderate adverse cumulative impacts.

Impairment Determination. Seabeach amaranth has not been found in the Seashore since 2005, and for reasons discussed in the seabeach amaranth impact analysis in the plan/EIS, it is thought that the species may possibly be extirpated from the Seashore, thus creating a potential impairment before the no-action alternatives A and B were implemented. However, as noted in the USFWS 5-year review of the plant species, populations of seabeach amaranth may still be present, existing in the seed bank, even though plants are not visible for several years. NPS Management Policy 1.4.7 (NPS 2006c) provides that if there is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within NPS authorities and available resources, to eliminate the impairment. Although developing a specific plan to remedy the potential impairment is outside the scope of this plan/EIS, the desired future conditions for seabeach amaranth described in chapter 1 of this plan/EIS state that the Seashore will develop a seabeach amaranth restoration plan for four suitable sites. A restoration plan would be consistent with NPS Management Policy 4.4.2.2, which provides that NPS will strive to restore extirpated native plant and animal species to parks whenever certain criteria are met. Although unmanaged or poorly managed beach driving can constitute an important threat to the species, it can be mitigated by using vehicle corridors, and closures and buffers to protect the plants and seeds. The relative contribution of various factors, both human and natural, to the possible extirpation of the species from the Seashore is unknown. However, the action alternatives in this plan/EIS have been developed to manage beach driving so that its effects are at a sufficiently low intensity to not preclude restoration of seabeach amaranth to the Seashore. Moreover, seabeach amaranth has been known to reoccur on its own in areas where it has not occurred for many years. For example, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years before plants were discovered in 1990, 1991, and again in 1992, though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks. Therefore, this impairment determination focuses on how alternative C

protects potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants, if discovered or reintroduced.

Implementation of alternative C would not impair seabeach amaranth because the adverse impacts to seabeach amaranth habitat are low enough that sufficient functional habitat would remain to maintain a sustainable population in the Seashore, if the species reappears or is reintroduced to the Seashore. Historically, most areas where seabeach amaranth has been found at the Seashore were either in established bird closures or other areas closed to vehicular traffic. Under alternative C, in addition to areas closed seasonally for shorebird nesting, suitable habitat at the points and spits used by seabeach amaranth for two or more of the preceding 5 years would be seasonally closed as well, which would protect additional seabeach amaranth habitat, if the species is rediscovered or reintroduced. Some other areas would not be designated as ORV routes to provide areas for visitors to enjoy without the presence of vehicles. Alternative C would provide about 40 miles of habitat protected at least seasonally from vehicles, which have more adverse impacts than pedestrians to seabeach amaranth. If plants are found outside an existing closure, the Seashore would install 30-foot (9.1-meter) by 30-foot (9.1-meter) closures around them for protection from vehicle or foot traffic. Before bird or turtle closures are reopened to ORV traffic, the areas would be surveyed for seabeach amaranth plants. If found, the plants would be protected by a 30-foot (9.1-meter) by 30-foot (9.1-meter) closure. The potential for undetected plants outside closures to be crushed and seeds pulverized or buried to a depth where they cannot germinate was deemed to constitute a minor to moderate adverse impact in the plan/EIS analysis because sufficient habitat inside closures is protected to maintain a sustainable population of seabeach amaranth, if rediscovered or reintroduced.

Cumulative impacts from combining the effects of alternative C with effects of other past, present, and future planned actions in the state of North Carolina would likely result in measurable or perceptible adverse effects (beyond the level of disturbance or harm that would occur naturally) and result in a change in the abundance and distribution of plants or quantity and quality of available habitat over the long-term, but the magnitude would be low enough to allow sufficient population numbers and functional habitat to remain to maintain a sustainable population in the Seashore, if plants reappear or are reintroduced. Therefore, the seabeach amaranth impacts would not result in impairment.

Determination of Effect. Under alternative C, resources management activities would result in long-term moderate benefits to seabeach amaranth if plants are detected on the Seashore. Benefits would be due to the protection provided by installing closures around plants that are detected, surveying for plants in August when they are visible, installing prenesting and other closures for nesting bird species that overlap seabeach amaranth habitat, and surveying bird and turtle closures for plants prior to reopening these closures to ORVs and other recreational uses. Additional protection would be provided by identifying suitable seabeach amaranth habitat prior to June 1 at the spits and points where plants have been observed in more than one of the past five years and protecting these areas (i.e., establish a seabeach amaranth SMA). The establishment of shorebird SMAs and other year-round ORV closures would close approximately 41 miles of Seashore beach to ORV use from March 15 to October 14, minimizing potential impacts to seabeach amaranth and its habitat in these areas.

ORV and other recreational use would have long-term minor to moderate adverse impacts on seabeach amaranth as plants may go undetected and would therefore remain unprotected from recreational disturbance. Seasonal restrictions on ORV use at most locations where seabeach amaranth has historically been found, due to seabeach amaranth and shorebird SMAs, would help protect the species from impacts in those areas during the plant's growing season. Constructing six new beach access ramps would eliminate some potential habitat for the species. During seabeach amaranth's dormant season, more areas of the Seashore are open to ORV use, and while there would be no plants to be impacted, seeds of the plant could be either pulverized or buried by ORVs driving over them. Under the ESA, these impacts

would result in a finding of may affect / are likely to adversely affect seabeach amaranth because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant, or beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative C would also likely cause adverse effects.

Impacts of Alternative D: Increased Predictability and Simplified Management

Resources Management Activities. Surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected under alternative D would be the similar to alternatives A, B, and C, but establishment of year-round SMAs would provide additional benefits as more areas would be closed to ORVs year-round and the chance of finding plants would be greater. These additional protections would result in long-term moderate to major beneficial impacts to seabeach amaranth.

Other management activities under alternative D would be the same as those under alternative C, except for the following management changes that would provide additional protection of seabeach amaranth habitat.

Under alternative D, approximately 41 miles of beach would be protected by SMAs or other ORV closures, and these closures would be year-round. Therefore, this habitat would be protected from potential adverse impacts from ORV use. Although some habitat may eventually move through some succession stages making it unsuitable for seabeach amaranth, given the dynamic nature of the Seashore, those areas would likely be small in area compared to the overall habitat being protected. Therefore, these year-round closures would result in long-term moderate to major beneficial impacts, with the extent of the benefits dependent on the location and size of the closures.

Overall, because of the increased level of protection of seabeach amaranth habitat and plants under alternative D, when compared to other alternatives, species management actions would have long-term moderate to major beneficial impacts.

ORV and Other Recreational Use. Under alternative D, the impacts from ORV and other recreational use would be less than under alternative C since ORV use would be prohibited year-round in most areas where seabeach amaranth has historically been found. In addition, four new beach access ramps would be constructed and would eliminate some potential seabeach amaranth habitat; however, the amount of habitat impacted would be small when compared to the overall available habitat in the Seashore. Therefore, the new ramps would have long-term negligible to minor adverse impacts. Overall, ORV and other recreational use would result in long-term minor adverse impacts. Because there would be approximately 41 miles of beach designated as non-ORV year-round, the adverse impacts under alternative D would be greatly reduced compared to the other alternatives and would be long-term minor adverse.

Cumulative Impacts. Cumulative impacts to seabeach amaranth under alternative D would be the same as those described under alternative A. Although alternative D provides significant protection of seabeach amaranth plants and habitat, the adverse effects on seabeach amaranth from other actions occurring in North Carolina would still exist. While they would be offset somewhat by the protection afforded the plant and its habitat under alternative D, the effects, when added to those under alternative D, would result in long-term minor adverse cumulative impacts.

Conclusion. Overall surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected would reduce potential impacts from ORV and other recreational use, resulting in long-term moderate to major beneficial impacts. Because of the amount of beach habitat protected from ORVs year-round under alternative D, the chances are greatly reduced that ORV and other

recreational activities could result in plants being run over/trampled and seeds being pulverized or buried to a depth where they cannot germinate. ORV and other recreational use under alternative D would result in long-term minor adverse impacts to seabeach amaranth.

Past, present, and future activities both inside the Seashore and within the plant's historical range in North Carolina, when combined with the impacts of ORVs, other recreational use, and resources management activities for this species, would result in long-term minor adverse cumulative impacts.

Impairment Determination. Seabeach amaranth has not been found in the Seashore since 2005, and for reasons discussed in the seabeach amaranth impact analysis in the plan/EIS, it is thought that the species may possibly be extirpated from the Seashore, thus creating a potential impairment before the no-action alternatives A and B were implemented. However, as noted in the USFWS 5-year review of the plant species, populations of seabeach amaranth may still be present, existing in the seed bank, even though plants are not visible for several years. NPS Management Policy 1.4.7 (NPS 2006c) provides that if there is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within NPS authorities and available resources, to eliminate the impairment. Although developing a specific plan to remedy the potential impairment is outside the scope of this plan/EIS, the desired future conditions for seabeach amaranth described in chapter 1 of this plan/EIS state that the Seashore will develop a seabeach amaranth restoration plan for four suitable sites. A restoration plan would be consistent with NPS Management Policy 4.4.2.2, which provides that NPS will strive to restore extirpated native plant and animal species to parks whenever certain criteria are met. Although unmanaged or poorly managed beach driving can constitute an important threat to the species, it can be mitigated by using vehicle corridors, and closures and buffers to protect the plants and seeds. The relative contribution of various factors, both human and natural, to the possible extirpation of the species from the Seashore is unknown. However, the action alternatives in this plan/EIS have been developed to manage beach driving so that its effects are at a sufficiently low intensity to not preclude restoration of seabeach amaranth to the Seashore. Moreover, seabeach amaranth has been known to reoccur on its own in areas where it has not occurred for many years. For example, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years before plants were discovered in 1990, 1991, and again in 1992, though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks. Therefore, this impairment determination focuses on how alternative D protects potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants, if discovered or reintroduced.

Implementation of alternative D would not impair seabeach amaranth because the adverse impacts to seabeach amaranth habitat are low enough that sufficient functional habitat would remain to maintain a sustainable population in the Seashore, if the species reappears or is reintroduced to the Seashore. The effects on seabeach amaranth of constructing four new ORV access ramps were deemed negligible to minor because the amount of potential habitat affected would be small compared to the total amount of habitat in the Seashore. Historically, most areas where seabeach amaranth has been found at the Seashore would not be designated as ORV routes during any season. On the approximately 41 miles of beach, which would be closed year-round to ORVs, there would be no adverse effects from ORVs on either plants or seeds. If plants are found outside an existing closure, the Seashore would install 30-foot (9.1-meter) by 30-foot (9.1-meter) closures around them for protection from vehicle or foot traffic. The potential for undetected plants outside closures in ORV corridors to be crushed and seeds pulverized or buried to a depth where they cannot germinate was deemed to constitute a minor adverse impact in the plan/EIS analysis because the impacts would be measurable or perceptible, but would not be beyond the level of disturbance or harm that would occur naturally and be localized in a small area. The natural function and character of the seabeach amaranth community would not be affected and sufficient habitat would be protected to maintain a sustainable population of seabeach amaranth, if rediscovered or reintroduced.

Cumulative impacts from combining the effects of alternative D with effects of other past, present, and future planned actions in the state of North Carolina would likely result in measurable or perceptible adverse effects. However, changes to local population numbers and population structure that might occur would be small and the natural function and character of the seabeach amaranth community would not be affected. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore, if plants reappear or are reintroduced. Therefore the seabeach amaranth impacts would not result in impairment.

Determination of Effect. Under alternative D, resources management activities would result in long-term moderate to major benefits to seabeach amaranth if plants are detected in the Seashore. Benefits would be due to the protection provided by installing closures around plants that are detected, surveying for plants in August when they are visible, installing prenesting and other closures for nesting bird species that overlap seabeach amaranth habitat, and surveying bird and turtle closures for plants prior to reopening these closures to ORV and other recreational use. Additional protection would be provided by identifying suitable seabeach amaranth habitat prior to June 1 at the spits and Cape Point where plants have been observed in more than one of the past five years and protecting these areas (i.e., establish a seabeach amaranth SMA). SMAs, both seabeach amaranth and shorebird, would be closed to ORVs year-round under alternative D. Combined with other year-round ORV closures, these areas would protect approximately 41 miles of Seashore beach virtually eliminating potential impacts to seabeach amaranth and its habitat in these areas.

ORV and other recreational use would have long-term minor adverse impacts on seabeach amaranth due to reduced recreational access throughout the Seashore. Year-round restrictions on ORV use at most locations where seabeach amaranth has historically been found, due to seabeach amaranth and shorebird SMAs, would help protect the species from impacts in those areas. Constructing four new beach access ramps would eliminate some potential habitat for the species. During seabeach amaranth's dormant season some areas of the Seashore remain open to ORV use, and while there would be no plants to be impacted, seeds of the plant could be either pulverized or buried by ORVs driving over them. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect seabeach amaranth because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative D would also likely cause adverse effects.

Impacts of Alternative E: Variable Access and Maximum Management

Resources Management Activities. Surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected under alternative E would be the same as under alternatives A, B, C, and D, resulting in long-term minor to moderate beneficial impacts.

Other management activities under alternative E would be the same as under alternative C, except for the following management changes that would slightly reduce the overall beneficial impacts.

Under alternative E, approximately 35 miles of beach would be protected by SMAs or other ORV closures during the breeding season. These areas would generally be closed to ORVs from March 15 to August 31, except Bodie Island Spit, Cape Point, and South Point, which would be managed under ML2 procedures and open year-round but limited to an access corridor with a pass-through zone March 15 to August 31. The access corridor may be closed depending on breeding shorebird buffers. These areas would reopen to ORV use only after the area had been thoroughly surveyed for seabeach amaranth plants in August, so any plants would not be impacted; however, suitable habitat that is reopened would be subject to impacts from ORVs and pedestrians as described under alternative A. The ORV pass-through access corridors would potentially allow some additional habitat to be impacted year-round, depending on

shorebird breeding closures, but overall the closures would provide long-term moderate beneficial impacts as a result of SMA closures to ORV use from March 15 to August 31.

Overall, because of the protection provided to seabeach amaranth habitat and individual plants, alternative E would have long-term minor to moderate beneficial impacts, as three SMAs would be managed under ML2 procedures during the breeding season and more recreational access would be allowed than under action alternatives C and D.

ORV and Other Recreational Use. Under alternative E, the impacts from ORV and other recreational use would be similar to those under alternative C with the following exceptions. Under alternative E, in all locations open to ORV use that are not in front of villages, a 32.8-foot (10-meter) wide ORV-free zone would be created in the ocean backshore wherever there is sufficient beach width to allow an ORV corridor of at least 98.4 feet (30 meters) above the mean high tide line. This ORV-free corridor would protect some of the beach from ORV use and reduce impacts on seabeach amaranth plants and habitat. However, the area would be fairly narrow and it is unknown if the areas to be protected are more suitable for seabeach amaranth than the unprotected areas. Therefore, the impacts would be long-term minor to moderate beneficial. The ORV pass-through access corridors in areas under ML2 management would allow some ORV impacts to seabeach amaranth habitat in those areas, depending on shorebird breeding closures, and would have long-term minor to moderate adverse impacts. In addition, seven new beach access ramps would be constructed throughout the Seashore. This would eliminate some potential seabeach amaranth habitat; however, the amount of habitat impacted would be small when compared to the overall available habitat on the Seashore. Therefore, the new ramps would have long-term negligible to minor adverse impacts and overall, ORV and other recreational use would have long-term minor to moderate adverse impacts to seabeach amaranth due to the increased level of recreational access allowed when compared to the other action alternatives.

Cumulative Impacts. Cumulative impacts to seabeach amaranth under alternative E would be the same as those described under alternative A. Although alternative E would provide some additional benefits to the plant, the adverse effects on seabeach amaranth from other actions occurring in North Carolina would still exist and would not be greatly offset by the additional protection afforded under alternative E. Therefore, the effects of these other actions, added to the effects of actions under alternative E, would result in long-term minor to moderate adverse cumulative impacts.

Conclusion. Overall surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected would reduce potential impacts from ORV use and other activities (i.e., pedestrian use and pets), resulting in long-term minor to moderate beneficial impacts. Because ORV and other recreational uses would be restricted in areas of known seabeach amaranth habitat, the chances would be reduced that plants could be run over/trampled and seeds being pulverized or buried to a depth where they cannot germinate. ORV and other recreational use under alternative E would result in long-term minor to moderate adverse impacts to seabeach amaranth.

Past, present, and future activities both on the Seashore and within the plant's historical range in North Carolina, when combined with the impacts of ORVs, other recreational use, and resources management activities for this species, would result in long-term minor to moderate cumulative adverse impacts.

Impairment Determination. Seabeach amaranth has not been found in the Seashore since 2005, and for reasons discussed in the seabeach amaranth impact analysis in the plan/EIS, it is thought that the species may possibly be extirpated from the Seashore, thus creating a potential impairment before the no-action alternatives A and B were implemented. However, as noted in the USFWS 5-year review of the plant species, populations of seabeach amaranth may still be present, existing in the seed bank, even though plants are not visible for several years. NPS Management Policy 1.4.7 (NPS 2006c) provides that if there

is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within NPS authorities and available resources, to eliminate the impairment. Although developing a specific plan to remedy the potential impairment is outside the scope of this plan/EIS, the desired future conditions for seabeach amaranth described in chapter 1 of this plan/EIS state that the Seashore will develop a seabeach amaranth restoration plan for four suitable sites. A restoration plan would be consistent with NPS Management Policy 4.4.2.2, which provides that NPS will strive to restore extirpated native plant and animal species to parks whenever certain criteria are met. Although unmanaged or poorly managed beach driving can constitute an important threat to the species, it can be mitigated by using vehicle corridors, and closures and buffers to protect the plants and seeds. The relative contribution of various factors, both human and natural, to the possible extirpation of the species from the Seashore is unknown. However, the action alternatives in this plan/EIS have been developed to manage beach driving so that its effects are at a sufficiently low intensity to not preclude restoration of seabeach amaranth to the Seashore. Moreover, seabeach amaranth has been known to reoccur on its own in areas where it has not occurred for many years. For example, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years before plants were discovered in 1990, 1991, and again in 1992, though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks. Therefore, this impairment determination focuses on how alternative E protects potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants, if discovered or reintroduced.

Implementation of alternative E would not impair seabeach amaranth because the adverse impacts to seabeach amaranth habitat are low enough that sufficient functional habitat would remain to maintain a sustainable population in the Seashore, if the species reappears or is reintroduced to the Seashore. The effects on seabeach amaranth of constructing seven new ORV access ramps were deemed negligible to minor because the amount of potential habitat affected would be small compared to the total amount of habitat in the Seashore. Historically, most areas where seabeach amaranth has been found at the Seashore were either in established bird closures or other areas closed to vehicular traffic. Under alternative E, in addition to areas closed seasonally for shorebird nesting, suitable habitat at the points and spits used by seabeach amaranth for two or more of the preceding 5 years would be seasonally closed as well, which would protect additional seabeach amaranth habitat, if the species is rediscovered or reintroduced. Some other areas would not be designated as ORV routes to provide areas for visitors to enjoy without the presence of vehicles. The 10-meter-wide backshore zone, which would be closed seasonally to ORVs wherever there is sufficient beach width to allow an ORV corridor of at least 30 meters above the mean high tide line, would protect some additional habitat. Alternative E would provide about 41 miles of habitat protected, at least seasonally, from vehicles, which have more adverse impacts than pedestrians to seabeach amaranth. If plants are found outside an existing closure, the Seashore would install 30-foot by 30-foot closures around them for protection from vehicle or foot traffic. Before bird or turtle closures are reopened to ORV traffic, the areas would be surveyed for seabeach amaranth plants. If found, the plants would be protected by a 30-foot by 30-foot closure. The potential for undetected plants outside closures, or in access corridors with pass-through zones at Bodie Island Spit, Cape Point, and South Point, to be crushed and seeds pulverized or buried to a depth where they cannot germinate was deemed to constitute a minor to moderate adverse impact in the plan/EIS analysis because sufficient habitat inside closures is protected to maintain a sustainable population of seabeach amaranth, if rediscovered or reintroduced.

Cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in the state of North Carolina would likely result in measurable or perceptible adverse effects (beyond the level of disturbance or harm that would occur naturally) and result in a change in the abundance and distribution of plants or quantity and quality of available habitat over the long-term, but the magnitude would be low enough to allow sufficient population numbers and functional habitat to remain to maintain a sustainable population in the Seashore, if plants reappear or are reintroduced. Therefore the seabeach amaranth impacts would not result in impairment.

Determination of Effect. Under alternative E, resources management activities would result in long-term minor to moderate benefits to seabeach amaranth if plants are detected on the Seashore. Benefits would be due to the protection provided by installing closures around plants that are detected, surveying for plants in August when they are visible, installing prenesting and other closures for nesting bird species that overlap seabeach amaranth habitat, and surveying bird and turtle closures for plants prior to reopening these closures to ORV and other recreational use. Approximately 35 miles of beach would be protected by SMAs or other ORV closures from March 15 to August 31. Bodie Island Spit, Cape Point, and South Point would be under ML2 procedures and potentially open year-round but limited to a corridor with a pass-through zone March 15 to August 31. These closures would protect seabeach amaranth and its habitat during these timeframes, but would allow ORV impacts to occur during the dormant season when these areas are reopened.

ORV and other recreational use would have long-term minor to moderate adverse impacts on seabeach amaranth as plants may go undetected and therefore unprotected from recreation use of the Seashore. Seasonal restrictions on ORV use at most locations where seabeach amaranth has historically been found, due to seabeach amaranth and shorebird SMAs, would help protect the species from impacts in those areas. Some additional seabeach amaranth habitat would be protected, for in all areas open to ORV use that are not in front of villages, a 32.8-foot (10-meter) wide ORV-free zone would be created in the ocean backshore wherever there is sufficient beach width to allow an ORV corridor of at least 98.4 feet (30 meters) above the mean high tide line. Constructing seven new beach access ramps could eliminate some potential habitat for the species, but these areas are not known to be habitat for seabeach amaranth. During seabeach amaranth's dormant season more areas of the Seashore are open to ORV use, and while there would be no plants to be impacted, seeds of the plant could be either pulverized or buried by ORVs driving over them. Under the ESA, these impacts would result in a finding of may affect / are likely to adversely affect seabeach amaranth because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative E would also likely cause adverse effects.

Impacts of Alternative F: Management Based on Advisory Committee Input

Resources Management Activities. Surveys conducted for seabeach amaranth plants and protection measures implemented when plants are detected under alternative F would be the same as under all other alternatives, resulting in long-term minor-to moderate beneficial impacts.

Protection measures under alternative F would be the same as under alternative E, except for the following management changes.

Under alternative F approximately 39 miles of beach would be protected by SMAs or other ORV closures. In general, these areas would be closed from March 15 to July 31 or later if chicks still have not fledged. Bodie Island Spit would be managed under ML2 procedures and have a pedestrian access corridor while Cape Point and South Point, also managed under ML2 procedures, would have an ORV access corridor that may be closed depending on breeding shorebird buffers. Though these SMAs could potentially reopen to ORV use prior to the annual August survey for seabeach amaranth, they would be surveyed for seabeach amaranth prior to reopening them and any plants found would be protected with 30-foot (9.1-meter) by 30-foot (9.1-meter) closures, so any plants would not be impacted. Also, at the spits and Cape Point the interior habitat would revert to a wintering closure for piping plovers and would provide protection to any plants that may occur away from the immediate ocean shoreline and closer to the dunes or interior habitat. However, habitat in other areas that is reopened and suitable for seabeach amaranth would be subject to impacts from ORVs and pedestrians as described under alternative A. The pedestrian corridors and the ORV pass-through corridor would also potentially allow some additional

habitat to be impacted year-round, depending on shorebird breeding closures. Therefore, these closures would provide long-term moderate beneficial impacts.

Overall, because of the protection provided to seabeach amaranth habitat and individual plants, alternative F would have long-term minor to moderate beneficial impacts.

ORV and Other Recreational Use. Under alternative F, the impacts from ORV and other recreational use would be the similar to those under alternative E. The construction of nine new beach access ramps would eliminate some potential seabeach amaranth habitat; however, the amount of habitat impacted is small when compared to the overall available habitat on the Seashore. Therefore, the new ramps would have long-term negligible to minor adverse impacts, and, overall, ORV and other recreational use would result in long-term minor to moderate adverse impacts on seabeach habitat.

Cumulative Impacts. Cumulative impacts to seabeach amaranth under alternative F would be the same as those described under alternative A. Although alternative F would provide some additional benefits to the plant, the adverse effects on seabeach amaranth from other actions occurring in North Carolina would still exist and would not be greatly offset by the additional protection afforded under alternative F. Therefore, the effects of these other actions, added to the effects of actions under alternative F would result in long-term minor to moderate adverse cumulative impacts.

Conclusion. Overall, resources management activities would reduce potential impacts from ORV and other recreational use, resulting in long-term minor to moderate beneficial impacts. Because ORV and other recreational use could result in plants being run over/trampled and seeds being pulverized or buried to a depth where they cannot germinate, alternative F would have long-term minor to moderate adverse impacts.

Past, present, and future activities both on the Seashore and within the plant's historical range in North Carolina, when combined with the impacts of ORVs, other recreational use, and resources management activities for this species, would result in long-term minor to moderate adverse cumulative impacts.

Impairment Determination. Seabeach amaranth has not been found in the Seashore since 2005, and for reasons discussed in the seabeach amaranth impact analysis in the plan/EIS, it is thought that the species may possibly be extirpated from the Seashore, thus creating a potential impairment before the no-action alternatives A and B were implemented. However, as noted in the USFWS 5-year review of the plant species, populations of seabeach amaranth may still be present, existing in the seed bank, even though plants are not visible for several years. NPS Management Policy 1.4.7 (NPS 2006c) provides that if there is, or will be, an impairment, the decision-maker must take appropriate action, to the extent possible within NPS authorities and available resources, to eliminate the impairment. Although developing a specific plan to remedy the potential impairment is outside the scope of this plan/EIS, the desired future conditions for seabeach amaranth described in chapter 1 of this plan/EIS state that the Seashore will develop a seabeach amaranth restoration plan for four suitable sites. A restoration plan would be consistent with NPS Management Policy 4.4.2.2, which provides that NPS will strive to restore extirpated native plant and animal species to parks whenever certain criteria are met. Although unmanaged or poorly managed beach driving can constitute an important threat to the species, it can be mitigated by using vehicle corridors, and closures and buffers to protect the plants and seeds. The relative contribution of various factors, both human and natural, to the possible extirpation of the species from the Seashore is unknown. However, the action alternatives in this plan/EIS have been developed to manage beach driving so that its effects are at a sufficiently low intensity to not preclude restoration of seabeach amaranth to the Seashore. Moreover, seabeach amaranth has been known to reoccur on its own in areas where it has not occurred for many years. For example, seabeach amaranth was extirpated in New York from Long Island's barrier beaches for 35 years before plants were discovered in 1990, 1991, and again in 1992,

though it is not known if this reoccurrence resulted from seed dispersal from other plant populations or exposure of local seed banks. Therefore, this impairment determination focuses on how alternative F protects potential habitat where plants might eventually occur, as well as unknown sites where seeds might be, in addition to protecting plants, if discovered or reintroduced.

Implementation of alternative F would not impair seabeach amaranth because the adverse impacts to seabeach amaranth habitat are low enough that sufficient functional habitat would remain to maintain a sustainable population in the Seashore, if the species reappears or is reintroduced to the Seashore. The effects on seabeach amaranth of constructing nine new ORV access ramps were deemed negligible to minor because the amount of potential habitat affected would be small compared to the total amount of habitat in the Seashore. Historically, most areas where seabeach amaranth has been found at the Seashore were either in established bird closures or other areas closed to vehicular traffic. Under alternative F, in addition to areas closed seasonally for shorebird nesting, suitable habitat at the points and spits used by seabeach amaranth for two or more of the preceding 5 years would be seasonally closed as well, which would protect additional seabeach amaranth habitat, if the species is rediscovered or reintroduced. Some other areas would not be designated as ORV routes to provide areas for visitors to enjoy without the presence of vehicles. The 10-meter-wide backshore zone, which would be closed year-round to ORVs wherever there is sufficient beach width to allow an ORV corridor of at least 30 meters above the mean high tide line, would protect some additional habitat year-round. Alternative F would provide about 39 miles of habitat protected, at least seasonally, from vehicles, which have more adverse impacts than pedestrians to seabeach amaranth. If plants are found outside an existing closure, the Seashore would install 30-foot by 30-foot closures around them for protection from vehicle or foot traffic. Before bird or turtle closures are reopened to ORV traffic, the areas would be surveyed for seabeach amaranth plants. If found, the plants would be protected by a 30-foot by 30-foot closure. The potential for undetected plants outside closures, to be crushed and seeds pulverized or buried to a depth where they cannot germinate was deemed to constitute a minor to moderate adverse impact in the plan/EIS analysis because sufficient habitat inside closures is protected to maintain a sustainable population of seabeach amaranth, if rediscovered or reintroduced.

Cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in the state of North Carolina would likely result in measurable or perceptible adverse effects (beyond the level of disturbance or harm that would occur naturally) and result in a change in the abundance and distribution of plants or quantity and quality of available habitat over the long-term, but the magnitude would be low enough to allow sufficient population numbers and functional habitat to remain to maintain a sustainable population in the Seashore, if plants reappear or are reintroduced. Therefore the seabeach amaranth impacts would not result in impairment.

Determination of Effect. Under alternative F, resources management activities would result in long-term minor to moderate benefits to seabeach amaranth if plants are detected in the Seashore. Benefits would be due to the protection provided by installing closures around plants that are detected, surveying for plants in August when they are visible, installing prenesting and other closures for nesting bird species that overlap seabeach amaranth habitat, and surveying bird and turtle closures for plants prior to reopening these closures to ORV and other recreation use. Approximately 39 miles of beach would be protected by SMAs or other ORV closures from March 15 to July 31. Bodie Island Spit and South Point would be managed under ML2 procedures and would have an ORV pass-through corridor that may be closed depending on breeding shorebird buffers. These closures would protect seabeach amaranth and its habitat during these timeframes, but would allow ORV impacts to occur during the seasons when these areas are reopened.

ORV and other recreational use would have long-term minor to moderate adverse impacts on seabeach amaranth as plants may go undetected and would therefore be unprotected from recreation use of the

Seashore. Seasonal restrictions on ORV use at seabeach amaranth and shorebird SMAs would help protect the species from impacts in those areas. Some additional seabeach amaranth habitat would be protected, for in all areas open to ORV use that are not in front of villages, a 32.8-foot (10-meter) wide ORV-free zone would be created in the ocean backshore wherever there is sufficient beach width to allow an ORV corridor of at least 98.4 feet (30 meters) above the mean high tide line. Constructing eight new beach access ramps would eliminate some potential habitat for the species. During seabeach amaranth's dormant season more areas of the Seashore are open to ORV use, and while there would be no plants to be impacted, seeds of the plant could be either pulverized or buried by ORVs driving over them. Under the ESA, these impacts would result in a finding of may affect / likely to adversely affect for seabeach amaranth because the actions would result in direct or indirect impacts to the species that are not discountable, insignificant or beneficial. Though there would be beneficial impacts from resources management activities, the actions under alternative F would also likely cause adverse effects.

TABLE 54. SUMMARY OF IMPACTS TO SEABEACH AMARANTH UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Resources Management Activities					
Overall, because of the protection of seabeach amaranth habitat and plants under alternative A, resources management actions would have long-term minor to moderate beneficial impacts, if plants are detected.	Overall, because of the protection of seabeach amaranth habitat and plants under alternative B, resources management actions would have long-term minor to moderate beneficial impacts, if plants are detected.	Overall, because of the protection of seabeach amaranth habitat and plants under alternative C, resources management actions would have long-term moderate beneficial impacts to seabeach amaranth as the establishment of SMAs and increased protection for the species would occur compared to alternatives A and B.	Overall, because of the increased level of protection of seabeach amaranth habitat and plants under alternative D, when compared to other alternatives, resources management actions would have long-term moderate to major beneficial impacts.	Overall, because of the protection of seabeach amaranth habitat and plants under alternative E, resources management actions would have long-term minor to moderate beneficial impacts as ORV access to more areas would be allowed during the germination period, than under action alternatives C and D.	Overall, because of the protection of seabeach amaranth habitat and plants under alternative F, resources management actions would have long-term minor to moderate beneficial impacts as ORV access to more areas would be allowed during the germination period, than under action alternatives C and D.
ORV And Other Recreational Use					
Overall, ORV and other recreational use under alternative A would have long-term moderate adverse impacts as plants may go undetected, and therefore unprotected from this use.	Overall, ORV and other recreational use would result in long-term moderate adverse impacts. Slightly more protection would be provided for the species when compared to alternative A, due to shorebird breeding closures being larger and lasting longer.	Overall, ORV and other recreational use would result in long-term minor to moderate adverse impacts. Because of the establishment of SMAs and protection of approximately 41 miles of beach, the adverse impacts under alternative C would likely be long-term minor to moderate adverse.	Overall ORV and other recreational use would result in long-term minor adverse impacts. Because the establishment of SMAs closed to ORVs year-round would protect approximately 41 miles of beach, the adverse impacts under alternative D would be greatly reduced compared to the other alternatives and result in long-term minor adverse impacts.	Overall, ORV and other recreational use would have long-term minor to moderate adverse impacts to seabeach amaranth due to the increased level of recreational access allowed when compared to the other action alternatives.	Overall, ORV and other recreational use would be similar to those under alternative E and result in long-term minor to moderate adverse impacts to seabeach amaranth.

STATE-LISTED AND SPECIAL STATUS SPECIES

GUIDING REGULATIONS AND POLICIES

The NPS *Management Policies 2006* state that NPS will inventory, monitor, and manage state and locally listed species in a manner similar to its treatment of federally listed species to the greatest extent possible. In addition, the NPS will inventory other native species that are of special management concern to parks (such as rare, declining, sensitive, or unique species and their habitats) and will manage them to maintain their natural distribution and abundance (NPS 2006c, sec. 4.4.2.3). As a result, the NPS is obligated to manage access to important habitat for such species. In addition, one of the Seashore's management goals is to provide protection for species that occur within the Seashore and that suffer population reductions or require special management. Therefore, an analysis of the potential impacts to state-listed species and certain Seashore sensitive species is included in this section.

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

The following information was used to assess impacts on state-listed and special status species:

1. Species found in areas likely to be affected by management actions described in the alternatives.
2. Habitat loss or alteration caused by the alternatives.
3. Displacement and disturbance potential of the actions and the species' potential to be affected by the activities.

Specific methodologies that were implemented and assumptions that were made that pertained to the American oystercatcher, colonial waterbirds, Wilson's plover, and red knot are described under the relevant species impact analysis below.

Although the action alternatives involve the construction of ramps, parking areas, and interdunal roads, construction activities would occur outside of the bird breeding season, during daylight hours, and outside of any key breeding or foraging habitat. In the unlikely event that state-listed or special status species are found in a construction area, the area would be under a resource closure and no construction would occur. Therefore, impacts from construction were assumed to be negligible.

Study Area

The study area for state-listed and special status species is defined as the Seashore for the analysis of the impacts of the alternatives and defined as the state of North Carolina for the analysis of cumulative impacts.

Impact Thresholds

A summary of impacts to state-listed and special status species under all alternatives is provided in table 55 at the end of this section.

The following thresholds for evaluating impacts to state-listed and special status species were defined.

Negligible: There would be no observable or measurable impacts to state-listed/special status species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.

Minor Adverse: Impacts on state-listed/special status species, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Occasional responses by some individuals to disturbance could be expected, but without interference to feeding, reproduction, resting, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors might occur. However, some impacts might occur during critical reproduction periods for a native species, but would not result in injury or mortality. Sufficient habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Moderate Adverse: Impacts on state-listed/special status species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Frequent responses by some individuals to disturbance could be expected, with some negative impacts to feeding, reproduction, resting, or other factors affecting local population levels. Some impacts might occur during critical periods of reproduction or in key habitats in the Seashore and result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Major Adverse: Impacts on state-listed/special status species, their habitats, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Impacts would occur during critical periods of reproduction or in key habitats in the Seashore and result in direct mortality or loss of habitat. Local population numbers, population structure, and other demographic factors might experience large declines.

Duration: Short-term effects would be up to two breeding seasons for state-listed/special status species.

Long-term would be anything beyond two breeding seasons for state-listed/special status species.

Species-Specific Methodology and Assumptions

Potential impacts on state-listed/special status species populations and habitat were evaluated based on available data on the species' past and present occurrence at the Seashore, as well as the species' association with humans, pets, predators, and ORVs. Information on habitat and other existing data were acquired from staff at the Seashore, the USFWS, and available literature. American oystercatchers, Wilson's plover, and the red knot are identified as a species of high concern by the U.S. Shorebird Conservation Plan. American oystercatchers are listed as a species of special concern in North Carolina. The colonial waterbird species addressed in this analysis are state-listed threatened and species of special concern and include the common tern, least tern, gull-billed tern, and black skimmer.

The analysis focuses on effects to state-listed and special status species from a variety of human recreational activities, as well as impacts incurred as a result of surveying and management activities.

The following assumptions were made regarding the analysis for all alternatives:

- An indirect impact from recreation use is the attraction of mammalian and bird predators to trash associated with recreation use (USFWS 1996a). Predation continues to be a major factor affecting the reproductive success of piping plovers (Elliot-Smith and Haig 2004), as well as other shorebirds at the Seashore. The Seashore would enforce proper trash disposal and anti-wildlife feeding regulations to reduce the attraction of predators to the area under all alternatives. Nevertheless, as demonstrated by the Seashore's annual species reports, predation continues to be a threat to species success at the Seashore (see "Chapter 3: Affected Environment"). Recreational use that brings humans into areas where state-listed/sensitive species reside would continue to have indirect impacts by attracting mammalian predators, resulting in long-term moderate impacts under all alternatives as impacts could be detectable and outside the range of natural variability, but would not result in large declines in population as the Seashore takes steps to protect listed species from predation.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Resources Management Activities

Establishment of Prenesting Closures. Under alternative A, specific prenesting closures would not be established for American oystercatchers, colonial waterbirds, or Wilson's plover. For American oystercatchers and colonial waterbirds, closures would be established only when a territory is established or a nest is located. Although these species would be able to utilize prenesting closures for piping plover that are in effect April 1, no specific prenesting closures for these other species would be established. The April 1 prenesting closures for piping plover would occur at the start of, rather than before, the breeding season, and would not be available to early nesting American oystercatchers; however, these areas would be available for Wilson's plover, which nest around the same time as the piping plover. For terns and black skimmers that nest at the spits, Cape Point, and South Beach in May and June, these closures would provide protection if they nest inside the closure, but there would not be prenesting protection provided to these species at many other locations, including areas that have been utilized for nesting in the past three years. Because there are no specific prenesting closures for state-listed and special status species apart from the piping plover prenesting areas, there would be overall long-term moderate adverse impacts to these species, except for minor adverse impacts for Wilson's plover, which generally would nest within the prenesting areas established for piping plover. Because red knot do not breed at the Seashore, there would be no impacts from the establishment of prenesting closures.

Surveying and Monitoring. Under alternative A, Seashore staff would continue to survey recent American oystercatcher breeding areas two times per week from March 15 to June 15. Surveys for colonial waterbirds would also be two times per week from May 1 to June 15. Because surveys would be restricted to recent breeding areas, surveys may not detect American oystercatchers or colonial waterbirds that establish territories in new habitat or historic nest sites. American oystercatcher and colonial waterbird nests would be observed at least three times per week. American oystercatcher broods would be observed once daily, while colonial waterbird broods would be observed at one-day to two-day intervals. Wilson's plover nests and broods would be observed incidental to piping plover monitoring. For all state-listed/special status species, when broods are mobile, more frequent observations would be provided along with enforcement presence. Monitoring would end when all chicks have fledged.

Although surveying would provide substantial benefits to the species from data collected, surveying would bring people and/or essential vehicles into direct short-term contact with state-listed/special status species and their habitat, and these activities themselves are a known risk factor (McGowan 2004; Sabine 2005; Nol and Humphrey 1994; Simons and Schulte 2008; Corbat and Bergstrom 2000). Seashore staff would use best professional judgment and take precautions to minimize disturbance during surveying; however, all state-listed/special status species are highly vulnerable to disturbance and are known to abandon habitat when they are impacted by pedestrians, vehicles, pets, and even resource managers in or near their nesting habitat (Sabine 2005; Corbat and Bergstrom 2000). Surveying would include collection of data by Seashore staff, whose presence has the potential to lead to flushing responses, which in turn could have the potential to negatively impact feeding, reproduction, resting, or other factors. Therefore, under alternative A, species surveying could likely have long-term minor adverse impacts, from the introduction of human disturbance during these activities but overall surveying would provide long-term benefits to the species as it would allow the Seashore to better manage the species. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse.

Buffer/Closure Establishment. Management under alternative A would begin with surveying for breeding activity beginning on March 15 for American oystercatchers and May 1 for colonial waterbirds. Prenesting areas for piping plovers would be established at spits, Cape Point, and South Beach, based on an annual habitat survey. Other species would potentially use breeding habitat protected within the piping plover prenesting areas. During prenesting, a 33-meter (100-foot) wide ORV and pedestrian corridor would be established at the spits, Cape Point, and South Beach, and pedestrian access would be prohibited outside of ORV corridors including breeding areas beyond the symbolic fencing. The ORV/pedestrian corridor would be delineated with posts placed up to 33 meters (100 feet) above the high tide line. In areas of reduced corridor width (i.e., narrower than 33 meters [100 feet]), a speed limit of 10 mph would be posted. Prenesting areas would be removed if no bird activity is seen by July 15 or when the area has been abandoned for a 2-week period, whichever comes later.

Outside of the piping plover prenesting areas, closures/buffers would be activated if American oystercatchers, colonial waterbirds, or Wilson's plover establish a territory or nest(s) are located. Management of Wilson's plover would be incidental to piping plover management. Closures would be removed when areas have been abandoned for a two week period. If territorial or courting birds are observed outside of existing closures, based on bird behavior and suitable habitat, buffers would be expanded to accommodate the birds. An ORV/pedestrian corridor would be provided above the high tide line.

These closures provide buffers around courting American oystercatchers and colonial waterbirds, which would have a substantial beneficial effect if implemented in a timely manner. Yet, as stated previously, the management actions under alternative A would bring people, essential vehicles, and equipment into direct contact with state-listed/special status species and their habitat and would provide for closures only after territorial behavior or nests are observed. These activities, as with surveying, are known risk factors. American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Cohen et al. in press). Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas, would not be fully protected under alternative A.

Under alternative A, buffers/closures would be established for nesting American oystercatchers based on the adult's reaction to human disturbance. Closures would vary in size depending upon best professional judgment. When resource closures are created around nests, the ORV corridor would adjust whenever possible to allow ORV passage, and the width of ORV corridor would be reduced if necessary. For

colonial waterbirds, a buffer/closure of 50 to 100 meters (150 feet to 300 feet) would be established around the nest or colony based on observed bird behavior, while maintaining the ORV/pedestrian corridor, if possible. If the buffer and the corridor overlap each other, then staff would reduce the corridor width if necessary. For both species, in areas in which the buffer zone would eliminate the ORV corridor, an alternate ORV route would be identified if available, or a bypass provided if possible. Observations and resultant management would be responsive to individuality in bird behavior when determining adequate size of closure zones around nests.

A 50- to 100-meter (150- to 300-foot) buffer zone would be established if unfledged chicks are observed, which would adjust in size as a function of chick mobility. However, observations of chick movements may not be sufficient to adjust buffers such that they ensure protecting chicks from ORV/pedestrian impact. For example, if observations are made during times of low chick mobility, buffers would adjust to 50 meters (150 feet) and result in leaving unprotected chicks that move greater than 50 meters (150 feet) at another time. An alternate ORV/pedestrian access route or bypass would be provided to open areas beyond the closure, if possible. The 33-meter (100-foot) wide ORV corridor would be reopened in recent or current nesting areas after chicks fledge. The 33-meter (150-foot) ORV corridor would re-established after August 31. Under alternative A, no additional buffers or closures would be provided to foraging adult state-listed/special status species.

Although establishment of buffers around nesting/fledging areas and posting of nests with symbolic fencing can provide a major deterrent to the entry of people, pets, and ORVs into their habitats, alternative A species management would continue to bring people, essential vehicles, and equipment into direct contact with the American oystercatcher and colonial waterbirds and their habitat, and these activities are known risk factors (Buckley and Buckley 1976; Erwin 1989, 1980; Cohen et al. in press). Also since first-time breeders are even less tolerant to disturbance than are older, established breeders (Nol and Humphrey 1994), buffers for first-time breeders may not provide sufficient protection.

With the closures and buffers for nesting areas under alternative A that may not provide sufficient protection for species, management that begins after the species are known to arrive at the Seashore, lack of certain buffers such as adult foraging buffers, and the flexibility of moving the ORV corridor to enable access adjacent to nesting areas, impacts from closures/buffers under alternative A would be long-term moderate adverse, depending on the sensitivity of each species to disturbance.

Wintering/Nonbreeding Management. Nonbreeding surveys for American oystercatchers, Wilson's plover, and red knot would be conducted according to the NPS SECN survey protocol, with no nonbreeding surveys for colonial waterbirds. These surveying activities would have minor adverse impacts (due to human disturbance as discussed above) and long-term benefits related to the increase in knowledge about the species. Lack of nonbreeding surveys for colonial waterbirds would have long-term minor to moderate adverse impacts, as data would not be collected to assist in the determination of future management (nonbreeding) of these birds.

No nonbreeding closures would be established for state-listed/special status species, although these species could utilize the nonbreeding closures for piping plover that would include suitable interior habitats at spits and at Cape Point year-round. Being able to utilize other species closures would have some long-term benefits, as some protection is offered during this sensitive life stage. However, these closures would not be specific to the state-listed/special status species and would not include ocean beach habitat, resulting in long-term minor adverse impacts. Wilson's plover would benefit from nonbreeding closures for piping plover as they utilize similar nonbreeding habitat.

Education/Public Outreach. Under alternative A, the public would continue to receive information at the visitor centers about state-listed/sensitive species and their ecology and the measures the Seashore is

taking to protect the species. The public would also continue to be notified about closures that would limit ORV or pedestrian traffic, as well as when these closures reopen. Such public outreach is beneficial to the species as it educates the public to the specific needs of the species and alerts the public ahead of time to areas where they cannot go due to potential impacts to the species. Therefore, public outreach as part of species management would have long-term beneficial impacts.

Overall Impact of Resources Management Activities. The overall impact of resources management activities (primarily resulting from the effects of surveying and field activities) for each species under alternative A would be as follows:

- American oystercatcher. Impacts would be long-term minor to moderate adverse as surveying and lack of specific prenesting closures for this species may miss early nesters. Piping plover prenesting closures, which could be utilized by this species as well, would not protect a number of American oystercatcher nest sites used in recent years. Also, buffer distances based on bird behavior may not provide adequate protection for the species.
- Colonial waterbirds. Impacts would be long-term minor to moderate adverse as no prenesting closures would be established for colonial waterbirds. Some species, such as terns and black skimmers may be able to utilize the prenesting closures established for piping plovers; however, those prenesting areas would not protect a number of colonial waterbird nest sites used in recent years. Also, buffer distances based on bird behavior may not provide adequate protection for the species.
- Wilson's plover. Impacts would be long-term minor adverse as the habitat for this species would be well surveyed during piping plover surveys and this species would be able to take advantage of management measures for piping plover as their breeding seasons and habitat requirements are similar. Also, buffer distances based on bird behavior may not provide adequate protection for the species. Some benefits may occur from incidental management of Wilson's plover during piping plover management activities, both during breeding and nonbreeding seasons.
- Red knot. Impacts to nonbreeding red knot would be long-term minor adverse as their prime foraging habitat (ocean shoreline) would not be afforded protection by nonbreeding closures, although the ability of this species to use wintering closures for piping plover at inlets and Cape Point would result in some benefit, albeit minimal. As red knot are not present at the Seashore for breeding, any impacts to this species from surveying and field activities for other species would be long-term negligible adverse.

ORV and Other Recreational Use

ORV and Pedestrian Access. Alternative A would designate the entire ocean beach of the Seashore as an ORV route or area. There would be no designated non-ORV areas, although temporary closures would occur for resource protection and safety reasons, and seasonal closures would occur in front of the villages. Alternative A would provide for closures of piping plover prenesting areas, while maintaining access to the inlets and Cape Point. The prenesting closures, as well as closures based on observations of breeding behavior, foraging, and chick movements, may benefit other species. An ORV/pedestrian corridor would be provided above the high tide line. In areas of reduced corridor width (i.e., less than 33 meters [100 feet]), traffic signs and a 10 mph speed limit would be posted. The ORV corridor would be adjusted whenever possible to allow vehicle passage. If an ORV corridor is not feasible for safety reasons or insufficient area, an alternate ORV route would be identified if possible. If there is no alternate route available, Seashore staff would consider establishing a bypass route. Seashore staff would allow management to be responsive to individuality in bird behavior when determining adequate size of closure zones. If an alternate route or bypass is not feasible, an ORV closure would be initiated. This should limit

adverse impacts to state-listed/special status species, but compliance with closures may not be absolute, resulting in short-term moderate to major adverse impacts if non-compliance occurs. Recreation use under the actions defined in alternative A would bring ORVs, essential vehicles (for safety, enforcement, etc.), pedestrian, pets, and other recreational activities in close proximity to state-listed/special status species and their habitat, and these activities are all known risk factors to these species. Oystercatchers need large, undisturbed beach areas for successful nesting and they are particularly sensitive to humans, vehicles, and unleashed pets in or near their nesting habitat (Simons and Schulte 2008). Although there would be buffers and substantial rerouting, it is likely that some American oystercatchers could be disturbed during the most critical periods of reproduction and within key American oystercatcher habitat, resulting in direct mortality, abandonment, or loss of habitat. This would be especially true if closure compliance is lacking and/or if the breach of the closure occurs in the earlier life stages. Direct mortality, abandonment, and loss of habitat have and would continue to lead to some annual and seasonal declines in the oystercatcher population at the Seashore, and impacts would be long-term moderate to major adverse. Colonial waterbirds and Wilson's plovers would be affected especially during prenesting, territory establishment, courtship and nesting phases (Cohen et al. in press; Corbat and Bergstrom 2000), although some Wilson's plover nesting habitat would be protected within the piping plover prenesting areas. Some of these impacts could occur during critical, early stages of reproduction and within key colonial waterbird and Wilson's plover habitat and result in abandonment of nest sites or loss of otherwise suitable habitat and could result in long-term moderate to major adverse impacts.

There would be no year-round or seasonal closures specifically to protect key red knot habitat. Recreational activities that occur in the months when red knots are present on Seashore beaches have the potential to impact resting and foraging red knots, as a result of vehicle use and associated noise and presence of people and pets. Of particular concern is when these disturbance factors result in red knots being forced to fly while they are foraging. Frequent escape flights means that time spent foraging is reduced and replaced by an increase in time spent flying, resulting in the chance that birds would not be able to add the body fat they need for their long-distance migration, resulting in long-term minor to moderate adverse impacts to red knots.

Night-Driving Restrictions. Under alternative A, there would be no limitations on night driving. American oystercatchers, Wilson's plover, and red knot are known to be active at night (Simons and Schulte 2008; Morrier and McNeil 1991; Niles et al. 2007) and would be subject to vehicular and pedestrian disturbance. This disturbance can impact their foraging behavior and has been shown to result in disorientation and even abandonment of oystercatcher chicks (Simons and Schulte 2008). Allowing night driving under alternative A would result in long-term moderate adverse impacts to birds that forage at night.

Commercial Fishing. Under alternative A, commercial fishing would be managed under the commercial fishing special use permit. As part of this permit, terms and conditions would be placed on the permit holder, including a prohibition on entering resource closures. All other closures (safety and seasonal) would be accessible by commercial fishing permit holders. As resource closures would be off limits to commercial fishermen, there would be long-term negligible adverse impacts to state-listed/special status species from this use.

Permitting/Carrying Capacity Requirements. Under alternative A, there would be no permitting or carrying capacity requirements for ORV use at the Seashore. A permitting system would provide the Seashore with a method for dealing with non-compliance, as well as providing education to ORV users regarding the importance of state-listed and special status species habitat at the Seashore. Lack of a permit system under alternative A would have long-term moderate adverse impacts. The lack of prenesting closures for these species (or other proactive protection of nesting habitat) would result in adverse impacts that would be exacerbated by the lack of a carrying capacity requirement. These conditions would

result in long-term moderate adverse impacts to most state-listed/special status species that nest on Seashore beaches, as unrestricted numbers of ORVs would be allowed in recent breeding areas prior to the implementation of resource closures that would occur only after breeding activity is observed. For American oystercatchers that regularly forage on the ocean shoreline and on the soundside outside of resource protection areas, there would be long-term moderate to major adverse impacts, as the lack of a carrying capacity would increase the possibility of greater concentrations of ORVs, thereby increasing the potential for disturbance to oystercatchers. For Wilson's plover, which typically would nest in piping plover prenesting areas, the lack of a carrying capacity would cause long-term minor adverse impacts.

Pet/Other Recreational Activity Restrictions. Alternative A would prohibit camping and restrict beach fires to the hours of 6:00 a.m. until midnight, and would allow pets at the Seashore year-round, in accordance with 36 CFR 2.13. The prohibition of camping and restriction of beach fires after midnight would have long-term benefits to state-listed/special status species, as disturbance from these activities would be reduced or eliminated. The presence of pets at the Seashore, including during breeding season, has the potential to impact state-listed/special status species as some visitors to the Seashore do not observe the requirement for pets to be restrained in some manner, and buffers for these species may not be adequate under alternative A. If there is little or limited compliance with pet restrictions in the areas of closures, a negative effect on the state-listed/special status species could result (USFWS 1996a). This would be mitigated by the prohibition of pets from the landward side of the posts delineating the ORV corridor at the spits and Cape Point, by the prohibition of pets within symbolic fencing around any bird closure area, and through education and outreach efforts via the Seashore field personnel and partnerships with local volunteers and organizations, but could still result in long-term minor adverse impacts, due to non-compliance and lack of appropriate buffers.

Overall Impact of ORV and Other Recreational Use. The overall impact of ORV and other recreational uses for each species under alternative A would be as follows:

- American oystercatcher. Impacts would be long-term moderate to major adverse as buffers that adjust frequently based on bird behavior are more subject to non-compliance. The lack of designated non-ORV areas, a permitting system, carrying capacity, or seasonal night-driving restrictions, and allowing pets at the Seashore during breeding season would contribute to these adverse impacts.
- Colonial waterbirds. Impacts would be long-term moderate to major adverse as buffers may not be adequate to protect the species, and disturbance from recreational uses is more likely. The lack of designated non-ORV areas, a permitting system, carrying capacity, or seasonal night-driving restrictions, and allowing pets in the vicinity of breeding birds would also contribute to adverse impacts.
- Wilson's plover. Impacts would be long-term moderate to major adverse as no specific management would be provided for this species, although they could utilize buffers and closures established for piping plover. The lack of designated non-ORV areas, a permitting system, carrying capacity, or seasonal night-driving restrictions, and allowing pets at the Seashore during breeding season would contribute to these adverse impacts.
- Red knot. Impacts would be long-term moderate adverse as no specific management would be provided for this species especially during a key life stage of wintering. The lack of designated non-ORV areas, a permitting system, or night-driving restrictions when red knots are at the Seashore, and allowing pets at the Seashore during the migrating/nonbreeding season would contribute to these adverse impacts. Impacts to red knots would be lower than other species as they would not be subject to impacts during their breeding cycle and their use of the Seashore corresponds to times of lower visitation.

Cumulative Impacts. The following cumulative assessment applies to all the state-listed / special status bird species addressed in this section of the plan/EIS, since so many of the cumulative effects applied similarly to all of these species. While these species may use the Seashore differently (nesting vs. wintering) or arrive at the Seashore at different times, in general the below actions would occur year-round and have the potential to impact all of the state-listed/special status species to some degree. The cumulative impact of each alternative for each species references this section, but provides an assessment of all cumulative effects, including those of each individual alternative added to the impacts discussed below. The past, present, and future actions discussed under cumulative impact scenario could be expected to have a range of impact on all the state-listed / special status bird species addressed in this section of the plan/EIS.

Various dredging is occurring in the vicinity of the Seashore, such as the dredging of Oregon Inlet. These dredging activities fall under two categories: major dredging and maintenance activities. For the dredging of the federally authorized navigation channel at Oregon Inlet, major dredging occurs approximately every four to five years, with sand being deposited in areas outside the Seashore, such as on Pea Island. Major dredging of Oregon Inlet is typically avoided during the breeding season; however, maintenance dredging does occur and could result in short-term minor adverse impacts due to disturbance. When major dredging projects do occur, it is common for bird habitat at the southern end of Bodie Island Spit to slough off into the channel for a number of months after the dredging operation, which could cause short-term minor to moderate adverse effects to habitat.

Storms and other weather events during the breeding season (March – August) of locally sensitive bird species can result (depending upon storm intensity) in disturbance of nesting state-listed/special status birds or even in the washing away of nests or eggs. In addition to the timing of summer storms, storm severity is also an important variable. Powerful storms can surge high up and overwash large areas of breeding habitat including even up to the toe of the dune and beyond and result in loss of scrapes, nests, eggs, chicks and even breeding adults. Conversely, winter, late fall, and early spring storms are capable of being beneficial to state-listed / special status birds by depositing new materials and creating overwash areas and hence new nesting habitat for state-listed / special status birds or having long-term adverse impacts by eroding and removing otherwise suitable habitat. Hence, the type and level of impacts to nesting state-listed / special status birds depends on the timing and severity of storm events and whether they result in net habitat creation or destruction.

Hurricanes can also affect American oystercatchers, Wilson's plover, and colonial waterbirds because of the impact of major storms on staff resources. Storm recovery efforts that temporarily pull staff from resources management (including species monitoring or law enforcement) activities during the breeding season would have a short-term minor adverse impact. Conversely, hurricane recovery that takes place outside of the breeding season would have no or little effect. Because the hurricane season overlaps essentially the entire breeding season, the loss of staff services would have a short-term adverse impact on these birds.

Commercial fish harvesting would have a negligible impact on American oystercatchers, Wilson's plovers, and red knots because these birds do not feed on any commercially important fish. However, American oystercatchers, Wilson's plovers, and red knots feed on some of the same prey items of fish species that may be harvested and, as such, harvest of fish may mean greater prey encounters for these bird species. In this case, commercial fishing would have a long-term negligible to minor adverse impact on American oystercatchers, Wilson's plovers, and red knots. Colonial waterbirds on the other hand, most likely feed on the young year classes of some of the fish targeted by commercial fishermen. In this case, the harvest of commercial fish would have a long-term minor adverse impact on colonial waterbirds.

Past, current, and future planning efforts can also affect locally sensitive bird species. For example new development could result from the implementation of the County Land Use Development Plans for Dare and Hyde counties, including expected revisions to the Dare County Plan. The details of any plan revisions are not certain and the potential for impacts on these bird species is indeterminate at this time. If increased development within the Seashore's boundaries would result from the implementation of these plans, this may have minor adverse impacts on state-listed / special status species, because development might result in measurable increases in recreational beach use, with corresponding increases in recreational impacts to these species. If visitation on the Outer Banks increases greatly, this would also increase the likelihood of American oystercatcher vehicle strikes as the species flies across NC-12 from nesting sites on the ocean shoreline to forage in the Pamlico Sound. Therefore, an increase in visitation would likely result in an increased chance of conflicts between this species and ORV.

The education aspect of the Seashore's Long-Range Interpretive Plan would provide long-term benefits to state-listed / special status birds as it would help to educate visitors about the conservation needs of the birds that inhabit the Seashore and the protection measures that are put in place to help protect them.

The Seashore's Predator Management Plan would provide long-term substantial benefits by helping to control mammalian predators, such as fox and others, which prey upon bird adults, eggs, and young. Predator trapping might result in short-term minor disturbance to nests and young, or result in loss of nests or hatchlings if trappers are not cognizant of nest locations. However, overall predator management actions would be highly beneficial to state-listed or special status bird species.

The Cape Lookout Interim Protected Species Management Plan provides beneficial impacts to all state-listed/special status birds at the Seashore through the management policies that it employs. The outcome of the Cape Lookout National Seashore ORV management plan/EIS would also have direct long-term impacts on bird populations within the Seashore as well as within the state of North Carolina. Specifically, it would have an impact on the region's goal of achieving compliance with the Piping Plover Recovery Plan. However, whether the impact of the ORV plan would be beneficial or adverse to state-listed / special status birds would depend upon the management decisions that are made and ultimately implemented.

The replacement of the Herbert C. Bonner Bridge may have minor adverse impacts on state-listed / special status birds. Construction noise and lighting may adversely impact courting, nesting, and foraging of state-listed / special status birds. The presence of shading from the bridge and pilings driven into the substrate may also alter the optimal suitability of the beach surrounding the bridge for both nesting and foraging state-listed/special status birds in the vicinity of the impact. However, the new bridge would also provide some benefits by allowing barrier island processes to occur more naturally than with the bridge it replaces. To the extent that the new bridge would allow the natural formation of new habitats such as overwash fans, new inlets, and low sloping beaches it might provide additional suitable habitat for state-listed / special status birds. In this case, the impact of the Herbert C. Bonner Bridge would be long-term with benefits to American oystercatchers, Wilson's plovers, and red knots in the vicinity of the bridge.

The overall combined impacts of these past, current, and future actions would be long-term minor to moderate adverse. These impacts, combined with the moderate to major long-term adverse impacts under alternative A, would result in long-term moderate to major adverse cumulative impacts.

Conclusion. The overall impact for each species under alternative A would be as follows:

- American oystercatcher. Impacts of resources management activities (primarily resulting from the effects surveying and field activities) would be long-term minor to moderate adverse as any surveying and lack of specific prenesting closures for this species may miss early nesters. Also,

buffer distances based on bird behavior may not provide adequate protection for the species. Impacts from ORV and other recreational use would be long-term moderate to major adverse as buffers that adjust frequently based on bird behavior are more subject to non-compliance. The lack of designated non-ORV areas, a permitting system, carrying capacity, or night-driving restrictions, and allowing pets in the vicinity of breeding birds would contribute to adverse impacts.

- Colonial waterbirds. Impacts of resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term minor to moderate adverse as surveying and lack of specific prenesting closures for colonial waterbirds may miss early nesters. Also, buffer distances (150–300 feet) may not provide adequate protection, especially if buffer distances are based on observed bird behavior and the birds are not being continuously observed/monitored. Impacts of ORV and other recreational use would be long-term moderate to major adverse as buffers may not be adequate to protect the species, and disturbance from recreational uses is more likely. The lack of designated non-ORV areas, a permitting system, carrying capacity, or night-driving restrictions, and allowing pets in the vicinity of breeding birds would also contribute to adverse impacts.
- Wilson's plover. Impacts of resources management activities (primarily resulting from the effects of surveying and field activities) would be long-term minor adverse as the habitat for this species would be well surveyed during piping plover surveys and this species would be able to take advantage of management measures taken for piping plover as their breeding seasons and habitat requirements are similar. Also, buffer distances based on bird behavior may not provide adequate protection for the species. Some benefits may occur from incidental management of Wilson's plover during piping plover management activities, both during breeding and nonbreeding seasons. Impacts of ORV and other recreational use would be long-term moderate to major adverse as no specific management would be provided for this species, although they could utilize buffers and closures established for piping plover. The lack of designated non-ORV areas, a permitting system, carrying capacity requirements, or night-driving restrictions, and allowing pets in the vicinity of breeding birds would also contribute to adverse impacts.
- Red knot. Impacts to nonbreeding red knots would be long-term minor adverse as their prime foraging habitat (ocean shoreline) would not be afforded protection by nonbreeding closures. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. Impacts of ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species especially during a key life stage of wintering. The lack of designated non-ORV areas, a permitting system, no night-driving restrictions during the time period when red knot are present at the Seashore, and allowing ORVs, people, and pets at the Seashore during the nonbreeding season in the vicinity of this species would contribute to adverse impacts. Impacts to red knots would be lower than with other species as they would not be subject to impacts during their breeding cycle and their use of the Seashore corresponds to times of lower visitation.

Cumulative impacts under alternative A would be long-term moderate to major adverse.

Impairment Determination: Implementation of alternative A has the potential for impairment to common terns, gull-billed terns, and black skimmers because it may result in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Numbers of these three species nesting in the Seashore have already declined substantially and are at sufficiently low levels for colonial nesting species that, over the long term life of the plan, measures such as prenesting closures and larger buffers for these species, which are not provided by alternative A,

would likely be needed to restore Seashore population levels to the point that it could be determined that impairment would not result. Implementation of alternative A would not impair American oystercatcher and least terns because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. This is so, even though frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding or reproduction, and impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals. Implementation of alternative A would not result in impairment to Wilson's plover because its breeding biology and habitat requirements are similar to that of piping plover, and it would benefit from resource closures provided for piping plover under alternative A. Alternative A would designate all of the ocean beach as an ORV route and permit year-round unrestricted night driving on the beach. Under alternative A, prenesting closures would not be installed for the state-listed and special status species (American oystercatcher, Wilson's plover, and the colonial waterbird species [common tern, least tern, gull-billed tern, and black skimmer]) that nest in the Seashore. Red knot do not breed in the Seashore and would not be affected by management during the breeding season. No specific management for red knot during the nonbreeding season (when they are present in the Seashore) would be provided under alternative A.

Piping plover prenesting closures would be established by April 1 in suitable habitat in areas used by piping plover during the past three breeding seasons or in new piping plover habitat identified during the annual habitat assessment. These piping plover closures would be used by Wilson's plover, which nest in similar habitat and around the same time as piping plover. However, like piping plover, Wilson's plover arriving before April 1, when the piping plover closures are installed, may abandon their attempts to establish a territory and attract a mate or may choose less optimal habitat because of human disturbance during a critical period of reproduction. Under alternative A, Seashore staff would begin surveying for piping plover once a week from March 15 to 31. Wilson's plover would be observed incidental to piping plover surveying, which would result in less robust data collection for the species, and specific management measures would not be provided for Wilson's plover. Wilson's plover are subject to the same disturbance factors as piping plover including beachgoers, pets, and ORV traffic on beaches. Wilson's plovers leave their nests when disturbed and are extremely reluctant to return when intruders are anywhere near, a practice that exposes eggs to predation and overheating.

American oystercatchers may also nest in piping plover prenesting closures. However, oystercatchers also nest in other locations in the Seashore. In these other locations, they would not be protected by prenesting closures from disturbance by ORVs and other recreational activities during a period when they are particularly sensitive to disturbance. Also, oystercatchers may begin breeding activities in mid-February or early March before the piping plover prenesting closures are established on April 1. Surveying would be conducted in recent breeding areas two times a week for oystercatchers from March 15 to June 15 and for colonial waterbirds from May 1 to June 15. For colonial waterbirds that nest at the spits, Cape Point, and South Beach, the piping plover prenesting closures would provide protection from disturbance, if they nest inside the closures. However, other nesting locations used by these species in recent years would not be protected with prenesting closures. For oystercatchers and colonial waterbirds, if territorial behavior / courtship behavior is observed during two consecutive surveys, then observation would increase to three times a week and a buffer would be established. If scrapes or eggs are observed, observation would increase to three times a week and a buffer established. The size of nesting buffers for American oystercatchers would be established based on the reaction of adults to human disturbance and would vary in size. Adult foraging buffers would not be established. For colonial waterbird nests, a 150- to 300-foot buffer would be established, with the exact distance within that range dependent on best professional judgment based on adult reaction to human disturbance. The smaller buffers in the 150- to 300-foot range would likely be inadequate for the common tern, gull-billed tern, and black skimmer, which are more sensitive to disturbance than least terns. Alternative A does not require that the larger 300-foot buffers be provided for these species. Even if provided, they are smaller than recommended in some of the scientific

literature for these species, which are more easily disturbed than least terns. Oystercatchers with unfledged chicks would be observed once daily; colonial waterbirds with unfledged chicks would be observed at one-day to two-day intervals. Observation would be more frequent when broods are mobile. American oystercatcher and colonial waterbird unfledged chick buffers would initially be 150- to 300-feet and then vary in size within that range based on best professional judgment and adult reaction to human disturbance, and for oystercatchers on brood mobility. Although, under alternative A, the need to adjust buffers frequently would result in disturbance, the buffers would help prevent, but not eliminate, further disturbance. If installation of buffers or adjustments to the buffer are not made quickly or if nests are missed by observers, the birds may be adversely affected. Because chick buffers are relatively small, would be variable based on adult response to human disturbance and on chick behavior, and could change frequently, additional disturbance to these species may occur, including from the increased chances for intentional or unintentional visitor noncompliance with the closures. The oystercatcher chick buffer would move with the chicks and would provide more protection than a stationary buffer of the same size.

Alternative A would provide a 24-hour-per-day ORV corridor to almost the entire ocean beach of the Seashore including, where beach width is sufficient, a corridor adjacent to areas used by these species, except for chick closures for oystercatchers. This would increase opportunities for noncompliance with resource protection closures. Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. American oystercatchers, Wilson's plover, and red knots are known to be active at night and would be subject to vehicular and pedestrian disturbance. This disturbance can affect their foraging behavior and has been shown to result in disorientation and even abandonment of oystercatcher chicks. Plover and oystercatcher chick response to vehicles can increase their vulnerability to ORVs. Unrestricted night driving during critical periods of reproduction may result in harassment, injury, or mortality to one or more individuals of these night foraging species. Under alternative A, ORVs would bring more people into the vicinity of breeding areas used by state-listed and special status species, where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to adversely affect the reproductive success of shorebirds at the Seashore. The indirect impacts of attracting predators would be detectable and beyond the level of harm that can occur naturally, but are not expected to result in large declines in population because the Seashore takes management action to protect state-listed species from predation.

Nonbreeding closures would not be established for state-listed or special status species, although these species could use the interior habitat at spits and at Cape Point that would be closed to ORV and other recreational use for piping plover during the nonbreeding season, resulting in year-round protected interior habitat in these areas for all species. No areas of shoreline would be protected for nonbreeding shorebird foraging under alternative A. Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore. Under alternative A, pets are allowed on the beach year-round at the Seashore, but prohibited from the landward side of the posts delineating the ORV corridor at the spits and Cape Point and inside bird closures. Because some visitors do not keep their pets restrained on a 6-foot or shorter leash or crated as required, allowing pets in the vicinity of resource closures could result in harassment, injury, or mortality to one or more individuals.

The plan/EIS analysis evaluated impacts on state-listed and special status species from ORV and other recreational use and from lack of specific management measures, such as (1) prenesting closures, (2) winter foraging closures on the shoreline, (3) prescribed buffers for oystercatchers or Wilson's plover, (4) buffer distances that may not provide adequate protection (especially if buffer distances are based on observed bird behavior and the birds are not being continuously observed), (5) buffer distances that even at the large end of the allowed range may not be adequate for the more sensitive species of colonial

waterbirds, (6) lack of designated non-ORV areas, and (7) lack of night-driving restrictions. Overall, the impacts to American oystercatcher, least tern, and Wilson's plover were deemed by the plan/EIS impact analysis to be between moderate and major adverse because impacts on these species or their habitats would be expected to be outside the level that occurs naturally, and small changes to local population numbers, population structure, and other demographic factors may occur. Some impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals. However, implementation of alternative A would not cause large declines in population numbers for American oystercatcher, least tern, and Wilson's plover. Sufficient population numbers and functional habitat would remain to maintain a sustainable population of these species in the Seashore. Overall, the impacts to gull-billed tern, common tern, and black skimmer were deemed by the plan/EIS impact analysis to be moderate to major adverse because implementation of alternative A could result in substantial declines in population numbers or failure to restore sufficient numbers to maintain a sustainable population in the Seashore for these three species.

From 1999 to 2009, the oystercatcher population at the Seashore experienced declines in numbers from 41 to 23 pairs. The population stabilized at 23 pairs from 2006 through 2009, including during 2006 and 2007, when management under alternative A was implemented at the Seashore. For several reasons, the colonial waterbird data for the Seashore are not sufficient to support a trend analysis for the two years (2006 and 2007) that management under alternative A was in effect. A nest survey was not conducted in 2006; annual nest surveys did not begin until 2007; and survey methodology varied over the years, including among the recent annual surveys. For example, the Seashore's 2008 annual report for colonial waterbirds notes that an important factor to recognize when comparing the 2008 breeding season to the previous season is that more emphasis was placed on collecting colonial waterbird data in 2008. Due to staffing levels in 2008, it was possible to spend more time monitoring the waterbird colonies. Colonies were surveyed on foot at least once a week by small groups of bio-technicians, producing relatively reliable nest and chick counts. In previous years (including 2007), colonies were rarely walked through and were usually surveyed by one bio-technician telescoping the colony of birds. Because of the differences in survey techniques, it is difficult to accurately compare 2008 data with 2007 data. Additionally, one overview of the status of gull-billed terns commented on the lack of population data for the species and noted that counts from single colonies or even single regions may be impossible to interpret in isolation.

(<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Gelochelidon+nilotica>). In the 2007 survey, which occurred under the Interim Strategy, 6 gull-billed tern nests, 109 common tern nests, 194 least tern nests, and 11 black skimmer nests were documented at the Seashore. In 2008 and 2009, 232 and 577 least tern nests, respectively, were recorded at the Seashore under procedures modified by the consent decree. In 2008, 4 black skimmer nests and 19 common tern nests were recorded. In 2009, 61 black skimmer and 53 common tern nests were found.

Although Wilson's plovers are often seen by Seashore staff during their observations of piping plovers, no indications of nesting had been documented until 2009. There are no data on reproductive success of Wilson's plover at the seashore.

The analysis in the plan/EIS of cumulative impacts combined the effects of alternative A with effects of other past, present, and future planned actions in and around the Seashore, such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the Seashore, commercial fish harvesting, and increased interpretative programs as part of the Seashore's long-range interpretive plan. The plan/EIS impact analysis deemed the cumulative impacts to be between moderate and major adverse for the American oystercatcher, least tern, and Wilson's plover because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore and to be moderate to major adverse for the black skimmer, common tern, and gull-billed tern because a decrease in Seashore populations levels or a failure to restore

levels that are needed to maintain a sustainable population in the Seashore could result. Therefore the American oystercatcher, least tern, and Wilson's plover impacts would not result in impairment, and the black skimmer, common tern, and gull-billed tern impacts have the potential to result in impairment.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Resources Management Activities

Establishment of Prenesting Closures. As with alternative A, under alternative B specific prenesting closures would not be established for American oystercatchers, colonial waterbirds, or Wilson's plover. For American oystercatchers and colonial waterbirds, closures would be established only when a territory is established or a nest is located. Although these species would be able to utilize prenesting closures for piping plovers that are in effect by March 15, no specific prenesting closures for these other species would be established at other locations, including many areas that had been used for nesting in the past three years. The piping plover prenesting closures would be established at Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, North Ocracoke Spit, and South Point by March 15 and would be delineated to incorporate to the maximum extent the areas delineated in the 2008 prenesting closure maps and would include to the maximum extent possible the soundside intertidal zone, areas of moist soil habitat, ocean backshore, dunes, dry sand flats, overwashes, blowouts, and areas of the ocean tidal zone consistent with the 2008 prenesting closures. These closures would remain in place until the later part of July 15 or two weeks after the last chick within the area has fledged, as determined by two consecutive monitoring events.

As under alternative A, during prenesting, a 33-meter (100-foot) wide ORV and pedestrian corridor would be established and pedestrian access would be prohibited outside of ORV corridors including breeding areas beyond the symbolic fencing. The ORV/pedestrian corridor would be delineated with posts placed up to 33 meters (100 feet) above the high tide line. In areas of reduced corridor width (i.e., narrower than 33 meters [100 feet]), a speed limit of 10 mph would be posted. All prenesting closures would be removed when areas have been abandoned for a two-week period. In addition, under alternative B in all locations not in front of the villages, outside of the piping plover prenesting areas and open to ORV use, the NPS would provide an ORV-free zone from March 15 to November 30 in the ocean backshore at least 10 meters (30 feet) wide and running the length of the site, wherever backshore habitat exists, provided there is sufficient beach width to allow an ORV corridor of at least 20 meters (60 feet) above the mean high tide line. This ORV-free zone would be adjacent to the toe of the primary dune whenever a primary dune exists.

Under alternative B, the implementation of prenesting closures for piping plover at the inlets, Cape Point, and South Beach and the ocean backshore closures at other locations by March 15 would be early enough in the breeding season that it would be beneficial to early nesting American oystercatchers, as well as to other species that typically nest later. Because there are no specific prenesting closures for state-listed and special status species, apart from the piping plover prenesting areas, many areas that had been used for nesting in the past three years would not be protected until breeding activity is observed. There would be overall long-term moderate adverse impacts to these species, except for minor adverse impacts for Wilson's plover, which generally would nest within the prenesting areas established for piping plover.

Surveying and Monitoring. Surveying and monitoring for state-listed and special status species would occur as described for alternative A. In addition, under alternative B trained NPS biologists or field technicians would survey Cape Point and South Beach, Hatteras Inlet Spit, and the northern and southern ends of Ocracoke at least once every two days from March 15 to April 15, and daily from April 16 to July 15. Seashore staff would monitor Bodie Island Spit at least daily from March 15 to July 15.

Surveying would likely have long-term minor adverse impacts, but overall surveying would provide long-term benefits to the species. Under alternative B, impacts from species surveying measures would have more of a beneficial effect on nesting state-listed/special status species and their habitat than alternative A due to earlier and increased monitoring of the inlets, Cape Point, and South Beach. Alternative B would also have a more beneficial effect on state-listed and special status species due to piping plover prenesting areas being installed by March 15, instead of April 1 as under alternative A. This would likely reduce disturbance of other species present at these locations during the early part of the breeding season.

Although surveying would provide substantial benefits to the species from data collected, surveying would bring people and/or essential vehicles into direct short-term contact with state-listed/special status species and their habitat, as described under alternative A. Therefore, under alternative B, species surveying could likely have long-term minor adverse impacts from the introduction of human disturbance during these activities, but overall surveying would provide long-term benefits to the species as it would allow the Seashore to better manage the species. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse.

Buffer/Closure Establishment. If breeding behavior, including but not limited to territorial behavior, courtship, mating, confirmed scrapes, or other nest-building activities, is observed outside of existing closures, Seashore staff would automatically establish prescribed species-specific buffers, rather than providing flexible buffers based on observations of bird behavior as would occur under alternative A. If the NPS observes breeding behavior (as defined in the consent decree) of American oystercatchers, colonial waterbirds, or Wilson's plover, the NPS would establish the prescribed buffers as quickly as possible, but always within eight daylight hours. Upon discovery of an active nest or chicks that are outside an existing closure, protective measures would be taken immediately to close and establish the buffers described above. Symbolic fencing with the applicable buffer distances stated above would be installed as soon as NPS staff can reasonably be mobilized to install the fencing, but always within six daylight hours.

The size and timing of these buffers would have a beneficial effect for American oystercatchers, colonial waterbirds, and Wilson's plover. The NPS would rely upon monitoring to detect the presence of breeding activity in many locations that are otherwise open to ORV use and associated recreational activities. Under alternative B, people, their pets, and vehicles could still come into direct contract with state-listed/special status species prior to the detection of breeding activity by NPS staff, although it would be to a much lesser extent than alternative A. Larger buffer distances and timely installation of resource closures for observed breeding behaviors would minimize disturbance to pairs during territory establishment. These activities, as with surveying, are known risk factors. As described under alternative A, American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Cohen et al. in press). Hence, a March 15 start to management could mean that early nesting American oystercatchers, especially those that establish territories outside of recently used nesting areas, would not be fully protected under alternative B.

Under alternative B, buffers/closures would be established for breeding behavior and nesting American oystercatchers for a distance of 150 meters (450 feet). A buffer of 200 meters (600 feet) would be established for unfledged oystercatcher chicks. For the least tern, a colonial waterbird, a buffer/closure of 100 meters (300 feet) would be established for breeding behavior and nesting and a buffer of 200 meters (600 feet) would be established for unfledged least tern chicks. For all other colonial waterbirds, a buffer/closure of 200 meters (600 feet) would be established around the nest or colony based on observed bird behavior for breeding, nesting, and protection of unfledged chicks. When multiple species are present, the greatest applicable buffer distance would be used. If NPS staff observe disturbance from

ORVs and/or pedestrians, buffers would be expanded in 50-meter (150-foot) increments until no disturbance occurs. If a deliberate violation occurs that disturbs wildlife or vandalizes nests or fencing, the buffer would be expanded by 50 meters (150 feet) on the first offense. If there are multiple occurrences in the same area, the buffer would be expanded by 100 meters (300 feet) and 500 meters (1500 feet) for the second and third violations respectively. If a violator is apprehended, the NPS would not be required to institute expanded buffers.

In contrast to alternative A, when resource closures using the prescribed buffers are created around nests under alternative B, the ORV corridor would not be reduced to accommodate an ORV corridor. When resource closures are created or expanded around observed breeding activity or nests, due to the larger buffer distances provided under alternative B, the ORV corridor would likely be closed in most cases and a bypass in the immediate vicinity of the site would be precluded. Unfledged chick buffers would follow a prescribed distance, and the size of the buffer would be maintained as chicks move. Although it is possible under alternative B, as described under alternative A, that observations of chick movements may not be sufficient to adjust buffers such that they always ensure timely protection of chicks from ORV/pedestrian impact, the increased monitoring and larger buffer/closure areas under alternative B would likely reduce any potential effects to negligible. As under alternative A, an alternate ORV/pedestrian access route would be provided to open areas beyond the closure, if possible. The ORV corridor would be reopened in recent or current nesting areas after chicks fledge. As under alternative A, no additional buffers or closures would be provided to foraging adult state-listed/special status species under alternative B.

Under alternative B, establishment of increased buffer zones around breeding/nesting/fledging areas for all nesting state-listed/special status species, implementation of stipulations for increasing buffer zones should there be a violation of these zones from ORV or pedestrian use, and posting of nests with symbolic fencing would provide some deterrent to the entry of people, pets, and ORVs into their habitats and greatly reduce the possibility of disturbance to species, including first time breeders, and habitat compared to alternative A.

By clearly defining triggers for closure establishment, increasing closures sizes and reducing the time it takes to implement closures to protect species, alternative B would provide more benefits to American oystercatchers and colonial waterbirds by reducing disturbance to potential and nesting pairs. If breeding behavior, including but not limited to territorial behavior, courtship, mating, confirmed scrapes, or other nest-building activities, is observed outside of existing closures, the NPS would automatically establish prescribed species-specific buffers, rather than providing flexible buffers based on observations of bird behavior as would occur under alternative A. If breeding behavior is observed, appropriate buffers would be established within eight daylight hours. If an active nest or chicks are discovered outside of an existing closure, protective measures would be established immediately and appropriate buffers would be established within six daylight hours. Symbolic fencing consisting of wooden post, bird usage signs, string, and flagging tape would be installed as soon as NPS staff can be reasonably mobilized to install the fencing.

With larger buffers and more timely closures for breeding/nesting/fledging areas under alternative B, impacts from closures/buffers under alternative B would be long-term minor adverse.

Wintering/Nonbreeding Management. Nonbreeding surveys for American oystercatchers, Wilson's plover, and red knots would be conducted according to the NPS SECN survey protocol, with no nonbreeding surveys for colonial waterbirds. These surveying activities would have minor impacts (due to human disturbance as discussed above) and long-term benefits related to the increase in knowledge about the species. Lack of nonbreeding surveys for colonial waterbirds would have long-term moderate adverse

impacts, as data would not be collected to assist in the determination of future management (nonbreeding) of these birds.

No nonbreeding closures would be established for state-listed/special status species, although these species could utilize the nonbreeding closures for piping plover that would include suitable interior habitats at spits and at Cape Point year-round. Being able to utilize other species closures would have some long-term benefits, as some protection is offered during this sensitive life stage. However, these closures would not be specific to the state-listed/special status species and would not include ocean beach habitat, resulting in some long-term minor adverse impacts. Wilson's plover would benefit from nonbreeding closures for piping plover as they utilize similar nonbreeding habitat.

Education and Outreach. Under alternative B and as described under alternative A, the public would continue to receive information at the visitor centers and ORV access points about state-listed/special status species and their ecology and the measures the Seashore is taking to protect the species. The public would also be informed through weekly Beach Access Reports, weekly Resource Management Reports, Google Earth, and information available on the Seashore's website. As with alternative A, public outreach as part of species management would have long-term beneficial impacts, with the expanded outreach having greater impacts than alternative A.

Overall Impact of Resources Management Activities. The overall impact of resources management activities (primarily resulting from the effects of surveying and field activities) for each species under alternative B would be as follows:

- American oystercatcher. Establishment of piping plover prenesting closures earlier in the season that could be used by oystercatchers and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, resources management activities on the whole would provide information and result in actions that would be beneficial to the species.
- Colonial waterbirds. Establishment of piping plover prenesting closures earlier in the season that would be used by some colonial waterbird species and establishment of larger, pre-set buffers would result in long-term beneficial impacts to colonial waterbirds. While there would still be minor adverse impacts related to human disturbance during field activities, resources management activities on the whole would provide information and result in actions that would be beneficial to the species.
- Wilson's plover. Establishment of piping plover prenesting closures earlier in the season that could be used by other species and establishment of larger, pre-set buffers for piping plover, used by Wilson's plover, would result in long-term beneficial impacts to Wilson's plover. While there would still be minor adverse impacts related to human disturbance during field activities, species surveying and field activities on the whole would provide information and result in actions that would be beneficial to the species.
- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. The red knot would benefit from extended breeding season closures for other species and from wintering closures for piping plover at the inlets and Cape Point, although benefits would be minimal as red knot prefer ocean beach habitat. Impacts to nonbreeding red knot would be long-term minor adverse as their prime foraging habitat (ocean shoreline) would not be afforded protection by nonbreeding closures.

ORV and Other Recreational Use

ORV and Pedestrian Access. Alternative B would designate the entire ocean beach of the Seashore as an ORV route or area. There would be no designated non-ORV areas, although temporary closures would occur for resource protection and safety reasons, and seasonal closures would occur in front of the villages. Alternative B would provide for closures of piping plover prenesting areas, which may benefit other species, as well as closures based on observations of breeding behavior, foraging, and chick movements. Under the consent decree, for the benefit of all bird species, from March 15 to November 30, in all locations not in front of villages, outside of the prenesting areas, and open to ORV use, the NPS would provide an ORV-free zone in the ocean backshore at least 10 meters wide and running the length of the site, wherever backshore habitat exists, provided there is sufficient beach width to allow an ORV corridor at least 20 meters above the mean high tide line. This zone shall be adjacent to the toe of the primary dune whenever a primary dune exists (i.e., ORVs should be restricted to a corridor between the mean high tide line and the edge of the zone of the protected backshore).

Under alternative B and as described in the previous section, staff would monitor shorebird breeding habitat for signs of breeding behavior and human disturbance and to ensure the timely installation of resource closures and the adequacy of prescribed buffers. Resource protection areas would not be adjusted to accommodate ORV use. Based on the size of the prescribed buffers, the ORV corridor is likely to be closed at any location in which breeding activity is observed.

Recreation and commercial fishing use under the restrictions defined in alternative B would greatly reduce the proximity of ORVs, essential vehicles (for safety, enforcement, etc.), pedestrian, pets, and other recreation activities to state-listed/special status species and their habitat compared to alternative A. It is likely that outside of existing resource protection closures, some species could still be disturbed, albeit briefly, until NPS monitoring detects the breeding activity and establishes the prescribed buffers. Even after closures have been established, American oystercatchers could leave the closures to forage and during this time would not be protected from disturbance. Compliance with closures may not be absolute, resulting in minor to possibly moderate adverse impacts if non-compliance occurs. Disturbance during the most critical periods of reproduction and within key habitats could occur, resulting in direct mortality, abandonment or loss of habitat, if closure compliance is lacking and/or if the breach of the closure occurs in the earlier life stages, even with the measures to increase buffers when a violation of the closure occurs.

Under alternative B, as described under alternative A, there would be no year-round or seasonal closures specifically to protect key red knot habitat. Recreation and commercial fishing activities that occur in the months when red knots are in residence on beaches in the Seashore have the potential to impact resting and foraging red knots from vehicle use and associated noise and presence of people and pets. Of particular concern is when these disturbance factors result in red knots being forced to fly while they are foraging. Frequent escape flights means that time spent foraging is reduced and replaced by an increase in time spent flying, resulting in the chance that birds would not be able to add the body fat they need for their long-distance migration. Impacts to red knots would be long-term minor to moderate adverse.

Night-Driving Restrictions. Under alternative B, all recreational ORV traffic would be prohibited in the ocean intertidal zone, ocean backshore, and dunes, from 10:00 p.m. until 6:00 a.m. between May 1 and September 15. However, from September 16 to November 15, night-driving permits would be available for authorized nonessential driving between the hours of 10:00 p.m. and 6:00 a.m. The permit would contain restrictions on light use during the September 16 to November 15 permitted night-driving period. Furthermore, the NPS retains the discretion to limit night driving to certain areas or routes, based on resource protection considerations. American oystercatchers, Wilson's plover, and red knot are known to be active at night (Simons and Schulte 2008; Morrier and McNeil 1991; Niles et al. 2007) and would be subject to disturbance from vehicular and pedestrian disturbance. This disturbance can impact their

foraging behavior and has been shown to result in disorientation and even abandonment of American oystercatcher chicks (Simons and Schulte 2008). Restrictions on night driving under alternative B would provide long-term benefits to state-listed/special status species; however, night driving could still result in long-term minor adverse impacts during the time when night driving is allowed by permit. Further, night-driving restrictions that begin after dark, in this case 10:00 p.m., do not offer full nighttime protection to the species.

Commercial Fishing. Commercial fishing restrictions under alternative B would be similar to those under alternative A, with those holding commercial fishing permits restricted from night driving from 10:00 p.m. until 5:00 a.m. (as opposed to 6:00 a.m. for recreational users) from May 1 to September 15. As with recreational users, commercial fishing permit holders can get a permit for night driving from September 16 to November 15. Presence of commercial fishing operations would have a long-term negligible adverse impact, with beneficial impacts from night-driving restrictions.

Permit/Carrying Capacity Requirements. As described above, alternative B would require a fall seasonal night-driving permit, although the educational information provided by the permit would not be relevant to bird species, which would limit the beneficial impacts of this requirement. Given the lack of prenesting closures for these species outside of the piping plover prenesting closures, with more immediate, larger buffers and longer lasting closures once breeding behavior is observed, the lack of a carrying capacity would have long-term minor adverse impacts to most state-listed/special status species that nest on Seashore beaches, as unrestricted numbers of ORVs would be allowed in recent breeding areas prior to the implementation of resource closures increasing the potential for disturbance. For American oystercatchers that regularly forage on the ocean shoreline and on the soundside outside of resource closures, there would be the potential for long-term minor to moderate adverse impacts as they forage in areas used by ORVs, as described under alternative A.

Pet/Other Recreational Activity Restrictions. Alternative B would have the same restrictions on camping, beach fires, and pets as under alternative A, with the addition of no ORV use from 10:00 p.m. to 6:00 a.m. during May 1 to September 15, resulting in benefits to state-listed/special status species. As with alternative A, there is the potential for non-compliance with pet regulations that would be mitigated by the prohibition of pets from the landward side of the posts delineating the ORV corridor at the spits and Cape Point, the prohibition of pets within symbolic fencing around any bird closure area, and through education and outreach efforts via the Seashore field personnel and partnerships with local volunteers and organizations, and would result in long-term minor adverse impacts, due to non-compliance.

Overall Impact of ORV and Other Recreational Use. The overall impact of ORV and other recreational use for each species under alternative B would be as follows:

- American oystercatcher. Establishment of prenesting closures for piping plover earlier in the season, implementation of larger, more immediate buffers, longer lasting closures for American oystercatchers once breeding behavior occurs, and night-driving restrictions would benefit the American oystercatcher. However, recreational use, with no carrying capacity, would still occur in the vicinity of this species and the established buffers may not be large enough to afford adequate protection. Because the birds would not be under constant observation, disturbance may go undetected and implementation of adequate buffers may be delayed in some nesting locations. Compliance with closures may not be absolute, resulting in minor to moderate adverse impacts if non-compliance occurs. Further adverse impacts would result from allowing pets in the Seashore during breeding season, resulting in the possibility of non-compliance with these regulations. Because of these factors, impacts to American oystercatchers from ORV use and other recreational activities would be long-term moderate adverse.

- Colonial waterbirds. Impacts to colonial waterbirds from ORV and other recreational use would be long-term moderate adverse, for the same reasons as American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term minor to moderate adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Impacts to red knots from ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species especially during a key life stage of wintering. Although this species may benefit from longer lasting breeding season closures for other species and from winter closures established for piping plovers, the lack of designated non-ORV areas, a year-round permitting system, no night-driving restrictions when red knots are at the Seashore, and allowing pets at the Seashore during the migrating/nonbreeding season would contribute to these adverse impacts.

Cumulative Impacts. Cumulative actions and their associated impacts under alternative B would be the same as those described under alternative A. Although alternative B does provide greater protection that would be beneficial to state-listed / special status bird species, the adverse effects on birds from other actions occurring in the region would still exist. The overall combined impacts of these past, current, and future actions would be long-term minor to moderate adverse. These impacts, combined with the long-term moderate adverse impacts under alternative B, would result in long-term moderate adverse cumulative impacts.

Conclusion. The overall impact to each state-listed and special status species under alternative B would be:

- American oystercatcher. While there would still be minor adverse impacts related to human disturbance during species surveying and field activities, on the whole these activities would provide information and result in actions that would be beneficial to the species. Establishment of prenesting closures for piping plover earlier in the season, implementation of larger more immediate buffers and longer lasting closures for American oystercatchers once breeding behavior occurs, and night-driving restrictions would result in long-term benefits for this species. Recreational use, with the lack of designated non-ORV areas, year-round permits, or carrying capacity requirements, would still occur in the vicinity of this species. Because the birds would not be under constant observation, disturbance may go undetected and implementation of adequate buffers may be delayed in some nesting locations. Compliance with closures may not be absolute, resulting in minor to possibly moderate adverse impacts if non-compliance occurs. Further adverse impacts would result from allowing pets in the Seashore during breeding season, resulting in the possibility of non-compliance with these regulations. Because of these factors, impacts to American oystercatchers from recreation and other activities would be long-term moderate adverse.
- Colonial waterbirds. Impacts and benefits of surveying and field activities, and impacts of recreation and other activities, would be the same as described for American oystercatchers above for the same reasons. Because of these factors, impacts to colonial waterbirds could be long-term moderate adverse.
- Wilson's plover. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover and would therefore be provided slightly more protection than other state-listed/special status species.

Impacts to Wilson's plover from recreation and other activities would be long-term minor to moderate adverse.

- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. The red knot would benefit from extended breeding season closures for other species and from wintering closures for piping plover at the inlets and Cape Point, although benefits would be minimal as red knot prefer ocean beach habitat. Impacts to nonbreeding red knot would be long-term minor adverse as their prime foraging habitat (ocean shoreline) would not be afforded protection by nonbreeding closures. Impacts of ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species especially during a key life stage of wintering, increasing the possibility of disturbance to the species from recreational use. The lack of designated non-ORV areas, allowing night driving during the time period when red knot are present at the Seashore, and allowing ORVs, people, and pets at the Seashore during the nonbreeding season in the vicinity of this species would contribute to adverse impacts.

Cumulative impacts under alternative B would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative B would not impair state-listed and special status species because although frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding or reproduction, and impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Under alternative B, prenesting closures would not be installed for the state-listed and special status species (American oystercatcher, Wilson's plover, and the colonial waterbird species [common tern, least tern, gull-billed tern, and black skimmer]) that nest in the Seashore. Red knot do not breed in the Seashore and would not be affected by management during the breeding season. No specific management for red knot during the nonbreeding season (when they are present in the Seashore) would be provided under alternative B.

Piping plover prenesting closures would be established by March 15 in suitable habitat in areas used by piping plover during the past three breeding seasons or in new piping plover habitat identified during the annual habitat assessment. These piping plover closures would be used by Wilson's plover, which nest in similar habitat and around the same time as piping plover. Wilson's plover are subject to the same disturbance factors as piping plover including beachgoers, pets, and ORV traffic on beaches. Wilson's plover leave their nests when disturbed and are extremely reluctant to return when intruders are anywhere nearby, a practice that exposes eggs to predation and overheating. Under alternative B, the implementation of prenesting closures for piping plover at the inlets, Cape Point, and South Beach, and the ocean backshore closures at other locations by March 15 would be early enough in the breeding season that it would be beneficial to early nesting American oystercatchers, as well as to other species that typically nest later. Because there are no specific prenesting closures for state-listed and special status species, apart from the piping plover prenesting areas, many areas that had been used for nesting in the past three years would not be protected until breeding activity is observed. Surveying and monitoring for state-listed and special status species would occur as described for alternative A. In addition, under alternative B, Cape Point and South Beach, Hatteras Inlet Spit, and the northern and southern ends of Ocracoke would be surveyed at least once every two days from March 15 to April 15 and daily from April 16 to July 15. Seashore staff would monitor Bodie Island Spit at least daily from March 15 to July 15.

American oystercatchers may also nest in piping plover prenesting closures in addition to nesting in other locations in the Seashore. In these other locations they would not be protected by prenesting closures from disturbance by ORVs and other recreational activities during a period when they are particularly sensitive to disturbance. Also, oystercatchers may begin breeding activities in mid-February or early March before the piping plover prenesting closures are established. Hence, a March 15 start to management could mean that early nesting American oystercatchers, especially those that establish territories outside of recently used nesting areas, would not be fully protected under alternative B.

Under alternative B, if breeding behavior is observed outside of existing closures, Seashore staff would automatically establish prescribed species-specific buffers, rather than providing flexible buffers based on observations of bird behavior. The Seashore staff would establish the prescribed buffers as quickly as possible, but always within eight daylight hours.

Under alternative B, there would still be disturbance to state-listed/special status species prior to the detection of breeding activity by Seashore staff, although to a much lesser extent than under alternative A. Establishing increased buffer zones for all nesting state-listed/special status species, providing stipulations for increasing buffer zones should there be a violation of these zones, and posting nests with symbolic fencing would help deter the entry of people, pets, and ORVs into their habitats and greatly reduce the possibility of disturbance to species.

When resource closures using the prescribed buffers are created around nests under alternative B, the closures would not be reduced to accommodate an ORV corridor.

Although the entire ocean beach would continue to be considered an ORV route, alternative B would prohibit recreational ORV use between the hours of 10:00 p.m. and 6:00 a.m. between May 1 and September 15. From September 16 through November 15, night driving would be allowed by permit only. American oystercatchers, Wilson's plover, and red knot are known to be active at night and would be subject to vehicular and pedestrian disturbance, which could result from recreational access to beaches between dusk and 10:00 p.m. This disturbance can affect their foraging behavior and has been shown to result in disorientation and even abandonment of oystercatcher chicks. Allowing some night driving during critical periods of reproduction may result in harassment, injury, or mortality to one or more individuals of these night foraging species. Under alternative B, ORVs would bring people into the vicinity of breeding areas used by state-listed and special status species, where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to adversely affect the reproductive success of shorebirds at the Seashore. The indirect impacts of attracting predators would be detectable and beyond the level of harm that can occur naturally, but are not expected to result in large declines in population because the Seashore takes management action to protect state-listed species from predation.

Nonbreeding closures would not be established for state-listed or special status species, although these species could use the interior habitat at spits and at Cape Point that would be closed to ORV and other recreational use for piping plover during the nonbreeding season, resulting in year-round protected interior habitat in these areas for all species. No areas of shoreline would be protected for nonbreeding shorebird foraging under alternative B. Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Under alternative B, pets would be allowed on the beach year-round at the Seashore, but prohibited from the landward side of the posts delineating the ORV corridor at the spits and Cape Point and inside bird closures. Because some visitors do not keep their pets restrained on a 6-foot or shorter leash or crated as

required, allowing pets in the vicinity of resource closures could result in harassment, injury, or mortality to one or more individuals.

The plan/EIS analysis evaluated impacts from ORV and other recreational use and from lack of specific management measures on state-listed and special status species, such as prenesting closures, winter foraging closures on the shoreline, lack of designated non-ORV areas, and night-driving restrictions that do not begin until 10:00 p.m. Overall, the impacts were deemed by the plan/EIS impact analysis to be moderate adverse because impacts on these species or their habitats would be expected to be outside the level that occurs naturally and small changes to local population numbers, population structure, and other demographic factors may occur. Some impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals. However, implementation of alternative B would not cause large declines in population numbers. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

From 1999 to 2009, the oystercatcher population at the Seashore experienced declines in numbers from 41 to 23 pairs. The population stabilized at 23 pairs from 2006 through 2009, including the 2008 and 2009 breeding seasons when management under alternative B was implemented at the Seashore. Unfortunately, the colonial waterbird data for the Seashore are not sufficient to support a recent trend analysis for management under the no-action alternatives. Survey methodology varied over the years, including among the recent annual surveys. For example, the Seashore's 2008 annual report for colonial waterbirds notes that an important factor to recognize when comparing the 2008 breeding season to previous seasons is that more emphasis was placed on collecting colonial waterbird data in 2008. Due to staffing levels in 2008, it was possible to spend more time monitoring the waterbird colonies. Colonies could be surveyed on foot at least once a week by small groups of bio-technicians. These surveys produced relatively reliable nest and chick counts. In previous years, colonies were rarely walked through and were usually surveyed by one bio-technician telescoping the colony of birds. Because of the differences in survey techniques, it is difficult to accurately compare 2008 and 2009 data with previous years' data. Additionally, one overview of the status of gull-billed terns commented on the lack of population data for the species and noted that counts from single colonies or even single regions may be impossible to interpret in isolation. (<http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Gelochelidon+nilotica>). In the 2009 survey, 0 gull-billed tern nests, 53 common tern nests, 577 least tern nests, and 61 black skimmer nests were documented at the Seashore. Overall, colonial waterbird populations were higher during the 2009 season than they were during the 2008 season, with a total of 691 birds in 2009, and 255 birds counted in 2008. However, for the reasons explained above, an adequate comparison to older data may not be valid.

Although Wilson's plovers are often seen by Seashore staff during their observations of piping plovers, no indications of nesting had been documented until 2009. There are no data on reproductive success of Wilson's plovers at the seashore. Resources management staff at the Seashore has not yet begun surveying the entire Seashore for red knots, which are known to use areas outside the points and spits.

The analysis in the plan/EIS of cumulative impacts combined the effects of alternative B with effects of other past, present, and future planned actions in and around the Seashore, such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the Seashore, commercial fish harvesting, and increased interpretative programs as part of the Seashore's long-range interpretive plan. The plan/EIS impact analysis deemed the cumulative impacts to be minor to moderate adverse because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the state-listed and special status species impacts would not result in impairment.

Impacts of Alternative C: Seasonal Management

Resources Management Activities

Establishment of Prenesting Closures. Under alternative C, the NPS would establish SMAs based on an annual habitat assessment for management of all breeding shorebirds and subject to periodic review. Each SMA would be under ML1 or ML2 management procedures, as described in table 10 (chapter 2). All breeding shorebird SMAs would be posted as prenesting closures using symbolic fencing by March 15 at sites involving American oystercatchers and Wilson's plover and by April 15 at sites involving colonial waterbirds. If multiple species exist on each site, closures would begin on the earliest date. Proactive closures of these areas would provide long-term beneficial impacts to state-listed/special status species, greater than those under alternatives A and B, which do not offer this wide a range of protection.

Surveying and Monitoring. Surveys of prenesting closures for all state-listed/special status species would occur three times per week. Surveys for American oystercatchers and Wilson's plover would begin on March 15 and surveys for colonial waterbirds would begin on May 1. Surveys for suitable habitat outside of SMAs would also occur three times per week once breeding pairs are present.

The NPS would conduct nest surveys from a distance for American oystercatchers and Wilson's plover at least three times per week in areas managed under ML1 procedures. Colonial waterbirds in areas with ML1 procedures would be observed at least three times per week from a distance that does not disturb the birds. Nest count estimates would be conducted during the peak nesting period for each species, which generally is during the last week of May and the first week of June, but could be later, especially for black skimmers. For all species that have incubating birds that cannot be observed from a distance, continuation of incubation and/or status of the colony would be determined on a weekly basis (or as staff is available). The NPS would observe nests under ML2 procedures daily from a distance as long as this can be performed without disturbing the colony or incubating bird. For incubating birds that cannot be observed from a distance, nests/colonies would be checked every three days with minimum disturbance to the incubating bird and/or colony. Colonial waterbird colonies would be surveyed for hatching (approximately 21 days after initial nest observations).

For unfledged chicks, the NPS would survey broods and colonies every other day under ML1 procedures. Under ML2 procedures, American oystercatcher, Wilson's plover, and colonial waterbird chicks would be observed once daily. For American oystercatchers and Wilson's plover, observation ends once chicks have fledged. For colonial waterbirds, a survey would be conducted during peak fledge (approximately 20 days after hatch counts). Observations would end after no unfledged chicks have been observed on three consecutive surveys.

Under alternative C, surveys would concentrate in established SMAs, which may not detect American oystercatchers or colonial waterbirds that establish territories in new habitat. However, surveying under alternative C would increase knowledge on how and when special status/state-listed species use the Seashore and enable adaptive management initiatives, which would contribute to better management.

Prenesting surveys under alternative C would not be as frequent as those under alternatives A and B; however, due to the designation of SMAs and suitable habitat surveys outside of SMAs, effects of survey times to implement closures would be the same. Under alternative C, under ML1 procedures less monitoring of nests would occur; however there would be no ORV or pedestrian access allowed. Under ML2 procedures, birds would be monitored more frequently (the same as nesting areas under alternatives A and B) due to the presence of an ORV and/or pedestrian corridor. Alternative C would likely have long-term minor adverse impact on nesting state-listed/special status species from survey time and frequencies during the prenesting and nesting season at the Seashore, with overall long-term beneficial

impacts from the species protection measures that result from surveying activities. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse.

Establishment of Buffers/Closures. Under alternative C, as described under alternative B, closure of prenesting areas by March 15 (in most cases) and/or April 15 for colonial waterbirds would have a more beneficial effect due to closures occurring earlier, ensuring a reduction of disturbance for colonial waterbirds during breeding (courtship, mating, scrapes, etc.). As described above, under alternative C SMAs would be established and managed under ML1 or ML2 procedures. ML1 procedures would not allow ORV or pedestrian access when prenesting closures are in effect. ML2 procedures (Bodie Island Spit, Cape Point, and South Point) would establish a narrow pedestrian access corridor. Upon first observation of breeding activity, the standard buffers would apply, which depending on the circumstances may close the access corridor. Pets, kite flying, ball and Frisbee tossing, or similar activities would be prohibited in access corridors while prenesting closures are in effect. If no breeding activity is observed in SMAs by July 31, or two weeks after all chicks have fledged (whichever is later), prenesting closures would be adjusted to the configurations of Nonbreeding Shorebird SMAs (established from annual monitoring of presence, abundance, and behavior of migrating and wintering shorebirds from July through May).

Under alternative C, a total of seven SMAs would be closed to ORV and pedestrian access and managed under ML1 procedures from March 15 through October 14 due to multiple species closures. A total of three SMAs would be managed under ML2 procedures and would be closed to ORV use from March 15 through October 14, but would provide a pedestrian access corridor generally below the high tide line and no greater than 10 meters (30 feet) above the high tide line. Buffers would be applied to courtship/mating, nesting, and unfledged chick activities both within and outside of designated SMAs. All SMAs would maintain a 300-meter (900-foot) buffer during all activities for all state-listed / special status bird species. ML2 buffer areas would vary by species and activity. ML2 procedures for American oystercatchers would establish 150-meter (450-foot) buffers for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. Under ML2 procedures, buffers for least terns, a colonial waterbird, would be 100 meters (300 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. All other colonial waterbird buffers under ML2 procedures would be 200 meters (600 feet) for breeding, nesting, and unfledged chick activities. For areas where breeding activity is observed outside of prenesting areas, ML1 procedures would determine the buffers. For alternative C, buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer for the particular management level (ML1 or ML2). Under alternative C, as described under alternative B, if NPS staff observe disturbance from ORVs and/or pedestrians, buffers would be expanded in 50-meter (150-foot) increments until no disturbance occurs. Under alternative C, for all species buffers/closures, vehicles and/or pedestrians may be allowed to pass through portions of the buffer or closures that are considered inaccessible to chicks because of steep topography, dense vegetation, or other naturally occurring obstacles. Establishment of SMAs and implementation of larger buffer sizes would have long-term beneficial impacts to state-listed and special status species.

Under alternative C, as described under alternatives A and B, observations of chick movements may not be sufficient to adjust buffers such that they ensure protecting chicks from ORV/pedestrian impact; however, increased larger buffer/closure areas under alternative C would likely reduce any potential effects to negligible. As described under alternatives A and B, no additional buffers or closures would be provided to foraging adult state-listed/special status species under alternative C, although species would likely indirectly benefit from the protections provided to piping plover foraging habitat.

Under alternative C, establishment of SMAs with ML1 and ML2 procedures, increased buffer zones around breeding/nesting/fledging areas for all nesting state-listed/special status species, and posting of nests with symbolic fencing would not only eliminate ORV and pedestrian use in multiple high use bird areas, but also provide a major deterrent to the entry of people, pets, and ORVs into habitats and greatly reduce the possibility of disturbance to species, including first time breeders, and habitat compared to alternatives A and B.

Under alternative C, as described under alternatives A and B, oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Cohen et al. in press). Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas would not be fully protected under alternative C.

Under alternative C, prenesting closures in SMAs would provide buffers around courting oystercatchers, Wilson's plover, and colonial waterbirds, which could have a beneficial effect. Under ML1, areas as closed to ORV and pedestrian access would reduce potential effects of bringing people, essential vehicles, and equipment into direct contact with state-listed/special status species and their habitat when compared to management under alternatives A and B. Under ML2 procedures, management of these areas would also reduce potential effects of vehicle collisions and disturbance by closing areas to ORV use; however, allowing a pedestrian corridor through the area combined with a reduction in buffer size for breeding, nesting, and unfledged chick activities would still bring people into direct contact with species.

With the designated SMA closures, ML1 and ML2 procedures and associated buffers for breeding/nesting/fledging areas, impacts from closures/buffers under alternative C would be long-term minor adverse.

Wintering/Nonbreeding Management. Nonbreeding surveys for American oystercatchers, Wilson's plover and red knots, would be conducted according to the NPS SECN survey protocol, although unlike alternatives A and B, surveys for some colonial waterbirds would be included. These surveying activities would have minor impacts (due to human disturbance as discussed above) and long-term benefits related to the increase in knowledge about the species.

Under alternative C, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species compared to alternatives A and B, which do not have provisions to protect these nonbreeding species. Overall, management of species during nonbreeding would result in long-term beneficial impacts.

Education and Outreach. Under alternative C and as described under alternative B (including weekly resource and access reports, information on the Seashore website, and use of Google Earth), the public would continue to receive information at the visitor centers about state-listed/special status species and their ecology and the measures the Seashore is taking to protect the species. In addition, the public would be provided education through the required ORV use permit and protected species information would be provided at all access points. As with alternative A, public outreach as part of species management would have long-term beneficial impacts, with the expanded outreach having greater impacts than alternative A.

Overall Impact of Resources Management Activities. The overall impact of resources management activities (primarily resulting from the effects of surveying and field activities) for each species under alternative C would be as follows:

- American oystercatcher. Implementation of 10 SMAs that are closed to ORVs during the breeding season would provide a proactive resource closure early in the breeding season. Establishment of prenesting closures earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, on the whole, resources management activities would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to the American oystercatcher, greater than those provided under alternative B.
- Colonial waterbirds. Impacts to colonial waterbirds from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.
- Wilson's plover. Impacts to Wilson's plover from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.
- Red knot. Nonbreeding shorebird SMAs and the establishment of non-ORV areas along the ocean shoreline would result in beneficial impacts to nonbreeding red knots. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed to ORVs year-round, would be beneficial to those red knot that happen to use those areas, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative C, approximately 27 miles of shoreline would be designated for ORV use year-round; approximately 29 miles would be designated for seasonal ORV use from October 15 through March 14; and approximately 12 miles would be designated as non-ORV year-round. The speed limit would be 15 mph unless otherwise posted and permits would be required for all ORVs. Three SMAs managed under ML2 procedures would maintain an open pedestrian access corridor, subject to resource closures, along the shoreline to the inlet or point.

The seasonal restrictions under alternative C would reduce the potential of disturbance and nest abandonment from direct short-term contact with people and/or essential vehicles compared to alternatives A and B, which would result in a beneficial impact. Although these measures should limit adverse impacts to state-listed/special status species, compliance with closures may not be absolute, since alternative C still includes pedestrian access to the three major points and spits during the summer season, and the areas that are closed to ORV over the rest of the Seashore are not expansive or contiguous. This could result in short-term minor to moderate adverse impacts if non-compliance occurs, but for the most part the populations would remain functional, and impacts limited to minor adverse by the restrictions extending through October 14 in all SMAs. Under alternative C, there would be seasonal ORV closures and recreational restrictions in key red knot habitat reducing the potential to impact resting and foraging red knots from vehicle use and associated noise and presence of people and pets.

Night-Driving Restrictions. Under alternative C, all nonessential ORV traffic would be prohibited from all areas (other than the soundside) between 7:00 p.m. to 7:00 a.m. from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles holding a valid ORV permit. Furthermore, the NPS retains the discretion to limit night driving to certain areas or routes, based on resource protection considerations. Because these species are known to be active at night (Staine and Burger 1994; Majka and Shaffer 2008), chick and fledgling response to vehicles can increase their vulnerability to ORVs (USFWS 1996a), the high level of protection at night from May 1 to November 15 under alternative C would result in long-term beneficial impacts because it would reduce the potential for disturbance to birds that could result in mortality, and would be more beneficial than alternative B because the restrictions start before dark.

Commercial Fishing. Management of commercial fishing vehicles would be the same as under alternative A and would be managed by the terms and conditions in the commercial fishing special use permit, which include restriction from entering resource closures. Commercial fisherman would not be required to obtain an ORV permit, but would be regulated under their existing commercial fishing special use permit. Under alternative C, commercial fishing vehicles would be authorized to enter non-ORV areas except for full resource closures and lifeguarded beaches. Night-driving restrictions, which are applicable to all ORV use, could be slightly modified outside of existing resource closures for commercial fishing uses. Presence of commercial fishing operations would have a long-term negligible adverse impact on state-listed/special status species, with long-term minor to moderate benefits from night-driving restrictions.

Permit/Carrying Capacity. As described above under the night-driving restrictions and education/outreach sections, alternative C would require a permit for ORV use, which would include seasonal restrictions on night driving. As stated in these sections, the educational information provided by the required permit would result in benefits to state-listed/sensitive species as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance with these restrictions. There would be no impacts related to the implementation of a carrying capacity requirement under alternative C, as ORVs would not be permitted in resource protection areas.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all designated Breeding Shorebird SMAs from March 15 to October 15 and within all Nonbreeding Shorebird SMAs that are otherwise open to recreational use. However, compliance would be needed to ensure that this reduces the risks of impacts. In addition, an educational permit would be required for any beach fire year-round, which would inform visitors about species protection issues related to this recreational use. Camping restrictions would be the same as alternative A, with additional requirements for removing beach equipment. These restrictions would result in long-term benefits to species at the Seashore, further reducing pressure to state-listed/special status species from recreational activity.

Overall Impact of ORV and Other Recreational Use. The overall impact of ORV and other recreational use for each species under alternative C would be as follows:

- American oystercatchers. Implementation of a permit system with an educational component, larger buffer sizes, seasonal night-driving restrictions, establishment of breeding and nonbreeding SMAs, and not allowing pets in SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special status species. However, alternative C does manage three SMAs under ML2 procedures, which provide for some level of pedestrian access into these areas and introduces the potential for impacts to the species. Although there would be some protection measures in place, ORV and other recreational use could still have impacts to the species, resulting in long-term minor to moderate adverse to American oystercatchers.

- Colonial waterbirds. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse, less than those under alternative A and B. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize the closures for piping plover, in addition to the specific buffers/closures provided for the species, and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative C that offer this wintering species further protection.

Cumulative Impacts. Cumulative actions and their associated impacts under alternative C would be the same as those described under alternatives A and B (long-term minor to moderate adverse). Although alternative C provides additional protection that would be beneficial to state-listed / special status bird species, the adverse effects on birds from other actions occurring in the region would still exist. The impact of these past, current, and reasonably foreseeable future actions, when combined with the long-term beneficial and long-term minor to moderate adverse impacts of alternative C, would result in long-term minor to moderate adverse cumulative impacts.

Conclusion. The overall impacts to state-listed/special status species under alternative C would be as follows:

- American oystercatcher. Establishment of prenesting closures earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, species surveying and field activities on the whole would provide information and result in actions that would be beneficial to the species. Implementation of SMAs that provide a proactive resource closure early in the breeding season, a permit system with an educational component, establishment of nonbreeding SMAs, seasonal night-driving restrictions, as well as larger buffer sizes and earlier prenesting closures, would provide long-term beneficial impacts to American oystercatchers, greater than those under alternative B. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special status species. However, alternative C does manage three SMAs under ML2 procedures, which provides for some level of pedestrian access into these areas, which introduces the potential for impacts to the species. Although there would be some protection measures in place, ORV and other recreational use could still have long-term minor to moderate adverse impacts to American oystercatchers.
- Colonial waterbirds. Impacts to colonial waterbirds from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as discussed for American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for the American oystercatcher, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American

oystercatchers and colonial waterbirds, it also tends to utilize the closures for piping plover, in addition to the specific buffers/closures provided for the species, and would therefore be provided slightly more protection than other state-listed/special status species.

- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would be beneficial, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B. Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative C that offer this wintering species further protection.

Cumulative impacts under alternative C would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative C would not impair state-listed and special status species because although frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding or reproduction, and impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

Under alternative C, the Seashore would establish SMAs that proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. Establishing SMAs is unlike the no-action alternatives, which do not provide specific protection for state-listed /special status species early in the breeding season or in the nonbreeding season. Under alternative C, ORVs would be prohibited in SMAs between March 15 and October 14. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. SMAs at Bodie Island Spit, Cape Point, and South Point would be closed to ORVs with a narrow pedestrian access corridor. The remaining SMAs and areas outside of SMAs would not allow ORV or pedestrian access while prenesting closures are in effect. Pets would be prohibited within all designated Breeding Shorebird SMAs from March 15 to October 15. Pets would be prohibited within all Nonbreeding Shorebird SMAs that are otherwise open to recreational use.

From March 15 to July 15, Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting closures two times per week, increasing to three times per week once birds are present. All breeding shorebird SMAs would be posted as prenesting closures using symbolic fencing by March 15 at sites involving American oystercatchers and Wilson's plover, and by April 15 at sites involving colonial waterbirds. If multiple species exist on each site, closures would begin on the earlier date.

Prenesting surveys under alternative C would not be as frequent as those under alternatives A and B. However, due to the designation of SMAs and suitable habitat surveys outside of SMAs, effects of survey times to implement closures would be the same. Each SMA would be under ML1 or ML2 management procedures. Under alternative C, ML1 procedures would require less monitoring of nests; however, there would be no ORV or pedestrian access allowed. Under ML2 procedures, birds would be monitored more frequently (the same as nesting areas under alternatives A and B) due to the presence of an ORV and/or pedestrian corridor.

American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time. Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas, would not be fully protected under alternative C.

Buffers would be applied both within and outside of designated SMAs. All SMAs would maintain a 300-meter (900-foot) buffer during all breeding activities for all state-listed/special status bird species. ML2 buffer areas would vary by species and activity. ML2 procedures for American oystercatchers would establish 150-meter (450-foot) buffers for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. Under ML2, buffers for least terns would be 100 meters (300 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. All other colonial waterbird buffers under ML2 procedures would be 200 meters (600 feet) for breeding, nesting, and unfledged chick activities. For areas where breeding activity is observed outside of prenesting areas, ML1 procedures would determine the buffers. For alternative C, buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer for the particular management level (ML1 or ML2).

Under alternative C, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, Seashore staff would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species. Effects from commercial fishing would not be observable or measurable and would be within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Under alternative C, all nonessential ORV traffic would be prohibited from all areas (other than the sound side) between 7:00 p.m. to 7:00 a.m. from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles holding a valid ORV permit.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. However, alternative C would require a permit for ORV use, which includes an educational component. Because ORV users would be more aware of the regulations in place to protect state-listed/special status species, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Violations may result in permit revocation, which is expected to increase compliance. Under alternative C, ORVs would bring people into the vicinity of shorebirds where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of shorebirds; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance or harm that would occur naturally, but is not expected to result in large declines in population because the Seashore takes management action to protect state-listed species from predation.

Implementation of SMAs that provide a proactive resource closure early in the breeding season, a permit system with an educational component, establishment of nonbreeding SMAs, seasonal night-driving restrictions beginning at 7:00 p.m., as well as larger buffer sizes and earlier prenesting closures, would

limit the potential for impacts to state-listed/special status species. However, alternative C does manage three SMAs under ML2 procedures, which provides for some level of pedestrian access into these areas, introducing the potential for adverse impacts to state-listed/special status species.

The impact analysis of alternative C deemed adverse impacts to state-listed/special status species from ORV and other recreational use to be minor to moderate because impacts would be detectable, and could be beyond the level of disturbance or harm that would occur naturally. Although some impacts might occur during critical reproductive periods or in key habitats in the Seashore and could result in injury or mortality, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

The analysis in the plan/EIS of cumulative impacts combined the effects of alternative C with effects of other past, present, and future planned actions in and around the Seashore including major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the Seashore, commercial fish harvesting, and increased interpretative programs as part of the Seashore's long-range interpretive plan. The plan/EIS impact analysis deemed the cumulative impacts to be minor to moderate adverse because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the state-listed and special status species impacts would not result in impairment.

Impacts of Alternative D: Increased Predictability and Simplified Management

Resources Management Activities

Establishment of Prenesting Closures. Under alternative D, as described under alternative C, the NPS would establish SMAs based on an annual habitat assessment for management of all breeding shorebirds and subject to periodic review. All SMAs under alternative D would be managed under ML1 procedures during the breeding season (areas of larger, longer lasting buffers with less monitoring and closures to all ORV and pedestrian access) and would be closed year-round to ORV use. Under alternative D, breeding season closures of SMAs and the year-round prohibition of ORV in SMAs would have a long-term beneficial effect on all state-listed/special status species due to continual protection of all activities associated with shorebirds at the Seashore (breeding and nonbreeding) from ORV disturbance, and protection from pedestrian disturbance during the prenesting period. Establishment of these SMAs would have long-term beneficial impacts, which would be greater than those under alternatives A, B, or C, because of the size and duration of the closures, particularly when considering the year-round prohibition of ORV in these areas.

Surveying and Monitoring. Surveys of prenesting closures for all state-listed/special status species would occur three times per week. Surveys for American oystercatchers and Wilson's plovers would begin on March 15 and surveys for colonial waterbirds would begin on May 1. Surveys for suitable habitat outside of SMAs would also occur three times per week once breeding pairs are present.

Under ML1 procedures at all locations, the NPS would conduct nest surveys from a distance for American oystercatchers and Wilson's plover at least 3 times per week. Colonial waterbirds would also be observed at least three times per week from a distance that does not disturb the birds. Nest count estimates would be conducted during the peak nesting period for each species, which generally is during the last week of May and the first week of June, but could be later, especially for black skimmers. For all species that have incubating birds that cannot be observed from a distance, nest checks would occur on a weekly basis (or as staff is available). Colonial waterbird colonies would be surveyed for hatching (approximately 21 days after initial nest observations).

For unfledged chicks, the NPS would survey broods and colonies every other day. For American oystercatchers and Wilson's plover, observations end once chicks have fledged. For colonial waterbirds, a survey would be conducted during peak fledge (approximately 20 days after hatch counts). Observations would end after no unfledged chicks have been observed on three consecutive surveys. Under alternative D, as described under alternative C, surveys would concentrate in established SMAs, which may not detect American oystercatchers or colonial waterbirds that establish territories in new habitat.

Although surveying would provide substantial benefits to the species from data collected, surveying would bring people and/or essential vehicles into direct short-term contact with state-listed/special status species and their habitat, as described under alternative A. Therefore, under alternative D, species surveying could likely have long-term minor adverse impacts, from the introduction of human disturbance during these activities but overall surveying would provide long-term benefits to the species as it would allow the Seashore to better manage the species through the implementation of adaptive management initiatives. Many of the surveying and field activities would occur outside of the primary time when red knots are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse.

As described under alternative C, surveying under alternative D would result in long-term beneficial impacts to state-listed/special status species.

Buffer/Closure Establishment. As described above, under alternative D, all SMAs would be managed under ML1 procedures. All 10 SMAs would be closed to ORV access year-round and would be closed pedestrian access and managed under ML1 procedures during the breeding season. Upon first observation of breeding activity, the standard buffers would apply. Buffers would be applied to courtship/mating, nesting, and unfledged chick activities both within and outside of designated SMAs. Under alternative D, as described under alternative C, ML1 procedures would maintain a 300-meter (900-foot) buffer during all activities for all state-listed / special status bird species. For areas where breeding activity is observed outside of prenesting areas, ML1 procedures would apply to determine prescribed buffer distances. For alternative D, as described under alternative C, buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer under ML1 procedures. Under alternative D, as described under alternatives B and C, if NPS staff observe disturbance from ORVs and/or pedestrians, buffers would be expanded in 50-meter (150-foot) increments until no disturbance occurs. Also, for all species buffers/closures, vehicles and/or pedestrians may be allowed to pass through portions of the buffer or closures that are considered inaccessible to chicks because of steep topography, dense vegetation, or other naturally occurring obstacles.

Under alternative D, closure of SMAs to ORVs year-round and to pedestrians during the breeding season would result in a substantial beneficial effect to all state-listed/special status species and their habitat by eliminating potential effects of bringing people, essential vehicles, and equipment into direct contact with state-listed/special status species and their habitat when compared to management under alternatives A, B, and C. As described under alternatives A, B, and C, American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Cohen et al. in press). Closure of SMAs to ORVs year-round and to pedestrians during the breeding season would ensure that early nesting American oystercatchers, except those that establish territories outside of areas that have not been utilized within the past five years, would be fully protected under alternative D. The year-round SMAs would provide long-term beneficial impacts to all state-listed/special status species at the Seashore.

Under alternative D, as described under alternatives A, B, and C, observations of chick movements may not be sufficient to adjust buffers such that they ensure protecting chicks from ORV/pedestrian impact; however, buffer/closure areas under alternative D would likely reduce any potential effects to negligible as many of the species would occur in the large SMAs. As described under alternatives A, B, and C, no additional buffers or closures would be provided to foraging adult state-listed/special status species under alternative D, although these species would likely indirectly benefit from the protections provided to piping plover foraging habitat and the large year-round SMAs.

Under alternative D, establishment of year-round SMAs managed under ML1 procedures during the breeding season, prenesting closures and increased buffer zones around breeding/nesting/fledging areas for all nesting state-listed/special status species and posting of nests with symbolic fencing, would not only eliminate ORV and reduce pedestrian use in historic bird use areas, but would also greatly reduce the possibility of disturbance to species (including first time breeders) and habitat compared to alternatives A, B, and C. With the designated SMA closures and implementation of buffers in areas not within closures, impacts from closures/buffers under alternative D would be long-term and beneficial to all breeding and nonbreeding state-listed / special status species by ensuring undisturbed nesting and wintering habitat.

Wintering/Nonbreeding Management. Nonbreeding surveys for American oystercatchers, Wilson's plover, red knots, and some species of colonial waterbirds would be conducted using the NPS SECN survey protocol. These surveying activities would have minor impacts due to disturbance from monitors, although the surveys would result in long-term benefits related to the increase in knowledge about the species and improvements in management methods.

Under alternative D, as described under alternative C, Nonbreeding Shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs, although non-conflicting, non-motorized recreational uses would be allowed. Nonbreeding resource closures would be established at the points and spits. These nonbreeding SMAs would include areas of suitable nonbreeding habitat that has had concentrated foraging by migrating/wintering shorebirds in more than one (i.e., two or more) of the past five years and is managed to reduce human disturbance during the nonbreeding season. This may include portions of breeding SMAs that provide suitable nonbreeding habitat during periods of overlap between the breeding and migrating season and designated non-ORV areas that are set aside to provide pedestrians with the opportunity for a natural beach experience. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species. Overall, management of species during nonbreeding would result in long-term beneficial impacts.

Education and Outreach. Under alternative D and as described under alternative A, the public would continue to receive information at the visitor centers about state-listed/special status species and their ecology and the measures the Seashore is taking to protect these species. In addition, the public would be provided education through the required ORV use permit, and protected species information would be provided at all access points. As with alternative A, public outreach as part of species management would have long-term beneficial impacts, with the expanded outreach having greater impacts than alternative A.

Overall Impact of Resources Management Activities. The overall impact of resources management activities (primarily resulting from the effects of surveying and field activities) for each species under alternative D would be as follows:

- American oystercatcher. Establishment of 10 SMAs that are closed to ORVs year-round and all managed under ML1 procedures during the breeding season would provide long-term benefits to breeding and wintering American oystercatchers, greater than those under alternative C. Additional benefits would be provided from surveying and closures outside of these established SMAs, as well as from the education and outreach provided. These surveying and field activities would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would and result in long-term beneficial impacts to this species, greater than those provided under alternative B.
- Colonial waterbirds. Impacts to colonial waterbirds from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.
- Wilson's plover. Impacts to Wilson's plover from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.
- Red knot. Nonbreeding shorebird SMAs and the establishment of non-ORV areas along the ocean shoreline would result in beneficial impacts to nonbreeding red knots. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, all of which are closed to ORVs year-round would result in long-term beneficial impacts to red knot when compared to all other alternatives.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative D, approximately 27 miles of shoreline would be designated for ORV use and approximately 41 miles would be designated as non-ORV year-round. There would be no seasonally designated ORV use areas. Compliance with closures would likely be easier for the public as the large SMAs areas would be clearly defined and predictable, and users would be educated as to where these areas are upon receiving an ORV use permit. Establishment of large, year-round SMAs that are managed under ML1 procedures during the breeding season, as well as educational information from a permit system, would provide a more defined separation of uses and reduced potential for recreational disturbance to birds than under alternatives A, B, or C. Impacts to state-listed and special status species from ORV and pedestrian access would be expected to be long-term minor adverse, as some interactions may still cause disturbance, but these events would likely be infrequent.

Night-Driving Restrictions. Under alternative D, night driving of all nonessential ORV traffic would be the same as under alternative C and would result in long-term beneficial impacts as it would further reduce the potential for disturbance to night-foraging birds that could result in mortality.

Commercial Fishing. Commercial fishing activities under alternative D would be managed the same as under alternative C, resulting in long-term negligible adverse impacts to state-listed/special status species, with long-term minor to moderate benefits from night-driving restrictions.

Permit/Carrying Capacity Requirements. As described above under the night-driving restrictions and education/outreach sections, alternative D would require a permit for ORV use, which includes night driving. As stated in these sections, the educational information provided by the required permit would result in benefits to state-listed/sensitive species as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance. There would be no impacts related to carrying capacity, as ORV use would not be permitted in resource protection areas.

Pets/Other Recreational Activity Requirements. Pets would be prohibited within all SMAs year-round. Camping would not be permitted at the Seashore, and beach fires would be regulated with a non-fee educational permit, as described under alternative C. Prohibition of pets within the SMAs year-round and additional education from a beach fire permit would be expected to have long-term beneficial impacts to the species, greater than those under alternative C, provided the level of non-compliance is kept low.

Overall Impact of ORV and Other Recreational Use. The overall impact of ORV and other recreational use for each species under alternative D would be as follows:

- American oystercatcher. Providing large SMAs that are closed year-round to ORVs and closed to pedestrians during the breeding season would provide large undisturbed areas for both breeding and nonbreeding oystercatchers. Further benefits would be provided by seasonal night-driving restrictions, the establishment of a permit system with an educational component, and prohibition of pets in SMAs year-round. With these measures in place, impacts to American oystercatchers from ORV and other recreational use would be long-term minor adverse, as the chance of disturbance still exists, but would be lower than that under the other alternatives evaluated.
- Colonial waterbirds. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor adverse, for the same reasons as American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term negligible to minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the buffers/closures provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Impacts to red knot from recreation and other activities would be long-term negligible to minor adverse due to the additional nonbreeding closures provided under alternative D that offer this wintering species further protection, as well as the large year-round SMAs that would offer further protection during red knot wintering.

Cumulative Impacts. Cumulative actions and their associated impacts under alternative D would be the same as those described under alternative A (long-term minor to moderate adverse). Although alternative D provides additional protection that would be beneficial to state-listed / special status bird species, the adverse effects on birds from other actions occurring in the region would still exist. The impact of these past, current, and reasonably foreseeable future actions, when combined with the long-term beneficial and long-term negligible to minor adverse impacts of alternative D, would result in long-term minor adverse cumulative impacts.

Conclusion. Overall impacts to state-listed/special status species under alternative D would be as follows:

- American oystercatcher. Establishment of 10 SMAs that are closed year-round to ORVs and closed to pedestrians and managed under ML1 procedures during the breeding season would provide long-term benefits to breeding and wintering American oystercatchers. Additional

benefits would be provided from surveying and closures outside of these established SMAs, as well as from the education and outreach provided. These surveying and field activities would all contribute to further knowledge about the species that would contribute to better management, and result in long-term beneficial impacts. Providing large SMAs that are closed to ORVs year-round and to pedestrians during the breeding season would provide the American oystercatcher a large undisturbed area for both breeding and nonbreeding. Further benefits would be provided by seasonal night-driving restrictions, prohibition of pets within SMAs, and the establishment of a permit system. With these measures in place, impacts to American oystercatchers from ORV and other recreational use would be long-term minor adverse, as the chance of disturbance still exists, but would be lower than that under the other alternatives evaluated.

- Colonial waterbirds. Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for the American oystercatcher. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor adverse, for the same reasons as American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for the American oystercatcher, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term negligible to minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the specific buffers/closures provided for the species, and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, which are closed to ORVs year-round, would be beneficial, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B. Impacts to red knot from ORV and other recreational use would be long-term negligible to minor adverse due to the additional nonbreeding closures provided under alternative D that offer this wintering species further protection, as well as the large year-round SMAs that would offer further protection during red knot wintering.

Cumulative impacts under alternative D would be long-term minor adverse.

Impairment Determination. Implementation of alternative D would not impair state-listed and special status species because sufficient population numbers and functional habitat would remain to maintain a sustainable population at the Seashore. Some impacts might occur during critical reproductive periods, but would not result in injury or mortality. Sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

Under alternative D, the Seashore would establish SMAs that proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. Under alternative D, all public access (ORV and pedestrian) would be precluded from all SMAs during the breeding season and from ORV use year-round. Pets would be prohibited in all designated SMAs year-round. From March 15 through July 15, Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting

closures two times per week, increasing to three times per week once birds are present. Although Wilson's plovers are often seen by Seashore staff during their observations of piping plovers, no indications of nesting had been documented until 2009. There are no data on reproductive success of Wilson's plover at the Seashore. Wilson's plover are subject to the same disturbance factors as piping plover including beachgoers, pets, and ORV traffic on beaches. Wilson's plovers leave their nests when disturbed and are extremely reluctant to return when intruders are anywhere near, a practice that exposes eggs to predation and overheating.

All SMAs under alternative D would be managed under ML1 procedures during the breeding season, which would result in areas of larger, longer lasting buffers with less frequent monitoring, in addition to closures for ORV and pedestrian access.

American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time. Closure of SMAs to ORVs year-round and to pedestrians during the breeding season would ensure that early nesting American oystercatchers, except those that establish territories outside of areas that have not been utilized within the past five years, would be fully protected under alternative D.

Buffers would be applied both within and outside of designated SMAs. All SMAs would maintain a 300-meter (900-foot) buffer during all breeding activities for all state-listed/special status bird species. For areas where breeding activity is observed outside of prenesting areas, ML1 procedures would determine the buffers. Buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later.

Under alternative D, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species.

Under alternative D, all nonessential ORV traffic would be prohibited from all areas (other than the sound side) between 7:00 p.m. to 7:00 a.m. from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles holding a valid ORV permit. Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. However, alternative D would require a permit for ORV use that includes an educational component. Because ORV users would be more aware of the regulations in place to protect state-listed/special status species, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Violations may result in permit revocation, which is expected to increase compliance. Under alternative D, ORVs would bring people into the vicinity of shorebirds where trash associated with recreation use would continue to attract mammalian and avian predators. However, alternative D prohibits ORV use in SMAs year-round and pedestrian use during the breeding season, thereby reducing the impacts of predators in these areas. Predation is known to affect the reproductive success of shorebirds; the indirect impacts of attracting

predators would be detectable and beyond the level of disturbance or harm that would occur naturally, but is not expected to result in large declines in population because the Seashore takes management action to protect state-listed species from predation.

Implementation of SMAs that provide a proactive resource closure early in the breeding season, a permit system with an educational component, establishment of nonbreeding SMAs, seasonal night-driving restrictions beginning at 7:00 p.m., prohibition of ORV use in SMAs year-round, as well as larger buffer sizes and earlier prenesting closures, would limit the potential for impacts to state-listed/special status species.

The impact analysis of alternative D deemed adverse impacts to state-listed/special status species from ORV and other recreational use to be minor because, although impacts would be detectable, they would not be beyond the level of disturbance or harm that would occur naturally. Some impacts, which would not result in injury or mortality, might occur during critical reproductive periods, but sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

The analysis in the plan/EIS of cumulative impacts combined the effects of alternative D with effects of other past, present, and future planned actions in and around the Seashore, such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the Seashore, commercial fish harvesting, and increased interpretative programs as part of the Seashore's long-range interpretive plan. The plan/EIS impact analysis deemed the cumulative impacts to be minor adverse because sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore. Therefore, the state-listed and special status species impacts would not result in impairment.

Impacts of Alternative E: Variable Access and Maximum Management

Resources Management Activities

Establishment of Prenesting Closures. Under alternative E, as described under alternative C and D, the NPS would establish SMAs based on an annual habitat assessment for management of all breeding shorebirds and subject to periodic review. Seven SMAs would be managed under ML1 procedures and three under ML2 procedures. All Breeding Shorebird SMAs would be posted as prenesting closures using symbolic fencing by March 15 at sites involving American oystercatchers and Wilson's plover and by April 15 at sites involving colonial waterbirds. If multiple species exist on each site, closures would begin on the earliest date. Under alternative E, as described under alternative C, closure of prenesting areas by March 15 (in most cases) and/or April 15 for colonial waterbirds would have a more beneficial effect due to closures occurring earlier, ensuring a reduction of disturbance for colonial waterbirds during breeding (courtship, mating, scrapes, etc.).

Surveying and Monitoring. Surveys of prenesting closures for all state-listed/special status species would occur three times per week. Surveys for American oystercatchers and Wilson's plovers would begin on March 15 and surveys for colonial waterbirds would begin on May 1. Surveys for suitable habitat outside of SMAs would also occur 3 times per week once breeding pairs are present. Prenesting surveys under alternative E would not be as frequent as those under alternatives A and B; however, due to the designation of SMAs as prenesting closures and suitable habitat surveys outside of prenesting closures, effects of survey times to implement closures would be the same. Under alternative E, under ML1 procedures, less monitoring of nests would occur; however there would be no ORV or pedestrian access allowed. Under ML2 procedures, SMAs with this management would be monitored more frequently (the same as nesting areas under alternatives A and B) due to the presence of an ORV and/or pedestrian corridor.

Under ML1 procedures, NPS would conduct nest surveys from a distance for American oystercatchers and Wilson's plover at least three times per week. Colonial waterbirds would also be observed at least three times per week from a distance that does not disturb the birds. Nest count estimates would be conducted during the peak nesting period for each species, which generally is during the last week of May and the first week of June, but could be later, especially for black skimmers. For all species that have incubating birds that cannot be observed from a distance, nest checks would occur on a weekly basis (or as staff is available). Colonial waterbird colonies would be surveyed for hatching (approximately 21 days after initial nest observations). For unfledged chicks, NPS would survey broods and colonies every other day under ML1 procedures.

Under ML2 procedures, American oystercatcher and Wilson's plover chicks would be observed once daily for at least one-half hour and colonial waterbird colonies would be observed daily. For American oystercatchers and Wilson's plover, observations would end once chicks have fledged. For colonial waterbirds, a survey would be conducted during peak fledge (approximately 20 days after hatch counts). Observations would end after no unfledged chicks have been observed on three consecutive surveys.

Under alternative E, as described under alternatives C and D, surveys would concentrate in established SMAs, which may not detect American oystercatchers or colonial waterbirds that establish territories in new habitat. Surveying activities under alternative E would likely have long-term minor adverse impacts on nesting state-listed/special status species as a result of survey time and frequencies during the prenesting and nesting season at the Seashore. Although surveying can bring people into contact with the species and cause disturbance, overall species surveying would provide long-term beneficial impacts as it would provide the NPS with the information needed to implement adaptive management measures, and enhance future management. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse.

Buffer/Closure Establishment. Under alternative E SMAs would be established and designated either ML1 or ML2. ML1 areas would not allow ORV or pedestrian access when prenesting closures are in effect. Bodie Island Spit, Cape Point, and South Point would be managed under ML2 procedures, and narrow ORV access corridors would be established in these areas. Upon first observation of breeding activity, the standard buffers would apply, which depending on the circumstances may close the access corridor. Pets, kite flying, ball and Frisbee tossing, or similar activities would be prohibited in access corridors while prenesting closures are in effect. If no breeding activity is observed in SMAs by July 31, or two weeks after all chicks have fledged (whichever is later), prenesting closures would be adjusted to the configurations of Nonbreeding Shorebird SMAs (as determined from annual monitoring of presence, abundance, and behavior of migrating and wintering shorebirds from July through May).

Under alternative E, a total of three SMAs would be closed to ORV access year-round. During the breeding season, a total of seven SMAs would be closed to ORV and pedestrian access under ML1 procedures areas from March 15 through August 31; and a total of three areas would be managed under ML2 procedures, which would allow an ORV access corridor with a pass-through zone from March 15 to August 31, subject to resource closures. Buffers would be applied to courtship/mating, nesting, and unfledged chick activities both within and outside of designated SMAs. Under ML1 procedures, a 300-meter (900-foot) buffer would be maintained during all activities for all state-listed / special status bird species. Under ML2 procedures, buffer areas would vary by species and activity. For ML2 procedures, buffers for American oystercatchers would be 150 meters (450 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. ML2 buffers for least terns, a colonial waterbird, would be 100 meters (300 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. All other colonial waterbird ML2 buffers would be 200 meters (600 feet) for breeding, nesting, and unfledged chick activities. For areas where breeding activity is observed outside of

prenesting areas, buffers under ML1 would apply. For alternative E, buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer for that management level. Under alternative E, as described under alternatives B and C, if NPS staff observe disturbance from ORVs and/or pedestrians, buffers would be expanded in 50-meter (150-foot) increments until no disturbance occurs. Under alternative E, for all species buffers/closures, vehicles and/or pedestrians may be allowed to pass through portions of the buffer or closures that are considered inaccessible to chicks because of steep topography, dense vegetation, or other naturally occurring obstacles.

Under alternative E, closure of three SMAs year-round and prenesting closures in all SMAs would provide buffers around courting American oystercatchers, Wilson's plover, and colonial waterbirds, which could have a substantial beneficial effect. ML1 procedures that close areas to ORV and pedestrian access from March 15 to August 31 would reduce potential effects of bringing people, essential vehicles, and equipment into direct contact with state-listed/special status species and their habitat when compared to management under alternatives A and B; however the reduction of effects would not be as much as those under alternative C given the longer period of ORV closure under that alternative (October 14). Under ML2, the three SMAs that would have an ORV pass-through zone would have greater adverse impacts from disturbance than would occur in the three SMAs under alternative C that would have a pedestrian access corridor under ML2 procedures, due to the potential effects of vehicle collisions and disturbance from bringing people into direct contact with species.

Under alternative E, as described under alternatives A, B, and C, American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Cohen et al. in press). Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas would not be fully protected under alternatives A, B, C, or E.

Under alternative E, as described under alternatives A, B, and C, observations of chick movements may not be sufficient to adjust buffers such that they ensure protecting chicks from ORV/pedestrian impact; however, increased closure areas under alternative E would likely reduce any potential effects to negligible. As described under alternatives A, B, C, and D, no additional buffers or closures would be provided to foraging adult state-listed/special status species under alternative E, although species would likely indirectly benefit from the protections provided to piping plover foraging habitat.

Under alternative E, establishment of SMAs with ML1 and ML2 procedures, closure of some SMAs to ORV use year-round, increased buffer zones around breeding/nesting/fledging areas for all nesting state-listed/special status species, and posting of nests with symbolic fencing would reduce ORV and pedestrian use in multiple high use bird areas during sensitive timeframes, provide a major deterrent to the entry of people, pets, and ORVs into habitats, and greatly reduce the possibility of disturbance to species (including first time breeders) and habitat compared to alternatives A and B.

With the designated SMA closures, ML1 and ML2 procedures and associated buffers for breeding/nesting/fledging areas, impacts from closures/buffers under alternative E would be long-term minor adverse.

Wintering/Nonbreeding Management. Nonbreeding surveys for American oystercatchers, Wilson's plover and red knots, would be conducted according to the NPS SECN survey protocol, although unlike the no-action alternatives, surveys for some colonial waterbirds would be included. These surveying activities would have minor impacts (due to human disturbance as discussed above) and long-term benefits related to the increase in knowledge about the species. Surveying activities would have negligible impacts to red

knots during the breeding season (for other state-listed/special status species) at the Seashore, and long-term benefits related to the increase in knowledge about the species resulting from nonbreeding surveys.

Under alternative E, as described under alternatives C and D, Nonbreeding Shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs. These nonbreeding SMAs would include areas of suitable nonbreeding habitat that has had concentrated foraging by migrating/wintering shorebirds in more than one (i.e., two or more) of the past five years and is managed to reduce human disturbance during the nonbreeding season. This may include portions of breeding SMAs that provide suitable nonbreeding habitat during periods of overlap between the breeding and migrating season and designated non-ORV areas that are set aside to provide pedestrians with the opportunity for a natural beach experience. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species. Management of wintering/nonbreeding populations would provide long-term benefits, but these benefits would not be as great as those under alternative D, as alternative E would provide an increased level of recreational access and therefore an increased potential for disturbance to state-listed/special status species.

Education and Outreach. Under alternative E, impacts as a result of education and outreach efforts, including educational information from a required ORV permit, would be long-term and beneficial, as described under alternative C.

Overall Impact of Resources Management Activities. The overall impact of resources management activities (primarily resulting from the effects of surveying and field activities) for each species under alternative E would be as follows:

- American oystercatcher. Implementation of 10 SMAs, 7 of which are closed to ORVs during the breeding season, would provide a proactive resource closure early in the breeding season. Establishment of prenesting closures earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts from human disturbance during field activities, resources management activities on the whole would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to this species, greater than those provided under alternative B.
- Colonial waterbirds. Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.
- Wilson's plover. Impacts to Wilson's plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.
- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed year-round, would be beneficial, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative E, approximately 33 miles of shoreline would be designated for ORV use year-round; approximately 20 miles would be seasonally designated for ORV use from September 1 through March 14; and approximately 15 miles would be designated as non-ORV year-round. The speed limit would be 15 mph unless otherwise posted, and permits would be required for all ORVs. Three SMAs (under ML2 procedures) would maintain an ORV corridor with a pass-through zone from March 15 to August 31, subject to resource closures.

Management of ORV and pedestrian access under alternative E would reduce the potential for disturbance and nest abandonment from direct contact with people and vehicles compared to alternatives A and B, but would have greater impacts than alternative C as a result of the increased amount of recreational access provided by the establishment of an ORV corridor in areas under ML2 procedures and a reduction in the length of closure in areas under ML1 procedures from October 14 under alternative C to August 31. Adverse impacts would also be greater under alternative E than alternative D, which has all SMAs closed to ORVs year-round and closed to pedestrian use during the breeding season. As described under alternative C, these measures should limit adverse impacts to state-listed / special status species; however, compliance with closures may not be absolute, resulting in adverse impacts if non-compliance occurs, but for the most part the populations would remain functional and adverse impacts limited in the SMAs by the seasonal or year-round restrictions.

Under alternative E, there would be seasonal closures in key red knot habitat reducing the potential to impact resting and foraging red knots from vehicle use and associated noise and presence of people and pets.

Overall, there would be long-term minor to moderate adverse impacts to nesting state-listed/special status species from ORV and pedestrian access under alternative E as providing more areas managed under ML2 procedures during the breeding season would result in more recreational access and an increased chance of species disturbance. Impacts to nonbreeding red knots would be long-term minor adverse.

Night-Driving Restrictions. Under alternative E, night-driving restrictions for all nonessential ORV traffic would be similar to alternative B. American oystercatchers, Wilson's plover, and red knot are known to be active at night (Simons and Schulte 2008; Morrier and McNeil 1991; Niles et al. 2007), and would be subject to disturbance from vehicular and pedestrian disturbance. This disturbance can impact their foraging behavior and has been shown to result in disorientation and even abandonment of American oystercatcher chicks (Simons and Schulte 2008). Restrictions on night driving under alternative E would provide long-term benefits to state-listed/special status species; however, night driving could still result in long-term minor adverse impacts during the time when night driving is allowed by permit. Further, night-driving restrictions that begin after dark, in this case 10:00 p.m., do not offer full nighttime protection to the species.

Commercial Fishing. Management of commercial fishing under alternative E would be the same as alternative C, resulting in long-term negligible adverse impacts from the presence of commercial fishing vehicles, with long-term minor to moderate benefits from night-driving restrictions.

Permit/Carrying Capacity. As described above under the night-driving restrictions and education/outreach sections, alternative E would require a permit for ORV use, which would include night driving. As stated in these sections, the educational information provided by the required permit would result in benefits to state-listed/sensitive species as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance.

There would be no impacts related to the implementation of a carrying capacity requirement under alternative E, because ORVs would not be permitted within resource protection areas.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all SMAs, as described under alternative C. This would include the ORV pass-through zones under alternative E and the seasonal prohibition dates would be March 15 to August 31. As with alternative C, an educational permit would be required for any beach fire year-round, which would inform visitors about species protection issues related to this recreational use.

Camping restrictions would be the same as alternative C; however, the Seashore would issue park-and-stay permits for overnight beach use at selected spits and points that are not closed for resource protection. The provision for park-and-stay overnight at some spits and points during portions of the breeding season when resource closures do not preclude access would increase the potential for human disturbance to breeding and nesting birds adjacent to those locations.

Overall, restrictions on pets, camping, and beach fires would result in long-term benefits to species at the Seashore, further reducing pressure to state-listed/special status species from recreational activity, with the potential for long-term minor to moderate adverse impacts from the park-and-stay option, which would occur outside of resource closures.

Overall Impact of ORV and Other Recreational Use. The overall impact of ORV and other recreational use for each species under alternative E would be as follows:

- American oystercatcher. Implementation of a permit system with an educational component, larger buffer sizes, seasonal night-driving restrictions, restrictions on pets in SMAs, and establishment of breeding and nonbreeding SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special status species. However, alternative E does allow an ORV access corridor at three SMAs managed under ML2 procedures during the breeding season (more than the other action alternatives), which provide for some level of pedestrian or ORV access into these area, which introduces the potential for impacts to the species. Although there would be some protection measures in place, recreational use could still result in long-term minor to moderate adverse impacts to American oystercatchers.
- Colonial waterbirds. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as those discussed above for American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the buffers/closures provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative E that offer this wintering species further protection; however, there would be greater adverse impacts than under alternatives D or F due to fewer miles of shoreline being closed to ORVs under alternative E during the nonbreeding season.

Cumulative Impacts. Cumulative actions and their associated impacts under alternative E would be the same as those described under alternatives A, B, C, and D (long-term minor to moderate adverse).

Although alternative E provides additional protection which would be beneficial to state-listed / special status bird species, the adverse effects on birds from other actions occurring in the region would still exist. The impact of these past, current, and reasonably foreseeable future actions would be minor adverse. These impacts, when combined with the long-term beneficial and long-term minor to moderate adverse impacts of alternative E, would have long-term minor to moderate cumulative impacts.

Conclusion. Overall impacts to state-listed/special status species under alternative E would be as follows:

- American oystercatcher. Establishment of prenesting closures earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, resource management activities on the whole would provide information and result in actions that would be beneficial to the species. Implementation of SMAs that provide a proactive resource closures early in the breeding season, a permit system with an educational component, seasonal night-driving restrictions, as well as larger buffer sizes and earlier prenesting closures, would provide long-term beneficial impacts to the American oystercatcher, greater than those under alternative B. Implementation of a permit system with an educational component, seasonal night-driving restrictions, prohibition of pets in the SMAs during breeding season, and establishment of breeding and nonbreeding SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special status species. However, alternative E does allow ORV access to three SMAs that would be managed under ML2 procedures during the breeding season (more than the other action alternatives), which provide for some level of pedestrian or ORV access into these area and which introduces the potential for impacts to the species. Although there would be some protection measures in place, recreational use could still result in long-term minor to moderate adverse impacts to American oystercatchers.
- Colonial waterbirds. Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers. Impacts to colonial waterbirds from ORV and other recreation use would be long-term minor to moderate adverse, for the same reasons as American oystercatchers under this alternative.
- Wilson's plover. Impacts to Wilson's plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to closures/buffers provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed to ORVs year-round, would be beneficial, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B. Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative E that offer this wintering species further protection, with greater adverse impacts than under alternatives D or F from fewer miles of shoreline being closed to ORVs under alternative E during the nonbreeding season.

Cumulative impacts under alternative E would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative E would not impair state-listed and special status species. because although frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding or reproduction, and impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

Under alternative E, the Seashore would establish SMAs, which proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. Under alternative E, ORVs would be prohibited in SMAs from March 15 through August 31, except for Bodie Island Spit, Cape Point, and South Point where an ORV corridor and pass-through zone would be established at the start of the breeding season. The pass-through zone would be in effect during prenesting and incubation periods only and would be subject to resource closures if necessary. The remaining SMAs and prenesting closures outside of SMAs would not allow ORV or pedestrian access while prenesting closures are in effect. Alternative E would prohibit pets within all SMAs from March 15 through August 31.

Surveys of prenesting closures for all state-listed/special status species would occur three times per week. Surveys for American oystercatchers and Wilson's plover would begin on March 15 and surveys for colonial waterbirds would begin on May 1.

Each SMA would be under ML1 or ML2 management procedures. Under alternative E, ML1 procedures would require less monitoring of nests; however there would be no ORV or pedestrian access allowed. Under ML2 procedures, birds would be monitored more frequently due to the presence of an ORV and/or pedestrian corridor. Under alternative E, a total of three SMAs would be closed to ORV access year-round. During the breeding season, a total of seven SMAs would be closed to ORV and pedestrian access under ML1 procedures areas from March 15 through August 31; and a total of three areas would be managed under ML2 procedures.

American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time. Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas would not be fully protected under alternative E.

Buffers would be applied both within and outside of designated SMAs. All SMAs would maintain a 300-meter (900-foot) buffer during all breeding activities for all state-listed/special status bird species. ML2 buffer areas would vary by species and activity. ML2 procedures for American oystercatchers would establish 150-meter (450-foot) buffers for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. Under ML2, buffers for least terns would be 100 meters (300 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. All other colonial waterbird buffers under ML2 procedures would be 200 meters (600 feet) for breeding, nesting, and unfledged chick activities. For areas where breeding activity is observed outside of prenesting areas, ML1 procedures would determine the buffers. Buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer for the particular management level (ML1 or ML2).

Under alternative E, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species.

Alternative E would prohibit recreational ORV use between the hours of 10:00 p.m. and 6:00 a.m. between May 1 and September 15. From September 16 through November 15, ORV routes with no or a low density of turtle nests would reopen to ORV use between 10:00 p.m. and 6:00 a.m., subject to terms and conditions of permit.

American oystercatchers, Wilson's plover, and red knot are known to be active at night and would be subject to vehicular and pedestrian disturbance, which could result from recreational access to beaches between dusk and 10:00 p.m. This disturbance can affect their foraging behavior and has been shown to result in disorientation and even abandonment of oystercatcher chicks. Allowing some night driving during critical periods of reproduction may result in harassment, injury, or mortality to one or more individuals of these night foraging species.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. However, alternative E would require a permit for ORV use that includes an educational component. Because ORV users would be more aware of the regulations in place to protect state-listed/special status species, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Violations could result in permit revocation, which is expected to increase compliance. Alternative E would establish a park-and-stay overnight option at some spits and points during portions of the breeding season, when resource closures do not preclude access. It would also promote water taxi service to some points and spits. Alternative E would provide for self-contained vehicle camping from November 1 to March 31 at three of the Seashore's campgrounds. Under alternative E, ORVs would bring people into the vicinity of shorebirds where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of shorebirds; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance or harm that would occur naturally, but would not be expected to result in large declines in population because the Seashore takes management action to protect state-listed species from predation.

Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

The impact analysis of alternative E deemed adverse impacts to state-listed/special status species from ORV and other recreational use to be minor to moderate because impacts would be detectable and could be beyond the level of disturbance or harm that would occur naturally. Although some impacts might occur during critical reproductive periods or in key habitats in the Seashore and could result in injury or mortality, sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore.

The analysis in the plan/EIS of cumulative impacts combined the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore, such as major dredging and

maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the Seashore, and increased interpretative programs as part of the Seashore's long-range interpretive plan. The cumulative impacts were deemed to be minor to moderate adverse in the plan/EIS impact analysis because impacts on state-listed/special status species and their habitats would be detectable and could be beyond the level of disturbance or harm that would occur naturally. Some negative impacts to feeding, reproduction, resting or other factors affecting local population levels would occur and may result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore. Therefore, the state-listed/special status impacts would not result in impairment.

Impacts of Alternative F: Management Based on Advisory Committee Input

Resources Management Activities

Establishment of Prenesting Closures. Under alternative F, as described under alternatives C, D, and E, the NPS would establish SMAs based on an annual habitat assessment for management of all breeding shorebirds and subject to periodic review. Each SMA would be managed under ML1 or ML2 procedures. All Breeding Shorebird SMAs would be posted as prenesting closures using symbolic fencing by March 15 at sites involving American oystercatchers and Wilson's plover and by April 15 at sites involving colonial waterbirds. If multiple species exist on each site, closures would begin on the earliest date. Establishment of closures early in the season would have long-term beneficial impacts to these species.

Surveying and Monitoring. Surveys of prenesting closures for all state-listed/special status species would occur three times per week. Surveys for American oystercatchers and Wilson's plover would begin on March 15 and surveys for colonial waterbirds would begin on May 1. Surveys for suitable habitat outside of SMAs would also occur three times per week once breeding pairs are present. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse.

Under ML1 procedures at all locations, the NPS would conduct nest surveys from a distance for American oystercatchers and Wilson's plover at least 3 times per week. Colonial waterbirds would also be observed at least three times per week from a distance that does not disturb the birds. Nest count estimates would be conducted during the peak nesting period for each species, which generally is during the last week of May and the first week of June, but could be later, especially for black skimmers. For all species that have incubating birds that cannot be observed from a distance, nest checks would occur on a weekly basis (or as staff is available). Colonial waterbird colonies would be surveyed for hatching (approximately 21 days after initial nest observations). For unfledged chicks, NPS would survey broods and colonies every other day under ML1 procedures.

In three SMAs with ML2 procedures, American oystercatcher and Wilson's plover chicks would be observed once daily for at least one-half hour and colonial waterbird colonies would be observed daily. For American oystercatchers and Wilson's plover, observations end once chicks have fledged. For colonial waterbirds, a survey would be conducted during peak fledge (approximately 20 days after hatch counts). Observations would end after no unfledged chicks have been observed on three consecutive surveys.

Under alternative F, as described under all other action alternatives, surveys would concentrate in established SMAs, which may not detect American oystercatchers or colonial waterbirds that establish territories in new habitat. As described under all other alternatives, surveying under alternative F would provide benefits to the species.

Under alternative F, as described under alternative B, C, and E, closure of prenesting areas by March 15 (in most cases) and/or April 15 for colonial waterbirds would have a more beneficial effect due to closures occurring earlier, ensuring a reduction of disturbance for colonial waterbirds during breeding (courtship, mating, scrapes, etc.) than under alternative A. Prenesting surveys under alternative F would not be as frequent as those under alternatives A and B; however, due to the designation of SMAs as prenesting closures and suitable habitat surveys outside of prenesting closures, effects of survey times to implement closures would be the same. Under alternative F, under ML1 procedures, less monitoring of nests would occur; however, there would be no ORV or pedestrian access allowed. SMAs under ML2 procedures would be monitored more frequently (the same as nesting areas under alternatives A and B) due to the presence of an ORV and/or pedestrian corridor. Alternative F would likely have minor adverse impacts on nesting state-listed/special status species from survey time and frequencies during the prenesting and nesting season at the Seashore, but overall the information provided would allow the Seashore to implement adaptive management initiatives, thereby improving future management, resulting in overall long-term beneficial impacts.

Buffer/Closure Establishment. Under alternative F, SMAs would be established and managed under ML1 or ML2 procedures. Areas under ML1 procedures under alternative F would not allow ORV or pedestrian access when prenesting closures are in effect (generally March 15 to July 31, except for the SMA near ramp 68, which would be in effect through October 31). SMAs under ML2 procedures would establish either a narrow ORV access corridor (where ORV use permitted) or a pedestrian access corridor. Bodie Island Spit would only allow a pedestrian access corridor under alternative F, while Cape Point and South Point would allow an ORV access corridor from March 15 through July 31. Upon first observation of breeding activity, the standard buffers would apply, which depending on the circumstances may close access corridors. Pets, kite flying, ball and Frisbee tossing, or similar activities would be prohibited in access corridors while prenesting closures are in effect. If no breeding activity is observed in SMAs by July 31, or two weeks after all chicks have fledged (whichever is later), prenesting closures would be adjusted to the configurations of Nonbreeding Shorebird SMAs (established from annual monitoring of presence, abundance, and behavior of migrating and wintering shorebirds from July through May).

Under alternative F, a total of seven SMAs would be managed under ML1 procedures and would be closed to both ORVs and pedestrians during the breeding season. Of these, four SMAs would be designated as non-ORV year-round; one SMA would be designated as non-ORV from March 15 through October 31; and two SMAs would be designated as non-ORV from March 15 through July 31, or two weeks after all chicks have fledged. Three SMAs would be managed under ML2 procedures during the breeding season. Of these, during the breeding season, Bodie Island Spit would have a pedestrian access corridor, subject to resource closures, and Cape Point and South Point would have ORV access corridors, subject to resource closures. Buffers would be applied to courtship/mating, nesting, and unfledged chick activities both within and outside of all designated SMAs. SMAs under ML1 procedures would maintain a 300-meter (900-foot) buffer during all activities for all state-listed / special status bird species. ML2 buffer areas would vary by species and activity. Under ML2 procedures, buffers for American oystercatchers would be 150 meters (450 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. Under ML2 procedures, buffers for least terns, a colonial waterbird, would be 100 meters (300 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. All other colonial waterbird buffers under ML2 procedures would be 200 meters (600 feet) for breeding, nesting, and unfledged chick activities. For areas where breeding activity is observed outside of prenesting areas, buffers under ML1 procedures would apply. For alternative F, buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer for that management level. Under alternative F, as described under alternatives B through E, if NPS staff observe disturbance from ORVs and/or pedestrians, buffers would be expanded in

50-meter (150-foot) increments until no disturbance occurs. Under alternative F, for all species buffers/closures, vehicles and/or pedestrians may be allowed to pass through portions of the buffer or closures that are considered inaccessible to chicks because of steep topography, dense vegetation, or other naturally occurring obstacles.

Under alternative F, closure of four SMAs to ORVs year-round and prenesting closures in all SMAs as of March 15 would provide buffers around courting oystercatchers, Wilson's plovers, and colonial waterbirds, which could have a substantial beneficial effect. Management of areas under ML1 procedures as closed to ORV and pedestrian access from March 15 to July 31 or two weeks after all chicks have fledged, whichever is later, would reduce potential effects of bringing people, essential vehicles, and equipment into direct contact with state-listed/special status species and their habitat when compared to management under alternatives A and B. However, the reduction of effects would not be as much as those under alternatives C or E given the longer period of closure under those alternatives (October 14 and August 31 respectively). Management of two of three SMAs under ML2 procedures with an ORV corridor under alternative F would have greater adverse effects from disturbance than SMAs with ML2 procedures under alternative C (which has three SMAs with pedestrian access corridors) but less adverse effects than alternative E (which has three SMAs with ORV access corridors), due to the potential effects of vehicle collisions and disturbance from bringing people into direct contact with species.

American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time (Cohen et al. in press). Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas, would not be fully protected under alternatives A, B, C, E, or F.

Under alternative F, as described under alternatives A, B, C, and E, observations of chick movements may not be sufficient to adjust buffers such that they ensure protecting chicks from ORV/pedestrian impact; however, increased closure areas under alternative F would likely reduce any potential effects to negligible. As described under all of the other alternatives, no additional buffers or closures would be provided to foraging adult state-listed/special status species under alternative F, although species would likely indirectly benefit from the protections provided to piping plover foraging habitat.

Under alternative F, establishment of SMAs with ML1 or ML2 procedures; closures of four SMAs to ORV use year-round, prenesting closures, and increased buffer zones around breeding/nesting/fledging areas for all nesting state-listed/special status species; implementation of the stipulation to increase buffer zones should there be a violation of these zones from ORV or pedestrian use; and posting of nests with symbolic fencing, would not only eliminate or significantly reduce ORV and pedestrian use in multiple high use bird areas during sensitive timeframes, but would also provide a major deterrent to the entry of people, pets, and ORVs into habitats and greatly reduce the possibility of disturbance to species (including first time breeders) and habitat compared to alternatives A and B. Overall reduction of effects would be greater under alternative F than those under alternatives C and E due to year-round closure to ORVs of four SMAs; however a reduction in the period of closure for the remaining areas under ML1 procedures from October 14 and August 31 under alternatives C and E, respectively, to July 31 or two weeks after all chicks have fledged under alternative F could result in increased potential for disturbance of unfledged chicks and increase the risk of impacts from human disturbance to unfledged chicks of some species that fledge through mid-August. The potential for disturbance would be minimized, in part, as breeding areas would not reopen to recreational use until after all chicks in an area have fledged, which could be after July 31 depending upon the species.

With the designated SMA closures, ML1 and ML2 procedures, and associated buffers for breeding/nesting/fledging areas, impacts to state-listed/special status species as a result of the buffers and closures provided under alternative F would be long-term minor adverse.

Wintering/Nonbreeding Management. Nonbreeding surveys for American oystercatchers, Wilson's plover and red knots, would be conducted according to the NPS SECN survey protocol, although unlike the no-action alternatives, surveys for some colonial waterbirds would be included. These surveying activities would have minor impacts (due to human disturbance as discussed above) and long-term benefits related to the increase in knowledge about the species. Surveying activities would have negligible impacts to red knots during the breeding season (for other state-listed/special status species) at the Seashore, and long-term benefits related to the increase in knowledge about the species resulting from nonbreeding surveys.

Under alternative F, as described under alternatives C, D, and E, Nonbreeding Shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, NPS would establish non-ORVs areas along the ocean shoreline to provide less disturbed foraging, resting, and roosting areas for migrating and wintering shorebirds. Under alternative F, three "floating" non-ORV areas would also be established during the nonbreeding season between ramp 23 and ramp 34, between ramp 45 and 49, and between ramp 72 and the inlet. All "floating" areas would be established based on the annual habitat assessment and nonbreeding surveys. These nonbreeding closures would provide long-term benefits under alternative F, with these benefits being greater than alternatives C and E due to the addition of "floating" closures.

Education and Outreach. Under alternative F, the public would continue to receive information at the visitor centers about state-listed/special status species and their ecology and the measures the Seashore is taking to protect the species. In addition, the public would be provided education through the required ORV use permit and protected species information would be provided at all access points. As with alternative A, public outreach as part of species management would have long-term beneficial impacts, with the expanded outreach having greater impacts than alternative A.

Overall Impact of Resources Management Activities. The overall impact of resources management activities (primarily resulting from the effects of surveying and field activities) for each species under alternative F would be as follows:

- American oystercatcher. Implementation of 10 SMAs, 8 of which are closed to ORVs (with one open to pedestrians only) during the breeding season, would provide a proactive resource closure early in the breeding season. Establishment of prenesting closures through SMAs earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, resources management activities on the whole would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to the species, greater than those provided under alternative B.
- Colonial waterbirds. Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.
- Wilson's plover. Impacts to Wilson's plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.

- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed year-round, would be beneficial, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B. Additional benefits, when compared to the other alternatives, would be realized under alternative F from “floating” nonbreeding closures that would provide four additional miles of protection during this time.

ORV and Other Recreational Use

ORV and Pedestrian Access. Under alternative F, approximately 29 miles of shoreline would be designated for ORVs use year-round; approximately 23 miles would be seasonally designated for ORV use from August 1 through March 14 (one area from November 1 through March 14); and approximately 16 miles would be designated as non-ORVs year-round. The speed limit would be 15 mph unless otherwise posted and permits would be required for all ORVs. Two SMAs (managed under ML2 measures) would maintain an ORV corridor, subject to resource closures, from March 15 to July 31 or two weeks after chicks fledge; and one SMA (managed under ML2 procedures) would maintain a pedestrian corridor, subject to resource closures, from March 15 through July 31 or two weeks after chicks fledge. Management of commercial fishing vehicles would be the same as under alternative A, except commercial fisherman would not be required to obtain an ORV permit, commercial fishing vehicles would be authorized to enter non-ORV areas except for full resource closures, and night-driving restrictions could be slightly modified outside of existing resource closures.

Management of ORV and pedestrian access under alternative F would reduce the potential of disturbance and nest abandonment from direct short-term contact with people and/or essential vehicles compared to alternatives A and B, but would have greater impacts than alternative C due to the existence of an ORV corridor in two areas subject to ML2 measures and a reduction in the length of closures under ML1 from October 14 under alternative C to July 31 under alternative F. Impacts would also be greater under alternative F than alternative D, which has all SMAs closed to ORVs year-round and closed to pedestrian use during the breeding season. Impacts of alternative F would also be slightly greater than alternative E for colonial waterbirds and Wilson’s plover, due to the reduction in length of closures in some seasonal SMAs from August 31 to July 31. Re-opening SMAs to recreational use earlier than August 31 could result in increased potential for disturbance of unfledged chicks as some species of colonial waterbirds and Wilson’s plover fledge through mid-August. The potential for disturbance would be minimized, in part, as the areas would not reopen until two weeks after all chicks have fledged, which could be after July 31. As described under all of other alternatives, these measures should limit adverse impacts to state-listed/special status species; however, compliance with closures may not be absolute, resulting in short-term moderate to major adverse impacts if non-compliance occurs. However, for the most part, the populations would remain functional and impacts limited to minor to moderate adverse by the seasonal or year-round restrictions in the SMAs.

Under alternative F, there would be seasonal closures in key red knot habitat reducing the potential to impact resting and foraging red knots from vehicle use and associated noise and presence of people and pets, including the addition of four miles of “floating” closures that would offer greater protection to this species than alternatives A, B, C, or E.

Overall, there would be long-term minor to moderate adverse impacts to nesting state-listed/special status species, and long-term minor adverse impacts to red knot from ORV and pedestrian access under alternative F.

Night-Driving Restrictions. Under alternative F, all nonessential ORV traffic would be prohibited from all areas (other than the soundside), from one hour after sunset until approximately one-half hour after sunrise from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles with a valid ORV permit. Furthermore, the NPS retains the discretion to limit night driving to certain areas or routes, based on resource protection considerations. Because some species are known to be active at night (Staine and Burger 1994; Majka and Shaffer 2008), and chick and fledgling response to vehicles can increase their vulnerability to ORVs (USFWS 1996a), the high level of protection at night from May 1 to November 15 under alternative F would result in long-term beneficial impacts because it would reduce the potential for disturbance to birds that could result in mortality. Beneficial impacts under alternative F would be greater than those under alternatives B or E, due to the restrictions beginning at one hour after sunset instead of 10:00 p.m.

Commercial Fishing. Commercial fishing would be managed the same as under alternative C, resulting in long-term negligible adverse impacts from the presence of commercial fishing vehicles, with long-term minor to moderate benefits from night-driving restrictions.

Permits/Carrying Capacity. Alternative F would require a permit for ORV use, including night driving. As stated in these sections, the educational information provided by the required permit would result in benefits to state-listed/sensitive species as ORV users would be more aware of the regulations in place to protect these species, which would likely result in a higher level of compliance. There would be no impacts related to carrying capacity as ORV use would not be permitted within resource protection areas.

Pets/Other Recreational Activity Restrictions. Pets would be prohibited within all SMAs, which would greatly reduce the likelihood of pet disturbance in state-listed/special status species breeding areas; however, compliance is needed to ensure that this reduces the risk of impacts. Camping and beach fire restrictions would be the same as those under alternative C, with the addition of restricting beach fires from May 1 to November 15 to Coquina Beach, Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras Village, and Ocracoke day use area. These additional restrictions, along with the limitation of pets to village beaches during breeding season would result in long-term beneficial impacts to species at the Seashore as recreational pressures to state-listed/special status species would be further reduced.

Overall Impact of ORV and Other Recreational Use. The overall impact of ORV and other recreational use for each species under alternative F would be as follows:

- American oystercatcher. Implementation of a permit system with an educational component, larger buffer sizes, seasonal night-driving restrictions, prohibition of pets in the Seashore during breeding season including in front of the villages, and establishment of breeding and nonbreeding SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special status species. However, alternative F does manage three SMAs under ML2 procedures, which provide for some level of pedestrian or ORV access into these areas, which introduces the potential for impacts to the species. As there would be some protection measures in place, but recreational use could still have impacts to the species, impacts to American oystercatchers would be long-term minor to moderate adverse.
- Colonial waterbirds. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as American oystercatchers under this alternative, in addition to having some SMAs under ML2 procedures that open earlier than under other action alternatives.
- Wilson's plover. Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American

oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the buffers/closures provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.

- Red knot. Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative F that offer this wintering species further protection, including four miles of “floating” closures.

Cumulative Impacts. Cumulative actions and their associated impacts under alternative F would be the same as those described under alternatives A, B, C, D, and E (long-term minor to moderate adverse). Although alternative F provides additional protection that would be beneficial to state-listed / special status bird species, the adverse effects on birds from other actions occurring in the region would still exist. The cumulative impact of these past, current, and reasonably foreseeable future actions would be minor to moderate adverse. These impacts, when combined with the long-term beneficial and long-term minor to moderate adverse impacts of alternative F, would have long-term minor to moderate adverse cumulative impacts.

Conclusion. Overall, impacts to state-listed/special status species under alternative F would be as follows:

- American oystercatcher. Establishment of prenesting closures through SMAs earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts from human disturbance during field activities, resources management activities on the whole would provide information and result in actions that would be beneficial to the species. Implementation of SMAs that provide a proactive resource closure early in the breeding season, a permit system with an educational component, seasonal night-driving restrictions, as well as larger buffer sizes and earlier prenesting closures, would provide long-term beneficial impacts to the American oystercatcher, greater than those under alternative B. Prohibition of pets in SMAs during breeding season and establishment of nonbreeding SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to oystercatchers. However, alternative F does manage some SMAs under ML2 procedures, which provide for some level of pedestrian or ORV access into these areas, which introduces the potential for impacts to the species. Although there would be some protection measures in place, recreational disturbance could result in long-term minor to moderate adverse impacts to American oystercatchers.
- Colonial waterbirds. Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers. Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as American oystercatcher under this alternative.
- Wilson’s plover. Impacts to Wilson’s plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover. Impacts to Wilson’s plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to closures/buffers specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.
- Red knot. Many of the surveying and field activities would occur outside of the primary time when red knot are present at the Seashore. Therefore, any impacts to this species from surveying

and field activities would be long-term negligible adverse. However, the ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed to ORVs year-round, would be beneficial, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B. Additional benefits, when compared to the other alternatives, would be realized under alternative F from “floating” nonbreeding closures that would provide four additional miles of protection during this time. Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative F that offer this wintering species further protection, including four miles of “floating” closures.

Cumulative impacts under alternative F would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative F would not impair state-listed and special status species because although frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding or reproduction, and impacts would occur during critical periods of reproduction or in key habitats in the Seashore and could result in harassment, injury, or mortality to one or more individuals, sufficient population numbers and functional habitat would remain to maintain a sustainable population in the Seashore.

Under alternative F, the Seashore would establish SMAs, which proactively reduce or preclude recreational use early in the breeding season. SMAs are areas of suitable habitat that have had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding or nonbreeding season. Under alternative F, ORVs would be prohibited in SMAs from March 15 through July 31, or two weeks after all the chicks in the area have fledged (whichever comes later), for all seasonal areas except for 0.5 mile southwest of ramp 68 to 1.2 miles northeast of ramp 70, which would be closed to ORVs through October 31, and except at Cape Point and South Point where an ORV corridor would be established (subject to standard resource protection buffers and subject to resource closures) from March 15 through July 31. Four SMAs, including Hatteras Inlet Spit and North Ocracoke spit, would be closed to ORVs year-round. SMAs would be posted as prenesting closures by March 15 to protect birds establishing territories early in the breeding season. The remaining SMAs and prenesting closures outside of SMAs would not allow ORV or pedestrian access while prenesting closures are in effect. Alternative F would prohibit pets in all designated breeding shorebird SMAs from March 15 to July 31, or two weeks after all shorebird breeding activities have ceased or all chicks in the area have fledged, whichever comes later. In addition to nonbreeding shorebird SMAs, under alternative F, an additional four miles of ocean shoreline would be considered “floating” closures and would be closed to ORVs during the nonbreeding season. From March 15 through July 15, Seashore staff would survey prenesting closures three times per week and suitable habitat outside of prenesting closures two times per week, increasing to three times per week once birds are present.

All breeding shorebird SMAs would be posted as prenesting closures using symbolic fencing by March 15 at sites involving American oystercatchers and Wilson’s plover and by April 15 at sites involving colonial waterbirds. If multiple species exist on each site, closures would begin on the earliest date. Surveys for American oystercatchers and Wilson’s plover would begin on March 15, and surveys for colonial waterbirds would begin on May 1.

Each SMA would be under ML1 or ML2 management procedures. Under alternative F, ML1 procedures would require less monitoring of nests; however, there would be no ORV or pedestrian access allowed. Under ML2 procedures, birds would be monitored more frequently due to the presence of an ORV and/or pedestrian corridor.

Under alternative F, a total of seven SMAs would be managed under ML1 procedures and would be closed to both ORVs and pedestrians during the breeding season. Of these, four SMAs would be designated as non-ORV year-round; one SMA would be designated as non-ORV from March 15 through October 31; and two SMAs would be designated as non-ORV from March 15 through July 31, or two weeks after all chicks have fledged. Three SMAs would be managed under ML2 procedures during the breeding season. Of these, during the breeding season, Bodie Island Spit would have a pedestrian access corridor, subject to resource closures, and Cape Point and South Point would have ORV access corridors, subject to resource closures.

American oystercatchers at the Seashore can begin courting and nesting as early as mid-February or early March and be particularly sensitive to disturbance at that time. Hence, a March 15 start to management could mean that early nesting oystercatchers, especially those that establish territories outside of historic areas, would not be fully protected under alternative F.

Buffers would be applied both within and outside of designated SMAs. All SMAs would maintain a 300-meter (900-foot) buffer during all breeding activities for all state-listed/special status bird species. ML2 buffer areas would vary by species and activity. ML2 procedures for American oystercatchers would establish 150-meter (450-foot) buffers for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. Under ML2, buffers for least terns would be 100 meters (300 feet) for breeding and nesting activities and 200 meters (600 feet) for unfledged chick activity. All other colonial waterbird buffers under ML2 procedures would be 200 meters (600 feet) for breeding, nesting, and unfledged chick activities. For areas where breeding activity is observed outside of prenesting areas, ML1 procedures would determine the buffers. For alternative F, buffers would be removed outside of prenesting areas if no breeding activity is observed for a two-week period or when associated breeding activity has concluded, whichever is later. If breeding activity or scraping is observed outside of an existing closure, buffers would be expanded to accommodate the designated buffer for the particular management level (ML1 or ML2).

Under alternative F, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for all migratory and nonbreeding state-listed/special status species.

Under alternative F, all nonessential ORV traffic would be prohibited from all areas (other than the sound side), from one hour after sunset until approximately one-half hour after sunrise from May 1 to November 15. From November 16 to April 30, ORV use would be allowed 24 hours per day in designated ORV routes for vehicles with a valid ORV permit. Effects from commercial fishing would not be observable or measurable and would be well within natural fluctuations because the special use permit under which commercial fishing is managed prohibits entering resource closures and because a relatively small number of commercial fishermen operate inside the Seashore.

Although most visitors respect closures, closure intrusions by vehicles, pedestrians, and pets may result in harassment, injury, or mortality to one or more individuals. However, alternative F would require a permit for ORV use that includes an educational component. Because ORV users would be more aware of the regulations in place to protect state-listed/special status species, the permit requirement would likely increase compliance with buffers, closures, and other restrictions. Violations may result in permit revocation, which is expected to increase compliance. Alternative F would also establish a new voluntary

resource education program targeted toward non-ORV beach users. Under alternative F, ORVs would bring people into the vicinity of state-listed/special status species where trash associated with recreation use would continue to attract mammalian and avian predators. Predation is known to affect the reproductive success of shorebirds; the indirect impacts of attracting predators would be detectable and beyond the level of disturbance or harm that would occur naturally, but would not be expected to result in large declines in population because the Seashore takes management action to protect state-listed species from predation.

The impact analysis of alternative F deemed adverse impacts to state-listed/special status species from ORV and other recreational use to be minor to moderate because impacts would be detectable, and could be beyond the level of disturbance or harm that would occur naturally. Although some impacts might occur during critical reproductive periods or in key habitats in the Seashore and could result in injury or mortality, sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore.

The analysis in the plan/EIS of cumulative impacts combined the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore, such as major dredging and maintenance dredging of Oregon Inlet, storms and other weather events, local development, predator management by the seashore, and increased interpretative programs as part of the Seashore's long-range interpretive plan. The cumulative impacts were deemed to be minor to moderate adverse in the plan/EIS impact analysis because impacts on state-listed/special status species and their habitats would be detectable and could be beyond the level of disturbance or harm that would occur naturally. Some negative impacts to feeding, reproduction, resting or other factors affecting local population levels may occur and may result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and functional habitat would exist to maintain a sustainable population in the Seashore. Therefore, the state-listed/special status impacts would not result in impairment.

TABLE 55. SUMMARY OF IMPACTS TO STATE-LISTED AND SPECIAL STATUS SPECIES UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
American Oystercatcher – Resources Management Activities					
Impacts would be long-term minor to moderate adverse as surveying and lack of specific prenesting closures for this species may miss early nesters. Piping plover prenesting closures, which could be utilized by this species as well, would not protect a number of American oystercatcher nest sites used in recent years. Also, buffer distances based on bird behavior may not provide adequate protection for the species.	Establishment of piping plover prenesting closures earlier in the season that could be used by oystercatchers and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, resources management activities on the	Implementation of 10 SMAs that are closed to ORVs during the breeding season would provide a proactive resource closure early in the breeding season. Establishment of prenesting closures earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would still be minor adverse impacts	Establishment of 10 SMAs that are closed to ORVs year-round and all managed under ML1 procedures during the breeding season would provide long-term benefits to breeding and wintering American oystercatchers, greater than those under alternative C. Additional benefits would be provided from surveying and closures outside of these established SMAs,	Implementation of 10 SMAs, 7 of which are closed to ORVs during the breeding season, would provide a proactive resource closure early in the breeding season. Establishment of prenesting closures earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts to American oystercatchers. While there would	Implementation of 10 SMAs, 8 of which are closed to ORVs (with 1 open to pedestrians only) during the breeding season, would provide a proactive resource closure early in the breeding season. Establishment of prenesting closures through SMAs earlier in the season and establishment of larger, pre-set buffers would result in long-term beneficial impacts

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
	whole would provide information and result in actions that would be beneficial to the species.	related to human disturbance during field activities, on the whole, resources management activities would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to the American oystercatcher, greater than those provided under alternative B.	as well as from the education and outreach provided. These surveying and field activities would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to this species, greater than those provided under alternative B.	still be minor adverse impacts from human disturbance during field activities, resources management activities on the whole would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to this species, greater than those provided under alternative B.	to American oystercatchers. While there would still be minor adverse impacts related to human disturbance during field activities, resources management activities on the whole would provide information that would enable the implementation of adaptive management initiatives and contribute to better management. These activities would result in long-term beneficial impacts to the species, greater than those provided under alternative B.
American Oystercatcher – ORV And Other Recreational Use					
Impacts would be long-term moderate to major adverse as buffers that adjust frequently based on bird behavior are more subject to non-compliance. The lack of designated non-ORV areas, a permitting system, carrying capacity, or seasonal night-driving restrictions, and allowing pets at the Seashore during breeding season would contribute to these adverse impacts.	Establishment of prenesting closures for piping plover earlier in the season, implementation of larger, more immediate buffers, longer lasting closures for American oystercatchers once breeding behavior occurs, and night-driving restrictions would benefit the American oystercatcher. However, recreational use, with no carrying capacity, would still occur in the vicinity of this species and the established	Implementation of a permit system with an educational component, larger buffer sizes, seasonal night-driving restrictions, establishment of breeding and nonbreeding SMAs, and not allowing pets in SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special	Providing large SMAs that are closed year-round to ORVs and closed to pedestrians during the breeding season would provide large undisturbed areas for both breeding and nonbreeding oystercatchers. Further benefits would be provided by seasonal night-driving restrictions, the establishment of a permit system with an educational component, and prohibition of pets in SMAs year-round. With these measures in	Implementation of a permit system with an educational component, larger buffer sizes, seasonal night-driving restrictions, restrictions on pets in SMAs, and establishment of breeding and nonbreeding SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting recreational uses early in the breeding season, and limit the potential for	Implementation of a permit system with an educational component, larger buffer sizes, seasonal night-driving restrictions, prohibition of pets in the Seashore during breeding season including in front of the villages, and establishment of breeding and nonbreeding SMAs would benefit the American oystercatcher. SMAs would provide a proactive method of limiting

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
	<p>buffers may not be large enough to afford adequate protection. Because the birds would not be under constant observation, disturbance may go undetected and implementation of adequate buffers may be delayed in some nesting locations. Compliance with closures may not be absolute, resulting in minor to moderate adverse impacts if non-compliance occurs. Further adverse impacts would result from allowing pets in the Seashore during breeding season, resulting in the possibility of non-compliance with these regulations. Because of these factors, impacts to American oystercatchers from ORV use and other recreational activities would be long-term moderate adverse.</p>	<p>status species. However, alternative C does manage three SMAs under ML2 procedures, which provide for some level of pedestrian access into these areas and introduces the potential for impacts to the species. Although there would be some protection measures in place, ORV and other recreational use could still have impacts to the species, resulting in long-term minor to moderate adverse impacts to American oystercatchers.</p>	<p>place, impacts to American oystercatchers from ORV and other recreational use would be long-term minor adverse, as the chance of disturbance still exists, but would be lower than that under the other alternatives evaluated.</p>	<p>impacts to state-listed/special status species. However, alternative E does allow an ORV access corridor at three SMAs managed under ML2 procedures during the breeding season (more than the other action alternatives), which provide for some level of pedestrian or ORV access into these area, which introduces the potential for impacts to the species. Although there would be some protection measures in place, recreational use could still result in long-term minor to moderate adverse impacts to American oystercatchers.</p>	<p>recreational uses early in the breeding season, and limit the potential for impacts to state-listed/special status species. However, alternative F does manage three SMAs under ML2 procedures, which provide for some level of pedestrian or ORV access into these areas, which introduces the potential for impacts to the species. As there would be some protection measures in place, but recreational use could still have impacts to the species, impacts to American oystercatchers would be long-term minor to moderate adverse.</p>
Colonial Waterbirds – Resources Management Activities					
<p>Impacts would be long-term minor to moderate adverse as no prenesting closures would be established for colonial waterbirds. Some species, such as terns and black skimmers may be able to utilize the prenesting closures established for piping plovers; however, those prenesting areas would not protect a number of</p>	<p>Establishment of piping plover prenesting closures earlier in the season that would be used by some colonial waterbird species and establishment of larger, pre-set buffers would result in long-term beneficial impacts to colonial waterbirds. While there would still be minor adverse</p>	<p>Impacts to colonial waterbirds from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.</p>	<p>Impacts to colonial waterbirds from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.</p>	<p>Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.</p>	<p>Impacts to colonial waterbirds from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers.</p>

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
colonial waterbird nest sites used in recent years. Also, buffer distances based on bird behavior may not provide adequate protection for the species.	impacts related to human disturbance during field activities, resources management activities on the whole would provide information and result in actions that would be beneficial to the species.				
Colonial Waterbirds – ORV And Other Recreational Use					
Impacts would be long-term moderate to major adverse as buffers may not be adequate to protect the species, and disturbance from recreational uses is more likely. The lack of designated non-ORV areas, a permitting system, carrying capacity, or seasonal night-driving restrictions, and allowing pets in the vicinity of breeding birds would also contribute to adverse impacts.	Impacts to colonial waterbirds from ORV and other recreational use would be long-term moderate adverse, for the same reasons as American oystercatchers under this alternative.	Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as American oystercatchers under this alternative.	Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor adverse, for the same reasons as American oystercatchers under this alternative.	Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as those discussed above for American oystercatchers under this alternative.	Impacts to colonial waterbirds from ORV and other recreational use would be long-term minor to moderate adverse, for the same reasons as American oystercatchers under this alternative, in addition to having some SMAs under ML2 procedures that open earlier than under other action alternatives.
Wilson's Plover – Resources Management Activities					
Impacts would be long-term minor adverse as the habitat for this species would be well surveyed during piping plover surveys and this species would be able to take advantage of management measures for piping plover as their breeding seasons and habitat requirements are similar. Also, buffer distances based on bird behavior may not provide adequate protection for the species. Some benefits may occur from incidental	Establishment of piping plover prenesting closures earlier in the season that could be used by other species and establishment of larger, pre-set buffers for piping plover, used by Wilson's plover, would result in long-term beneficial impacts to Wilson's plover. While there would still be minor adverse impact related to human disturbance during field activities, species surveying and field activities	Impacts to Wilson's plover from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.	Impacts to Wilson's plover from surveying and field activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.	Impacts to Wilson's plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.	Impacts to Wilson's plover from resources management activities would be long-term beneficial, for the same reasons as discussed above for American oystercatchers, with slightly greater benefits as this species would also benefit from the management measures applied to piping plover.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
management of Wilson's plover during piping plover management activities, both during breeding and nonbreeding seasons.	on the whole would provide information and result in actions that would be beneficial to the species.				
Wilson's Plover – ORV And Other Recreational Use					
Impacts would be long-term moderate to major adverse as no specific management would be provided for this species, although they could utilize buffers and closures established for piping plover. The lack of designated non-ORV areas, a permitting system, carrying capacity, or seasonal night-driving restrictions, and allowing pets at the Seashore during breeding season would contribute to these adverse impacts.	Impacts to Wilson's plover from ORV and other recreational use would be long-term minor to moderate adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover and would therefore be provided slightly more protection than other state-listed/special status species.	Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse, less than those under alternative A and B. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize the closures for piping plover, in addition to the specific buffers/closures provided for the species, and would therefore be provided slightly more protection than other state-listed/special status species.	Impacts to Wilson's plover from ORV and other recreational use would be long-term negligible to minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the buffers/closures provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.	Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the buffers/closures provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.	Impacts to Wilson's plover from ORV and other recreational use would be long-term minor adverse. Although this species would face the same adverse impacts as American oystercatchers and colonial waterbirds, it also tends to utilize closures for piping plover, in addition to the buffers/closures provided specifically for this species, and would therefore be provided slightly more protection than other state-listed/special status species.
Red Knot – Resources Management Activities					
Many of the surveying and field activities for other species would occur outside of the primary time when the red knot is a resident at the Seashore. Therefore, any impacts to this species from surveying and field activities for other species would be long-term negligible adverse.					
Impacts to nonbreeding red knot would be long-term minor adverse as their prime foraging habitat (ocean shoreline) would not be afforded protection by nonbreeding closures, although the ability of this species to use wintering closures for piping plover at inlets and Cape Point would result in some benefit.	The red knot would benefit from extended breeding season closures for other species and from wintering closures for piping plover at the inlets and Cape Point. Impacts to nonbreeding red knot would be long-term minor adverse as their prime foraging habitat	Nonbreeding shorebird SMAs and the establishment of non-ORV areas along the ocean shoreline would result in beneficial impacts to nonbreeding red knots. However, the ability of this species to use wintering closures that have been	Nonbreeding shorebird SMAs and the establishment of non-ORV areas along the ocean shoreline would result in beneficial impacts to nonbreeding red knots. However, the ability of this species to use wintering closures that have been	The ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed year-round, would be beneficial, and overall result in long-term beneficial impacts	The ability of this species to use wintering closures that have been established for piping plover as well as the establishment of SMAs, some of which are closed year-round, would be beneficial, and overall result in long-term beneficial impacts

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
	(ocean shoreline) would not be afforded protection by nonbreeding closures.	established for piping plover as well as the establishment of SMAs, some of which are closed to ORVs year-round, would be beneficial to those red knot that happen to use those areas, and overall result in long-term beneficial impacts to the species when compared to alternatives A and B.	established for piping plover as well as the establishment of SMAs, all of which are closed to ORVs year-round would result in long-term beneficial impacts to red knot when compared to all other alternatives.	to the species when compared to alternatives A and B.	to the species when compared to alternatives A and B. Additional benefits, when compared to the other alternatives, would be realized under alternative F from “floating” nonbreeding closures that would provide four additional miles of protection during this time.
Red Knot – ORV And Other Recreational Use					
Impacts would be long-term moderate adverse as no specific management would be provided for this species especially during a key life stage of wintering. The lack of designated non-ORV areas, a permitting system, or night-driving restrictions when red knots are at the Seashore, and allowing pets at the Seashore during the migrating/nonbreeding season would contribute to these adverse impacts. Impacts to red knots would be lower than other species as they would not be subject to impacts during their breeding cycle and their use of the Seashore corresponds to times of lower visitation.	Impacts to red knots from ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species especially during a key life stage of wintering. Although this species may benefit from longer lasting breeding season closures for other species and from winter closures established for piping plovers, the lack of designated non-ORV areas, a year-round permitting system, no night-driving restrictions when red knots are at the Seashore, and allowing pets at the Seashore during the migrating / nonbreeding season would contribute to these adverse impacts.	Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative C that offer this wintering species further protection.	Impacts to red knot from recreation and other activities would be long-term negligible to minor adverse due to the additional nonbreeding closures provided under alternative D that offer this wintering species further protection as well as the large year-round SMAs that would offer further protection during red knot wintering.	Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative E that offer this wintering species further protection; however, there would be greater adverse impacts than under alternatives D or F due to fewer miles of shoreline being closed to ORVs under alternative E during the nonbreeding season.	Impacts to red knot from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative F that offer this wintering species further protection, including four miles of “floating” closures.

WILDLIFE AND WILDLIFE HABITAT

GUIDING REGULATIONS AND POLICIES

The Seashore's Resource Management Plan (NPS 1997) identifies the following natural resource-related goals to provide direction for future management of the Seashore:

- Identify visitor uses and impacts to establish appropriate management policies that would meet the needs of the Seashore visitor while providing for the preservation and protection of the resources unimpaired for future generations.
- Continue to provide rigorous enforcement, research, environmental surveying, and applied resource management in accordance with available funding and direction.
- Continue to closely monitor and regulate recreational use in accordance with environmental, ecological, and preservation considerations.

Service-wide NPS regulations and policies, including the NPS *Organic Act of 1916*, NPS *Management Policies 2006* (NPS 2006c), and the NPS Natural Resource Management Reference Manual 77, also direct national parks to provide for the protection of Seashore resources. The *Organic Act* directs national parks to conserve wildlife unimpaired for future generations and is interpreted to mean that native animal life is to be protected and perpetuated as part of a park unit's natural ecosystem. Parks rely on natural processes to control populations of native species to the greatest extent possible; otherwise, they are protected from harvest, harassment, or harm by human activities.

The NPS *Management Policies 2006* state that the NPS “will maintain as parts of the natural ecosystems of parks all plants and animals native to park ecosystems. The term “plants and animals” refers to all five of the commonly recognized kingdoms of living things and includes such groups as flowering plants, ferns, mosses, lichens, algae, fungi, bacteria, mammals, birds, reptiles, amphibians, fishes, insects, worms, crustaceans, and microscopic plants or animals.” The NPS will achieve this by:

- preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur;
- restoring native plant and animal populations in parks when they have been extirpated by past human-caused actions; and
- minimizing human impacts on native plants, animals, populations, communities, and ecosystems, and the processes that sustain them (NPS 2006c).

Section 4.1 of NPS *Management Policies 2006* states that “natural resources will be managed to preserve fundamental physical and biological processes, as well as individual species, features, and plant and animal communities. The Service will not attempt to solely preserve individual species (except threatened or endangered species) or individual natural processes; rather, it will try to maintain all the components and processes of naturally evolving park ecosystems, including the natural abundance, diversity, and genetic and ecological integrity of the plant and animal species native to those ecosystems” (NPS 2006c). According to Section 8.2.2.1 of the NPS *Management Policies 2006*, “Superintendents will develop and implement visitor use management plans and take action, as appropriate, to ensure that recreational uses and activities in the park are consistent with its authorizing legislation or proclamation and do not cause unacceptable impacts on park resources or values” (NPS 2006c).

Seashore wildlife has evolved in a barrier island ecosystem, which is dependent on the continuation of natural shoreline processes. Barrier islands are highly dynamic with changes in sea level, wave and wind action, and ocean currents continuously creating and altering habitat for wildlife through the processes of erosion and accretion of shorelines and sand dunes; overwash across the islands; and the formation, migration, and closure of inlets. To protect coastal barrier processes, the *NPS Management Policies 2006* direct that natural shoreline processes such as erosion, deposition, dune formation, overwash, inlet formation, and shoreline migration will be allowed to continue without interference (NPS 2006c, sec. 4.8.1.1). The policies further state, “[w]here human activities or structures have altered the nature or rate of natural shoreline processes, the Service will, in consultation with appropriate state and federal agencies, investigate alternatives for mitigating the effects of such activities or structures and for restoring natural conditions.”

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

The following describes the methodology used to evaluate the impacts of the proposed alternatives on general wildlife at the Seashore. This discussion focuses on those species that may potentially be impacted by the actions described in the proposed alternatives and is, therefore, directed toward specific wildlife, including invertebrates and “other” bird species (those not state or federally protected or species of special concern). The analysis is organized according to those two wildlife types. Although a number of studies have investigated ORV impacts on invertebrates found on sandy beaches, the studies have focused on a relatively small number of species, and only a few of the studies have occurred on southeastern U.S. beaches that would have similar species to the beaches of Cape Hatteras National Seashore. There have also not been any comprehensive studies within the Seashore to determine the species composition and abundance of invertebrates within the bird foraging habitat. As a result, sufficient information is not available to provide a site-specific assessment of impacts of ORVs on all of the invertebrate species inhabiting the wrack, intertidal sand flats, island spits, and the high energy intertidal zone at the Seashore. Therefore, impacts to invertebrates are discussed in general terms, based on existing studies and, where possible, impacts on species specific to the Seashore are discussed.

Potential impacts on other bird species and their associated habitat focused on shorebirds that would likely be using the same habitats as the protected species addressed in this plan/EIS. Information about habitat and other existing data were acquired from staff at the Seashore, the USFWS, and available literature (see the Literature Review in appendix A). A comprehensive list of other bird species can be found in “Chapter 3: Affected Environment.”

For each alternative, potential impacts on wildlife and wildlife habitat were evaluated based on the pattern of proposed ORV use at the Seashore, resulting from what areas are open to ORV and other recreational uses and for what duration, the nature of habitats and species present, and the nature of coastal barrier processes that create and alter habitat. Primary steps in assessing impacts on wildlife and wildlife habitat were to determine (1) the potential for species to occur in habitats likely to be affected by management actions described in the alternatives; (2) current and future use and distribution of ORVs by alternative; (3) habitat impact or alteration caused by the alternatives; and (4) disturbance potential of the action and the potential to directly or indirectly affect wildlife or wildlife habitat as a result of ORV activities. The information contained in this analysis was obtained through best professional judgment of the Seashore staff and experts in the field and by reviewing applicable scientific literature.

A summary of impacts to wildlife and wildlife habitat under all alternatives is provided in table 56 at the end of this section. The following thresholds for evaluating impacts to wildlife and wildlife habitat were defined.

Negligible: There would be no observable or measurable impacts to native species, their habitats, or the natural processes sustaining them. Impacts would be well within natural fluctuations.

Minor Adverse: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, but would not be outside the natural range of variability. Occasional responses by some individuals to disturbance could be expected, but without interference to feeding, reproduction, resting, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors might occur. However, some impacts might occur during critical reproduction periods for a species, but would not result in injury or mortality. Sufficient habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Moderate Adverse: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable and could be outside the natural range of variability. Frequent responses by some individuals to disturbance could be expected, with some negative impacts to feeding, reproduction, resting, or other factors affecting local population levels. Some impacts might occur during critical periods of reproduction or in key habitats in the Seashore and result in harassment, injury, or mortality to one or more individuals. However, sufficient population numbers and habitat in the Seashore would remain functional to maintain a sustainable population in the Seashore.

Major Adverse: Impacts on native species, their habitats, or the natural processes sustaining them would be detectable, would be expected to be outside the natural range of variability, and would be permanent. Frequent responses by some individuals to disturbance would be expected, with negative impacts to feeding, reproduction, or other factors resulting in a decrease in Seashore population levels or a failure to restore levels that are needed to maintain a sustainable population in the Seashore. Impacts would occur during critical periods of reproduction or in key habitats in the Seashore and result in direct mortality or loss of habitat. Local population numbers, population structure, and other demographic factors might experience large declines.

Duration: Short-term effects would be one to two breeding seasons for bird species and one to two years for all other native species.

Long-term would be anything beyond two breeding seasons for bird species or two years for all other native species.

Study Area

The study area for assessment of the various alternatives is the Seashore boundary. The study area for the cumulative impacts analysis is the Seashore plus the adjacent lands outside of the Seashore boundaries on Bodie, Hatteras, and Ocracoke islands.

Impacts Common to All Alternatives

Impacts to Invertebrates—Resources Management Activities. Under all alternatives, species surveying and management would occur for piping plover, sea turtles, and seabeach amaranth. These

surveying activities may vary in duration between alternatives, but the use of ATVs/UTVs and, in some cases, ORVs to conduct certain surveying and management activities is a constant among alternatives.

Management activities that would have the greatest potential to impact invertebrates include the use of vehicles for surveying and management because of the potential for mortality of individual invertebrates caused by compaction under vehicle tires. Seashore staff would continue to use ATVs/UTVs and occasionally ORVs to conduct bird and turtle surveys and also to establish resource closures as required based on species behavior under all alternatives. Staff would avoid driving across the wrack line, an area known to contain high number of invertebrates, and would only drive during nighttime hours when patrolling for law enforcement reasons, which would limit impacts to invertebrates in this area. Driving in the wrack line would be limited because studies have shown that areas closed to ORV use have higher densities of invertebrates in these areas (Landry 2004; Kluft and Ginsberg 2009; Moss and McPhee 2006). Due to the limited amount of vehicle use by staff and the fact that such use would occur predominantly during the day, impacts to beach invertebrates from resources management activities would be long-term negligible adverse across all alternatives.

Impacts to Other Bird Species—Resources Management Activities. Under all alternatives, Seashore staff would perform surveys of recent breeding areas for protected species and would also continue to monitor breeding, nesting, and fledging activities throughout the breeding season. Although the time and duration of these surveys may vary between alternatives, common to all alternatives is that surveying and monitoring activities would bring staff and/or vehicles into contact with other bird species, increasing the potential for disturbance. However, the majority of these other bird species are not at the Seashore during their breeding cycle, which would reduce the impacts of disturbance from resources management staff under all alternatives. Also, many of the surveying and field activities for protected species would occur outside of the primary time when other bird species are residents at the Seashore. Because resource protection staff would also take proper measures to minimize any disturbance to these species, surveying activities associated with all alternatives would only result in negligible adverse effects on other bird species.

Also common to all alternatives is the provision of prenesting habitat closures for protected species, species closures for breeding activities, and closure of nonbreeding wintering habitat. All alternatives include the establishment of prenesting closures for recent piping plover breeding areas, and nesting buffers and closures around established territories and nests of colonial waterbirds and American oystercatchers. The symbolic fencing would deter the entry of people, pets, and ORVs into these habitats. Although the size and location of these closures vary between the alternatives, these closures would be implemented under each alternative and would benefit birds other than the piping plover, American oystercatcher, and other protected species. Species that are not listed as state or federally protected or are not species of special concern would also benefit from the management measures for protected species under all of the alternatives. However, the majority of the other bird species would not be present at the Seashore to take advantage of prenesting closures established for piping plover or other breeding bird species. Therefore, the establishment of prenesting closures would only result in minimal benefits for other bird species.

Because these other bird species are at the Seashore during wintering and migration, they would be most affected by the wintering/nonbreeding management actions included in this plan/EIS. These impacts are discussed below under each specific alternative.

Predation. An indirect impact from ORV and recreational use is the attraction of mammalian and bird predators to the waste stream associated with recreational use (USFWS 1996a). Although the Seashore would enforce proper trash disposal and anti-wildlife feeding regulations, recreational use would continue to have indirect impacts on other bird species through the attraction of predators. These predators are a

well-known factor in nest failure for piping plovers and all ground nesting birds within the Seashore. However, because the majority of these other bird species do not breed at the Seashore, they are not subject to predation pressures during this life cycle stage. However, under all alternatives, some adult migratory bird species could still be taken by predators, resulting in long-term negligible to minor adverse impacts to other bird species at the Seashore.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Under alternative A, there would be no construction activities implemented and therefore no construction related impacts would occur to wildlife or wildlife habitat. Activities that could potentially impact wildlife and wildlife habitat under alternative A would be associated with species surveying and management, the continued recreational use of ORVs, and pedestrian activity.

Impacts to Other Bird Species

Resources Management Activities. No nonbreeding closures would be established for other bird species, although these species could utilize the nonbreeding closures for piping plover that would include suitable interior habitats at spits and at Cape Point year-round. Being able to utilize other species closures would have some long-term benefits, as some protection is offered during this sensitive life stage. However, these closures would not be specific to other bird species and would not include ocean beach habitat, resulting in long-term minor adverse impacts to other bird species.

ORV and Other Recreational Use. Alternative A would permit ORV access to all areas of the Seashore, 24 hours a day, except those areas that are closed for resource protection during breeding season, or those areas closed for administrative or safety purposes. ORV and other recreational activities that occur in the months when other bird species are in residence on Seashore beaches have the potential to impact resting and foraging birds from vehicle use and associated noise and presence of people and pets. Of particular concern is when these disturbance factors result in birds being forced to fly while they are foraging, known as frequent escape flight. Frequent escape flights result in a reduction in time foraging and an increase in the time spent flying. Because foraging is replaced with flying, birds would not be able to add the body fat they need for migration, resulting in long-term minor to moderate adverse impacts.

Because this alternative would allow an unlimited number of vehicles and pedestrians to access most areas of the Seashore 24 hours a day, there is the potential for frequent disturbance to other bird species. Even though buffers would be established for protected species (which could be used by other bird species), it is likely that some birds could be disturbed by recreational or commercial fishing activities as vehicles disturbance can affect nonbreeding birds (Tarr 2008).

Impacts to other bird species from ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for these species especially during wintering and migration, when most of these species are present at the Seashore. The lack of designated non-ORV areas, a permitting system, or night-driving restrictions, and allowing pets at the Seashore during the migrating/nonbreeding season would contribute to these long-term moderate adverse impacts.

Impacts to Invertebrates

ORV and Other Recreational Use. Under alternative A, ORV routes would include the entire ocean beach and would include the wrack line, intertidal zone, or sand flats that would be open to ORV use unless closed by protected species closures. While the typical ORV use pattern within the Seashore is to drive on the upper beach, above the high tide line (Hardgrove pers. comm. 2005), when recreational

vehicles reach their destination they may drive into the intertidal zone and Seashore. Access to commercial fishing grounds also involves operating vehicles in the intertidal zone to reach desired fishing destinations. Driving on the sands of the intertidal zone would likely have adverse impacts on invertebrates due to mortality of individual species caused by compaction under vehicle tires. Access to the intertidal zone often requires vehicles to cross over the wrack line, which is normally deposited within the ORV corridor and is usually an area of high concentrations of invertebrates. Driving over the wrack line would cause damage and dispersal to an important source of food and habitat for many beach invertebrates (Kluft and Ginsberg 2009; Stephenson 1999).

Impacts of night driving on ghost crab populations at the Seashore are also a concern under alternative A. Though the extent of the ghost crab populations within the Seashore has not been documented, Wolcott and Wolcott (1984) concluded that even 20–50 vehicles driving at night could impact ghost crab populations, as demonstrated in their study at Cape Lookout National Seashore. As unlimited night driving would be allowed under alternative A, it can be expected that this level of traffic would have long-term minor to moderate adverse impacts on the ghost crab population.

In summary, the implementation of alternative A would result in long-term minor to moderate adverse impacts to invertebrate species primarily due to mortality arising from unlimited night driving in the intertidal and wrack areas.

Cumulative Impacts. Other past, present, and future planned actions within and the Seashore have the potential to impact invertebrates and other bird species. While the many different bird species considered in this section may arrive at the Seashore at different times (although not during breeding), in general the below actions would occur year-round and have the potential to impact many of the other bird species. Various dredging is occurring in the vicinity of the Seashore, such as the dredging of the federally authorized navigation channel at Oregon Inlet. These dredging activities fall under two categories: major dredging projects and maintenance activities. For the dredging of Oregon Inlet, major projects occur every four to five years, with sand being deposited in areas outside the Seashore, such as on Pea Island. While the actual dredging would impact benthic invertebrates within the channel, it would not directly impact invertebrates within the sandy beach habitat of the Seashore. However, during the dredging operations some heavy construction equipment may be used at the deposition site, which is typically Pea Island (USACE 2002; NPS 2007e, 2003e). Depending on the size and weight of the equipment and the timing and duration of the operations, there could be a short-term moderate adverse impact on some of the invertebrate species on Pea Island beaches due to crushing and compaction of the sand. However, given the total available spit habitat within the Seashore, the overall impact to the Seashore would be short-term minor to moderate adverse. The type and placement location of the dredged material, as well as the timing and frequency of placement, may also have adverse impacts on invertebrates in the study area. Deposition of dredged material has direct impacts to invertebrates in the area where the material is deposited, due to crushing under the weight of the material, changes in the sediment characteristics of the beach, and increases in turbidity. While populations of most beach invertebrates can recover fairly quickly from a single beach disposal event, annual sand placements could keep beach fauna in a long-term state of disturbance at reduced levels. Because the Pea Island population of ghost crabs is particularly sensitive to deposition of sand/dredge material, they would be adversely impacted within the beach disposal area (USFWS 2001). The effects of deposition of dredged materials would result in long-term moderate adverse impacts on invertebrates. Major or maintenance dredging can occur when many of these other bird species are using Seashore and could result in short-term minor adverse impacts due to disturbance. When major dredging projects do occur, it is common for bird habitat at the southern end of Bodie Island Spit to slough off into the channel for a number of months after the dredging operation, which could cause short-term minor to moderate adverse effects to habitat.

The replacement of the Herbert C. Bonner Bridge is likely to adversely affect invertebrates due to bridge piling placement, dredging, and deposition of dredged materials, which would result in similar impacts as the annual Oregon Inlet dredging, although bridge construction would be a one-time event with only short-term effects on invertebrates. The new bridge could disturb or displace some other bird species, but could also provide some long-term benefits by allowing barrier island processes to occur more naturally than the existing bridge and provide for new habitat opportunities. To the extent that the new bridge would allow the natural formation of new habitats, such as overwash fans, new inlets, and low sloping beaches, it might provide additional suitable habitat for other bird species. In addition, the final EIS for the project lays out a plan for avoidance, minimization, and compensatory mitigation to ensure impacts to wildlife and wildlife habitats, including invertebrate and other bird species habitats, are minimized (FHWA 2007). The final bridge alignment could result in the closure of ramp 4 and the construction of a new ramp 3 and associated parking north of Oregon Inlet Campground. The new ramp and parking area would be constructed in proximity to NC-12, but could result in the displacement of some bird species due to loss of habitat in the area of disturbance. However, due to the relatively small size of the construction area, sufficient habitat would remain to maintain a sustainable population in the Seashore and impacts to birds due to direct habitat loss would be long-term negligible to minor adverse. Impacts to beach invertebrates would be long-term negligible adverse due to the relatively small construction area, the mobility of invertebrates, and the distance of the facilities from the high energy shoreline where concentrations of invertebrates are higher.

Commercial fishing has been allowed within the Seashore in the past and would continue to be allowed under alternative A. Commercial fish harvesting would have long-term negligible impacts on other bird species because these birds do not feed on any commercially important fish. However, other bird species feed on some of the same prey items of fish species that may be harvested and, as such, harvest of fish may mean greater prey encounters for these bird species. In this case, commercial fishing would have long-term negligible to minor adverse impact on other bird species. Potential impacts to invertebrates from commercial fishing would result from vehicles driving in the intertidal area and over the wrack line, as discussed above under “ORV and Other Recreational Use.”

The implementation of the land use plans and zoning ordinances for Dare and Hyde counties that address how development can occur in the counties could result in additional residential development and an increase in the local population. This could result in adverse impacts on invertebrates and other bird species by increasing the amount of ORV traffic on the beaches, as well as decreasing the amount of habitat available to these species due to increased development pressures in the counties. However, that lack of detail on expected local development patterns makes it extremely difficult to estimate impacts on invertebrates and other bird species under alternative A.

The overall cumulative impact of these past, current, and future actions on other bird species would be long-term minor adverse, and when combined with the long-term minor to moderate adverse impacts under alternative A, would result in long-term minor to moderate adverse impacts to other bird species in the area of analysis.

The overall cumulative impact of these past, current, and future actions on invertebrates would be long-term negligible to moderate adverse; and when combined with the long-term minor to moderate adverse impacts in alternative A, would be long-term minor to moderate adverse depending upon the individual species of invertebrate.

Conclusion. Impacts to other bird species from resources management activities would be long-term minor adverse as nonbreeding closures would not be species-specific and therefore would not protect important habitat areas such as the ocean shoreline. Impacts of ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species, increasing the

possibility of disturbance to the species from recreational use. The lack of designated non-ORV areas, a permitting system, or night-driving restrictions during the time period when these species are present at the Seashore, and allowing ORVs, people and pets at the Seashore during the nonbreeding season in the vicinity of these species would contribute to adverse impacts.

Cumulative impacts to other bird species would be long-term minor to moderate adverse under alternative A.

Under alternative A, ORV and other recreational use would have negligible to moderate adverse impacts to invertebrate species within the Seashore due to habitat disturbance or direct mortality from vehicles either during species surveying and management or from recreational use, and alternative A has no areas closed to ORV use except for resource-related closures. The establishment of prenesting closures, resource closures, and buffers would result in long-term negligible adverse impacts on invertebrates due to vehicle use by resources management staff.

Cumulative impacts to invertebrates would be long-term minor to moderate adverse, depending on the species of invertebrate and level of disturbance.

Impairment Determination. Implementation of alternative A would not result in impairment to wildlife as sufficient population numbers and functional habitat would remain to maintain sustainable populations of invertebrates and other bird species in the Seashore. Implementation of alternative A would permit year-round unrestricted night driving on the beach and would designate the entire ocean beach as an ORV route. This alternative would also not contain specific nonbreeding shoreline closures that would benefit other bird species, which would result in unprotected habitat along the ocean shoreline. No construction would occur under alternative A. The plan/EIS impact analysis deemed the adverse effects on other wildlife from the implementation of alternative A to be moderate because, although occasional disturbance and harm to other wildlife or their habitat (beyond the level of disturbance and harm that can occur naturally) would be expected from ORV and other recreational use, the Seashore would maintain sustainable populations of invertebrates and other bird species.

Cumulative impacts from combining the effects of alternative A with effects of other past, present, and future planned actions in and around the Seashore would likely result in harassment, injury, or mortality to other wildlife at the Seashore. Even with these adverse effects, sufficient population numbers and functional habitat in the Seashore would remain to maintain sustainable populations of other bird species and invertebrates in the Seashore. Therefore, impacts to other wildlife would not result in impairment to these species.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Impacts to Other Bird Species

Resources Management Activities. No nonbreeding closures would be established for other bird species, although these species could utilize the nonbreeding closures for piping plovers that would include suitable interior habitats at spits and at Cape Point year-round. Being able to utilize other species closures would have some long-term benefits, as some protection is offered during this sensitive life stage. However, these closures would not be specific to other bird species and would not include ocean beach habitat, resulting in long-term minor adverse impacts to other bird species.

ORV and Other Recreational Use. Alternative B would designate the entire ocean beach of the Seashore as an ORV route or area. There would be no designated non-ORV areas, although temporary

closures would occur for resource protection and safety reasons, and seasonal closures would occur in front of the villages. Alternative B would provide for closures of piping plover prenesting areas, which may benefit other species, as well as closures based on observations of breeding behavior, foraging, and chick movements. Under the consent decree, for the benefit of all bird species, from March 15 to November 30, in all locations not in front of villages, outside of the prenesting areas, and open to ORV use, the NPS would provide an ORV-free zone in the ocean backshore at least 10 meters wide and running the length of the site, wherever backshore habitat exists, provided there is sufficient beach width to allow an ORV corridor at least 20 meters above the mean high tide line.

Under alternative B, as described under alternative A, there would be no year-round or seasonal closures specifically to protect habitat for other bird species. Recreational activities that occur in the months when other bird species are in residence on Seashore beaches have the potential to impact resting and foraging birds from vehicle use and associated noise and presence of people and pets. As described under alternative A, of particular concern is when disturbance results in birds being forced to fly while they are foraging, which would result in long-term minor to moderate adverse impacts as birds would not be able to add the body fat they need for migration.

Under alternative B, all recreational ORV traffic would be prohibited in the ocean intertidal zone, ocean backshore, and dunes, from 10:00 p.m. until 6:00 a.m. between May 1 and September 15. However, from September 16 to November 15, night-driving permits would be available for authorized nonessential driving between the hours of 10:00 p.m. and 6:00 a.m. Restrictions on night driving under alternative B would provide long-term benefits to other bird species that forage at night; however, night driving could still result in long-term minor adverse impacts during the time when night driving is allowed by permit. Further, night-driving restrictions that begin after dark, in this case 10:00 p.m., would not provide full nighttime protection for night-foraging birds.

Impacts to other bird species from ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for these species, especially during wintering. Although other bird species may benefit from longer lasting breeding season closures for protected species and from wintering closures established for piping plovers, the lack of designated non-ORV areas, a year-round permitting system, or night-driving restrictions when many other bird species are at the Seashore, and allowing pets at the Seashore during the migrating / nonbreeding season would contribute to these adverse impacts.

Impacts to Invertebrates

ORV and Other Recreational Use. ORV and other recreational use under alternative B would be similar to alternative A, except for restrictions on night driving and increased resource protection buffer distances. Alternative B would also involve the designation of an “ORV-free zone” in the ocean backshore (except in front of villages) when there is sufficient beach width to permit a 65.6-foot (20-meter) wide ORV corridor along the shoreline. Under alternative B, visitors would be allowed to operate ORVs in all areas of the Seashore, but driving between the hours of 10:00 p.m. and 6:00 a.m. would be prohibited from May 1 through September 15, and would require a permit from September 15 through November 15. However, commercial fishermen would be able to access the shoreline at 5:00 a.m. instead of 6:00 a.m., subject to certain restrictions per the June 2008 modification to the consent decree. As under alternative A, ORV use would be subject to temporary resource closures, seasonal ORV closures in front of the villages, and temporary ORV safety closures. Recreational ORV use would be expected to continue at levels similar to alternative A, but there would be substantially less night driving on an annual basis due to the restrictions. Because night driving would be limited, and night is the time when ghost crab are most active, alternative B would likely have long-term minor adverse impacts on the ghost crab population because the amount of time that ORVs spend in ghost crab habitat would be

limited. However, in those areas that require ORVs to frequently drive through the wrack due to insufficient beach width and/or protected species closures, both during day and nighttime, impacts to invertebrates within or near the wrack would be long-term minor adverse due to direct impacts from invertebrates being crushed by vehicles. Due to the amount of areas that would be closed for protected species under alternative B, impacts to all invertebrate species would be lower under alternative B when compared to alternative A.

In summary, the implementation of alternative B would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative B would be identical to those under alternative A. These impacts, when combined with the long-term minor to moderate adverse impacts under alternative B, would result in long-term minor to moderate adverse cumulative impacts to other bird species.

These actions would have long-term negligible to moderate adverse impacts for invertebrate species. These impacts, when combined with the long-term minor adverse impacts to invertebrates in alternative B, would result in long-term minor to moderate adverse cumulative impacts depending upon the individual species of invertebrate.

Conclusion. Impacts to other bird species would be long-term minor adverse as nonbreeding closures would not be species-specific and therefore would not protect important habitat areas such as the ocean shoreline when many of these species are wintering or migrating. Impacts of ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for these species, increasing the possibility of disturbance to the species from recreational use. The lack of designated non-ORV areas, allowing night driving during the time period when other bird species are present at the Seashore, and allowing ORVs, people and pets at the Seashore during the nonbreeding season in the vicinity of these species would contribute to adverse impacts.

Cumulative impacts to other bird species would be long-term minor to moderate adverse under alternative B.

ORV and other recreational use would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Impacts would be reduced when compared to alternative A due to limitations on ORV use at night and within the larger resource protection closures under alternative B.

Cumulative impacts to invertebrates would be long-term minor to moderate adverse, depending on the species of invertebrate.

Impairment Determination. Implementation of alternative B would not result in impairment to wildlife as sufficient population numbers and functional habitat would remain to maintain sustainable populations of invertebrates and other bird species in the Seashore. Implementation of alternative B would designate all of the ocean beach as an ORV route, but would restrict night driving between 10:00 p.m. and 6:00 a.m. from May 1 through September 15. This alternative would not contain specific shoreline nonbreeding closures that would benefit other bird species, which would result in unprotected habitat along the ocean shoreline. Alternative B would also allow night driving before 10:00 p.m. and outside the seasonal restrictions, which would result in impacts to birds and invertebrates that use the beaches during the night. The plan/EIS impact analysis deemed the adverse effects on other wildlife from the implementation of alternative B to be moderate because, although occasional disturbance and harm to other wildlife or their habitat (beyond the level of disturbance and harm that can occur naturally) would be expected from ORV

and other recreational use, the Seashore would maintain sustainable populations of invertebrates and other bird species.

Cumulative impacts from combining the effects of alternative B with effects of other past, present, and future planned actions in and around the Seashore would likely result in harassment, injury, or mortality to other wildlife at the Seashore. Even with these adverse effects, sufficient population numbers and functional habitat in the Seashore would remain to maintain sustainable populations in the Seashore. Therefore, impacts to other wildlife would not result in impairment to these species.

Impacts of Alternative C: Seasonal Management

Impacts to Other Bird Species

Resources Management Activities. Under alternative C, Nonbreeding Shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for migratory and nonbreeding bird species compared to alternatives A and B, which do not have provisions to protect nonbreeding shorebirds. As many of these species are not present at the Seashore for breeding, any impacts to other bird species from surveying and field activities for protected species would be long-term negligible adverse. Overall, resources management activities would result in long-term beneficial impacts for other bird species due to the establishment of large, Nonbreeding Shorebird SMAs.

ORV and Other Recreational Use. Alternative C would involve closing the spits, points, and other SMAs to vehicular access for seven months out of the year, although pedestrian access to the most popular recreation areas would still be possible via an access corridor. Species buffers under this alternative would be similar to those under alternative B, although they would be larger in areas where ML1 measures would apply. Under alternative C, other bird species would benefit from the lack of vehicles and reduced pedestrian presence at the SMAs between March 14 and October 15, although the beneficial impact would only apply to those species present at the Seashore during the seasonal closures. Because this alternative would require some level of resource education in order to receive an ORV permit, all species at the Seashore, including other bird species, would benefit from the increased level of resource stewardship that is associated with public awareness. Some additional recreational access would result from the establishment of the interdunal road between ramp 45 and ramp 49, but the roads would be closed during the prenesting period and provide additional habitat for non-listed species during that time. The interdunal road would provide access around Cape Point to new ramps 47 and 48, around sites typically used by other bird species at the Seashore. Use of the road should not result in measurable impacts to other bird species because they would either remain on the beach or within the forested wetlands in the interior of the island. An indirect impact from recreational use would be the attraction of mammalian and avian predators, as described under alternative A.

Closing approximately 29 miles of village beaches and SMAs to ORV use for seven months out of the year would result in fewer disturbances to other bird species that use the SMAs for foraging and would also reduce the waste stream and the local abundance of predators. There would continue to be disturbance to other bird species from vehicles and pedestrians, but it would be less than under the no-action alternatives due to the increased buffer distances, designation of some year-round non-ORV areas,

and seasonal closures of the SMAs under alternative C. As described under alternative A, of particular concern is when disturbance results in birds being forced to fly while they are foraging, which would result in adverse impacts as birds would not be able to add the body fat they need for migration. Impacts to other bird species from ORV and other recreational use under alternative C would be long-term minor adverse.

Construction Activities. Implementation of alternative C would involve the installation or replacement of six new ORV access ramps, construction of seven new or expanded parking lots, and the development of one new interdunal road from ramp 45 to ramp 49. Construction activities would result in the temporary displacement of some other bird species localized in the areas of proposed disturbance and would involve a loss of some marginal habitat near the parking areas. Impacts to other bird species would be short-term negligible to minor adverse because these short-term disturbance impacts and changes to these marginal areas of habitat would not be expected to be a factor in the continued existence of these species at the Seashore.

Impacts to Invertebrates

ORV and Other Recreational Use. Alternative C would involve the designation of some year-round ORV routes, as well as some routes and areas that would be open to ORV use from October 15 to March 14, primarily for resource protection reasons. Although the spits, points, and other SMAs would be closed to vehicular access for seven months out of the year, pedestrian access to the most popular recreation areas would still be possible via a pedestrian access corridor. ORV and pedestrian access would continue to be subject to temporary resource closures and nonbreeding habitat restrictions. Species buffers under this alternative would be similar to those under alternative B, although they would be larger in areas designated for ML1 measures. Alternative C would prohibit ORVs on the beaches between 7:00 p.m. and 7:00 a.m. from May 1 through November 15. This alternative would involve a permit system with an educational requirement and the possibility of revocation in the event of a violation.

Closing approximately 29 miles of beach to ORV use for seven months out of the year would result in fewer disturbances to beach invertebrates that inhabit the SMAs. Limiting vehicles to daytime use for 6.5 months of the year would reduce the potential for impacts to nocturnal invertebrates, such as the ghost crab, throughout the Seashore. However, vehicle use would still result in the loss of individual invertebrates, but would not be measurable and would be well within natural fluctuations as the area where driving would be permitted would be limited. Therefore, impacts to invertebrates from ORV and other recreational use under alternative C would be long-term negligible to minor adverse.

Construction Activities. Implementation of alternative C would involve the construction (or replacement) of six ORV access ramps, seven new or expanded parking lots, and one new interdunal road, which would extend from ramp 45 to ramp 49. Because the majority of invertebrate species identified inhabit the area between the dunes and the ocean, away from where construction would take place, proposed construction activities under this alternative would result in short-term negligible adverse impacts to invertebrates due to temporary displacement during construction activities.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative C would be identical to those under alternative A. The overall cumulative impact of these past, current, and future actions on other bird species would be long-term minor adverse, and when combined with the long-term minor adverse impacts under alternative C, would result in long-term minor adverse cumulative impacts to other bird species in the area of analysis.

These cumulative actions would have long-term negligible to moderate adverse impacts to invertebrates. These impacts, when combined with the long-term negligible to minor adverse impacts under alternative C, would result in long-term minor adverse cumulative impacts to invertebrates.

Conclusion. The establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would result in long-term beneficial impacts to other bird species when compared to alternatives A and B. Impacts from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative C that offer wintering species further protection.

Overall cumulative impacts to other bird species would be long-term minor adverse.

Impacts to invertebrates from species management and recreational activities under alternative C would be long-term negligible to minor adverse as there would still be recreational use in the wrack line area, but these species would benefit from nighttime and other closures. Proposed construction activities under this alternative would result in short-term negligible adverse impacts to invertebrates from disturbance during construction activities.

Overall cumulative impacts to invertebrate species would be long-term minor adverse.

Impairment Determination. Implementation of alternative C would not result in impairment to wildlife as sufficient population numbers and functional habitat would remain to maintain sustainable populations of invertebrates and other bird species in the Seashore. Alternative C would involve closing the spits, points, and other SMAs to vehicular access for seven months out of the year. Under alternative C, other wildlife species would benefit from the lack of vehicles and reduced pedestrian presence at the SMAs between March 14 and October 15, although the beneficial impact would only apply to those species present at the Seashore during the seasonal closures. Because this alternative would require an ORV permit with an educational component, all species at the Seashore, including other bird species and invertebrates, would benefit from the increased level of resource stewardship that is associated with increased public awareness. Closing approximately 29 miles of village beaches and SMAs to ORV use for seven months out of the year would result in fewer disturbances to other wildlife species that use the SMAs and would also reduce the waste stream and attraction of predators. Disturbance from vehicles and pedestrians would continue, but it would be less than the current level of use due to the increased buffer distances, designation of some year-round non-ORV areas, and seasonal closures of the SMAs under alternative C. Limiting vehicles to daytime use for 6.5 months of the year and having seasonal night-driving restrictions that start before dark (7:00 p.m.) would reduce the potential for impacts to nocturnal invertebrates, such as the ghost crab. Although vehicle use would result in the loss of individual invertebrates, the population effects would not be measurable and would be well within natural fluctuations because the areas where driving would be permitted would be limited.

The adverse effects on other wildlife from the implementation of alternative C were deemed to be minor in the plan/EIS analysis because, although occasional disturbance and harm to other wildlife or their habitat would occur from ORV and other recreational use, it would not be outside the level of disturbance or harm that would occur naturally and the Seashore would maintain sustainable populations of invertebrates and other bird species.

Cumulative impacts from combining the effects of alternative C with effects of other past, present, and future planned actions in and around the Seashore would likely result in harassment of other bird species and injury or mortality to invertebrates at the Seashore. Even with these adverse effects, sufficient population numbers and functional habitat would remain to maintain sustainable populations in the Seashore. Therefore, impacts to other wildlife would not result in impairment to these species.

Impacts of Alternative D: Increased Predictability and Simplified Management

Impacts to Other Bird Species

Resources Management Activities. Under alternative D, as described under alternative C, Nonbreeding Shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs, although non-conflicting, non-motorized recreational uses would be allowed. Nonbreeding resource closures would be established at the points and spits. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for migratory and nonbreeding species. As many of these species are not present at the Seashore for breeding, any impacts to other birds from surveying and field activities for protected species would be long-term negligible adverse. Overall, resources management activities would result in long-term beneficial impacts, which would be greater than those under alternative C due to the larger amount of year-round ORV closures under this alternative.

ORV and Other Recreational Use. Under alternative D, all areas that have historically supported sensitive species would be closed to ORV use year-round. Approximately 41 of the 68 miles of Seashore beaches would not be accessible for vehicular use. All 10 of the SMAs would be managed using ML 1 measures, which would involve larger, longer lasting species buffers with no pedestrian or ORV access corridors provided. ORV and pedestrian access would continue to be subject to temporary resource closures in the 27 miles of beach outside of the SMAs, in addition restrictions in nonbreeding habitat areas. Alternative D would prohibit ORVs on the beaches between 7:00 p.m. and 7:00 a.m. from May 1 through November 15. An indirect impact from recreational use would be the attraction of mammalian and avian predators, as described under alternative A, although the reduction in beach mileage open to ORV use under alternative D would reduce these indirect impacts. Because this alternative would require some level of resource education in order to receive an ORV permit, all species at the Seashore, including other bird species, should benefit from the increased level of resource stewardship that is associated with public awareness.

Closing approximately 41 miles of beach to ORV use year-round would result in fewer disturbances to other bird species that use the SMAs for foraging and a reduction in the waste stream and the local abundance of predators. There would continue to be disturbance to other bird species from vehicles and pedestrians, but there would be the lowest potential for disturbance under alternative D due to the increased buffer distances, limitation on the amount of beach available to ORVs and pedestrians, and provision of large, disturbance-free areas. As described under alternative A, of particular concern is when disturbance results in birds being forced to fly while they are foraging, which would result in adverse impacts as birds would not be able to add the body fat they need for migration. Therefore, impacts to other bird species from ORV and other recreational use under alternative D would be long-term negligible to minor adverse.

Construction Activities. Alternative D would require the least amount of construction of the action alternatives. This alternative would involve the construction (or replacement) of four ORV access ramps. Construction activities would result in the temporary displacement of some other bird species localized in the areas of proposed disturbance and would involve a loss of a small amount of marginal habitat. Construction impacts to other bird species would be short-term negligible adverse because these changes would not result in measurable impacts to other bird species populations.

Impacts to Invertebrates

ORV and Other Recreational Use. Under alternative D, all areas that have historically supported sensitive species would be closed to ORV use year-round. Approximately 41 of the 68 miles of Seashore beaches would not be accessible for vehicular use. All 10 of the SMAs would be managed using ML1 measures during the breeding season, which would involve larger, longer lasting species buffers with no pedestrian or ORV access corridors provided. ORV and pedestrian access would continue to be subject to temporary resource closures in the 27 miles of beach outside of the SMAs, in addition restrictions in nonbreeding habitat areas. Alternative D would prohibit ORVs on the beaches between 7:00 p.m. and 7:00 a.m. from May 1 through November 15.

Closing approximately 41 miles of beach to ORV use year-round would result in fewer disturbances to beach invertebrates that inhabit those beaches. Limiting vehicles to daytime use for 6.5 months of the year in the areas where ORV use is permitted would reduce the potential for impacts to nocturnal invertebrates throughout the Seashore. Under alternative D, the potential for impacts to invertebrates would be the lowest among all the alternatives. However, ORV use would still result in the loss of individual invertebrates, but would not be measurable and would be well within natural fluctuations. Therefore, impacts to invertebrates from ORV and other recreational use under alternative D would be long-term negligible adverse.

Construction Activities. As with alternative C, all construction under alternative D would occur outside areas of invertebrate habitat, and therefore this alternative would result in short-term negligible adverse impacts to invertebrates due to temporary displacement during construction activities, but no long-term loss of invertebrate habitat would occur.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative D would be identical to those under alternative A. Cumulative actions under alternative D would have long-term minor adverse impacts to other bird species. These impacts, when combined with the long-term negligible to minor adverse impacts of recreational use and the beneficial impacts from resources management activities, would result in long-term negligible to minor adverse cumulative impacts to other bird species.

Past, present, and reasonable foreseeable future actions would have long-term negligible to moderate adverse impacts on invertebrates. These impacts, when combined with the long-term negligible adverse impacts of alternative D, would result in long-term negligible to minor adverse cumulative impacts, depending upon the individual species of invertebrate.

Conclusion. The establishment of SMAs, which would be closed to ORVs year-round, would result in long-term beneficial impacts to other bird species. Beneficial impacts would be greater than those under alternative C due to the larger amount of mileage closed to ORV use year-round. ORV and other recreational use would result in long-term negligible to minor adverse impacts to other bird species due to the amount of beach closed to ORV use and the additional nonbreeding closures that offer wintering species further protection.

Overall cumulative impacts to other bird species would be long-term negligible to minor adverse in the area of analysis.

Recreational ORV use would result in long-term negligible adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Impacts to invertebrates would be reduced under this alternative due to the amount of beach closed to recreational use and night-driving

restrictions. Short-term negligible adverse impacts to invertebrates would occur due to temporary displacement during construction activities.

Overall cumulative impacts to invertebrate species would be long-term negligible to minor adverse depending upon the individual species of invertebrate.

Impairment Determination. Implementation of alternative D would not result in impairment to wildlife as sufficient population numbers and functional habitat would remain to maintain sustainable populations of invertebrates and other bird species in the Seashore. Approximately 41 of the 68 miles of Seashore beaches would not be accessible for vehicular use, and all of the SMAs would be managed with larger, longer-lasting species buffers with no pedestrian or ORV access corridors provided. Alternative D would prohibit ORVs on the beaches between 7:00 p.m. and 7:00 a.m. from May 1 through November 15. Because this alternative would require an ORV permit with an educational component, all species at the Seashore, including other bird species, would benefit from the increased level of resource stewardship that is associated with increased public awareness.

Closing approximately 41 miles of beach to ORV use year-round would result in fewer disturbances to other wildlife species that use the SMAs and would also result in a reduction in the waste stream and attraction of predators. The increased buffer distances, limitation on the amount of beach available to ORVs and pedestrians, and provision of large, disturbance-free areas would decrease the amount of impact on other wildlife species. Limiting vehicles to daytime use for 6.5 months of the year in the areas where ORV use is permitted would reduce the potential for impacts to nocturnal invertebrates and night-foraging birds throughout the Seashore. ORV use would still result in the loss of individual invertebrates, but would not be measurable and would be well within natural fluctuations. The adverse effects on other wildlife from the implementation of alternative D were deemed to be negligible to minor in the plan/EIS analysis because, although occasional disturbance and harm to other wildlife or their habitat would occur from ORV and other recreational use, it would not be outside the level of disturbance or harm that would occur naturally and the Seashore would maintain sustainable populations of invertebrates and other bird species.

Cumulative impacts from combining the effects of alternative D with effects of other past, present, and future planned actions in and around the Seashore would likely result in harassment of other bird species and injury or mortality to invertebrates at the Seashore. Even with these adverse effects, sufficient population numbers and functional habitat would remain to maintain sustainable populations in the Seashore. Therefore, impacts to other wildlife would not result in impairment to these species.

Impacts of Alternative E: Variable Access and Maximum Management

Impacts to Other Bird Species

Resources Management Activities. Under alternative E, as described under alternatives C and D, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. In addition to nonbreeding resource closures, the NPS would establish non-ORV areas along the ocean shoreline. This would ensure that adequate foraging, resting, and roosting areas would be provided for migratory and nonbreeding bird species compared to alternatives A and B, which do not have provisions to protect nonbreeding shorebirds. As many of these species are not present at the Seashore for breeding,

any impacts to other bird species from surveying and field activities for protected species would be long-term negligible adverse. Overall, management of species during nonbreeding would result in long-term, beneficial impacts.

ORV and Other Recreational Use. Alternative E provides an increased level of beach access for recreational purposes through strategies such as improving the interdunal road system, providing ORV access corridors to selected points and spits, allowing a park-and-stay option for ORVs at selected points and spits, and establishing a pedestrian trail near Oregon Inlet. Because this alternative would require some level of resource education in order to receive an ORV permit, all species at the Seashore, including other bird species, should benefit from the increased level of resource stewardship that is associated with public awareness. Some additional recreational access would result from the establishment of the interdunal road between ramp 45 and ramp 49, but portions of the beach would be closed during the prenesting period. The interdunal road would provide access around Cape Point to new ramps 47 and 48. Use of the road should not result in measurable impacts to other bird species because they would either remain on the beach or within the forested wetlands in the interior of the island. An indirect impact from recreational use would be the attraction of mammalian and avian predators, as described under alternative A. Increased levels of pedestrian and ORV access would still result in the generation of waste, which would increase the potential for predation when compared to alternatives C and D.

Closing approximately 35 miles of beach to ORV use for almost six months a year would reduce the potential for disturbances to other bird species that use these seasonally closed areas. However, this alternative would still allow access to some of these areas through an ORV access corridor or pedestrian trail. The relatively large protected species buffers would provide some mitigation from impacts of recreational disturbance, when compared to alternative A. As described under alternative A, of particular concern is when disturbance results in birds being forced to fly while they are foraging, which would result in adverse impacts as birds would not be able to add the body fat they need for migration. There would continue to be disturbance to other bird species from vehicles and pedestrians under alternatives E, and impacts would be long-term minor adverse.

Construction Activities. Implementation of alternative E would involve the construction (or replacement) of 7 new ORV access ramps, 14 new or expanded parking lots, 1 new interdunal road, and a pedestrian trail near Oregon Inlet. Construction activities would result in the temporary displacement of some other bird species localized in the areas of proposed disturbance and would involve a loss of some marginal habitat near the parking areas. Construction impacts to other bird species would be short-term negligible to minor adverse because they may be displaced during construction, but would not lose prime habitat.

Impacts to Invertebrates

ORV and Other Recreational Use. Alternative E would provide increased flexibility in the areas of beach accessible for recreational purposes through strategies such as improving the interdunal road system, and allowing a park-and-stay option for ORVs at selected points and spits. Alternative E also contains a seasonal aspect, which would result in certain routes and areas being open to ORV use from September 1 through March 14 and some ORV access would be provided via a corridor, subject to resource closures, to Bodie Island Spit, Cape Point, and South Point from March 15 through August 31. Protected species buffers would follow the ML1 measures at most areas of the Seashore, with the exception of Bodie Island Spit, Cape Point, and South Point, where ML2 buffers would apply. From May 1 through September 15, the ocean intertidal zone, ocean backshore, and dunes would be closed to ORV use from 10:00 p.m. to 6:00 a.m. ORV and pedestrian access would be subject to temporary resource closures and nonbreeding habitat restrictions. Like the other action alternatives, alternative E would involve an ORV permit system with an educational requirement.

Closing approximately 35 miles of beach to ORV use for almost six months a year would reduce the potential for disturbances to beach invertebrates that inhabit these seasonally closed areas. However, this alternative would still allow access to some of these areas through an ORV access corridor. Limiting vehicles to daytime use for 6.5 months of the year would reduce the potential for impacts to nocturnal invertebrates throughout the Seashore, although vehicles would still be allowed on beaches until 10:00 p.m. under this alternative, and some limited overnight use would be allowed with the park-and-stay option. Vehicle use would result in the loss of individual invertebrates, but would be well within natural fluctuations. Therefore, impacts to invertebrates from ORV and other recreational use under alternative E would be long-term minor adverse.

Construction Activities. As with alternative C, all construction under alternative E would occur outside areas of invertebrate habitat, and therefore this alternative would result in short-term negligible adverse impacts to invertebrates due to temporary displacement during construction activities, but no long-term loss of invertebrate habitat would occur.

Cumulative Impacts. The same past, present, and future impacts from cumulative actions described for alternative A would also occur under alternative E. Cumulative actions under alternative E would have long-term minor adverse impacts to other bird species. These impacts, when combined with the long-term minor adverse impacts of recreational use and the beneficial impacts from resources management activities, would result in long-term minor adverse cumulative impacts to other bird species.

Cumulative actions under alternative E would have long-term negligible to moderate impacts to invertebrate species. These impacts, when combined with the long-term negligible to minor adverse impacts of alternative E, would result in long-term minor adverse cumulative impacts to invertebrate species.

Conclusion. The establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would result in long-term beneficial impacts to other bird species. ORV and other recreational use would result in long-term minor adverse impacts to other bird species due to additional nonbreeding closures provided under alternative E that offer species further protection, with greater adverse impacts than under alternatives D or F from fewer miles of shoreline being closed to ORVs under alternative E during the nonbreeding season. Adverse impacts would be greater than those under alternatives C or D due to the increased level of recreational access provided under alternative E.

Cumulative impacts to other bird species would be long-term minor adverse.

Recreational ORV use would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Adverse impacts would be greater than those under alternatives C or D due to the increased level of recreational access provided under alternative E. Short-term negligible adverse impacts to invertebrates would occur due to temporary displacement during construction activities.

Overall cumulative impacts to invertebrates would be long-term minor adverse.

Impairment Determination. Implementation of alternative E would not result in impairment to wildlife as sufficient population numbers and functional habitat would remain to maintain sustainable populations of invertebrates and other bird species in the Seashore. Alternative E would provide an increased level of recreational beach access but would implement species protection through the use of SMAs and night-driving restrictions. This alternative would require an ORV permit with an educational component, and all species at the Seashore should benefit from the increased level of resource stewardship that is associated with increased public awareness.

Closing approximately 35 miles of beach to ORV use for almost six months a year would reduce the potential for disturbances to species that use these seasonally closed areas. However, this alternative would allow access to some of these areas through an ORV access corridor or pedestrian trail. The larger protected species buffers would provide additional protection for other wildlife. Limiting vehicles to daytime use for 6.5 months of the year would reduce the potential for impacts to nocturnal invertebrates and night-foraging birds throughout the Seashore, although vehicles would be allowed on beaches until 10:00 p.m. under this alternative, and limited overnight use would be allowed with the park-and-stay overnight option. Vehicle use would result in the loss of individual invertebrates, but would be well within natural fluctuations.

The plan/EIS analysis deemed the adverse effects on other wildlife from the implementation of alternative E to be minor because, although occasional disturbance and harm to other wildlife or their habitat would occur from ORV and other recreational use, it would not be outside the level of disturbance or harm that would occur naturally and the Seashore would maintain sustainable populations of invertebrates and other bird species.

Cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore would likely result in harassment of other bird species and injury or mortality to invertebrates at the Seashore. Even with these adverse effects, population numbers and functional habitat would remain to maintain sustainable populations in the Seashore. Therefore, impacts to other wildlife would not result in impairment to these species.

Impacts of Alternative F: Management Based on Advisory Committee Input

Impacts to Other Bird Species

Resources Management Activities. Under alternative F, as described under alternatives C, D, and E, nonbreeding shorebird SMAs would be established for migrating/wintering shorebirds at various locations throughout the Seashore. Closures would be installed no later than when breeding season closures are removed at the same location(s). Pets would be prohibited within Nonbreeding Shorebird SMAs. Nonbreeding resource closures would be established at the points and spits based on habitat used by wintering piping plovers in more than one of the past five years, the presence of birds at the beginning of the migratory season, and suitable habitat types based on the results of the annual habitat assessment. Under alternative F, three “floating” non-ORV areas would also be established during the nonbreeding season between ramp 23 and ramp 34, between ramp 45 and 49, and between ramp 72 and the inlet.

As many of these species are not present at the Seashore for breeding, any impacts to other bird species from surveying and field activities for protected species would be long-term negligible adverse. Overall, species management activities would result in long-term beneficial impacts to other bird species. Additional benefits, when compared to the other alternatives, would be realized under alternative F from “floating” nonbreeding closures that would provide four additional miles of protection during this time.

ORV and Other Recreational Use. Alternative F provides a level of recreational beach access similar to that under alternative E but would also include the development of three new interdunal roads, two of which would provide additional vehicular access on Hatteras Inlet Spit and North Ocracoke Spit. ORV and pedestrian access would continue to be subject to temporary resource closures and nonbreeding habitat restrictions. Because this alternative would require some level of resource education in order to receive an ORV permit, all species at the Seashore, including other bird species, should benefit from the increased level of resource stewardship that is associated with public awareness. Increased levels of pedestrian and ORV access would still result in the generation of waste, which would increase the potential for predation when compared to alternatives C and D.

Alternative F would involve closing the northern village beaches to ORVs for three months, southern village beaches for nine months, and closing some SMAs for approximately 4.5 months out of the year. Closing these areas seasonally to ORV use would reduce the potential for disturbances to other bird species that use these seasonally closed areas. However, this alternative would still allow access to some of these areas through a pedestrian corridor and trail or an ORV access corridor, subject to resource closures, along the shoreline to Cape Point. The relatively large protected species buffers would provide some mitigation from impacts of recreational disturbance, when compared to alternative A. As described under alternative A, of particular concern is when disturbance results in birds being forced to fly while they are foraging, which would result in adverse impacts as birds would not be able to add the body fat they need for migration. However, there would continue to be disturbance to other bird species from vehicles and pedestrians under alternative F and impacts would be long-term minor adverse.

Construction Activities. Implementation of alternative F would include the construction (or replacement) of 9 ORV access ramps, 12 new or expanded parking lots, 3 new interdunal roads, and pedestrian trails on Bodie and Ocracoke islands. Construction activities would result in the temporary displacement of bird species localized in the areas of proposed disturbance and would involve a loss of some marginal habitat near the parking areas. Construction impacts to other bird species would be short-term negligible to minor adverse as areas of important habitat would not be lost and there would not be noticeable impacts to populations.

Impacts to Invertebrates

ORV and Other Recreational Use. Alternative F provides a level of recreational beach access similar to that under alternative E, although there would be no park-and-stay option. Alternative F would also include the development of three new interdunal roads, two of which would provide additional vehicular access on Hatteras Inlet Spit and North Ocracoke Spit. Night driving would be similarly restricted from May 1 through November 15, but vehicles would be removed from the beaches starting one hour after sunset until approximately one-half hour after sunrise, which further limits the hours that vehicles are allowed on beaches in the evening hours. ORV and pedestrian access would continue to be subject to temporary resource closures and nonbreeding habitat restrictions. This alternative would involve a permit system with an educational requirement.

Alternative F would involve closing the northern village beaches to ORVs for three months, southern village beaches for nine months, and closing some SMAs for approximately 4.5 months out of the year. Closing these areas seasonally to ORV use would reduce the potential for disturbances to beach invertebrates that inhabit these areas. Limiting vehicles to daytime use for 6.5 months of the year would reduce the potential for impacts to nocturnal invertebrates throughout the Seashore. Vehicle use would result in the loss of individual invertebrates, but would not be measurable and would be well within natural fluctuations. Therefore, impacts to invertebrates from ORV and other recreational use under alternative F would be long-term minor adverse.

Construction Activities. As with alternative C, all construction under alternative F would occur outside areas of invertebrate habitat; therefore, this alternative would result in short-term negligible adverse impacts to invertebrates due to temporary displacement during construction activities, but no long-term loss of invertebrate habitat would occur.

Cumulative Impacts. The same past, present, and future impacts from cumulative actions described for alternative A would also occur under alternative F. Cumulative actions under alternative F would have long-term minor adverse impacts to other bird species. These impacts, when combined with the long-term minor adverse impacts of recreational use and the beneficial impacts from resources management activities, would result in long-term minor adverse cumulative impacts to other bird species.

Cumulative actions under alternative F would have long-term negligible to moderate adverse impacts to invertebrate species. These impacts, when combined with the long-term negligible to minor adverse impacts to invertebrates under alternative F, would result in long-term minor adverse cumulative impacts to invertebrates.

Conclusion. The establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would result in long-term beneficial impacts to other bird species. Additional benefits, when compared to the other alternatives, would be realized under alternative F from “floating” nonbreeding closures that would provide four additional miles of protection during this time. Impacts to other bird species from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative F that offer wintering species further protection, and including four miles of “floating” closures.

Cumulative impacts on other bird species under alternative F would be long-term minor adverse.

Recreational ORV use would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Short-term negligible adverse impacts to invertebrates would occur due to temporary displacement during construction activities.

Overall cumulative impacts to invertebrates would be long-term minor adverse.

Impairment Determination. Implementation of alternative F would not result in impairment to wildlife as sufficient population numbers and functional habitat would remain to maintain sustainable populations of invertebrates and other bird species in the Seashore. Alternative F would provide an increased level of recreational beach access but would implement species protection through the use of SMAs and night-driving restrictions. This alternative would require an ORV permit with an educational component, and all species at the Seashore would benefit from the increased level of resource stewardship that is associated with increased public awareness.

Alternative F would involve closing the northern village beaches to ORVs for three months, southern village beaches for nine months, and closing some SMAs for approximately 4.5 months out of the year. Closing these areas seasonally to ORV use would reduce the potential for disturbances to species that use these seasonally closed areas. However, this alternative would allow access to some of these areas through a pedestrian corridor and trail or an ORV access corridor, subject to resource closures, along the shoreline to Cape Point. The larger protected species buffers provide additional protection to other wildlife. Under alternative F, “floating” nonbreeding closures would provide four miles of protection, during the shorebird nonbreeding season, in addition to that provided by the nonbreeding shorebird SMAs. Limiting vehicles to daytime use (approximately one-half hour after sunrise to 1 hour after sunset) for 6.5 months of the year would reduce the potential for impacts to nocturnal invertebrates and night foraging birds throughout the Seashore. Vehicle use would result in the loss of individual invertebrates, but would not be measurable and would be well within natural fluctuations.

The plan/EIS impact analysis deemed the adverse effects on other wildlife from the implementation of alternative F to be minor because, although occasional disturbance and harm to other wildlife or their habitat would occur from ORV and other recreational use, it would not be outside the level of disturbance or harm that would occur naturally and the Seashore would maintain sustainable populations of invertebrates and other bird species.

Cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore would likely result in harassment of other bird species and injury or mortality to invertebrates at the Seashore. Even with these adverse effects, population

numbers and functional habitat would remain to maintain sustainable populations in the Seashore. Therefore, impacts to other wildlife would not result in impairment to these species.

TABLE 56. SUMMARY OF IMPACTS TO WILDLIFE AND WILDLIFE HABITAT UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Other Bird Species					
Many of the surveying and field activities for protected species would occur outside of the primary time when other bird species are residents at the Seashore. Therefore, any impacts to other bird species from surveying and field activities for protected species would be long-term negligible adverse.					
<p>Impacts to other bird species from resources management activities would be long-term minor adverse as nonbreeding closures would not be species-specific and therefore would not protect important habitat areas such as the ocean shoreline.</p> <p>Impacts of ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species, increasing the possibility of disturbance to the species from recreational use. The lack of designated non-ORV areas, a permitting system, or night-driving restrictions during the time period when these species are present at the Seashore, and allowing ORVs, people and pets at the Seashore during the nonbreeding season in the vicinity of these species would contribute to adverse impacts.</p>	<p>Impacts to other bird species would be long-term minor adverse as nonbreeding closures would not be species-specific and therefore would not protect important habitat areas such as the ocean shoreline when many of these species are wintering or migrating.</p> <p>Impacts of ORV and other recreational use would be long-term moderate adverse as no specific management would be provided for this species, increasing the possibility of disturbance to the species from recreational use. The lack of designated non-ORV areas, allowing night driving during the time period when other bird species are present at the Seashore, and allowing ORVs, people and pets at the Seashore during the nonbreeding season in the vicinity of these species would contribute to adverse impacts.</p>	<p>The establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would result in long-term beneficial impacts to other bird species when compared to alternatives A and B.</p> <p>Impacts from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative C that offer wintering species further protection.</p>	<p>The establishment of SMAs, which would be closed to ORVs year-round, would result in long-term beneficial impacts to other bird species. Beneficial impacts would be greater than those under alternative C due to the amount of mileage closed to ORV use year-round.</p> <p>ORV and other recreational use would result in long-term negligible to minor adverse impacts to other bird species due to the amount of beach closed to ORV use and the additional nonbreeding closures that offer wintering species further protection.</p>	<p>The establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would result in long-term beneficial impacts to other bird species.</p> <p>ORV and other recreational use would result in long-term minor adverse impacts to other bird species due to additional nonbreeding closures provided under alternative E that offer species further protection, with greater adverse impacts than under alternatives D or F from fewer miles of shoreline being closed to ORVs under alternative E during the nonbreeding season. Adverse impacts would be greater than those under alternatives C or D due to the increased level of recreational access provided under alternative E.</p>	<p>The establishment of both breeding and nonbreeding SMAs, some of which are closed to ORVs year-round, would result in long-term beneficial impacts to other bird species. Additional benefits, when compared to the other alternatives, would be realized under alternative F from "floating" nonbreeding closures that would provide four additional miles of protection during this time.</p> <p>Impacts to other bird species from ORV and other recreational use would be long-term minor adverse due to the additional nonbreeding closures provided under alternative F that offer wintering species further protection, including four miles of "floating" closures.</p>

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
There would be no construction and therefore no construction-related to disturbance to other bird species under the no-action alternatives.		Impacts to other bird species from construction activities would be short-term negligible to minor adverse due to temporary displacement during construction activities.			
Invertebrates					
The use of vehicles to conduct resources management activities would result in long-term negligible adverse impacts to invertebrates due to the potential for mortality of individual invertebrate species.					
Recreational ORV use would result in long-term minor to moderate adverse impacts to invertebrate species primarily due to mortality arising from unlimited night driving in the intertidal and wrack areas.	Recreational ORV use would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Impacts would be reduced when compared to alternative A due to limitations on ORV use at night and within the larger resources management closures under alternative B.	Recreational ORV use would result in long-term negligible to minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Impacts would be reduced due to longer seasonal restrictions on vehicle use under alternative C.	Recreational ORV use would result in long-term negligible adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Impacts to invertebrates would be reduced under this alternative due to the amount of beach closed to recreational use.	Recreational ORV use would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat. Adverse impacts would be greater than those under alternatives C or D due to the increased level of recreational access provided under alternative E.	Recreational ORV use would result in long-term minor adverse impacts to invertebrate species resulting from the continued use of ORVs in invertebrate habitat.
There would be no construction and therefore no construction-related to disturbance to invertebrates under the no-action alternatives.		Short-term negligible adverse impacts to invertebrates would occur due to temporary displacement during construction activities.			

SOUNDSCAPES

GUIDING REGULATIONS AND POLICIES

The NPS *Organic Act* (16 USC 1) establishes and authorizes the NPS “to conserve the scenery and the natural and historic objects and wildlife therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations” (NPS *Organic Act* [16 USC 1]). An important aspect of natural communities that the NPS wishes to preserve within our national parks is the natural soundscape, which protects visitor experience as well as wildlife.

Regarding general park soundscape management, NPS *Management Policies 2006*, Section 4.9 Soundscape Management, requires that the NPS “preserve, to the greatest extent possible, the natural soundscapes of parks.” Additionally, the NPS “will restore to the natural condition wherever possible those park soundscapes that have become degraded by the unnatural sounds (noise), and will protect natural soundscapes from unacceptable impacts” (NPS *Management Policies 2006* [NPS 2006c, sec 4.9]). Director’s Order 47: Soundscape Preservation and Management, was developed to emphasize NPS policies “that will require, to the fullest extent practicable, the protection, maintenance, or restoration of the natural soundscape resource in a condition unimpaired by inappropriate or excessive noise sources.”

This Director's Order also directs park managers to measure acoustic conditions, differentiate existing or proposed human-made sounds that are consistent with park purposes, set acoustic goals based on the sounds deemed consistent with the park purpose, and determine which noise sources are impacting the parks (NPS 2000a).

As discussed in Chapter 1: Purpose and Need for Action, ORV use within national parks is governed by Executive Order 11644, Use of Off-Road Vehicles on Public Lands, as amended by Executive Order 11989. In accordance with this executive order and as discussed in *NPS Management Policies 2006*, Section 8.2.3.1, Motorized Off-Road Vehicle Use, ORVs are allowed in locations where no adverse impacts to the natural, cultural, scenic and esthetic values would occur (*NPS Management Policies 2006* [NPS 2006c, sec 8.2.3.1]). Additionally, *NPS Management Policies 2006*, Section 8.2.3, Use of Motorized Equipment, acknowledges that motorized equipment operating in national parks could adversely impact the park's natural soundscape. To preserve the natural soundscape, park superintendents will manage when and where motorized equipment is used, evaluating effects on the natural soundscape against the natural ambient sound level (that which exists in the absence of human-induced sounds) (*NPS Management Policies 2006* [NPS 2006c, sec 8.2.3]).

Additionally, 36 CFR 2.12, Audio Disturbance, prohibits the operation of motorized vehicles within national parks in excess of 60 dBA at a distance of 50 feet from the source, or if below that noise level, noise which is unreasonable. Reasonableness is dependent upon several factors including the nature and purpose of the actor's conduct, location and time of occurrence, the park's purpose and the impact the noise has on park users (36 CFR 2.12).

METHODOLOGY, ASSUMPTIONS, AND IMPACT THRESHOLDS

The methodology used to assess impacts to the natural soundscape from the management of ORV use at the Seashore is consistent with *NPS Management Policies 2006* and Director's Order 47: Soundscape Preservation and Noise Management.

ORVs drive more on the ocean beaches than they do along the soundside. On the soundside, visitors typically drive from NC-12, a relatively short distance to soundside recreational areas and park their vehicles. Impacts to the natural soundscape, visitor experience and wildlife would be negligible on the soundside. Therefore, the impacts analysis for all alternatives focuses on the beach areas, where most ORV driving takes place.

Impacts to the natural soundscape of the Seashore from ORV use were assessed using published information from the FHWA regarding automobile noise emission levels for travel speeds of 15 and 25 mph, measured at reference distances of approximately 15 meters (49 feet). These travel speeds are consistent with current and future proposed action speed limits for ORVs in the Seashore. Using these known vehicle noise emission levels, which vary by frequency, for the aforementioned travel speeds, the NPS Natural Sounds Program extrapolated vehicle noise levels at several distances from an ORV track. The extrapolation accounts for the effects of atmospheric absorption of sound waves with frequency, which is dependent upon the atmospheric conditions of the Seashore. Specifically, factors including temperature and humidity affect sound absorption depending on the frequency spectrum of the sound wave (Caltrans 1998). Sound waves may be further attenuated by ground surfaces and vegetation. Soft surfaces, which include soft dirt, and vegetation, such as grass or scattered bushes and trees, tend to absorb some of the sound energy as it passes over them from source to receiver. Conversely, hard surfaces like parking lots and smooth bodies of water tend to reflect sound waves, thereby providing no additional attenuation of sound energy (Caltrans 1998). The Seashore contains a mixture of surfaces, therefore the extrapolated vehicular sound levels assume no significant ground or vegetation absorption.

If the ground surface between the source and receiver is soft and/or vegetated, there could be a slight attenuation of noise; however, it would be insignificant due to the short distances involved.

As noise from the surf is a predominant natural sound source at the Seashore, the Natural Sounds Program also calculated estimates of surf noise levels at several distances from an ORV track.⁵ These calculations assume a surf noise level estimate of 55 dBA as measured 15 meters (49 feet) from the surf line, which is representative of the maximum value of surf noise in a range (20–55 dBA) identified in *Disposition of Offshore Cooling Water Conduits SONGS Unit 1 EIR*, as discussed in Chapter 3: Affected Environment. This surf noise level is also consistent with estimates of ambient levels at the surf line based on calculations using the measurement data collected on Bodie Island and at Cape Point (refer to “Chapter 3: Affected Environment”). A median distance from the surf line to an ORV track of 21 meters (69 feet) was used as part of the calculation based on information from the NPS, which indicates typical distances between the surf line and ORV tracks ranging between 18 and 24 meters (59 and 79 feet) (Broili pers. comm. 2009).

Impacts to the natural soundscape were assessed according to distances at which vehicle noise dominates the sound energy, as compared to the predominant natural sound of the surf, both landward and seaward from a given ORV track. Thus, vehicular and surf noise level estimations were predicted for both landward and seaward directions from a given ORV track. No additional sources of noise, including from visitor presence throughout the Seashore, were considered as part of the impacts analysis. As vehicle counts on ORV tracks are not available, vehicle noise level predictions are representative of the intensity of the vehicle noise during a single pass-by event and do not reflect the frequency of occurrence. The landward and seaward vehicle and surf noise level predictions are provided in table 57 and table 58, respectively. The distances shown in both tables represent distances from a given ORV track in meters and feet. Since table 57 depicts vehicle and surf noise levels at distances landward from a given ORV track, the distance from the surf is determined by adding the median distance between the surf line and ORV track (21 meters [69 feet]) to the particular distance from the ORV track. For example, at a distance of 15 meters (49 feet) landward from the ORV track, a given receiver is located approximately 36 meters (118 feet) from the surf line. Conversely, since table 58 depicts vehicle and surf noise levels at distances (in meters and in feet) in a seaward direction from an ORV track, the distance from the surf line is given by subtracting the distance from the ORV track from the 21-meter (69-foot) distance between a typical ORV track and the surf line. For example, at a distance of 15 meters (49 feet) from an ORV track, a receiver is located approximately 6 meters (20 feet) from the surf line. Beyond 21 meters (69 feet) from an ORV track, a receiver is located in the ocean. Therefore, surf noise levels beyond 21 meters (69 feet) are listed as “N/A” (i.e., “not applicable”).

⁵ NPS protocols for acoustic monitoring at national parks (NPS 2006) were followed in collection of acoustic data at Cape Hatteras National Seashore to determine ambient conditions. The protocols attempt to capture spatial and temporal variability within the park. Therefore, monitors are typically not placed near sound sources that would dominate and mask other acoustic resources (i.e., birds, insects). Acoustic conditions at the surf were extrapolated using the collected data. The results of the extrapolation were verified and corroborated by published sources (*Disposition of Offshore Cooling Water Conduits SONGS Unit 1 EIR*) and the experiences of park managers.

TABLE 57. VEHICLE AND SURF NOISE LEVELS AT DISTANCES FROM AN ORV TRACK

Sound Source	Noise Level at Reference Distance (dBA)	Reference Distance of Measured Noise Level (meters)	Other Distances from an ORV Track in meters (feet)								
			4 (13)	10 (33)	15 (49)	20 (66)	30 (98)	50 (164)	150 (492)	200 (656)	250 (820)
Auto at 15 mph (FHWA)	52	15.24	64.0	56.0	52.5	49.9	46.3	41.7	31.5	28.7	26.4
Ocean surf ambient	55	15	52.8	51.8	51.2	50.6	49.7	48.2	44.4	43.3	42.4
Auto at 25 mph (FHWA)	59	15.24	71.0	63.0	59.4	56.9	53.3	48.7	38.5	35.7	33.4

Source: NPS Natural Sounds Program, September 17, 2009.

- Notes: 1. Distances are in meters and feet from a given ORV track. Assumed distance between ORV track and surf is 21 meters (69 feet).
2. Distance from surf may be calculated by adding the distance from the ORV track to 21 meters (69 feet).
3. Reference distances of sound sources represent locations where values are known based on measured, published data. Other distances from an ORV track are predicted sound levels based on the known, measured levels at the specified reference distances (Stanley pers. comm. 2009).

TABLE 58. SEAWARD VEHICLE AND SURF NOISE LEVELS AT DISTANCES FROM AN ORV TRACK

			Other Distances from an ORV Track in meters (feet)						
Sound Source	Noise Level at Reference Distance (dBA)	Reference Distance of Measured Noise Level (meters)	4 (13)	10 (33)	15 (49)	20 (66)	50 (164)	150 (492)	250 (820)
Auto at 15 mph (FHWA)	52	15.24	64.0	56.0	52.5	49.9	41.7	31.5	26.4
Ocean surf ambient	55	15	54.5	56.3	59.0	66.8	N/A	N/A	N/A
Auto at 25 mph (FHWA)	59	15.24	71.0	63.0	59.4	56.9	48.7	38.5	35.7

Source: NPS Natural Sounds Program, September 17, 2009.

- Notes: 1. Distances are in meters and feet from a given ORV track. Assumed distance between ORV track and surf is 21 meters (69 feet).
2. Distance to surf may be calculated by subtracting the distance from the ORV track from 21 meters (69 feet).
3. "N/A" ("not applicable") indicates the receiver is located in the ocean, and surf noise levels are not calculated.
4. Reference distances of sound sources represent locations where values are known based on measured, published data. Other distances from an ORV track are predicted sound levels based on the known, measured levels at the specified reference distances (Stanley pers. comm. 2009).

In addition to determining the impacts to the natural soundscape of the Seashore, considerations were given to visitor use as well as impacts to wildlife from ORV use. Impacts to visitors were evaluated based their ability to experience natural sounds of the Seashore and the effects on their awareness of vehicles.

Research has shown that human activities that generate high levels of anthropogenic noise (including vehicular traffic) can result in adverse impacts to animal behavior. Impacts to bird species include nest desertion and reduced pairing success. (Barber et al. in press). Noise inhibits the ability of wildlife to perceive natural sounds, an effect referred to as “masking.” Acoustic masking can interfere with the ability of wildlife to communicate with each other, for example, when sounding a warning to indicate an approaching predator (Barber et al. in press).

Consideration of the effects of ORV noise on wildlife included the potential for changes in communication by shifting call frequencies away from those typically associated with transportation noise (100Hz to 1 kHz). Species at greatest risk include the piping plover, black skimmer, Wilson’s plover, least tern, common tern and gull-billed tern. For example, the piping plover’s call is between 1 and 3 kHz, with most energy centered around 2kHz while the fundamental frequency of the black skimmer’s call is at or below 2 kHz. Similarly, most acoustic energy in the call of the Wilson’s plover occurs below 3 kHz. Therefore, since the acoustic energy of the calls of these bird species may fall within the frequency range associated with transportation noise, studies show that communication may be compromised for these bird species (Slabbekoorn and Boer-Visser 2006). Such an effect on wildlife communication would occur regardless of vehicle speed and the particular alternative implemented.

An additional consideration for wildlife impacts included the potential for reductions in listening area for predators seeking prey and reductions in alerting distance of prey listening for predators. More specifically, a 3 dBA increase in ambient sound levels by ORV noise would reduce a predator’s listening area by half, while the same decibel increase would reduce the alerting distance of prey by 30 percent. Similarly, a 3 dBA increase in ambient sound levels would also reduce, by 50 percent, the area in which humans may listen for birds. For example, under conditions where natural sounds prevail and ORV use is not present as an intrusion, prey listening for a predator may be able to hear a predator as far as 90 feet from said predator. However, if the introduction of ORV noise increases the ambient sound level by a factor of 3 dBA, the distance at which prey can hear the approaching predator reduces to 60 feet. These reduction factors are based on geometric spreading of sound energy in space and are larger for greater increases in the ambient environment. Although the impacts of noise on wildlife cannot be quantified for this analysis, in part because studies on ORV impacts on coastal wildlife were not available, it was assumed that increased ORV access or level of use would result in greater noise impacts to wildlife.

A summary of soundscapes impacts under all alternatives is provided in table 59 at the end of this section. Thresholds for identifying natural soundscapes impacts are defined as follows:

Negligible: Natural sounds would prevail; the area would be closed to vehicles or noise generated by the use of ORVs and construction would be infrequent or absent, and mostly not measurable or detectable.

Minor: (1) Vehicle noise dominates sound energy to a distance of 30 meters inland from the vehicle or to a distance of 10 meters toward the surf; OR, (2) sound energy from vehicle noise exceeds sound energy from the surf by 3 dBA to a distance of 10 meters from the vehicle in either direction. Noise from construction activities would be short-term, lasting only a few days to a week, and localized and would not occur in ecologically sensitive areas.

Moderate: (1) Vehicle noise dominates sound energy to a distance of 60 meters inland from the vehicle, or vehicle noise dominates sound energy to the surf line; OR (2) sound energy from vehicle noise exceeds sound energy from the surf by 3 dBA to a distance of 50 meters inland from the vehicle or 15 meters toward the surf. Noise from construction activities would be short-term, lasting only a few days to a week, but would be more widespread and may occur in ecologically sensitive areas.

Major: (1) Vehicle noise dominates sound energy at distances greater than 60 meters inland from the vehicle or sound energy from vehicle noise exceeds sound energy from the surf by 3 dBA beyond 50 meters inland from the vehicle; OR (2) vehicle noise levels at the surf line exceed sound energy from the surf by 3 dBA. Noise from construction activities would occur for over a period of several months in highly ecologically sensitive areas.

Duration: Short-term impacts would result from actions occurring over a period of less than one year.

Long-term impacts would result from actions occurring over a period of longer than one year and would occur intermittently over the life of the management plans.

The thresholds were based on representative beach width and represent the portion of the beach that would be subject to noise impacts. Specifically, the distance at which vehicle noise begins to dominate the natural ambient environment (the surf) is important because, at this point, vehicle noise is more likely to be audible to visitors and wildlife, and a situation is created in which natural sounds no longer predominate. Such distances are based on best available judgment, and in part on the area of affect around the vehicle in which the vehicle noise adds at least 3 dBA to the natural ambient environment.

Study Area

The study area for which soundscape impacts were assessed includes the entire area within the Seashore boundary.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Under alternative A, all areas of the Seashore would continue to be open to ORV use, unless closures were established for resource protection, administrative, or safety reasons. ORV use would also be temporarily prohibited during seasonal closures in front of villages from September 16 to May 14. The speed limit would be 25 mph (unless otherwise posted) on Seashore beaches for public and private vehicles, although the speed limit in front of villages (from September 16 to May 14) would be 10 mph.

According to table 57, a vehicle traveling at 25 mph would dominate the sound energy as far as 50 meters landward from an ORV track, producing a noise level of 48.7 dBA versus 48.2 dBA produced by the natural sound of the surf. Since vehicle noise dominates beyond 30 meters inland from the vehicle, landward impacts from ORV use on the beaches would be moderate adverse. Additionally, as depicted in table 58, a vehicle traveling at 25 mph would dominate the sound energy to a distance of 10 meters from an ORV track toward the surf. At 15 meters seaward, vehicle noise and surf sounds are nearly equivalent, with a vehicle contribution of 59.4 dBA and a contribution from the surf of 59.0 dBA. Since vehicle noise is still prevalent beyond 10 meters seaward from the ORV track, moderate adverse impacts to the natural soundscape would occur along the beaches between an ORV track and the surf.

In front of village beaches, during seasonal closures between September 16 and May 14, and in areas where an ORV corridor is less than 100 feet wide, when the speed limit is lowered from 25 mph to 10 mph, vehicle noise would be noticeably less and would not dominate the sound energy as far from the ORV track as a vehicle traveling at 25 mph. Comparing vehicle noise levels at 25 mph with those produced at 15 mph (15 mph may be used as a close approximation of noise levels produced by a vehicle traveling 10 mph), noise levels for the lower speed are approximately 7 dBA less for all distances inland and seaward from an ORV track. Additionally, noise emissions from vehicles traveling at 15 mph would dominate the sound energy to a distance of 15 meters inland from an ORV track, at which point vehicle noise levels would be 52.5 dBA while surf sounds would be 51.2 dBA. Thus, moderate adverse impacts occurring at 25 mph speeds would become minor adverse impacts inland from an ORV track when vehicle speeds are limited to 10 mph. Similarly, vehicle noise would dominate the sound energy to a distance of 4 meters from an ORV track toward the surf and become nearly equivalent at 10 meters from the ORV track. Therefore, minor adverse impacts to the natural soundscape would result from ORV use in front of village beaches during seasonal closures and in areas with ORV corridors less than 100 feet wide when speeds are lowered to 10 mph.

As noise from ORV use would add at least 3 dBA to the natural ambient sound levels within the Seashore, wildlife would also experience adverse impacts. Specifically, wildlife may experience impacts to their abilities to detect predators and hunt for prey, such that a predator's listening area and a prey's alerting distance may be reduced. At vehicle speeds of 25 mph, sound energy from the vehicle noise would exceed the sound energy from the surf by at least 3 dBA to a distance of approximately 30 meters inland from an ORV track (see table 57). Similarly, ambient levels would be increased by at least 3 dBA to a distance beyond 10 meters seaward from an ORV track, but not as far as the surf line (see table 58). Therefore, when vehicles are traveling at 25 mph, wildlife on the beaches would experience moderate adverse impacts. When speeds are reduced to 10 mph, increases of at least 3 dBA above the natural ambient would occur closer to ORV tracks, thereby creating adverse impacts to wildlife.

The presence of vehicles on the beaches at the Seashore would also adversely impact visitor use such that a visitor's ability to experience and enjoy the natural soundscape and their awareness of vehicles around them may be affected. Similar to wildlife, adding 3 dBA or more to the natural ambient environment results in a reduction of a visitor's listening area over which they can hear birds and insects and enjoy the sounds of the surf. Further, between ORV tracks and the surf, at distances where the sound of the surf dominates the sound energy, a potential reduction in vehicle awareness by visitors may result. The distance at which surf sounds dominate is further from an ORV track for higher speeds and closer for slower speeds. Therefore, the potential for reductions in visitor awareness actually increase for slower speeds. In relation to visitor enjoyment, a slower travel speed would reduce the potential for reductions in visitor listening areas since the area over which 3 dBA is added to the natural ambient environment would be smaller.

Under alternative A, the majority of beaches would be open to ORV use year-round, except if they are closed for temporary resource, safety, or administrative reasons. Due to the potential for year-round ORV use along most beach routes, impacts to the natural soundscape, wildlife, and visitor use would generally be regarded as long-term minor to moderate adverse but would have the potential to become short-term impacts depending on the length of closure periods. In front of village beaches, where ORV routes are specifically designated as being seasonally closed to ORVs from May 15 through September 15, impacts to the natural soundscape, wildlife and visitor use would be short-term minor to moderate adverse. During this four-month seasonal closure period, or during any closure period that limits ORV activity to less than one year, areas undergoing such closures would also experience short-term benefits due to the temporary lack of ORV noise. However, during closures, ORVs may potentially be diverted to other routes that remain open. Vehicle diversions would potentially increase the number of ORVs along these open routes and the frequency of occurrence of single ORV pass-by events. Impacts would remain minor to moderate

adverse, depending on vehicle speed, but vehicle noise may dominate the sound energy more frequently. Further, as identified in “Table 7, Off-Road Vehicle Routes and Areas” in chapter 2, some seasonal as well as year-round ORV routes have been designated as longstanding safety closures. In such areas, impacts would be negligible such that natural sounds would prevail due to the absence of ORVs. In the event that longstanding safety closures would be lifted, thus re-opening ORV routes in areas with such closures, impacts would be minor to moderate adverse, depending on vehicle travel speeds. The duration of these impacts would be short-term adverse in areas with seasonal ORV routes and long-term adverse in areas with year-round ORV routes. In general, all ORV use, as well as closure periods, would occur intermittently over the length of the management plan, thereby creating long-term minor to moderate adverse impacts, as well as long-term benefits (during closure periods) to the natural soundscape along the beaches of the Seashore.

Under alternative A, there would be no planned construction of new ORV access ramps or reconfigurations of existing ramps. Thus, there would be no construction noise-related impacts under this alternative.

Cumulative Impacts. Other past, present and planned future actions within the Seashore have the potential to affect the natural soundscape of the Seashore, which in turn may affect wildlife and visitor use. In recent years, hurricanes, storms, and other events have resulted in roads being overwashed with sand and water, including ramps to beaches and ORV corridors. Depending on the degree of damage following a storm, certain areas of the Seashore and some ORV routes may be closed off to visitors. Weather-related closures, as well as those associated with dredging, would reduce human-induced noise in closed areas. However, such closures would also potentially result in increased concentrations of ORVs and visitors in other areas of the Seashore that would remain open. Weather-related closures would result in minor to moderate adverse impacts regarded as short-term in duration depending on the length of the closure periods. Impacts would also be regarded as long-term as weather events and dredging may recur.

Additional adverse impacts may also result from current increases in vehicle traffic and village events bringing additional visitors to the Seashore. Increased recreational opportunities in the Corridor Management Plan for the Outer Banks Scenic Byway would also potentially attract additional visitors to the Seashore, thereby adding more vehicle traffic and visitor presence. Increased vehicle traffic and visitor presence would potentially increase the ambient sound environment. Adverse impacts would be long-term minor to moderate, depending upon vehicle speed limits. Further, the potential for aircraft overflights associated with military training operations would add an additional source of noise to the ambient environment of the Seashore. Adverse impacts would be short-term minor adverse, only lasting the duration of the overflight operation.

The Bonner Bridge replacement may create construction-related noise; however, as construction activities would be localized, impacts would be long-term minor adverse. Additional construction-related noise is associated with the berm construction under the CCC; however, such activities have occurred in the past. Continued maintenance of berms would potentially create localized, negligible adverse impacts.

The potential long-term minor to moderate adverse impacts from actions described above coupled with the minor to moderate adverse impacts associated with the implementation of alternative A, would result in long-term minor to moderate adverse cumulative impacts on the natural soundscape within the Seashore.

Conclusion. Based on predicted vehicle noise levels at distances both landward and seaward from an ORV track for a posted speed limit of 25 mph, vehicle noise would dominate the sound energy to distances between 30 and 60 meters inland from an ORV track and beyond 10 meters from an ORV track toward the surf line. Vehicle noise would also add 3 dBA or more to the natural ambient environment

within 50 meters inland and 15 meters seaward of a vehicle traveling at 25 mph. Conversely, for a posted speed limit of 10 mph, vehicle noise would dominate the sound energy between the ORV track and a distance of 30 meters inland from the track and would dominate within 10 meters seaward of the vehicle track. Further, for a 10 mph speed limit, both inland and seaward of a vehicle, vehicle noise would add 3 dBA or more to the natural ambient within 10 meters of the vehicle. As ORV driving is more prominent on the beaches, versus along the sound where visitors typically drive into recreational areas and park their vehicles, impacts to the natural soundscape, visitor use, and wildlife would be negligible on the sound. Therefore, long-term minor to moderate impacts, depending upon vehicle speed would occur along the beaches where most routes are established for ORV driving. While impacts over the majority of the Seashore beaches would be long-term adverse due to greater numbers of designated year-round ORV routes, impacts would be short-term adverse in the areas in front of village beaches, which are only opened seasonally to ORV use. Short-term adverse impacts would also result during other closure periods along any ORV route for resource protection, safety, or administrative purposes. During closures, the potential for increased vehicle concentrations along remaining open ORV routes would increase the frequency of occurrence of single ORV pass-by events. Impacts would remain minor to moderate adverse, depending on vehicle speed, but vehicle noise may dominate the natural soundscape more frequently. In general, as ORV use would continue intermittently over the life of the management plan, vehicle noise would be a recurring, long-term minor to moderate adverse impact in all areas of the Seashore beaches open to ORV driving. Additionally, as closure periods, which have the potential to provide short-term benefits, would be implemented throughout the life of the management plan, long-term benefits would arise.

Cumulative impacts to the natural soundscape would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative A would not result in impairment to soundscapes because the noise from ORV passages (i.e., from an ORV as it passes a set point) would still leave areas of the Seashore where natural sounds would predominate, including areas of visitor use. In general, ORV use would continue intermittently over the life of the plan throughout large areas of the Seashore. The impact analysis in this plan/EIS deemed vehicle noise to be a minor to moderate adverse impact in all areas of the Seashore beaches open to ORV driving. In these areas, noise from vehicles traveling 25 mph would exceed the sound energy generated by the surf (and inhibit the ability to hear natural sounds) to a distance of approximately 50 meters inland from an ORV track and to a distance of approximately 15 meters from the ORV track toward the surf line. Vehicle noise would also exceed the natural ambient environment by 3 dBA or more to a distance of approximately 33 meters inland and 13 meters seaward of a vehicle traveling at 25 mph, but areas where visitors could experience the natural sounds of the Seashore would still exist. Impacts from vehicles traveling under 25 mph, such as those in front of the villages where the speed limit would be 10 mph, would be less. Under these conditions during an ORV passage, opportunities to hear the sounds of nature would be degraded, however the size of the affected area and the differences between the vehicle noise and the sounds of the surf would not cause impairment of Seashore resources.

As the entire Seashore would be a designated route, the potential lifting of long-standing safety closures would open previously vehicle-free areas to ORVs, and would result in minor to moderate adverse impacts from the introduction of ORV noise to these areas, and the reduction in the ability for visitors and wildlife to experience natural sounds. Conversely, temporary closures (seasonal, resource, or safety related) would have the potential to provide benefits by providing areas for visitors and wildlife that are free of vehicle related noise. These temporary closures would be implemented throughout the life of the plan, resulting in long-term benefits. Reducing the speed limit in front of villages from 25 mph to 10 mph would also contribute to long-term beneficial impacts as slower moving vehicles produce less sound in these high visitor use areas, and provide greater opportunity for visitors to hear natural sounds and to be more aware of their surroundings. Although the impact analysis in this plan/EIS found minor to moderate

adverse impacts, there would also be beneficial impacts from closures, which would provide visitors the opportunity to experience the natural soundscape, as well as provide areas for wildlife without ORV sound. There would be no planned construction activities under alternative A, and therefore no impacts from construction noise. Cumulative impacts from combining the effect of alternative A with effects of other past, present, and future planned actions in and around the Seashore would likely contribute to a similar level of adverse impacts as alternative A, with noise being present for intervals of time, with beneficial impacts from intervals of natural sounds. Therefore, impacts to soundscapes would not result in impairment.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Under alternative B, areas accessible to ORVs would be similar to alternative A, except that the area from ramp 43 to 0.4 mile north would be open to ORVs year-round instead of just seasonally and large prenesting closures would be established. Basically, all areas of the Seashore would continue to be open to ORV use, unless closures are established for resource protection, administrative, or safety reasons or routes are designated for seasonal use. Further, vehicle speed limits for ORVs would be similar to those under alternative A, except that under alternative A, speeds would be limited to 25 mph with a reduction to 10 mph in front of villages during the off season (September 16 – May 14). Under alternative B, in general, a reduced speed limit (15 mph) would be imposed from May 15 through September 15 while the speed limit would increase to 25 mph from September 15 through May 14.

As ORV access areas and speed limits are similar to alternative A, during the time period when speed limits are 15 mph, impacts to the natural soundscape would be minor adverse and would become moderate adverse during times when the speed limit is increased to 25 mph. Adverse impacts to wildlife would be similar to those under alternative A. Larger resource protection buffers identified under this alternative would also further decrease the potential for vehicle noise impacts to ground-nesting birds as vehicle noise does not add 3 dBA or more to the ambient environment farther than 30 meters inland of a vehicle, even for higher speeds. Impacts to visitors would also be similar to those described under alternative A, although slower speeds imposed during the peak season when most visitors are on the beaches would potentially result in greater reductions in visitor awareness as surf sounds would dominate closer to vehicles. The duration of impacts would be long-term adverse along routes open year-round, including along the additional year-round route from ramp 43 to 0.4 mile north established under alternative B. As all ORV routes, including those open year-round, are subject to closures, long-term impacts would potentially become short-term adverse, depending on the length of the specific closure. Short-term benefits would also arise during closure periods that limit ORV activity to less than one year due to the lack of vehicle noise during these periods. Some additional short-term benefits would arise under alternative B due to regulations eliminating night driving over a period of approximately four months. However, similar to alternative A, closure periods present the potential for increased numbers of vehicles in areas where routes remain open, thereby more frequently dominating the sound energy in such areas. In general, all ORV use, as well as closure periods, would occur intermittently over the length of the management plan, thereby creating long-term minor to moderate adverse impacts, as well as long-term benefits (during closure periods) to the natural soundscape along the beaches of the Seashore.

Under alternative B, there would be no planned construction of new ORV access ramps or reconfigurations of existing ramps. Thus, there would be no construction noise-related impacts under this alternative.

Cumulative Impacts. Under alternative B, the same past, present and planned future actions within the Seashore have the potential to affect the natural soundscape of the Seashore, which in turn may affect wildlife and visitor use, as under alternative A. These long-term minor to moderate adverse impacts,

combined with the long-term minor to moderate adverse impacts of alternative B, would result in long-term minor to moderate cumulative impacts. However, the potential for such cumulative impacts would be somewhat reduced due to the seasonal elimination of night driving.

Conclusion. As described under alternative A, impacts to the natural soundscape within the Seashore would be minor to moderate, depending upon vehicle speed. Due to the slower speed limits proposed during the peak season when more visitors would be using beach areas, the potential for a greater reduction in visitor awareness would occur under alternative B as compared to alternative A. On beaches where ORV routes are open year-round, including the additional year-round route established under alternative B, impacts would be long-term adverse, but would potentially become short-term adverse during closure periods. In locations where ORV routes are specifically designated as “seasonal,” impacts would be short-term adverse. As with alternative A, closures of any kind present the potential for increased concentrations of vehicles in areas where ORV routes remain open. In such areas, the potential for vehicle noise to more frequently dominate the sound energy would arise. Aside from the short-term benefits that would occur in areas undergoing closure periods of any kind, additional short-term benefits may occur under alternative B as a result of regulations imposed to seasonally eliminate night driving. In general, all ORV use, as well as closure periods, would occur intermittently over the length of the management plan, thereby creating long-term minor to moderate adverse impacts, as well as long-term benefits (during closure periods), to the natural soundscape along the beaches of the Seashore. Adverse impacts to wildlife would be similar to those under alternative A.

Cumulative impacts to the natural soundscape would be long-term minor to moderate adverse.

Impairment Determination. Implementation of alternative B would not result in impairment to soundscapes because the noise from ORV passages (i.e., from an ORV as it passes a set point) would still leave areas of the Seashore where natural sounds would predominate, including areas of visitor use. In general, ORV use would continue intermittently over the life of the plan throughout large areas of the Seashore. The impact analysis in this plan/EIS deemed vehicle noise to be a minor to moderate adverse impact in all areas of the Seashore beaches open to ORV driving. In these areas, noise from vehicles traveling 25 mph would exceed the sound energy generated by the surf (and inhibit the ability to hear natural sounds) to a distance of approximately 50 meters inland from an ORV track and to a distance of approximately 15 meters from the ORV track toward the surf line. Vehicle noise would also exceed the natural ambient environment by 3 dBA or more to a distance of approximately 33 meters inland and 13 meters seaward of a vehicle traveling at 25 mph, but areas where visitors could experience the natural sounds of the Seashore would still exist. Impacts from vehicles traveling under 25 mph, such as those in front of the villages where the speed limit would be 10 mph, would be less. Under these conditions during an ORV passage, opportunities to hear the sounds of nature would be degraded, however the size of the affected area and the differences between the vehicle noise and the sounds of the surf would not cause impairment of Seashore resources.

Short-term benefits would arise in areas that are temporally closed to ORV use, either from seasonal, safety, or resource closures, which would limit ORV activity and provide an area free of ORV noise during these periods, allowing visitors to experience the natural soundscape. Some additional short-term benefits would arise under alternative B from seasonal night-driving restrictions over a period of approximately four months, which would provide those experiencing the Seashore at night an experience free of vehicle noise while the restrictions are in place, and from reducing the speed limit from 25 mph to 10 mph in front of villages, which would provide greater opportunity for visitors to hear natural sounds and to be more aware of their surroundings in these high visitor use areas. Although the impact analysis in this plan/EIS found minor to moderate adverse impacts, there would be beneficial impacts from closures, which would provide visitors the opportunity to experience the natural soundscape in areas of temporary closure or as a result of seasonal night-driving restrictions, as well as providing areas for wildlife without

ORV sound. There would be no planned construction activities under alternative B, and therefore no impacts from construction noise. Cumulative impacts from combining the effects of alternative B with effects of other past, present, and future planned actions in and around the Seashore, would likely contribute to a similar level of adverse impacts as alternative B, with noise being present for intervals of time, with beneficial impacts from intervals of natural sounds. Therefore, impacts to soundscapes would not result in impairment.

Impacts of Alternative C: Seasonal Management

Under alternative C, ORV access would be prohibited in all areas of the Seashore except where an ORV route is specifically designated. Areas of high resource sensitivity and high visitor use could be designated as seasonal ORV routes, with restrictions based on seasonal resource and visitor use, or as year-round non-ORV areas. Generally, most areas where there is a seasonally designated ORV route would be open to ORVs from October 15 to March 14. Areas of historically lower visitor use and resource sensitivity would be designated as year-round ORV routes, subject to temporary resource closures. Additionally, ORV speeds would be limited to 15 mph (unless otherwise posted), with no proposed increases during the off season.

Similar to impacts described under alternatives A and B for a 15 mph speed limit, impacts both inland and seaward along the Seashore beaches would be long-term minor adverse in areas designated for year-round ORV use with the potential to become short-term in duration during temporary resource closures. Further, impacts to the natural soundscape in areas specifically designated for seasonal ORV use would be short-term minor adverse as seasonal closures would generally limit ORV activity in such areas to five months (i.e., ORV routes would generally be open from March 15 to Oct 14). Compared to alternatives A and B, seasonal closures under alternative C would last approximately three months longer, thus providing longer periods for natural sounds to prevail in seasonally closed areas. Unlike alternatives A and B, which allow for ORV access throughout the entire Seashore, the establishment of vehicle-free areas year-round under alternative C would result in areas of long-term negligible adverse impacts such that ORV noise is absent, and natural sounds would prevail. The establishment of non-ORV areas and additional seasonally designated ORV areas with longer closure periods under alternative C would create fewer areas open to ORV use as compared to alternatives A and B. Therefore, the spatial extent of short-term benefits would be greater than under alternatives A and B. Conversely, the potential would also exist for increased concentrations of ORVs in areas that would remain open to ORV use. As described under alternatives A and B, diversion of ORVs to open areas would potentially result in vehicle noise more frequently dominating the sound energy in such areas. Given the potential for fewer open ORV areas, vehicle concentrations in open areas under alternative C may be potentially greater than under alternatives A and B, thereby potentially increasing the frequency of vehicle noise in such areas. In general, all ORV use, as well as closure periods, would occur intermittently over the length of the management plan, thereby creating long-term minor adverse impacts, as well as long-term benefits (during closure periods), to the natural soundscape along the beaches of the Seashore where ORV use is allowed.

As described under alternatives A and B for a 15 mph speed limit, adverse impacts to wildlife would occur. However, under alternative C, additional resource protection closures outside of the breeding season, as well as designated vehicle-free areas, would be established based on an annual nonbreeding habitat assessment conducted after the breeding season. Such closures and designated vehicle-free areas would provide areas of nonbreeding shorebird habitat with reduced human disturbance and additional short-term and long-term benefits. Non-ORV areas would also result in some wildlife impacts, with potentials for ORV pass-by events only for administrative purposes. Additional larger resource protection buffers, as compared to alternatives A and B, would also reduce the potential for impacts to ground-nesting birds as they may be located further from vehicles.

Impacts to visitor use would also be similar to alternatives A and B. However, under this alternative, seasonal restrictions on ORV use, as well as designated non-ORV route areas based on locations of high visitor use, would potentially reduce the impacts to visitor awareness of vehicles on the beaches, as well as visitors' ability to experience natural sounds.

As part of this alternative, existing ramps would be improved, reconfigured and/or supplemented by new ramps, including the construction of a new ramp 47. As noise from construction activities would be localized and of a short duration, construction and reconfiguration of ramps would create short-term minor adverse impacts.

Cumulative Impacts. Under alternative C, the same past, present and planned future actions within the Seashore have the potential to affect the natural soundscape of the Seashore, which in turn may affect wildlife and visitor use, as under the no-action alternatives. These long-term minor to moderate adverse impacts, combined with the long-term minor adverse impacts of alternative C, would result in long-term minor adverse cumulative impacts, which would potentially be reduced due to seasonal restrictions on ORV use and designated non-ORV areas under this alternative.

Conclusion. As described under alternative B, impacts to the natural soundscape resulting from a 15 mph speed limit would be minor adverse. However, the potential for wildlife and visitor use impacts, as well as the extent of such impacts, may be reduced due to seasonal restrictions and designated non-ORV areas. Like under alternatives A and B, impacts would be long-term adverse for year-round ORV areas, potentially becoming short-term subject to temporary resource closures. As seasonal closures would limit ORV activity to less than a year, short-term adverse impacts would result. Closures of any kind, depending on the closure length, would also provide short-term benefits by providing noise-free periods. Under alternative C, there would be areas of negligible impacts due to designated non-ORV areas and greater opportunities for natural sounds to prevail due to longer seasonal closure periods as compared to alternatives A and B. Conversely, fewer open ORV areas and longer seasonal closure periods also present the potential for greater concentrations of ORVs in areas with open ORV routes, thereby increasing the frequency of vehicle noise in such areas. In general, all ORV use, as well as closure periods, would occur intermittently over the length of the management plan, thereby creating long-term minor adverse impacts, as well as long-term benefits (during closure periods), to the natural soundscape along the beaches of the Seashore where ORV use is allowed. Construction activities associated with ramp reconfigurations and improvements, as well as the addition of a new ramp, would be localized and of a short duration. Therefore, construction-related impacts would be minor adverse.

Cumulative impacts to the natural soundscape would be long-term minor adverse.

Impairment Determination. Implementation of alternative C would not result in impairment to soundscapes because the noise from ORV passages (i.e., from an ORV as it passes a set point) would still leave areas of the Seashore where natural sounds would predominate, including areas of visitor use, and increase the opportunity to experience natural sounds when compared to the current condition. In general, ORV use would continue intermittently over the life of the plan throughout the Seashore, but would be limited as a result of the establishment of seasonal SMAs. The impact analysis in this plan/EIS deemed vehicle noise to be a minor adverse impact in all areas of the Seashore beaches open to ORV driving. In these areas, noise from vehicles traveling 15 mph would only exceed sound energy generated by the surf (and inhibit the ability to hear natural sounds) to a distance of approximately 20 meters inland from an ORV track and to a distance of approximately 10 meters from the ORV track towards the surf. Vehicle noise would also exceed the natural ambient environment by 3 dBA or more to a distance of approximately 12 meters inland and 8 meters seaward of a vehicle traveling at 15 mph, leaving many areas of the Seashore where natural sounds would predominate for visitor enjoyment. Under these conditions during an ORV passage, opportunities to hear the sounds of nature would be degraded to a

certain degree, which would be less than the existing condition. Due to the size of the affected area and the differences between the vehicle noise and the sounds of the surf, impairment of Seashore resources would not occur.

Prohibiting ORV access in all areas of the Seashore, except where an ORV route is specifically designated, would result in less area of the Seashore being open to ORV use year-round than is currently occurring, and more areas free of vehicle noise that would benefit both visitors and wildlife. Alternative C would designate areas of high resource sensitivity and high visitor use as seasonal (typically from March 15 to October 14) or year-round non-ORV areas, with long-term beneficial impacts from an absence of ORV sound in these areas. These seasonal closures would be approximately three months longer than existing conditions, providing longer periods of time for visitors to experience natural sounds in seasonally closed areas. Throughout the Seashore, where ORV use is permitted, the speed limit would be reduced from 25 mph to 15 mph (unless otherwise posted), which would also contribute to long-term beneficial impacts because slower moving vehicles produce less sound. A reduction of sound as a result of a reduced speed limit throughout the Seashore would also provide additional opportunities for visitors to have an experience free of vehicle noise. Additional beneficial impacts would result from seasonal night-driving restrictions, which would create vehicle-free beaches at night from May 1 to November 15, 7:00 p.m. to 7:00 a.m., which would provide those experiencing the Seashore at night the opportunity to have an experience free of vehicle noise while the restrictions are in place. Improving, reconfiguring, and adding new ramps and parking areas would result in noise from construction. The impact analysis in this plan/EIS deemed these construction impacts to be minor because they would be expected to be localized and of short duration, and would not inhibit the long-term ability to experience natural sounds at the Seashore. Overall, as found in the impact analysis of this plan/EIS, impacts would be long-term minor adverse, with short- and long-term beneficial impacts as ORV use and the resulting soundscape impacts are limited in certain areas of the Seashore. Although sounds related to ORV use would be experienced at times throughout the Seashore, many opportunities to experience natural sound would exist due to the extent of seasonal and year-round non-ORV areas, seasonal night-driving restrictions, and lowered speed limits. Cumulative impacts from combining the effect of alternative C with effects of other past, present, and future planned actions in and around the Seashore would likely contribute to a similar level of adverse impacts as alternative C, with noise being present for intervals of time, with beneficial impacts from intervals of natural sounds. Therefore, impacts to soundscapes would not result in impairment.

Impacts of Alternative D: Increased Predictability and Simplified Management

Under this alternative, ORV routes would be determined by identifying areas that historically do not support sensitive resources and areas of lower visitor use. These areas would be designated ORV routes year-round. Unlike under alternative C, areas of historically high resource sensitivity or high visitor use would not be designated as ORV routes. Year-round vehicle-free areas would include the area in front of villages and lifeguarded beaches, as well as designated SMAs. Additionally, ORV speeds would be limited to 15 mph (unless otherwise posted), with no proposed increases during the offseason.

Compared to the no-action alternatives, as well as alternative C, the designated ORV use and non-ORV use areas proposed under this alternative would decrease the area over which vehicle noise may potentially impact the natural soundscape of the Seashore. Specifically, alternative D would provide the largest area of long-term negligible impacts along the beaches since approximately 41 miles of beach would become year-round non-ORV areas. In such areas, natural sounds would prevail, thus providing a long-term benefit to the natural soundscape, also over the largest area among all alternatives. Similar to the no-action alternatives and alternative C, in areas designated as year-round ORV routes, impacts would be long-term minor adverse due to the proposed 15 mph vehicle speed limit and potential for ORV activity occurring for more than one year. Impacts may potentially become short-term minor adverse in year-round ORV use areas subject to temporary resource closures. During such closures, short-term

benefits would occur due to the lack of ORV noise and would be long-term benefits considering that resource closures would recur throughout the life of the management plan. As with the no-action alternatives and alternative C, closure periods and a reduced number of open ORV routes creates the potential for higher concentrations of vehicles in areas remaining open to ORV use. Due to the greater number of non-ORV areas under this alternative as compared to the no-action alternatives and alternative C, alternative D presents the greatest potential for vehicle noise to dominate the sound energy more frequently (i.e., potential for greater vehicle pass-by events) in these areas.

Similar adverse impacts to wildlife would occur as described under alternatives A and B for a 15 mph speed limit. However, like under alternative C, additional resource protection closures, as well as designated vehicle-free areas in SMAs, would be established. Such closures and designated vehicle-free areas would provide additional short-term and long-term benefits as compared to the no-action alternatives. Larger designated non-ORV areas would also result in some adverse wildlife impacts as compared to alternative C. Further, larger resource protection buffers, as compared to alternatives A and B, would also reduce the potential for impacts to ground-nesting birds as they may be located farther from vehicles.

The greater number of designated non-ORV areas, particularly in areas of high visitor use, proposed under this alternative provides a greater number of places for visitors to experience and enjoy the natural soundscape of the Seashore without intermittent disturbances from vehicle pass-by events and reduces the potential for impacts to visitor awareness of vehicles. Particularly, residents and visitors staying in the villages would experience long-term negligible adverse impacts and long-term benefits while using village area beaches.

Similar to alternative C, as part of this alternative, existing ramps would be improved, reconfigured, and/or supplemented by new ramps. Impacts from construction-related activities would be localized and of short duration. Therefore, construction related noise impacts would be regarded as minor adverse.

Cumulative Impacts. Under alternative D, the same past, present and planned future actions within the Seashore have the potential to affect the natural soundscape of the Seashore, which in turn may affect wildlife and visitor use, as under the no-action alternatives. These long-term minor to moderate adverse impacts, combined with the long-term minor adverse impacts of alternative D, would result in long-term minor adverse cumulative impacts, which would potentially be the lowest level of impact of all alternatives, due to the largest extent of non-ORV use areas under alternative D.

Conclusion. As described under alternative A, impacts to the natural soundscape resulting from a 15 mph speed limit would be minor adverse. However, the potential for impacts to wildlife and visitor use from ORV noise would be the least under this alternative, as compared to the no-action and all action alternatives due to larger, year-round areas of designated non-ORV use. Adverse impacts would be long-term for all ORV routes since they are designated for year-round ORV use, but would potentially become short-term subject to temporary resource closures. During resource closures, short-term benefits would occur due to the lack of ORV noise and would also be long-term benefits since closures would recur throughout the life of the management plan. The key difference between this alternative and all other alternatives is that alternative D has the greatest extent of long-term negligible adverse impacts resulting from the number of year-round non-ORV route designations. Alternative D also has the greatest extent of long-term benefits to the natural soundscape, visitors, and wildlife due to these non-ORV areas. However, this alternative would also present the greatest potential for increased ORV pass-by events that dominate the sound energy in designated ORV areas due to the fewer number of open ORV areas in which vehicles may drive. Like under alternative C, construction related noise impacts from ramp improvements and the construction of a new ramp would be minor adverse.

Cumulative impacts to the natural soundscape would be long-term minor adverse.

Impairment Determination. Implementation of alternative D would not result in impairment to soundscapes because the noise from ORV passages (i.e., from an ORV as it passes a set point) would still leave areas of the Seashore where natural sounds would predominate, including areas of visitor use, and increase the opportunity to experience natural sounds when compared to the current condition. In general, ORV use would continue intermittently over the life of the plan throughout the Seashore, but would be limited as a result of the establishment of year-round SMAs. The impact analysis in this plan/EIS deemed vehicle noise to be a minor adverse impact in all areas of the Seashore beaches open to ORV driving. In these areas, noise from vehicles traveling 15 mph would only exceed sound energy generated by the surf (and inhibit the ability to hear natural sounds) to a distance of approximately 20 meters inland from an ORV track and to a distance of approximately 10 meters from the ORV track toward the surf. Vehicle noise would also exceed the natural ambient environment by 3 dBA or more to a distance of approximately 12 meters inland and 8 meters seaward of a vehicle traveling at 15 mph, leaving many areas of the Seashore where natural sounds would predominate for visitor enjoyment. Under these conditions during an ORV passage, opportunities to hear the sounds of nature would be degraded to a certain degree, which would be less than the existing condition. Due to the size of the affected area and the differences between the vehicle noise and the sounds of the surf, impairment of Seashore resources would not occur.

Prohibiting ORV access in all areas of the Seashore, except where an ORV route is specifically designated, would result in less area of the Seashore being open to ORV use year-round than is currently occurring and provide large areas of the Seashore where visitors and wildlife could experience natural sounds. Alternative D would establish ORV routes in areas that historically do not support sensitive resources and are areas of low visitor use, where visitors and wildlife sensitive to vehicle sounds would be less likely to occur. Outside these designated areas, year-round non-ORV areas would exist. Year-round vehicle-free areas would include the area in front of villages and lifeguarded beaches (typically high visitor use areas), as well as designated SMAs. These year-round closures would result in approximately 41 miles of the Seashore where natural sounds would prevail and be experienced by visitors year-round. Throughout the Seashore, where ORV use is permitted, the speed limit would be reduced from 25 mph to 15 mph (unless otherwise posted), which would also contribute to long-term beneficial impacts because slower moving vehicles produce less sound. A reduction of sound as a result of a reduced speed limit throughout the Seashore would also provide additional opportunities for visitors to have an experience free of vehicle noise. Additional beneficial impacts would result from seasonal night-driving restrictions, which would create vehicle-free beaches at night from May 1 to November 15, 7:00 p.m. to 7:00 a.m., and provide visitors with a nighttime experience that is free of vehicle noise. Improving, reconfiguring, and adding new ramps would result in noise from construction. The impact analysis in this plan/EIS deemed these construction impacts to be minor because they would be expected to be localized and of short duration, and would not inhibit the long-term ability to experience natural sounds at the Seashore. Overall, as found in the impact analysis of this plan/EIS, impacts would be long-term minor adverse, with short- and long-term beneficial impacts as ORV use and the resulting soundscape impacts would be limited in certain areas of the Seashore. Although sounds related to ORV use would be experienced in some areas of the Seashore, numerous opportunities to experience natural sound would exist due to the designation of year-round non-ORV areas. Additional benefits would be realized from the seasonal night-driving restrictions and lowered speed limits in areas where ORV use would be permitted. Cumulative impacts from combining the effect of alternative D with effects of other past, present, and future planned actions in and around the Seashore would likely contribute to a similar level of adverse impacts as alternative D, with noise being present for intervals of time, with beneficial impacts from intervals of natural sounds. Therefore, impacts to soundscapes would not result in impairment.

Impacts of Alternative E: Variable Access and Maximum Management

Management of ORV use under alternative E would be similar to management techniques proposed under alternative C with regards to the methodology for determining locations of ORV and non-ORV routes and access. Specifically, ORV access would be prohibited in all areas of the Seashore except where an ORV route is specifically designated. Areas of high resource sensitivity and high visitor use would generally be designated as seasonal ORV routes with restrictions based on seasonal resource and visitor use or as year-round non-ORV areas. Generally, most village beach areas where there is a designated seasonal ORV route would be open to ORVs from November 1 to March 31. Most areas of historically lower visitor use and resource sensitivity would be designated as year-round ORV routes, subject to temporary resource closures and limited access periods with ORV pass-through routes during shorebird breeding seasons. Additionally, ORV speeds would be limited to 15 mph (unless otherwise posted), with no proposed increases during the off season.

As alternative E would involve similar ORV management techniques as alternative C, impacts to the natural soundscape would also be similar. Both inland and seaward along the Seashore beaches, impacts would be minor adverse due to the proposed 15 mph speed limit. Like alternative C, in areas designated for year-round ORV use, adverse impacts would be long-term with the potential to become short-term in duration during temporary resource closures. Also, similar to alternative C, adverse impacts to the natural soundscape in areas specifically designated for seasonal ORV use would be short-term, as seasonal closures would generally limit ORV activity in such areas to between five and 6.5 months depending on whether the route is within a SMA. Short-term adverse impacts may also be regarded as long-term as vehicle use would be an intermittent recurring impact over the life of the management plan. Short-term benefits would also occur during seasonal and temporary resource closures due to the lack of ORV noise and would also be regarded as long-term benefits due to the recurrence of such closures over the life of the management plan. Compared to the no-action alternatives and similar to alternative C, this alternative would result in areas of long-term negligible impacts, which would also be regarded as long-term benefits, in beach locations where non-ORV use is specifically designated. However, the extent of such impacts and benefits would not be as large as under alternative D. As described under alternatives C and D, although seasonal and resource closures would provide benefit to areas by eliminating vehicle noise during those times, the potential would arise for increased vehicle concentrations along other routes that would remain open. The diversions to other open routes may not be as significant under this alternative as under alternative C or D given that some seasonal routes are open longer than others, ORV pass-through zones would be established in certain areas, and water taxi service to Bodie Island Spit and South Point would be available as an alternative option to driving. Although water taxi service would potentially create a temporary and occasional source of noise in the areas of the beach nearest the water taxi route, adverse impacts from the water taxis should be considered relative to the benefits associated with the potential reduction in vehicle use on the beach that the available service would provide.

Similar impacts to wildlife would occur as described under alternatives C and D for a proposed 15 mph speed limit. Additional resource protection closures, compared to the no-action alternatives, as well as designated vehicle-free areas or seasonally closed ORV routes in SMAs, would be established. Such closures and designated vehicle-free areas would provide additional short-term and long-term benefits as compared to the no-action alternatives, but not as much as under alternative D. Further, the establishment of pass-through zones during the shorebird breeding season would potentially result in additional periods of adverse impacts compared to alternatives C and D, although standard resource protection buffers would be applied. Designated non-ORV areas would also result in additional wildlife impacts as compared to the no-action alternatives. Larger resource protection buffers, as compared to the no-action alternatives, would also reduce the potential for impacts to ground-nesting birds as they may be located further from vehicles.

Impacts to visitor use in terms of visitor awareness of vehicles and visitor ability to enjoy the natural soundscape would be as described under alternatives C and D. The establishment of year-round vehicle-free areas, under the implementation of alternative E, particularly in areas of high visitor use, would provide opportunities for non-ORV users to experience the natural quiet. Areas open to seasonal use would also provide such opportunities, similar to alternative C, however, the earlier opening of seasonally designated ORV areas in addition to the opportunity for ORV pass-through zones would potentially result in fewer “noise-free” opportunities for visitors and a greater potential for reductions in visitor awareness of vehicles.

As with the other action alternatives, existing ramp relocation would occur, however more new ramps would be constructed. Although the potential exists for additional periods of construction, activities would still be localized and of short duration, thereby making construction-related impacts minor adverse, similar to the other action alternatives.

Cumulative Impacts. Under alternative E, the same past, present and planned future actions within the Seashore have the potential to affect the natural soundscape of the Seashore, which in turn may affect wildlife and visitor use, as under the no-action alternatives. These long-term minor to moderate adverse impacts, combined with the long-term minor adverse impacts of alternative E would result in long-term minor adverse cumulative impacts. However, the impact potential would be less than under the no-action alternatives, due to the implementation of seasonal ORV routes and designated non-ORV areas, but greater than under alternative D due to greater extent of ORV access and the establishment of ORV pass-through zones.

Conclusion. As described under alternative A, impacts to the natural soundscape on the beaches resulting from a 15 mph speed limit would be minor adverse. However, like under alternative C, the potential for wildlife and visitor use impacts, as well as the extent of such impacts, may be reduced due to seasonal restrictions and designated non-ORV areas. On the other hand, pass-through zones and earlier openings along seasonal routes under this alternative would potentially provide fewer “noise-free” periods for visitors and wildlife. Like under the no-action alternatives and alternatives C and D, impacts would be long-term adverse for year-round ORV areas, potentially becoming short-term subject to temporary resource closures. As seasonal closures would limit ORV activity to less than a year, short-term adverse impacts would result, which would also be regarded as long-term adverse impacts due to the fact that ORV use would recur intermittently over the life of the management plan. Closures of any kind, depending on the closure length, would also provide short-term and long-term benefits by providing temporary noise-free periods that would recur over the life of the management plan. Although areas of negligible impacts would also exist under this alternative due to designated non-ORV areas, their extent would not be as large as under alternative D. Vehicle diversions to other open routes may not be as significant under this alternative as under alternative C or D given that some seasonal routes are open longer than others, ORV pass-through zones would be established in certain areas, and water taxi service would be available as an alternative option to driving. Although under this alternative, more ramps would be constructed, as compared to alternatives C and D, construction-related impacts would remain minor adverse due to the localized nature and short duration of the activities.

Cumulative impacts to the natural soundscape would be long-term minor adverse.

Impairment Determination. Implementation of alternative E would not result in impairment to soundscapes because the noise from ORV passages (i.e., from an ORV as it passes a set point) would still leave areas of the Seashore where natural sounds would predominate, including areas of visitor use, and increase the opportunity to experience natural sounds when compared to the current condition. In general, ORV use would continue intermittently over the life of the plan throughout the Seashore, but would be limited as a result of the establishment of seasonal and year-round SMAs. The impact analysis in this

plan/EIS deemed vehicle noise to be a minor adverse impact in all areas of the Seashore beaches open to ORV driving. In these areas, noise from vehicles traveling 15 mph would only exceed sound energy generated by the surf (and inhibit the ability to hear natural sounds) to a distance of approximately 20 meters inland from an ORV track and to a distance of approximately 10 meters from the ORV track toward the surf. Vehicle noise would also exceed the natural ambient environment by 3 dBA or more to a distance of approximately 12 meters inland and 8 meters seaward of a vehicle traveling at 15 mph, leaving many areas of the Seashore where natural sounds would predominate for visitor enjoyment. Under these conditions during an ORV passage, opportunities to hear the sounds of nature would be degraded to a certain degree, which would be less than the existing condition. Due to the size of the affected area and the differences between the vehicle noise and the sounds of the surf, impairment of Seashore resources would not occur.

Prohibiting ORV access in all areas of the Seashore, except where an ORV route is specifically designated, would result in less area of the Seashore being open to ORV use year-round than is currently occurring, and provide more areas where visitors and wildlife can experience natural sounds. Areas of high resource sensitivity and high visitor use would generally be designated as seasonal ORV routes, with the seasonality of those restrictions based on the resource, or as year-round non-ORV areas. Generally, most village beach areas where there is a designated seasonal ORV route would be open to ORVs from November 1 to March 31, which represents typical times of lower visitor use for these areas. Most areas of historically lower visitor use and resource sensitivity would be designated as year-round ORV routes, subject to temporary resource closures and limited access periods with ORV pass-through routes during shorebird breeding seasons. These seasonal closures would be approximately 5 to 6.5 months longer than existing conditions (depending on whether the route is within an SMA), providing longer periods of time for natural sounds to prevail in seasonally closed areas and for visitors and wildlife to experience the benefits of reduced vehicle noise. Throughout the Seashore, where ORV use is permitted, the speed limit would be reduced from 25 mph to 15 mph (unless otherwise posted), which would also contribute to long-term beneficial impacts because slower moving vehicles produce less sound. A reduction of sound as a result of a reduced speed limit throughout the Seashore would also provide additional opportunities for visitors to have an experience free of vehicle noise. Additional beneficial impacts would result from seasonal night-driving restrictions, which would create vehicle-free beaches at night from May 1 to November 15, 10:00 p.m. to 6:00 a.m., and provide visitors with a nighttime experience that is free of vehicle noise. Additional noise sources could be created from the implementation of a park-and-stay option, as well as a water taxi, but available information on possible routes, vehicle types, and number of operations suggests that these sources would create only minor impacts to the soundscape. Improving, reconfiguring, and adding new ramps and parking areas would result in construction noise. The impact analysis in this plan/EIS deemed these impacts to be minor because they would be expected to be localized and of short duration, and would not inhibit the long-term ability to experience natural sounds at the Seashore. Overall, the impact analysis in this plan/EIS found that impacts would be long-term minor adverse, with short- and long-term beneficial impacts. Although sounds related to ORV use would be experienced at times throughout the Seashore, many opportunities to experience natural sound would exist due to the extent of seasonal and year-round non-ORV areas, seasonal night-driving restrictions, and lowered speed limits. Cumulative impacts from combining the effects of alternative E with effects of other past, present, and future planned actions in and around the Seashore, would likely contribute to a similar level of adverse impacts as alternative E, with noise being present for intervals of time, with beneficial impacts from intervals of natural sounds. Therefore, impacts to soundscapes would not result in impairment.

Impacts of Alternative F: Management Based on Advisory Committee Input

Management of ORV use under alternative F would be similar to management techniques proposed under alternatives C and E with regards to the methodology for determining locations of ORV and non-ORV

routes and access. Specifically, ORV access would be prohibited in all areas of the Seashore except where an ORV route is specifically designated. Areas of high resource sensitivity and high visitor use would generally be designated as seasonal ORV routes with restrictions based on seasonal resource and visitor use or as year-round non-ORV areas. Generally, most areas where there is a designated seasonal ORV route would be open to ORVs from either August 1 to March 14 or September 16 to May 14. Two areas on Ocracoke Island would only be open from November 1 to March 31 and November 1 to March 14. Most areas of historically lower visitor use and resource sensitivity would be designated as year-round ORV routes, subject to temporary resource closures and limited access through ORV pass-through zones during shorebird breeding season. Additionally, ORV speeds would be limited to 15 mph (unless otherwise posted), with no proposed increases during the off season.

As management techniques would be similar to those proposed under alternatives C and E, impacts to the natural soundscape would be similar. Both inland and seaward along the Seashore beaches, impacts would be minor adverse due to the proposed 15 mph speed limit. The duration of impacts would also generally be the same, with long-term adverse impacts occurring in regions with year-round ORV routes. Such impacts would potentially become short-term adverse subject to temporary closures. Also similar to alternative C, adverse impacts to the natural soundscape in areas specifically designated for seasonal ORV use would be short term. However, the length of seasonal closures would be shorter than under alternatives C and E, such that ORV use would be allowed along seasonal routes for approximately 7.5 to 8 months, depending on whether or not the route is in a SMA. Therefore, the period in which natural sounds would prevail would be shorter under this alternative. Short-term adverse impacts may also be regarded as long-term as vehicle use would be an intermittent recurring impact over the life of the management plan. Short-term benefits would also occur during seasonal and temporary resource closures due to the lack of ORV noise and would also be regarded as long-term benefits due to the recurrence of such closures over the life of the management plan. Compared to the no-action alternatives and similar to alternatives C and E, this alternative would result in areas of long-term negligible impacts, which would also be regarded as long-term benefits, in beach locations where non-ORV use is specifically designated. The extent of long-term negligible impacts and long-term benefits would potentially be greater than alternatives C and E due to the greater number of designated non-ORV routes. However, the extent of such impacts and benefits would not be as large as under alternative D. As described under the other action alternatives, although seasonal and resource closures would provide benefit to areas by eliminating vehicle noise during those times, the potential would arise for increased vehicle concentrations along other routes that would remain open. The time period of potential increased vehicle concentrations may be shorter under this alternative than under the other action alternatives given that seasonal routes are open longer.

As discussed in the other action alternatives, similar adverse impacts to wildlife would occur due to the proposed 15 mph speed limit. Additional resource protection closures, compared to the no-action alternatives, as well as designated vehicle-free areas or seasonally closed ORV routes in SMAs, would be established. Such closures and designated vehicle-free areas would provide additional short-term and long-term benefits as compared to the no-action alternatives, but not as much as under alternative D. Designated non-ORV areas would also result in additional wildlife impacts and benefits as compared to the no-action alternatives. The extent of such impacts and benefits due to non-ORV areas would be greater under this alternative compared to alternatives C and E since there would be a greater cumulative length of non-ORV areas under this alternative. Like under the other action alternatives, larger resource protection buffers, as compared to the no-action alternatives, would also reduce the potential for impacts to ground-nesting birds as they may be located further from vehicles.

Impacts to visitor use in terms of visitor awareness of vehicles and visitor ability to enjoy the natural soundscape would be as described under the other action alternatives. The establishment of year-round vehicle-free areas, under the implementation of alternative F, particularly in areas of high visitor use,

would provide opportunities for non-ORV users to experience the natural quiet. Areas open to seasonal use would also provide such opportunities, similar to alternatives C and E, however, the earlier opening of seasonally designated ORV areas would potentially result in fewer “noise-free” opportunities for visitors and a greater potential for reductions in visitor awareness of vehicles.

As with alternative E, existing ramp relocation would occur, and more new ramps would be constructed compared to the other action alternatives and the no-action alternatives. Although the potential exists for additional periods of construction, activities would still be localized and of short duration, thereby making construction-related impacts minor adverse.

Cumulative Impacts. Under alternative F, the same past, present and planned future actions within the Seashore have the potential to affect the natural soundscape of the Seashore, which in turn may affect wildlife and visitor use, as under the no-action alternatives. These long-term minor to moderate adverse impacts, combined with the long-term minor adverse impacts of alternative F would result in long-term minor adverse cumulative impacts. Like under the other action alternatives, the impact potential would be less than under the no-action alternatives, due to the implementation of seasonal ORV routes and designated non-ORV areas, but greater than under alternative D due to the greater extent of ORV access. Cumulative impacts may also be greater under this alternative compared to alternatives C and E, as ORV routes would open earlier, thereby providing shorter “noise-free” periods.

Conclusion. As described under alternative A, impacts to the natural soundscape on the beaches resulting from a 15 mph speed limit would be minor adverse. Like under alternatives C and E, the potential for wildlife and visitor use impacts from ORV noise may be reduced due to seasonal closures and designated non-ORV areas. However, seasonal routes would re-open earlier than under alternatives C and E, thereby creating shorter “noise-free” periods. Like under the no-action alternatives and the other action alternatives, impacts would be long-term adverse for year-round ORV areas, potentially becoming short-term subject to temporary resource closures. As seasonal closures would limit ORV activity to less than a year, short-term adverse impacts would result, which would also be regarded as long-term adverse impacts due to the fact that ORV use would recur intermittently over the life of the management plan. Closures of any kind, depending on the closure length, would also provide short-term and long-term benefits by providing temporary noise-free periods that would recur over the life of the management plan. Larger areas of negligible impacts due to designated non-ORV areas would also exist under this alternative as compared to the no-action alternatives and alternatives C and E. Vehicle diversions to other open routes may not be as significant under this alternative as under the other action alternatives given that some seasonal routes are open longer than others. Although under this alternative, more ramps would be constructed, as compared to alternatives C and D, construction-related impacts would remain minor adverse due to the localized nature and short duration of the activities.

Cumulative impacts to the natural soundscape would be long-term minor adverse.

Impairment Determination. Implementation of alternative F would not result in impairment to soundscapes because the noise from ORV passages (i.e., from an ORV as it passes a set point) would still leave areas of the Seashore where natural sounds would predominate, including areas of visitor use, and increase the opportunity to experience natural sounds when compared to the current condition. In general, ORV use would continue intermittently over the life of the plan throughout the Seashore, but would be limited as a result of the establishment of seasonal and year-round SMAs. The impact analysis in this plan/EIS deemed vehicle noise to be a minor adverse impact in all areas of the Seashore beaches open to ORV driving. In these areas, noise from vehicles traveling 15 mph would only exceed sound energy generated by the surf (and inhibit the ability to hear natural sounds) to a distance of approximately 20 meters inland from an ORV track and to a distance of approximately 10 meters from the ORV track towards the surf. Vehicle noise would also exceed the natural ambient environment by 3 dBA or more to

a distance of approximately 12 meters inland and 8 meters seaward of a vehicle traveling at 15 mph, leaving many areas of the Seashore where natural sounds would predominate for visitor enjoyment. Under these conditions during an ORV passage, opportunities to hear the sounds of nature would be degraded to a certain degree, which would be less than the existing condition. Due to the size of the affected area and the differences between the vehicle noise and the sounds of the surf, impairment of Seashore resources would not occur.

Prohibiting ORV access in all areas of the Seashore, except where an ORV route is specifically designated, would result in less area of the Seashore being open to ORV use year-round than is currently occurring, and provide more areas where visitors and wildlife can experience natural sounds. Areas of high resource sensitivity and high visitor use would generally be designated as seasonal ORV routes, with the seasonality of those restrictions based on the resource, or as year-round non-ORV areas. Generally, most areas where there is a designated seasonal ORV route would be open to ORVs from either August 1 to March 14 or September 16 to May 14. Two areas on Ocracoke Island would only be open from November 1 to March 31 and November 1 to March 14. During the periods when these areas would not be open to ORV use, both visitors and wildlife would experience benefits from a reduction in vehicle related noise and the ability to experience natural sounds. Most areas of historically lower visitor use and resource sensitivity would be designated as year-round ORV routes, subject to temporary resource closures and limited access through ORV pass-through zones during shorebird breeding season. These seasonal closures would be approximately 7.5 to 8 months longer than existing conditions (depending on whether the route is within an SMA), providing longer periods of time for natural sounds to prevail in seasonally closed areas and for visitors and wildlife to experience the benefits of reduced vehicle noise. Throughout the Seashore, where ORV use is permitted, the speed limit would be reduced from 25 mph to 15 mph (unless otherwise posted), which would also contribute to long-term beneficial impacts because slower moving vehicles produce less sound. A reduction of sound as a result of a reduced speed limit throughout the Seashore would also provide additional opportunities for visitors to have an experience free of vehicle noise. Additional beneficial impacts would result from seasonal night-driving restrictions, which would create vehicle-free beaches at night from May 1 to November 15, from one hour after sunset until turtle patrol has checked the beach (approximately one-half hour after sunrise) and provide visitors with a nighttime experience that is free of vehicle noise. Improving, reconfiguring, and adding new ramps and parking areas would result in noise from construction. The impact analysis in this plan/EIS deemed these construction impacts to be minor because they would be expected to be localized and of short duration, and would not inhibit the long-term ability to experience natural sounds at the Seashore. Overall, the impact analysis in this plan/EIS found that impacts would be long-term minor adverse, with short- and long-term beneficial impacts as ORV use and the resulting soundscape impacts would be limited in certain areas of the Seashore. Although sounds related to ORV use would be experienced at times throughout the Seashore, many opportunities to experience natural sound would exist due to the extent of seasonal and year-round non-ORV areas, seasonal night-driving restrictions, and lowered speed limits. Cumulative impacts from combining the effects of alternative F with effects of other past, present, and future planned actions in and around the Seashore would likely contribute to a similar level of adverse impacts as alternative F, with noise being present for intervals of time, with beneficial impacts from intervals of natural sounds. Therefore, impacts to soundscapes would not result in impairment.

TABLE 59. SUMMARY OF IMPACTS TO SOUNDSCAPES UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Overall, minor to moderate impacts, depending upon vehicle speed would occur along the beaches where most routes are established for ORV driving. While impacts over the majority of the Seashore beaches would be long-term adverse due to greater numbers of designated year-round ORV routes, impacts would be short-term adverse in the areas in front of village beaches, which are only opened seasonally to ORV use. Short-term adverse impacts would also result during other closure periods along any ORV route for resource protection, safety or administrative purposes. During closures, the potential for increased vehicle concentrations along remaining open ORV routes would increase the frequency of occurrence of single ORV pass-by events. Impacts would remain minor to moderate adverse, depending on vehicle speed, but vehicle noise may dominate the natural soundscape more frequently. In general, as ORV use would continue intermittently over the life of the	As described under alternative A, impacts to the natural soundscape within the Seashore would be minor to moderate, depending upon vehicle speed. Due to the slower speed limits proposed during the peak season when more visitors would be using beach areas, the potential for a greater reduction in visitor awareness would occur under this alternative as compared to alternative A. On beaches where ORV routes are open year-round, including the additional year-round route established under alternative B, impacts would be long-term adverse, but would potentially become short-term adverse during closure periods. In locations where ORV routes are specifically designated as “seasonal,” impacts would be short-term adverse. As with alternative A, closures of any kind present the potential for increased concentrations of vehicles in areas where ORV routes remain open. In such areas, the potential for vehicle noise to more frequently	As described under alternative B, impacts to the natural soundscape resulting from a 15 mph speed limit would be minor adverse. However, the potential for wildlife and visitor use impacts, as well as the extent of such impacts, may be reduced due to seasonal restrictions and designated non-ORV areas. Like under alternatives A and B, impacts would be long-term adverse for year-round ORV areas, potentially becoming short-term subject to temporary resource closures. As seasonal closures would limit ORV activity to less than a year, short-term adverse impacts would result. Closures of any kind, depending on the closure length, would also provide short-term benefits by providing noise-free periods. Under alternative C there would be areas of negligible impacts due to designated non-ORV areas and greater opportunities for natural sounds to prevail due to longer seasonal closure periods as compared to alternatives A and B. Conversely, fewer open ORV areas and longer	As described under alternative A, impacts to the natural soundscape resulting from a 15 mph speed limit would be minor adverse. However, the potential for impacts to wildlife and visitor use from ORV noise would be the least under this alternative, as compared to the no-action and all action alternatives due to larger areas of designated non-ORV use. During resource closures, short-term benefits would occur due to the lack of ORV noise and would also be long-term benefits since closures would recur throughout the life of the management plan. The key difference between this alternative and all other alternatives is that alternative D has the greatest extent of long-term negligible adverse impacts resulting from the number of year-round non-ORV route designations. Alternative D also has the greatest extent of long-term benefits to the natural soundscape, visitors and wildlife due to these non-ORV areas. However, this alternative would also present the	As described under alternative A, impacts to the natural soundscape on the beaches resulting from a 15 mph speed limit would be minor adverse. However, like under alternative C, the potential for wildlife and visitor use impacts, as well as the extent of such impacts, may be reduced due to seasonal restrictions and designated non-ORV areas. On the other hand, pass-through zones and earlier openings along seasonal routes under this alternative would potentially provide fewer “noise-free” periods for visitors and wildlife. Vehicle diversions to other open routes may not be as frequent under this alternative as under alternative C or D given that some seasonal routes are open longer than others, ORV pass-through zones would be established in certain areas, and water taxi service would be available as an alternative option to driving. Although under this alternative, more ramps would be constructed, as compared to alternatives C and D, construction-related impacts would remain	As described under alternative A, impacts to the natural soundscape on the beaches resulting from a 15 mph speed limit would be minor adverse. Like under alternatives C and E, the potential for wildlife and visitor use impacts from ORV noise may be reduced due to seasonal closures and designated non-ORV areas. However, seasonal routes would re-open earlier than under alternatives C and E, thereby creating shorter “noise-free” periods. Vehicle diversions to other open routes may not be as frequent under this alternative as under the other action alternatives given that some seasonal routes are open longer than others. Although under this alternative, more ramps would be constructed, as compared to alternatives C and D, construction-related impacts would remain minor adverse due to the localized nature and short duration of the activities.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
management plan, vehicle noise would be a recurring, long-term minor to moderate adverse impact in all areas of the Seashore beaches open to ORV driving. Additionally, as closure periods, which have the potential to provide short-term benefits, would be implemented throughout the life of the management plan, long-term benefits would arise. As noise from ORV use would add at least 3 dBA to the natural ambient sound levels within the Seashore, wildlife would also experience adverse impacts.	dominate the sound energy would arise. Aside from the short-term benefits that would occur in areas undergoing closure periods of any kind, additional short-term benefits may occur under alternative B as a result of regulations imposed to seasonally eliminate night driving. Impacts to wildlife would be similar to those under alternative A.	seasonal closure periods also present the potential for greater concentrations of ORVs in areas with open ORV routes, thereby increasing the frequency of vehicle noise in such areas. Construction activities would be localized and of short duration and would be minor adverse.	greatest potential for increased ORV pass-by events that dominate the sound energy in designated ORV areas due to the fewer number of open ORV areas in which vehicles may drive. Like under alternative C, construction related noise impacts from ramp improvements and the construction of a new ramp would be minor adverse.	minor adverse due to the localized nature and short duration of the activities.	

VISITOR USE AND EXPERIENCE

GUIDING REGULATIONS AND POLICIES

Cape Hatteras National Seashore's authorizing legislation states that the national seashore shall be set apart "for the benefit and enjoyment of the people." The authorizing legislation further states that "except for certain portions of the area, deemed to be especially adaptable for recreational uses, particularly swimming, boating, sailing, fishing, and other recreational activities of similar nature, which shall be developed for such uses as needed, the said areas shall be permanently reserved as a primitive wilderness and no development of the project or plan for the convenience of visitors shall be undertaken which would be incompatible with the preservation of the unique flora and fauna or the physiographic conditions now prevailing in this area" (NPS 1937, Section 4). Management goals related to ORV use are included in the Seashore's General Management Plan, which states, "Selected beaches will continue to be open for ORV recreational driving and in conjunction with surf fishing in accordance with the existing use restrictions" (NPS 1984). Providing for this use would occur in the context of the overall planning objective of preserving the cultural resources and the flora, fauna, and natural physiographic condition, while providing for appropriate recreational use and public access to the oceanside and soundside shores in a manner that will minimize visitor use conflict, enhance visitor safety, and preserve Seashore resources.

NPS *Management Policies 2006* (NPS 2006c, sec. 8.2) state that the enjoyment of park resources and values by the people of the United States is part of the fundamental purpose of all parks and that the NPS is committed to providing appropriate, high-quality opportunities for visitors to enjoy the parks.

Section 1.5 of *NPS Management Policies 2006* (NPS 2006c, sec. 1.5) states that in its role as steward of park resources, the NPS must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts on, park resources and values. When proposed park uses and the protection of park resources and values come into conflict, the protection of resources and values must be predominant. Appropriate visitor enjoyment is often associated with the inspirational qualities of the parks. As a general matter, preferred forms of enjoyment are those that are uniquely suited to the superlative natural and cultural resources found in the parks and that (1) foster an understanding of and appreciation for park resources and values, or (2) promote enjoyment through a direct association with, interaction with, or relation to park resources. These preferred forms of use contribute to the personal growth and well-being of visitors by taking advantage of the inherent educational value of parks. Equally important, many appropriate uses also contribute to the health and personal fitness of park visitors. These are the types of uses that the Service will actively promote, in accordance with the *Organic Act*.

As stated in *NPS Management Policies 2006* (NPS 2006c, sec. 8.2.3.1), off-road motor vehicle use in national park units is governed by Executive Order 11644 (Use of Off-Road Vehicles on Public Lands, as amended by Executive Order 11989). ORV routes and areas may be allowed only in locations where there will be no adverse impacts on the area's natural, cultural, scenic, and esthetic values, and in consideration of other existing or proposed recreational uses. The Executive Orders require that ORV routes and areas be located to minimize conflicts between ORV use and other existing or proposed recreational uses of the same or neighboring public lands and to ensure the compatibility of such uses with existing conditions in populated areas, taking into account noise and other factors.

While recreation is a key component of the *NPS Management Policies 2006*, the policies also instruct park units to maintain all native plants and animals as parts of the natural ecosystem. The NPS would achieve this by preserving and restoring the natural abundances, diversities, dynamics, distributions, habitats, and behaviors of native plant and animal populations and the communities and ecosystems in which they occur (NPS 2006c, sec. 4.4.1).

The goals of providing a variety of recreational opportunities while protecting the natural systems at Cape Hatteras National Seashore are evident in the objectives of this plan/EIS. With regard to visitor use and experience, the objectives state that this plan/EIS should:

- Ensure that ORV operators are informed about the rules and regulations regarding ORV use at the Seashore.
- Manage ORV use to allow for a variety of visitor use experiences.
- Minimize conflicts between ORV use and other uses.
- Ensure that ORV management promotes the safety of all visitors.

In addition, the Seashore has identified objectives for communicating with the general public and visitor population that enjoy the recreational opportunities and natural and cultural resources provided by the Seashore. Communication and information sharing is an integral component of ensuring visitor satisfaction. Thus, the proposed plan should also accomplish the following:

- Establish a civic engagement component for ORV management.
- Establish procedures for prompt and efficient public notification of beach access status, including any temporary ORV use restrictions for such things as ramp maintenance, resource and public safety closures, storm events, etc.

- Build stewardship through public awareness and understanding of NPS resources management and visitor use policies and responsibilities as they pertain to the Seashore and ORV management.

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

The potential for change in visitor experience was evaluated by assessing the limitations and assumed changes to visitor access and associated visitor uses, including ORV use, related to the proposed alternatives, and determining whether these projected changes would affect the visitor experience. The primary sources of data used to determine current visitation were surveys conducted by the NPS (RTI pers. comm. 2009a, 2009b, 2009c), the visitor use survey conducted by the Seashore in 2002 (University of Idaho 2003), and NPS visitor use statistics (NPS 2008e), as described in the “Chapter 3: Affected Environment.” The number of recreational visitors as reported by NPS is not a precise count, but is estimated from a variety of sources (NPS 1993). The estimated range for ORV numbers is based on NPS aerial survey counts adjusted by rental housing data to derive a minimum and maximum conservative estimate for oceanside ORV use.

The likelihood of partial or full beach resource closures and the associated restriction of ORV or pedestrian access were also considered in determining visitor use impacts. These closures are dependent on the breeding habits of specific species, particularly the piping plover, American oystercatcher, and four species of colonial waterbirds, including when the bird species court, establish territory, build nests, and lay eggs, as well as when the young first leave the nest to forage for food, and three species of sea turtles, including when turtles lay nests until turtle hatchlings return to the sea. Also, in evaluating visitor experience, the Seashore’s enabling legislation was considered so that the analysis of visitor experience considered not only the ability of visitors to engage in a desired activity, but if that activity is compatible with the preservation of the unique flora and fauna or the physiographic conditions.

In addition to visitor activities, the analysis of visitor use also considers the viewscape (night sky) and soundscape of the Seashore and potential visitor use conflicts. Soundscapes are covered separately in this plan/EIS, but noise impacts do influence visitor experience and are therefore mentioned in this analysis where appropriate. The alternatives were qualitatively analyzed and considered if, while engaging in their desired visitor activity, visitors would see and hear the sights and sounds expected under that activity. An important component of this experience that was specifically addressed in the impact thresholds is viewing night skies. The analysis of night skies looks at zones that have been identified in the Seashore by the NPS Night Skies Team (see “Chapter 3: Affected Environment”). The zones represent the conditions that should be occurring at the Seashore in regards to permanent lighting sources, and not necessarily what is occurring currently. For example, in the Naturally Dark Zone (NDZ) and Park Lighting Zone 1 (PLZ1), there is no expectation of artificial lighting. These zones exclude temporary lighting installed less than 60 days for special purposes (not ongoing) and all emergency lighting.

A summary of visitor use and experience impacts under all alternatives is provided in table 60 at the end of this section. The following thresholds for evaluating impacts on visitor use and experience were defined.

Negligible: Visitors would likely be unaware of impacts associated with proposed changes. There would be no noticeable change in visitor use and experience or in any defined indicators of visitor satisfaction or behavior.

Any permanent lighting would not change the existing lighting zone designation throughout the Seashore. Visitors would not have a noticeable change in the ability to experience night skies in the NDZ and PLZ1 zones.

Minor: Changes in visitor use or experience would be slight and detectable, but would not appreciably limit or enhance any critical characteristics of the visitor experience. Visitor satisfaction would remain stable.

New introduced sources of permanent light may slightly alter the desired lighting zone designation of an area. Visitors would have a noticeable, but slight, change in the ability to experience night skies in the NDZ and PLZ1 zones, but this change would not impact their overall visitor experience.

Moderate: A few critical characteristics of the existing visitor experience would change, and the number of visitors engaging in a specified activity would be altered. Some visitors participating in that activity or visitor experience might be required to pursue their choices in other available local or regional areas. Visitor satisfaction at the Seashore would begin to either decline or increase.

New introduced sources of permanent light would create a noticeable change in the desired lighting zone designation of an area. Visitors would have a noticeable change in the ability to experience night skies in the NDZ and PLZ1 zones, and this change would impact their overall visitor experience.

Major: Many critical characteristics of the existing visitor experience would change, and visitor satisfaction would be substantially decreased or enhanced. The number of visitors engaging in a specified activity would be substantially altered. Many visitors participating in an activity or visitor experience would not be able to pursue their choices in other local or regional areas.

Visitors would not be able to experience night skies in the NDZ and PLZ1 zones, and this change would impact their overall visitor experience.

Duration: Short-term impacts would occur sporadically throughout a year, but would generally last no more than three weeks per year.

Long-term impacts would occur more than three weeks per year and likely for consecutive years.

Study Area

The geographic study area for the visitor use and experience analysis includes the entire area within the Seashore boundary.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Under alternative A, all areas of the Seashore would continue to be open to ORV and pedestrian use, unless closures were established for resource protection, administrative, or safety reasons. Visitors could be restricted from popular areas, such as the points and spits, depending on the duration and extent of the closure, but in most cases, alternative or bypass routes would be identified and used to allow access to the maximum extent possible.

Resource Closures. Resource closures for birds would continue to be implemented annually, based on recent breeding activity on the spits, Cape Point, and South Beach and in other Seashore locations. Before implementing a closure, alternate access routes and then bypass criteria would be evaluated. An ORV and pedestrian corridor would be provided adjacent to closure areas unless species activity or safety issues required a full-beach closure. If a bypass is not available, a full-beach closure could limit ORV access through certain sections for a limited period, dependent on species behaviors and conditions.

Recent breeding activity for piping plover has been limited to Bodie Island Spit, Cape Point, South Beach, Hatteras Inlet Spit, and South Point. American oystercatchers nest in these areas as well, but not exclusively. Although the location of recent piping plover breeding areas could restrict large areas of each of the point and spits beginning in April, ORV corridors to the spits and Cape Point would most likely remain open throughout the early parts of the spring and summer. However, a full-beach closure could occur to protect piping plover or American oystercatcher chicks once they vacate the nest and begin foraging. Foraging activity could occur anytime throughout the summer months, and could last from 3 to 5 weeks, until the chicks take flight. As resource closures are closed to all visitor use, ORV users and other visitors would not be able to reach the spits unless alternate access was available via an existing interdunal road or bypass. However, this type of full beach closure is less likely under alternative A than under other alternatives.

Because turtles nest anywhere in the Seashore, partial and full-beach closures could occur anywhere along Seashore beaches throughout the summer and fall months, as hatchlings emerge from the nest. These nest closures generally last from approximately the 55th day after the nest is laid until the nests hatch. Full beach closures would be unlikely, however, since using alternative routes or applying the identified bypass criteria would help ensure that ORV and pedestrian access would continue to the points and spits and other portions of the beaches.

Of particular concern for all visitors is having access to the points and spits, especially for fishing and other recreational pursuits such as walking and beachcombing. The primary access to these areas are through ramp 4 (includes Bodie Island Spit), ramps 43 to ramp 49 (includes Cape Point), ramp 55 (includes Hatteras Inlet Spit), and on Ocracoke ramp 59 (includes North Ocracoke Spit) and ramps 70 and 72 (includes South Point). RTI, International estimates between 100,000 to 395,000 ORVs visit the Seashore annually (RTI pers. comm. 2009a), with an estimated 55%, or approximately 60,500 to 217,250 ORVs, expected to visit Seashore beaches during June through August. As indicated in the assessment of ramp usage for oceanside ramps during July 4 and Memorial Day, 2008, 75% of these ORVs use ramps for access to the points and spits, and therefore, an estimated 45,375 to 162,938 ORVs could be affected by closures. Applying a conservative high estimate of 2.7 passengers per ORV during the summer months (NPS 1993; RTI pers. comm. 2009c), this would represent about 122,000 to 440,000 visitors in ORVs that use the access ramps. Given the approximately 2.2 million visitors each year in recent years, this would have the potential to affect about 5 to 20% of the Seashore visitors annually. This estimate would represent the worst case scenario assuming that 75% of the ORV users are driving to the points and spits, and full beach closures at these access routes.

Therefore, under alternative A, partial-beach resource closures on the spits and points would result in restricting areas where ORV use and recreational pursuits could occur; however, pedestrians and visitors participating in activities such as swimming, sunbathing, beach walking, jogging, and shell collecting would be able to participate in activities outside of any resource closures. Therefore, the effects of partial beach resource closures on the visitor experience would result in long-term negligible to minor adverse impacts. If full-beach resource closures were implemented on the spits or along spit access routes, impacts to users would likely be long-term moderately adverse, even if the closure is temporary, since any full-beach resource closures that restrict ORV access and other visitor use would most likely occur during the summer months, when the majority of visitation occurs, and in areas where the majority of the use occurs. In the unlikely event that more than one spit or point experienced a full beach closure at the same time, impacts would be long-term moderate to major adverse due to the restriction of these highly popular locations for visitor recreational use.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the Seashore. Besides the spits, American oystercatchers and colonial waterbirds are found along the shore, from Cape Point north to Pea Island and in various areas between Cape Point and Hatteras Inlet and on Ocracoke Island. This breeding habitat occurs in vicinity of ORV access ramps where ORV use is much lighter. Based on aerial surveys conducted on July 4, 2008, the daytime count between ramps 23–38 (south of Salvo through south of Avon) is about 25% of the total oceanside ramp use, much less than the use that occurs at the more popular ramps near the spits. Generally, any ORVs and other dispersed recreation users would negotiate around these smaller closures throughout the Seashore, resulting in long-term negligible to minor adverse impacts because ORV and pedestrian accessibility would remain. Although a temporary full-beach resource closure could also occur in areas outside the spits, the adverse impacts would be long-term minor because the beach would remain open on either side of resource closure and would be accessible from an ORV ramp.

Safety Closures. In addition to resource closures, alternative A could continue the four existing safety closures and would continue the two administrative closures near the lighthouse and Buxton Woods. In addition, the village beaches would continue to be closed to ORV use in the busy summer months. These areas include a total of approximately 24 miles, or one-third of the total beach mileage, which would continue to be restricted to ORV users, resulting in long-term minor adverse impacts by limiting the ORV visitor use in these areas. Alternatively, these closures would continue to be a benefit related to protecting visitor safety and to those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise in more populated areas (e.g., the village beaches, the lighthouse administrative closure area). The 2002 visitor use survey found that visiting the lighthouses was the top reason for visiting the Seashore (followed by beach combing and fishing, and visiting historic sites was the second most popular activity reported by visitors, ranked just below sunbathing/swimming). Therefore, the restriction on ORV use at these administrative areas would continue to provide a long-term benefit to the many visitors that seek the experience of historic site and lighthouse viewing without interference from vehicle traffic and noise.

Permitting and Carrying Capacity Requirements. Alternative A does not include any permitting requirements for ORV use, and has no carrying capacity restrictions or associated capacity-related management measures. This is a short-term benefit to visitor experience for most ORV users because it eliminates paperwork and effort needed to get a permit. However, without this permitting program, there is no opportunity to require a mandatory review by ORV users of rules and regulations associated with ORV use at the Seashore. This can lead to ORV users not being aware of or misunderstanding the regulations and accordingly violating the regulations, which can result in short-term negligible to minor adverse impacts to visitor experiences at the Seashore. In addition, without the permit system, if there are violators, there would be no mechanism in place to revoke a permit and, as such, restrict access of violators to the Seashore.

The lack of any type of carrying capacity restrictions would generally be viewed as a benefit to ORV users in that there would be no restriction on the numbers of ORVs allowed on the beach in open areas, so there would be less chance of being turned away or not having the desired access during a beach vacation. However, the 2002 visitor use study (University of Idaho 2003) found that 27% of visitors felt “crowded to extremely crowded” and 43% felt “somewhat crowded,” and 49% of visitor groups reported that crowding “detracted from their park experience.” As such, under the existing conditions, almost half of the visitors indicated that crowding was adversely affecting their visitor experience, and these adverse effects would continue and potentially increase with increases in visitor use as indicated by the relatively steady long-term increase in visitation at the Seashore. Therefore, without carrying capacity limitations, a large number of vehicles could occur in a relatively small area, and short-term minor to moderate adverse impacts to visitor experience or satisfaction could occur if overcrowded conditions are reached, depending on the user’s tolerance for a high density of use.

Other Recreational Pursuits. Fishing tournaments, which occur during the spring and fall, would continue to use all the open Seashore beaches, except one-half mile on either side of Cape Point, one-half mile from Hatteras and Ocracoke Inlet, and one-half mile on the north side of Oregon Inlet, and all major nesting areas at the Seashore where resource closures related to bird breeding activity have occurred. Some resource closures could occur, but as explained above, these would not be overly restrictive due to options for providing access through or around turtle nests and the provision of an ORV corridor where possible for bird closures. Therefore, alternative A would result in short-term negligible adverse impacts to visitors participating in fishing tournaments because historical beach access for tournament fishermen would continue.

Pedestrians and other activities, such as swimming, sunbathing, beach walking, jogging, and shell collecting, would be allowed outside of any resource closures. In many cases, the defined ORV and pedestrian corridors would overlap or be the same, raising the possibility of conflict between ORV and non-ORV users and a diminished visitor experience for visitors seeking solitude and freedom from vehicular distractions. Because the width of the ORV corridor would be approximately 150 feet, sufficient room should be available for both ORVs and pedestrians. Because pedestrians and ORVs would be present in the same areas, the noise and the sight of vehicles could decrease the visitor experience for those visitors seeking solitude and a natural setting. Results of the 2002 survey indicated that vehicles on the beach was one of the top 3 factors that received the highest proportion of “detracted from my experience” ratings; however, this was only 18% of the 249 people surveyed. In addition, 34% said vehicles on the beach had no effect on their experience, 20% said they added to their experience, and 29% did not encounter vehicles (University of Idaho 2003). Therefore, impacts would be long-term moderate adverse to pedestrians and other non-ORV dependent visitors.

Recreational pursuits, such as kite flying and Frisbee and ball throwing, would not be allowed within or above all bird closures. These restrictions would have long-term negligible to minor adverse impacts on visitor use because many other locations exist throughout the Seashore that accommodate these or similar activities. Pets would need to be confined or on a leash at all times in all areas and would be prohibited within any symbolic fencing around any bird closure area. Even on a leash, pets are prohibited from the landward side of ORV corridors at the spits and points. These restrictions would have long-term minor adverse impacts on responsible pet owners because pets would be allowed in the Seashore, but would still need to be restrained following NPS regulations.

Night Sky. A somewhat unique aspect of visitor experience is the enjoyment of a dark night sky. Under alternative A, night driving would continue to be permitted, so there would be the possibility of disruption of night sky viewing due to vehicle lights on the beach and lighting from parked campers where people are fishing, especially in areas away from the villages, resulting in minor long-term adverse effects.

Overall Impact to Visitor Use. Those looking for an experience at the Seashore that includes ORV use would have long-term negligible to minor adverse impacts as some areas would be closed for resource protection, but alternative A would provide the most ORV access of any alternative. Should there be extensive resource closures in a given year, the potential for long-term moderate impacts exists. Those looking for a non-ORV experience at the Seashore would experience long-term moderate adverse impacts as alternative A does not provide for a specific separation of uses or designation of non-ORV areas. Since night driving would be permitted under alternative A, there would be short-term minor adverse impacts to night skies.

Cumulative Impacts. Other past, present, and planned future activities within the Seashore have the potential to affect visitors and the recreational opportunities supported within the Seashore. In recent years, hurricanes, storms, and other events, as well as the subsequent recovery time required following these events, have adversely impacted visitors. Barrier islands are dynamic and constantly being reshaped by forces of nature, such as weather events. Following these events, roads are often overwashed with sand and water, facilities destroyed, and portions of an island may be lost or reshaped. Visitors cannot consistently depend that the recreation opportunity or visitor experience they enjoyed during a recent or past visit may be available in the future. In addition, following an event, staff and other Seashore resources may be dedicated to recovery efforts rather than to facilitating visitor enjoyment in some areas throughout the Seashore. Depending on the degree of damage following a storm, areas of the Seashore may be closed for a substantial period of time. Thus, weather events may result in short- and long-term minor to major adverse impacts, depending upon the severity of the storm.

Adverse impacts may also result from other activities within the Seashore that restrict visitor use, including the dredging of the federally authorized navigation channel at Oregon Inlet, which causes temporary shoreline closures along Bodie Island, and the implementation of the Seashore's Resources management Plan, which, in the interest of protecting resources, may restrict some visitor opportunities.

Beneficial impacts to visitor experience have occurred, and would continue to occur into the future, from the implementation of the following Seashore plans or actions:

- *Cape Hatteras National Seashore General Management Plan* (NPS 1984), which considers visitor needs in managing Seashore resources.
- *Cape Hatteras National Seashore Comprehensive Interpretive Plan*, which would identify the interpretive programs and associated facilities necessary to inform and teach the public about the purpose and significance of the Seashore and the many resources and opportunities that comprise the Seashore.
- Bonner Bridge replacement, which would continue to ensure visitors and their vehicles access between Bodie and Hatteras islands along NC-12.

Actions, such as ongoing road maintenance and repair to NC-12 and associated bridges, would most likely provide long-term beneficial impacts to visitor use and experience because of the importance of the road in maintaining access, with short-term minor impacts during construction. The General Management Plan and interpretive plan would most likely provide long-term beneficial impacts because these plans and activities would ensure that visitor opportunities continue within the Seashore.

The potentially adverse impacts of storm events, in combination with the generally minor impacts of alternative A, would result in long-term moderate adverse cumulative impacts to ORV users and other visitors dependent on ORVs for access to particular areas of the Seashore. However, the beneficial impacts of Seashore plans and ongoing road maintenance, when combined with the impacts of alternative

A, would result in long-term negligible to minor adverse cumulative impacts for ORV users and long-term moderate adverse cumulative impacts for non-ORV users.

Conclusion. Resource closures on the spits and Cape Point would result in long-term negligible to minor adverse impacts if these closures are partial beach closures where ORVs and other visitors are able to negotiate around closures using ORV corridors and have continued access to favored destinations or fishing locations. Full-beach resource closures at the spits and points would generally result in long-term moderate adverse impacts to those visitors who regularly frequent these locations because of the inability to participate in recreational activities in these areas. In the unlikely event that more than one spit or point experienced a full beach closure at the same time, impacts would be short-term moderate to major adverse.

In areas outside the spits and Cape Point, partial-beach resource closures would result in long-term negligible to minor adverse impacts because ORVs and visitors would negotiate around these smaller closures. Full-beach resource closures in these areas would only be long-term minor adverse because the beach would remain open on either side of a resource closure and would be accessible from an ORV ramp. Because pedestrian use and most other recreational opportunities could occur outside resource closure areas, short-term minor adverse impacts would occur to these users. The lack of permits or a defined carrying capacity would be viewed as a benefit in that there would be no restriction on numbers of ORVs allowed on the beach in open areas and no additional effort to complete the necessary activities for a permit, but could lead to short-term minor to moderate adverse impacts to visitor experience or satisfaction if overcrowded conditions are reached. Lights associated with ORV use would result in long-term minor adverse effects on night sky, especially in areas away from the villages.

Cumulative impacts would be long-term negligible to minor adverse for ORV users, and long-term moderate adverse for non-ORV users.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Under alternative B, areas accessible to ORVs and pedestrians would be similar to alternative A, except that the area from ramp 43 to 0.4 mile north would be open to ORVs year-round instead of just seasonally and large prenesting closures would be implemented. Basically, all areas of the Seashore would continue to be open to ORV and pedestrian use, unless closures are established for resource protection, administrative, or safety reasons. However, under alternative B, resource closures would be based on buffers established under the consent decree, and these buffer distances are larger than those under alternative A (see table 10, chapter 2). In addition, the consent decree requires increasing resource protection buffer size if an area that was closed is deliberately violated, so buffers may be expanded and result in larger beach closures due to non-compliance. Also, under alternative B, the time of allowable ORV access would be regulated to eliminate night driving from May 1 to September 15, and to restrict it to only those with a permit from September 16 to November 15.

Resource Closures. Resource closures for birds would continue to be implemented annually, based on recent breeding activity, and an ORV and pedestrian corridor would be provided adjacent to closure areas unless species activity or safety issues required a closure. Because the resource closure buffers are larger than the buffers under alternative A, visitors could be restricted more often and for longer periods of time during the breeding season. A closure could temporarily limit ORV access through certain sections for an extended certain period, which would result in long-term moderate adverse impacts to users who wish to access a certain area that is closed.

Partial-beach resource closures on the spits and points would result in long-term minor adverse impacts because ORVs and their passengers would have access around these closures using ORV corridors and would not be impeded from reaching favored recreational destinations or fishing locations. However, if full-beach resource closures were implemented on the spits or along spit access routes, even though the closure may only be temporary, the inability to participate in recreational activities would result in long-term moderate adverse impacts to those visitors who regularly frequent that location. If full-beach closures occurred at more than one spit location at a time, which could occur more often under alternative B due to increased buffer sizes, moderate to major adverse impacts to fishermen and other ORV users accessing these areas could occur, depending upon the location and time frame.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the Seashore, which would temporarily block access for ORVs and other dispersed recreation users due to buffer size, usually resulting in long-term, minor to moderate and sometimes major impacts, depending upon the location of the closure. Full beach closures due to turtle nesting would sometimes occur after the nest reaches its hatch window. In some cases, using alternative routes or applying the identified bypass criteria would help provide ORV and pedestrian access around the turtle closures. A temporary full-beach resource closure could occur in areas outside the spits, and would be more likely under alternative B than under alternative A because the buffers are larger, and deliberate non-compliance would result in expanded closures. The adverse impacts would be long-term and moderate because the expanded buffers could make more beaches inaccessible, and continued expansion of buffers due to incidents of deliberate noncompliance could exacerbate the impact.

Regarding time of use, under alternative B, the consent decree includes night-time restrictions to offer additional protection of sea turtles. Vehicles would be prohibited from using the beach during the hours of 10:00 p.m. to 6:00 a.m. from May 1 to September 15 (with commercial fisherman being able to access the Seashore at 5:00 a.m.) and would require a permit to access the beaches with a vehicle during those hours from September 16 to November 15. Night driving would be allowed all other times of the year (November 16 to April 30). These restrictions would have long-term minor to major adverse impacts on visitors, depending on the desired visitor use and experience; for example, those wishing to surf fish at night would not be able to do so during the summer season, which would be considered a major long-term adverse effect on that group of visitors.

Safety Closures. Similar to alternative A, alternative B could continue the four existing safety closures, and would continue the two administrative closures near the lighthouse and Buxton Woods, and the village beaches would be closed to ORV use in the busy summer months. These restrictions would cause minor long-term adverse impacts to ORV users and would be a long-term benefit related to protecting visitor safety and to those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise in more populated areas. One area, from ramp 43 to 0.4 mile north, would be open to ORVs year-round instead of just seasonally, which would open up a small area near Cape Point Campground to ORV use. Also, under alternative B, there would be an ORV-free zone established in the ocean backshore where beaches are wide enough to accommodate a nearly 60-foot (20-meter) ORV corridor above the mean high tide from March 15 to November 15. This would allow non-ORV users to use an area of the upper beach without any direct disturbance from ORVs trying to access the same area, a small long-term benefit to the non-ORV users. However, since pedestrians and ORVs would be present on the same portion of the beach, the noise and the sight of vehicles would continue to decrease the visitor experience for those visitors seeking solitude and a natural setting, with short-term minor adverse impacts to those users.

Permitting and Carrying Capacity Requirements. Similar to alternative A, alternative B does not include any permitting requirements for daytime ORV use, and this would be beneficial to visitor experience for most ORV users because it eliminates paperwork and effort needed to get a permit. However, this

alternative does not provide a permitting system or a mandatory review of rules and regulations for ORV users and therefore has no opportunities to ensure that ORV users are knowledgeable about the regulations and also has no “teeth” to revoke permits of regulatory offenders. This could result in a long-term minor adverse impact because of the effects of these violators on the experience of other visitors. Nighttime permits required from September 16 to November 15 would provide educational benefits and be revocable if rules are not followed, a long-term benefit to the Seashore, as well as to visitors.

Alternative B has no formal carrying capacity provisions, although temporary closures could be enforced if traffic is impeded or if disorderly conduct occurs and continues, which has occurred during busy weekends. The lack of a defined carrying capacity would be viewed as a benefit in that there would be no restriction on numbers of ORVs allowed on the beach in open areas, so there would be less chance of being turned away or not having the desired experience during a beach vacation. However, this could lead to crowding, and short-term minor to moderate adverse impacts to visitor experience or satisfaction, depending on the user’s tolerance for a high density of use, as described under alternative A.

Other Recreational Pursuits. Similar to alternative A, pedestrian-based activities would be allowed outside of any resource closures. In most cases, the defined ORV and pedestrian corridors would overlap or be the same, raising the possibility of conflict between ORV and non-ORV users and a diminished visitor experience for visitors seeking solitude and freedom from vehicular distractions. Under alternative B, the speed limit would be lowered to 15 mph during the busiest tourist months, which would help reduce conflicts, both real and perceived, and accident potential, an issue of concern raised by the public during the scoping process, resulting in long-term benefits. Also, as previously noted, there would be an ORV-free zone established in the ocean backshore where beaches are wide enough to accommodate a 60-foot (20-meter) ORV corridor above the mean high tide from March 15 to November 15. This would slightly reduce the potential for direct conflicts between ORV and non-ORV users, a long-term benefit; however, the lack of designated non-ORV areas would result in long-term moderate adverse impacts to non-ORV users.

Like alternative A, recreational pursuits, such as kite flying and Frisbee and ball throwing, would not be allowed within or above all bird closures. These restrictions would have long-term negligible to minor adverse impacts on visitor use since many other locations exist throughout the Seashore that accommodate these or similar activities. Pets would need to be confined or on a leash at all times in all areas and would be prohibited within any bird closure area. These restrictions would have long-term minor adverse impacts on pet owners because pets would be allowed in the Seashore, but would still need to be restrained following NPS policy. Also, similar to alternative A, there would be only short-term negligible adverse impacts to visitors participating in fishing tournaments because historical beach access for tournament fishermen would continue.

Night Sky. Regarding the visitor experience of viewing the night sky, under alternative B the restriction on night driving from May 15 to September 15 would eliminate impacts during that period of time due to vehicle lights on the beach and lighting from parked vehicles where people are fishing, especially in areas away from the villages, resulting in long-term benefits for night sky experience. However, night driving would still occur under permit in the fall and during the remainder of the year, so impacts to night sky during those months would remain long-term negligible to minor adverse.

Overall Impact to Visitor Use. Those looking for an experience at the Seashore that includes ORV use would have long-term moderate to major adverse impacts as one or more spit or point would be closed for an extended period of time during the breeding season. During the remainder of the year, there would be negligible to minor adverse impacts to ORV users as limited areas would be closed for resource protection. Those looking for a non-ORV experience at the Seashore would experience long-term moderate adverse impacts as alternative B does not provide for a specific separation of uses outside of

seasonal ORV closures of village beaches and no non-ORV areas would be designated. Since night driving would be seasonally restricted under alternative B, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.

Cumulative Impacts. Under alternative B, the same past, present, and planned future activities within the Seashore that have the potential to affect visitors and the recreational opportunities within the Seashore would occur, and impacts would be the same as described under alternative A. The impacts of these actions, in combination with the mostly minor to potentially major impacts of alternative B, would result in long-term moderate to major adverse cumulative impacts to ORV users. However, while there would be some benefits for non-ORV users from the night-driving restrictions and reduced speed limits, the lack of designated non-ORV areas and the other actions and restrictions on ORV use under alternative B would result in long-term minor to moderate adverse cumulative impacts for visitors who desire an experience free of motorized vehicle presence, disturbance, lights, or noise.

Conclusion. Resource closures on the spits and Cape Point would result in long-term negligible to minor adverse impacts if there are partial resource closures where ORVs are able to negotiate around closure areas using ORV corridors and have continued access to favored destinations or fishing locations. Full-beach resource closures at the spits and points would be more likely than under alternative A and would result in long-term moderate to potentially major adverse impacts to those visitors who regularly frequent these locations because of the inability to participate in recreational activities. Those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise or visual disturbance could experience long-term benefits due to restrictions on nighttime driving and reduced speed limits during busy seasons, and long-term moderate adverse impacts due to the lack of designated non-ORV areas within the Seashore.

Because pedestrian use and most other recreational opportunities could occur outside resource closures, long-term minor to moderate adverse impacts would occur to these users. The lack of a permit system or carrying capacity would be viewed as a benefit in that there would be no restriction on numbers of ORVs allowed on the beach in open areas or needed paperwork to drive an ORV on the beach, but could lead to long-term minor to moderate adverse impacts to visitor experience or satisfaction if conditions reached overcrowded conditions and no traffic-based closures occurred. Lights associated with ORV use would result in long-term negligible to minor adverse effects to those visitors wishing to experience the night sky during the fall and winter periods when night driving is permitted or not restricted, and there would be long-term benefits to night sky viewing during the summer season when night driving is prohibited. The impacts to visitor use and experience prior to the June 2008 modifications to the consent decree would be the same as the impacts after the modification.

Cumulative impacts would be long-term moderate to major adverse for ORV users, and long-term minor to moderate adverse for non-ORV users.

Impacts of Alternative C: Seasonal Management

Under alternative C, areas accessible to ORVs and pedestrians would be determined by providing designated ORV use areas and pedestrian-free areas that are based largely on seasonal resource and visitor use characteristics, giving Seashore users a degree of predictability in knowing what areas are opened and what areas are closed. Under this alternative, ORV access would be prohibited in all areas of the Seashore except where an ORV route is specifically designated.

ORV routes and areas would be established seasonally (closed to ORV use from March 15 to October 15) in Rodanthe, Waves, Salvo, Avon, Frisco, Hatteras Village beaches, and Ocracoke Campground beach

(0.5 mile northeast to 0.5 mile southwest of ramp 68). The area on Buxton beach south to 0.4 mile north of ramp 43 and the Ocracoke Day Use Area beach from 1.2 miles northeast to 0.5 mile northeast of ramp 70 would be designated as non-ORV year-round. In addition to these areas, SMAs would be established, as described in chapter 2. All SMAs would be seasonally designated for ORV use from March 15 to October 15, consistent with the village beach closures. The majority of SMAs would be managed using ML1 measures, where both ORV and pedestrian activity would be prohibited during breeding activities. Bodie Island Spit, Cape Point, and South Point would be managed under ML2 measures, which would provide a pedestrian corridor during the seasonal ORV closure. Hatteras Inlet Spit and North Ocracoke Spit would be managed under ML1 measures, and closed to pedestrian use seasonally from March 15 until breeding activities are complete.

In areas where ORV use areas are identified, new and/or improved ramps would be added to ensure access to these areas on the oceanside, and existing soundside ramps would remain open. Interdunal roads available to ORV use would be the same as under alternative A, with the addition of providing additional pull-outs or widening where appropriate to provide safe passage. On South Beach, the existing interdunal road would be extended west of ramp 45 to a new ramp 47.

Within the areas open to ORV use, if resource concerns are present, they would be subject to closure using applicable buffer distances (see table 10, chapter 2). These buffer distances are greater than under the no-action alternatives. Also, under alternative C, the time of allowable ORV access would be regulated to eliminate night driving from May 1 to November 15, between 7:00 p.m. and 7:00 a.m. Because of the seasonal ORV closures, including the popular points and spits, increased buffers and night-driving regulations, visitors could be restricted from popular areas depending on the duration and extent of the closure and the desired time of use, resulting in long-term moderate to major adverse impacts to ORV users because they would not be able to engage in the activity they desire.

Resource Closures. Resource closures for birds would continue to be implemented annually, based on recent breeding activity. A pedestrian corridor would be provided adjacent to closure areas in SMAs managed under ML2 procedures (Bodie Island Spit, Cape Point, and South Point) unless species activity or safety issues required a closure. In SMAs designated for the use of ML1 measures (see table 10, chapter 2), pedestrian access would not be allowed in areas with closures, including prenesting closures. Under alternative C, visitors using ORVs would be restricted from the popular points and spits during the summer months. As noted under alternative A, the spits and points are of particular concern for visitors who wish to use these areas for fishing and other recreational pursuits, such as walking and beachcombing, and these areas accounted for about 75% of total ramp usage (RTI pers. comm. 2009a). Therefore, seasonal resource-based closures and restrictions under alternative C could affect a majority of oceanside ramp users, and result in long-term moderate to major impacts for users wishing to access these points by ORV in the summer. Three of the point and spit areas would have a pedestrian access corridor, subject to resource closures during the breeding season, resulting in a beneficial impact for visitors looking for solitude and a natural setting at the Seashore.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the Seashore. Depending upon the location of closures relative to ORV access ramps, and ORVs and other dispersed recreation users would generally negotiate around these smaller closures throughout the Seashore using alternate routes and access points, usually resulting in long-term negligible to minor adverse impacts because ORV accessibility would remain. Full beach closures due to turtle nesting would be lessened by the establishment of traffic detours behind nests, where appropriate. Under alternative C, turtle management activities would include creation of a “nest watch” program that would allow trained volunteers to watch nests that have reached their hatch windows to monitor hatchling emergence success. This would provide a new visitor experience, and one that is desired based on public comment, resulting in long-term beneficial impacts to visitors who seek to participate in such a program.

A temporary full-beach resource closure could occur in areas open to ORV use, but would be much less likely under alternative C than under the no-action alternatives since known breeding/hatching areas are within the SMAs and would generally already be closed to ORV use during the breeding season. As a result, the chance of a full beach closure in areas open to ORVs outside the SMAs is decreased, with the potential for long-term minor to moderate adverse impacts if temporary closures of these areas were to occur as it would further reduce the amount of area open for ORV use under alternative C and concentrate this use in different areas, subject to the parking restrictions.

Alternative C would provide for a special use permit, to be authorized by the Superintendent, which would allow temporary use of an ORV in a non-ORV use area. This special use permit would be authorized in the following limited circumstances: temporary emergency ORV use of non-ORV areas if needed to bypass sections of NC-12 that are closed for repairs; temporary non-emergency ORV use of non-ORV areas traditionally used by fishing tournaments that were established prior to January 1, 2009; and temporary non-emergency ORV use of non-ORV areas to transport mobility impaired individuals to join their family or friends on an open beach that is otherwise closed to ORV. In the instance of transporting a mobility impaired individual, ORV use would be limited to the shortest, most direct distance between the nearest designated ORV route and the location of the gathering. By providing for special use permits in these circumstances, short-term beneficial impacts would be realized by these user groups that would otherwise not be able to use an ORV in areas closed year-round or seasonally to ORV use.

To further address and facilitate access into non-ORV use areas, alternative C would include new or expanded parking lots to support pedestrian access as well as the consideration by the Seashore of applications for commercial use authorizations for a beach shuttle service. These elements would provide long-term beneficial impacts and work to mitigate the moderate to major adverse impacts that some user groups may experience as alternative ways to reach the Seashore would be provided if ORV use is not permitted.

Regarding time of use, under alternative C the seasonal night-time restrictions offer additional protection of sea turtles. Vehicles would be prohibited from using the beach during the hours of 7:00 p.m. to 7:00 a.m. from May 1 to November 15. Night driving would be allowed all other times of the year (November 16 to April 30). These restrictions would have long-term beneficial to long-term moderate to major adverse impacts on visitors, depending on the desired visitor use and experience. For example, those visitors wishing to experience the beach at night without ORVs present would have more opportunities to do so. Those visitors wishing to use ORVs to access surf fishing areas at night would not be able to do so during the summer and fall season, which would be considered a major long-term adverse effect on that group of visitors.

Safety Closures. Alternative C would establish specific criteria for implementation of a safety closure, including if there is debris on the beach, narrow beaches or congested areas. These closures would preclude ORV access, but allow pedestrian and commercial fishing access. No administrative closures would be established under this alternative. Although there is not an administrative closure at the former site of the Cape Hatteras Lighthouse, no ORV route would be established in this area, thus ORVs would not be permitted and village beaches would be closed during the summer either as a seasonal or as part of a year-round closure.

These areas include a total of approximately 40.6 miles (11.9 miles that would be designated as non-ORV year-round and 28.7 miles that would be seasonally designated for ORV use from October 15 until March 14), or about 60% of the total beach mileage, so these restrictions, particularly during the period from March 15 to October 14, would cause long-term moderate to major adverse impacts to ORV users and would be a long-term benefit related to protecting visitor safety and to those non-ORV users desiring a

vehicle-free experience with more natural views and no vehicle-related noise in more populated areas. Some areas that have been traditionally closed year-round due to seasonal restrictions and safety closures, such as Frisco Village beach and Hatteras Village beach, would now be open seasonally from October 15 to March 15. Access to these previously closed areas would provide ORV users with a long-term benefit. Since pedestrians and ORVs would be present on the same portion of the beach during the winter/spring season, the noise and the sight of vehicles would continue to decrease the visitor experience for those visitors seeking solitude and a natural setting, with long-term minor to moderate adverse impacts to those users.

Alternative C would include improvements to ramp access areas throughout the Seashore. These improvements would include ensuring that ramps are two-lanes wide and have standard regulatory signs and information boards, gates are installed at all ramps, and a designated air down area (for adjustment of tire pressure on ORVs) with a hardened surface is provided. These improvements to ramps and the creation of designated air down areas, would have beneficial impacts to ORV users, who noted a desire for these conditions during public scoping.

Permitting and Carrying Capacity Requirements. Alternative C would include permitting requirements for all ORV use, and could be viewed as a short-term minor to moderate adverse impact to visitor experience for most ORV users since it would result in paperwork and effort needed to get a permit. Permits would be available in person at designated areas or online and would be valid for 12 months from the purchase date, making the permit easy to obtain on an annual basis. There would be no limit on the number of permits issued, and, therefore, no adverse impacts from a perceived or actual scarcity of permits. The permit system would require ORV owners to complete a short education program in-person or online and pass a basic knowledge test. This requirement could be viewed by those seeking a permit as too cumbersome and would result in short-term minor to moderate adverse impacts to their experience. A fee would be charged to obtain a permit that would be based on cost recovery as described in the NPS Director's Order and Reference Manual 53. Depending on the level of fee, ORV users could experience minor to moderate impacts, depending on if they feel the fee would be cost prohibitive and impact their ability to access the Seashore.

Although some users may feel adverse impacts from implementation of a permit system, other users may see beneficial impacts as those visitors using ORV would be provided education and information with their permits that could influence their behavior and reduce potential for adverse resource impacts and conflicts with non-ORV visitors. Implementation of a permit system would provide the Seashore with a method to address those ORV users who violate Seashore policy, through revocation of permits, which could beneficially affect the experience of visitors through potentially fewer instances of encountering unlawful behavior of other visitor and associated conflicts.

Alternative C would not dictate parking configurations on the beach, but would include formal carrying capacity provisions, including the enforcement of temporary closures of areas once these limits are reached or if disorderly conduct occurs and continues, which has occurred during busy weekends. The implementation of a defined carrying capacity may be viewed as a benefit by those who feel that there are times when conditions are too crowded and that their visitor experience is adversely impacted by these crowded conditions. Others would view implementation of a carrying capacity as a short-term moderate to major adverse impact if they are unable to get to their desired area or are unable to participate in the planned recreational activity because capacity has been reached, as closures due to carrying capacity would be expected to occur for only a few hours on some days during peak use summer holiday weekends, based on past, current, and estimated future use levels. The determined carrying capacity would be subject to periodic review and may address these impacts if they arise.

Other Recreational Pursuits. Similar to alternative A, pedestrian-based activities would be allowed outside of any resource closures, but unlike A, this would include seasonal closure to all users of seven SMAs managed under ML1 measures and would allow a pedestrian access corridor, subject to resource closures, at three SMAs managed under ML2 management measures (Bodie Island Spit, Cape Point, and South Point). In most cases, where ORVs are allowed, the defined ORV and pedestrian corridors would overlap or be the same, raising the possibility of conflict between ORV and non-ORV users and a diminished visitor experience for visitors seeking solitude and freedom from vehicular distractions. However, due to the amount of area designated as non-ORV under alternative C, these impacts would be expected to be negligible. Under alternative C, the speed limit would be lowered to 15 mph year-round, which would help reduce conflicts, both real and perceived, and accident potential, an issue of concern raised by the public during the scoping process, resulting in long-term benefits.

Like alternative A, recreational pursuits, such as kite flying and Frisbee and ball throwing, would not be allowed within or above all bird closures. These restrictions would have long-term negligible to minor adverse impacts on visitor use since many other locations exist throughout the Seashore that accommodate these or similar activities. Also, similar to alternative A, there would be only short-term negligible adverse impacts to visitors participating in fishing tournaments because historical beach access for tournament fishermen would continue.

Pets would need to be confined or on a leash at all times in all areas and would be prohibited within any bird closure area. Further restrictions on pets would be implemented under alternative C, including a prohibition on pets within all designated SMAs from March 15 to October 15 and within all nonbreeding shorebird SMAs that are otherwise open to recreational use. These restrictions would have long-term moderate adverse impacts on pet owners because of the limited areas that they would be able to go with their pets at the Seashore. In addition, restrictions would be placed on the use of horses at the Seashore, with a prohibition of horse use in SMAs. While this would be a long-term adverse impact to visitors who want to ride horses within the SMAs, a long-term beneficial impact would also be realized by allowing horses use on village beaches from September 16 to May 14 each year.

Additional restrictions on beach fires would be implemented under alternative C with a non-fee educational permit required in order to have a beach fire. Beach camping would be prohibited and nighttime use would also be addressed through a policy that would restrict any beach equipment on the Seashore at night and direct the NPS to remove this equipment after it has been left for 24 hours. Users may experience short-term minor adverse impacts from these restrictions due to the extra effort required to obtain a beach fire permit and the requirement to remove their beach equipment every night.

Night Sky. Regarding the visitor experience of viewing the night sky, under alternative C the restriction on night driving from May 15 to November 15 would eliminate impacts during that period due to vehicle lights on the beach and lighting from parked vehicles where people are fishing, especially in areas away from the villages, resulting in long-term benefits for night sky experience. However, night driving would still occur under permit during the remainder of the year, so impacts to night sky during those months would remain long-term negligible to minor adverse.

Overall Impact to Visitor Use. Those looking for an experience at the Seashore that includes ORV use would have long-term moderate to major adverse impacts as the designation of non-ORV areas and the establishment of the SMAs would seasonally preclude ORV use from some areas of the Seashore that are popular ORV use areas. While three areas managed under ML2 procedures would have pedestrian access corridors, no ORV corridors would be provided in the SMAs, resulting in greater impacts to ORV users. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative C provides for pedestrian corridors in three SMAs under ML2 procedures, as well as providing additional non-ORV areas. Since night driving would be seasonally restricted under alternative C, there

would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.

Cumulative Impacts. Under alternative C, the same past, present, and planned future activities within the Seashore that have the potential to affect visitors and the recreational opportunities within the Seashore would occur, and impacts would be the same as described under alternative A. The impacts of these actions, in combination with the mostly minor to moderate and potentially major adverse impacts of alternative C, would result in long-term moderate to major adverse cumulative impacts to ORV users. However, the beneficial impacts of other actions and restrictions on ORV use under alternative C would provide long-term cumulative benefits for visitors who desire an experience free of motorized vehicle presence, disturbance, lights, or noise.

Conclusion. Designating ORV use areas and closures based on seasonal resource and visitor use patterns would result in long-term moderate to major adverse impacts to ORV users because the areas most used by ORV and favored destinations or fishing locations would be closed to ORV use seasonally. These impacts may be reduced to minor to moderate due to the additional accommodations made for pedestrian use including more parking, a possible beach shuttle, and special use permits to shuttle the mobility impaired. Seashore visitors not using or relying on ORVs would not experience many, if any, adverse impacts from these closures or from other safety closures, and those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise or visual disturbance could experience long-term benefits from the ORV-free areas, restrictions on nighttime driving, and reduced speed limits throughout the Seashore. In addition, visitors desiring an ORV-free experience would have more areas open to them year-round, as well as seasonally, and would experience long-term beneficial impacts.

Because pedestrians and most other recreational opportunities could occur outside seasonally restricted SMAs and other closures, short-term minor adverse impacts would occur to these users. The implementation of an ORV permit system and carrying capacity would be viewed as a benefit by those who would like to see a system in place with consequences for non-law abiding ORV users, as well as those who may perceive crowded conditions that impact their visitor use and experience. For other ORV users, these elements would have a long-term minor to moderate adverse impact as the permit system could be viewed as cumbersome and/or expensive, and short-term, minor to moderate impacts to those who may not be able to access a beach that has reached capacity. Elements that restrict the type of activities (such as kite flying) or the ability of Seashore users to have a campfire or bring pets could have long-term minor to moderate adverse impacts to specific user groups. Lights associated with ORV use would result in long-term negligible to minor adverse effects to those visitors wishing to experience the night sky during winter when night driving is permitted or not restricted, and there would be long-term benefits to night sky viewing during the summer season when night driving is prohibited.

Cumulative impacts would be long-term moderate to major adverse for ORV users, and long-term beneficial for non-ORV users.

Impacts of Alternative D: Increased Predictability and Simplified Management

Under alternative D, areas accessible to ORVs and pedestrians would be determined by providing the maximum amount of predictability regarding areas available for ORV use and vehicle-free areas for pedestrian use. This would result in applying restrictions to larger areas of the Seashore for longer periods of time to minimize changes in designated ORV and non-ORV areas over the course of a year. Under this alternative, ORV access would be prohibited in all areas of the Seashore, except where an ORV route is specifically designated.

All areas designated as a SMA would be closed to ORV use year-round, which would include high use areas such as all points and spits. In addition, all village beaches, lifeguarded beaches, and areas in front of campgrounds would have no ORV use year-round. This would result in 40.8 miles of beach being designated as non-ORV year-round under alternative D. In areas where ORV use is permitted, ramps to the oceanside would be maintained and new ramps added or expanded. On the soundside, access would remain the same as under the no-action alternatives and there would also be no change to the existing system of interdunal roads. In areas closed to ORV use year-round, new or expanded parking would be added to facilitate pedestrian access. Under alternative D, there would be no consideration of commercial use authorizations for a beach shuttle and no special use permits would be issued for temporary ORV use in non-ORV areas. Although accommodations would be made for pedestrian use with additional parking, the designation of about 60% of the Seashore mileage for no ORV use year-round would have a long-term major adverse impact to those visitors wishing to engage in ORV activities. Without providing seasonal access in SMAs, those wishing to use the spits and points with an ORV would need to engage in these activities elsewhere, resulting in a long-term major adverse impact. Pedestrians would be able to access SMAs once breeding activities are completed, but ORV use would be prohibited year-round, resulting in long-term benefits for non-ORV users.

In areas where ORV use areas are identified, new and/or improved ramps would be added to ensure access to these areas on the oceanside. Within the areas open to ORV use, if resource concerns are present, they would be subject to closure using applicable buffer distances (see table 10, chapter 2). These buffer distances are greater than under the no-action alternatives. Also, under alternative D, the time of allowable ORV access would be regulated to eliminate night driving from May 1 to November 15, between 7:00 p.m. and 7:00 a.m., as described under alternative C; however, under alternative D, this policy would not undergo periodic review as it would under alternative C. Because of the extensive year-round ORV closures, including the popular points and spits, increased buffers and night-driving regulations, ORV users would be restricted from popular areas, as well as other areas typically open to ORV use depending on the duration and extent of the closure and the desired time of use, resulting in long-term major adverse impacts to these users because they are not able to engage in the activity they desire.

Resource Closures. Resource closures for birds would continue to be implemented annually, based on recent breeding activity, but no pedestrian corridor would be provided in areas closed to ORV use including the points and spits, during the breeding season. Pedestrian access would be permitted on village beaches, campgrounds, and lifeguarded beaches. All SMAs would under ML1 management procedures, and pedestrians would not be permitted in these areas once prenesting closures were established until after breeding activity is completed. This means that these areas, including the points and spits, would be closed to pedestrians seasonally, so while breeding activities are occurring, these popular areas would not be available to visitors looking for solitude and a more natural setting at the Seashore. This would result in long-term moderate adverse impacts to those visitors looking for a solitude experience as they may need to go elsewhere in the Seashore during this timeframe. Outside the breeding season, the SMAs would provide large areas accessible to pedestrian use only, resulting in beneficial impacts to these users as they would be able to obtain their desired experience in a wide variety of areas.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the Seashore, and ORVs and other dispersed recreation users would generally negotiate around these smaller closures throughout the Seashore using alternate routes and access points. This would typically result in long-term minor adverse impacts because ORV accessibility would remain, but with limited area available for ORV use. Therefore impacts to ORV users would be greater than under the other alternatives. Full beach closures due to turtle nesting would be lessened by the establishment of traffic detours behind nests, where appropriate. Under alternative D, turtle management activities would include creation of a “nest watch” program that would allow trained volunteers to watch nests that have

reached their hatch windows to monitor hatchling emergence success. This would provide a new visitor experience, and one that is desired based on public comment, resulting in long-term benefits to visitors who seek to participate in such a program.

A temporary full-beach resource closure could occur in areas open to ORV use, but would be much less likely under alternative D than under the no-action alternatives since known breeding/hatching areas are within the SMAs and would generally already be closed to ORV use during the breeding season. As a result, the chance of a full beach closure in areas open to ORVs outside the SMAs is decreased, with the potential for long-term minor to moderate adverse impacts if temporary closures of these areas were to occur as it would further reduce the amount of area open for ORV use under alternative D and would concentrate this use in different areas, subject to the parking restrictions.

To further address and facilitate access into non-ORV use areas, alternative D would include new or expanded parking lots to support pedestrian access. As discussed above, this element would provide long-term beneficial impacts.

Regarding time of use, under alternative D the night-time restrictions offer additional protection of sea turtles. Vehicles would be prohibited from using the beach during the hours of 7:00 p.m. to 7:00 a.m. from May 1 to November 15. Night driving would be allowed all other times of the year (November 16 to April 30). These restrictions would have long-term beneficial to long-term moderate to major adverse impacts on visitors, depending on the desired visitor use and experience. For example, those visitors wishing to experience the beach at night without ORVs present would have more opportunities to do so. Those visitors wishing to use ORVs to access surf fishing areas at night would not be able to do so during the summer and fall season, which would be considered a long-term major adverse effect on that group of visitors.

Safety Closures. Alternative D would not establish specific safety closures or criteria for safety closures. ORV drivers would be responsible for recognizing and avoiding ORV safety hazards and would drive at their own risk. No administrative closures would be established under this alternative. Although there would be no administrative closure at the Cape Point Lighthouse, no ORV route would be established in this area, thus ORVs would not be permitted and village beaches would be closed during the summer either as a seasonal or as part of a year-round closure. As with alternative B, the NPS would retain the authority to implement a temporary emergency ORV closure in the case that ORV traffic is backing up on the beach access ramps, either on or off-beach bound, which threatens to impede traffic flow; ORV traffic on the beach is parked in such a way that two-way traffic is impaired; and/or multiple incidents of disorderly behavior are observed or reported. The absence of safety closures and administrative closures would have a long-term beneficial impact by potentially opening up new areas for ORV use, but this impact would be negligible as many of these areas such as village beach and the lighthouse, are year-round non-ORV areas.

Additionally, by restricting ORV use year-round in 60% of the Seashore and restricting pedestrian use in SMAs during the breeding season, visitors would be concentrated in a smaller area. This could create real or perceived concerns for crowding or visitor safety as opportunities for separation of uses is not provided, and result in long-term moderate to major adverse impacts to visitors who perceive crowded conditions or safety concerns.

Alternative D would include improvements to ramp characteristics throughout the Seashore. These improvements would include ensuring that ramps are two lanes wide and have standard regulatory signs and information boards, gates are installed at all ramps, and a designated air down area with a hardened surface is provided. These improvements to ramps and installation of amenities such as an air down area

would have long-term beneficial impacts to ORV users, who noted a desire for these conditions during public scoping.

Permitting and Carrying Capacity Requirements. Alternative D would include permitting requirements for all ORV use (as described under alternative C, except permits would be valid for a calendar year rather than for 12 months), and could be viewed as a short-term minor to moderate adverse impact to visitor experience for most ORV users since it would result in paperwork and effort needed to get a permit. As described under alternative C, the permit requirement could be viewed by those seeking a permit as too cumbersome and would result in short-term minor to moderate adverse impacts to their experience. Depending on the level of fee associated with the permit, ORV users could experience long-term minor adverse impacts, depending on if they feel the fee would prohibit their access and ability to experience the Seashore. As management costs are decreased under alternative D compared to other alternatives with permits, a lower permit fee and therefore lower level of impact would be expected. Although some users may feel adverse impacts from implementation of a permit system, other users may see long-term beneficial impacts as those visitors using ORV would be provided education and information with their permits that could influence their behavior and reduce potential for conflicts with non-ORV visitors. Implementation of a permit system would provide the Seashore with a method to address those ORV users who violate Seashore policy, through revocation of permits. The permit system would give Seashore staff a system with “teeth” to revoke permits of regulatory offenders, which could beneficially affect the experience of other visitors.

Alternative D requires that parking within ORV routes is only one vehicle deep and would prohibit stacking of vehicles in more than one row. This requirement would create a *de facto* carrying capacity that once the capacity of the one row is reached, no other vehicles would be permitted in that area. The parking restriction and associated carrying capacity would be expected to have long-term moderate to major adverse impacts on ORV users because with only 27.2 miles of beach potentially open to ORV use year-round, it is likely that this capacity would be reached during peak use periods such as holiday weekends and some users would not be able to reach locations or participate in the activities they desire. This effect would be amplified for those visitors that may be at the Seashore for a short period and do not get the opportunity to engage in their desired activity while they are there, resulting in short and long-term moderate to major adverse impacts, depending on the duration that visitors cannot access a desired area. For those visitors coming to the Seashore without an ORV, the parking and carrying capacity restrictions may have a long-term beneficial impact as under alternative D all Seashore users would use open beaches, regardless of the activity, and limiting the number of ORVs could reduce the potential for any visitor use conflicts and safety concerns in these areas open to use. Under alternative D, the speed limit would be lowered to 15 mph year-round, which would also help reduce conflicts, both real and perceived, and accident potential, an issue of concern raised by the public during the scoping process.

Other Recreational Pursuits. Like alternative A, recreational pursuits, such as kite flying and Frisbee and ball throwing, would not be allowed within or above all bird closures. These restrictions would have long-term minor adverse impacts on visitor use since many other locations exist throughout the Seashore that accommodate these or similar activities. Also, similar to alternative A, there would be only short-term negligible adverse impacts to visitors participating in fishing tournaments because historical beach access for tournament fishermen would continue.

Pets would need to be confined or on a leash at all times in all areas. Further restrictions on pets would be implemented under alternative D with pets prohibited within all designated SMAs year-round. These restrictions would have long-term minor to moderate adverse impacts on pet owners because of the limitations placed on pets in ORV use areas.

Alternative D would not include additional restrictions on beach fires and no permit would be required for this activity. Beach camping would be prohibited and nighttime use would be addressed through a policy that would restrict any beach equipment on the Seashore at night and direct the NPS to remove this equipment after it has been left for 24 hours. Users may experience minor impacts from these restrictions due to the extra effort to remove their beach equipment every night, but would likely feel it is beneficial not to have to obtain a permit for beach fires.

Night Sky. Regarding the visitor experience of viewing the night sky, under alternative D the restriction on night driving from May 15 to November 15 would eliminate impacts during that period due to vehicle lights on the beach and lighting from parked vehicles where people are fishing, especially in areas away from the villages, resulting in long-term benefits for night sky experience from May 1 to November 15. However, night driving would still occur under permit during the remainder of the year, so impacts to night sky during those months would remain negligible to minor adverse.

Overall Impact to Visitor Use. Those looking for an experience at the Seashore that includes ORV use would have long-term major adverse impacts as all SMAs and village beaches would be designated as non-ORV areas year-round, which would prohibit the use of ORV in many popular visitor use areas. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative D provides for many designated non-ORV areas throughout the Seashore, although pedestrian access would be prohibited in the SMAs during the breeding season. Since night driving would be seasonally restricted under alternative D, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.

Cumulative Impacts. Under alternative D, the same past, present, and planned future activities within the Seashore that have the potential to affect visitors and the recreational opportunities within the Seashore would occur, and impacts would be the same as described under alternative A. Other actions, primarily construction-related, would have short-term minor impacts. The impacts of these actions, in combination with the mostly moderate to major impacts of alternative D, would result in long-term major adverse cumulative impacts to ORV users. However, the beneficial impacts of other actions and restrictions on ORV use under alternative D would provide long-term cumulative benefits for visitors who desire an experience free of motorized vehicle presence, disturbance, lights, or noise.

Conclusion. Designating ORV use areas and closures based on simplified management and predictability would result in long-term major adverse impacts to ORV users that would not be able to access SMAs (and other designated non-ORV areas) by ORV year-round. Pedestrians at the Seashore would experience long-term minor adverse impacts during the breeding season when they cannot access SMAs, but long-term benefits the remaining times of the year as the number of non-ORV experiences would increase, with a greater level of benefit to this user group than the other alternatives.

Village beaches, campgrounds, and lifeguarded beaches would still be open to pedestrian use year-round, providing long-term beneficial impacts to visitors who want to use these areas without ORVs during the breeding season. Additional accommodations made for pedestrian use including more parking would also be a long-term beneficial impact.

The implementation of a permit system and carrying capacity would be viewed as a long-term benefit by those who would like to see a system in place with consequences for non-law abiding ORV users, as well as those who may perceive crowded conditions that impact their visitor use and experience. For other ORV users, these elements would have a short-term minor adverse impact as the permit system could be viewed as too cumbersome and/or expensive, and with the lower fees as a result of lower management costs, these impacts would be expected to be mostly minor. Long-term major adverse impacts may be felt by those ORV users who cannot access a beach that has reached capacity. Elements that restrict the type

of activities (such as kite flying) or the ability of Seashore users to bring pets could have long-term minor to moderate adverse impacts to specific user groups. Lights associated with ORV use would result in negligible to minor adverse effects to those visitors wishing to experience the night sky during winter when night driving is permitted or not restricted, and there would be long-term benefits to night sky viewing during the summer and fall season when night driving is prohibited.

Cumulative impacts would be long-term major adverse to ORV users, and long-term beneficial for non-ORV users.

Impacts of Alternative E: Variable Access and Maximum Management

Under alternative E, areas accessible to ORVs and pedestrians would be determined by a management strategy that ensures that there are a variety of experiences available to all Seashore users, with the necessary controls or restrictions to limit impacts to sensitive resources.

ORV routes and areas would be established seasonally (closed to ORV use from April 1 to October 31) in Rodanthe, Waves, Salvo, Avon, Frisco, Buxton beaches, and Ocracoke Campground beach (0.5 mile northeast to 0.5 mile southwest of ramp 68). Non-ORV use areas would be designated on Bodie Island from ramp 1 to approximately 0.5 mile south of Coquina Beach; Frisco and Hatteras Village beaches; and the Ocracoke Day Use Area beach, from 1.2 miles northeast of ramp 70 to 0.5 mile northeast of ramp 70. Seven SMAs would be closed to ORV use under ML1 measures during the breeding season from March 15 to August 31. Three popular visitor use areas within SMAs (Bodie Island Spit, Cape Point, and South Point) would have an ORV pass-through zone (no stopping of ORVs), subject to resource closures under ML2 measures, to allow visitors opportunities to access these sites during portions of the breeding season. In designated ORV use areas, alternative E would also provide for an ORV corridor above the high tide line March 15 to August 31 on the ocean beach. Where the corridor is at least 30 meters wide, it would be posted 10 meters seaward of the toe of the dune to provide an ocean backshore closure.

In designated ORV use areas, ramps would be added or relocated to ensure access to these areas on the oceanside. Soundside ORV access would be limited to designated boat ramps from the Cable Crossing and the Spur Road. The remaining soundside ramps would be closed to ORV use and small parking areas would be constructed to better accommodate pedestrian access.

Interdunal roads available to ORV use would be the same as under alternative A, with the addition of providing additional pull-outs or widening where appropriate to provide safe passage. In addition, on South Beach, the existing interdunal road would be extended west of ramp 45 to ramp 49, with a new ramp 48 established off of the interdunal road.

Within the areas open to ORV use, if resource concerns are present they would be subject to closure using applicable buffer distances (see table 10, chapter 2). These buffer distances are greater than under the no-action alternatives. Also, under alternative E, the time of allowable ORV access would be regulated to eliminate night driving from May 1 to November 15, between 10:00 p.m. and 6:00 a.m. Between September 16 and November 15, the areas that are closed to nighttime driving would be evaluated and those with low to no density of turtle nests may be reopened to ORV use.

The above measures would result in approximately 33 miles of beach designated for ORV use year-round, 20 miles seasonally designated for ORV use, and approximately 15 miles designated as non-ORV year-round. In three areas closed seasonally (Bodie Island Spit, Cape Point, and South Point), an ORV pass-through corridor would be provided at the start of the breeding season, subject to resource closures, which would allow access during portions of the breeding season and lessen the impact experienced by ORV users at these popular locations. Access provided by the designated routes and areas under alternative E

would have long-term minor to moderate adverse impacts on ORV users, depending on the user's ability to reach a certain area and participate in the activities they desire. The nighttime restrictions would have long-term minor to moderate adverse impacts on ORV users as night driving would be restricted, but the restriction would be for a shorter period than other action alternatives, and there would be an opportunity for night driving to resume in some areas starting in the fall.

Resource Closures. Resource closures for birds would continue to be implemented annually, based on recent breeding activity, and an ORV pass-through zone and pedestrian corridor would be provided within three SMAs under ML2 management procedures (Bodie Island Spit, Cape Point, and South Point), unless species activity or safety issues required a closure. In SMAs designated for the use of ML1 measures (see table 10, chapter 2), pedestrian access would not be allowed when resource closures, including prenesting closures, are in effect. Because of the resource closure buffers, visitors with ORVs would be precluded from the majority of the popular points and spits during the summer months. As noted under alternative A, the spits and points are of particular concern for visitors that wish to use these areas for fishing and other recreational pursuits such as walking and beachcombing, and these areas accounted for about 75% of total ramp usage (RTI pers. comm. 2009a). Therefore, seasonal closures at the points and spits under alternative E could affect a majority of oceanside ORV users; however, there would be ORV access at a number of other locations. Seasonal restrictions to popular areas of visitation would result in long-term moderate to major adverse impacts for users wishing to access these points by ORV in the summer. Portions of some of the point and spit areas may be open to pedestrian use during this time, resulting in a long-term beneficial impact for visitors looking for a more solitude experience at the Seashore.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the Seashore, and ORVs and other dispersed recreation users would generally negotiate around these smaller closures throughout the Seashore using alternate routes and access points. This would typically result in short-term negligible to minor adverse impacts, because ORV accessibility would remain. Full beach closures due to turtle nesting would be lessened by the establishment of traffic detours behind nests, where appropriate. Under alternative E, turtle management activities would include creation of a "nest watch" program that would allow trained volunteers to watch nests that have reached their hatch windows to monitor hatchling emergence success. This would provide a new visitor experience, and one that is desired based on public comment, resulting in long-term beneficial impacts to visitors who seek to participate in such a program.

A temporary full-beach resource closure could occur in areas open to ORV use, but would be much less likely under alternative E than under the no-action alternatives since known breeding/hatching areas would be within the SMAs and would generally already be closed to ORV use during the breeding season. As a result, the chance of a full beach closure in areas open to ORVs outside the SMAs is decreased, with the potential for long-term minor to moderate adverse impacts if temporary closures of these areas were to occur. The conditional ORV access corridors with pass-through zones, which would be allowed at the start of the breeding season in the Bodie Island Spit, Cape Point, and South Point SMAs under alternative E, would be subject to resource closures and would likely be closed to access for some portion of the breeding season, resulting in long-term moderate to major adverse impacts to visitors wanting to access those locations during that period.

Alternative E would provide for a special use permit, to be authorized by the Superintendent, which would allow temporary use of an ORV in a non-ORV area, as described under alternative C. By providing for special use permits in these circumstances, long-term beneficial impacts would be realized by these user groups that would otherwise not be able to use an ORV in areas closed year-round or seasonally to ORV use.

To further address and facilitate access into non-ORV use areas, alternative E would include new or expanded parking lots to support pedestrian access, as well as the consideration by the Seashore of applications for commercial use authorizations for a beach shuttle service. In addition to the shuttle system, under alternative E, the NPS would designate and post boat landing zones (“drop off” area) near the inlet at Bodie Island Spit and South Point that could be used to drop off pedestrians if/when the inlet shoreline is not otherwise closed to protect Seashore resources, with purpose of encouraging a water shuttle service. These elements would provide long-term beneficial impacts and work to mitigate the long-term minor to moderate to major adverse impacts that some user groups may experience as alternative ways to reach the Seashore would be provided if ORV use is not permitted.

Regarding time of use, under alternative E, the night-time restrictions offer additional protection of sea turtles. Vehicles would be prohibited from using the beach during the hours of 10:00 p.m. to 6:00 a.m. from May 1 to November 15, with the potential for some areas to reopen after September 15 if there are no to low density of turtle nests in certain areas of the Seashore. Night driving would be allowed all other times of the year (November 16 to April 30). These restrictions would have long-term benefits or long-term minor to moderate adverse impacts on visitors, depending on the desired visitor use and experience. For example, those visitors wishing to experience the beach at night without ORVs present would have more opportunities to do so. Those visitors wishing to use ORVs to access surf fishing areas at night would not be able to do so during the summer and fall season, which would be considered a long-term major adverse effect on that group of visitors.

Safety Closures. Alternative E would establish specific criteria for implementation of a safety closure, as detailed under alternative C. No administrative closures would be established under this alternative. Although there is not an administrative closure at the Cape Point Lighthouse, no ORV route would be established in this area, thus ORVs would not be permitted. Village beaches would be closed during the summer either as a seasonal or as part of a year-round closure. Alternative E would also implement additional pedestrian safety measures, requiring that village beaches open to ORV use during the winter season be at least 65.6 feet (20 meters) wide from the toe of the dune seaward to the mean high tide line in order to be open for ORV use. The safety closure criteria and beach width requirements in front of villages would provide a long-term beneficial impact to visitor safety with these measures.

These areas include a total of approximately 33.3 miles (14.5 designated as non-ORV year-round and 20.2 seasonally designated for ORV use during the nonbreeding season), or two-thirds of the total beach mileage during the peak summer season, so these restrictions would cause long-term moderate adverse impacts to ORV users and would be a long-term benefit related to protecting visitor safety and to those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise in more populated areas. Some areas that have been traditionally closed to ORVs year-round due to seasonal restrictions and safety closures, such as village beaches, would now be open seasonally from November 1 to March 31. Access to these previously closed areas would provide ORV users with a long-term benefit, but would result in long-term minor to moderate adverse impacts to non-ORV users. Since pedestrians and ORVs would be present on the same portion of the beach during the winter/spring season, the noise and the sight of vehicles would continue to decrease the visitor experience for those visitors seeking solitude and a natural setting, with long-term minor to moderate adverse impacts to those users.

Alternative E would include improvements to ramp characteristics throughout the Seashore, as described under alternative C. These improvements to ramps and creation of designated air down areas would have long-term beneficial impacts to ORV users, who noted a desire for these conditions during public scoping.

Permitting and Carrying Capacity Requirements. Alternative E would include permitting requirements for all ORV use (as detailed under alternative C), and could be viewed as a short-term minor to moderate

adverse impact to visitor experience for most ORV users since it would result in paperwork and effort needed to get a permit. Alternative E would differ from alternative C in that both weekly and 12-month permits would be available, with a lower fee for weekly permits than 12-month permits. This would provide flexibility to the visitor who may only be coming to the Seashore for a short period. Alternative E would also include additional permits that would permit “park-and-stay” overnight at designated locations and self-contained vehicle (SCV) camping at three NPS campgrounds during the off-season. Fees for park-and-stay and SCV camping permits would be determined separately from the ORV use permit.

As with alternative C, the educational and testing requirement under alternative E could be viewed by those seeking a permit as too cumbersome and would result in short-term minor to moderate adverse impacts to their experience. A fee would be charged to obtain a permit that would be based on cost recovery as described in the NPS Director’s Order and Reference Manual 53. Depending on the level of fee, which would be different for type and length of permit, ORV users could experience long-term minor to moderate impacts, depending on if they feel the fee would prevent them from experiencing the Seashore. However, offering a weekly permit in addition to the 12-month permit would offer a lower cost option for short-term visitors and would be a long-term beneficial impact. Although some users may feel adverse impacts from implementation of a permit system, other users may see long-term beneficial impacts as those visitors using ORVs would be provided education and information with their permits that could influence their behavior and reduce potential for conflicts with non-ORV visitors. For law-abiding visitors, implementation of a permit system would provide the Seashore with a method to address those ORV users who violate Seashore regulations, through revocation of permits. The permit system would give Seashore staff a system with “teeth” to revoke permits of regulatory offenders, which could beneficially affect the experience of law-abiding visitors. Additional long-term beneficial impacts would be realized as park-and-stay and SCV camping permits would allow visitors to engage in a previously prohibited use.

Alternative E would not dictate parking configurations on the beach, but would include formal carrying capacity provisions, which are most likely to take effect a few hours a day, for only a few days, during peak use periods such as summer holiday weekends and which would include the enforcement of temporary closures of areas once these limits are reached or if disorderly conduct occurs and continues, which has occurred during busy weekends. The implementation of a defined carrying capacity may be viewed as a short-term benefit by those who feel that there are times when conditions are too crowded and that their visitor experience is impacted by these crowded conditions. Others would view implementation of a carrying capacity as a short-term moderate to major adverse impact if they are unable to get to their desired area because the capacity has been reached, depending on how often they are unable to access their desired area. As some visitors are only at the Seashore for a limited time during a vacation, not being able to participate in the planned recreational activity because capacity has been reached would result in a long-term major adverse impact for that visitor group. The determined carrying capacity would be subject to periodic review and may address these impacts if they arise.

Other Recreational Pursuits. Similar to alternative A, pedestrian-based activities would be allowed outside of any resource closures. Unlike A, ORV routes and non-ORV areas would be formally designated under alternative E. Seven SMAs under ML1 measures would be closed to recreation during the breeding season and three SMAs under ML2 measures would allow an ORV access corridor during the breeding season, subject to resource closures. In areas designated for ORV use, the defined ORV and pedestrian corridors would overlap or be the same, raising the possibility of conflict between ORV and non-ORV users and a diminished visitor experience for visitors seeking solitude and freedom from vehicular distractions. However, due to the amount of area open to only non-ORV uses under alternative E, these impacts would be expected to be long-term negligible adverse. Under alternative E, the speed limit would be lowered to 15 mph year-round, which would help reduce conflicts, both real and perceived, and accident potential, an issue of concern raised by the public during the scoping process.

Like alternative A, recreational pursuits, such as kite flying and Frisbee and ball throwing, would not be allowed within or above all bird closures. These restrictions would have long-term minor adverse impacts on visitor use since many other locations exist throughout the Seashore that accommodate these or similar activities. Also, similar to alternative A, there would be only short-term negligible adverse impacts to ORV users participating in fishing tournaments because historical ORV access for tournament fishermen would continue.

Restrictions on pets would be the same as alternative C, except that pets would be prohibited within all designated breeding shorebird SMAs, including pass-through zones, from March 15 to August 31. These restrictions would have long-term minor to moderate adverse impacts on responsible pet owners because of the limited areas that they would be able to go with their pets at the Seashore. In addition, restrictions would be placed on the use of horses at the Seashore, with a prohibition of horse use in SMAs. While this would be a long-term minor to moderate adverse impact, a long-term beneficial impact would also be realized by allowing horses use on village beaches from September 16 to May 14 each year.

Additional restrictions on beach fires would be implemented under alternative E with a non-fee educational permit required in order to have a beach fire. Camping and nighttime use would be modified by allowing SCV camping and park-and-stay camping at specific locations in the Seashore that are detailed in table 8 in chapter 2. Although Seashore users may feel a short-term minor adverse impact from the requirement for a beach fire permit, long-term beneficial impacts would be realized from the addition of the park-and-stay and SCV camping options to visitor experience.

Night Sky. Regarding the visitor experience of viewing the night sky, under alternative E, the restriction on night driving from May 15 to November 15 would eliminate impacts during that period of time due to vehicle lights on the beach and lighting from parked vehicles where people are fishing, especially in areas away from the villages, resulting in long-term benefits for night sky experience. However, night driving would still occur under permit in the fall and during the remainder of the year, so impacts to night sky during those months would remain negligible to minor adverse from this use. Further night use that would be permitted under alternative E includes the park-and-stay permit option, which would result in vehicles on the beach overnight, and could contribute to interference with the night sky that would be noticeable and result in long-term moderate adverse impacts.

Overall Impact to Visitor Use. Those looking for an experience at the Seashore that includes ORV use would have long-term moderate adverse impacts as the designation of non-ORV areas and the establishment of the SMAs would preclude ORV use, either seasonally or year-round, from some areas of the Seashore that are popular visitor use areas. Three SMAs under ML2 management procedures would provide an ORV pass-through corridor at the start of the breeding season, subject to resource closures, lessening the impacts to this user group. Additional recreational opportunities such as park-and-stay and SCV camping would provide long-term benefits to ORV users. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative E provides for designated year-round non-ORV use areas, as well as seasonal ORV closures in areas such as village beaches and some of the SMAs. Since night driving would be seasonally restricted, but allowed until 10:00 p.m., under alternative E, there would be long-term moderate adverse impacts to night skies due to the hours of night driving allowed, implementation of park-and-stay opportunities, with long-term beneficial impacts during times of seasonal night-driving restrictions.

Cumulative Impacts. Under alternative E, the same past, present, and planned future activities within the Seashore that have the potential to affect visitors and the recreational opportunities within the Seashore would occur, and impacts would be the same as described under alternative A. Other actions, primarily construction-related, would have short-term minor impacts. The impacts of these actions, in combination with the mostly minor to moderate and potentially major impacts of alternative E, would result in long-

term moderate to major adverse cumulative impacts to ORV users. However, the beneficial impacts of other actions and restrictions on ORV use under alternative E would provide long-term cumulative benefits for visitors who desire an experience free of motorized vehicle presence, disturbance, lights, or noise.

Conclusion. Designating ORV use areas and closures based on providing maximum flexibility would result in long-term minor to moderate adverse impacts as many areas favored by ORV users, such as the spits and points, are within SMAs that would be seasonally closed to ORV. Major adverse impacts could occur to ORV users of the popular points/spits if pass-throughs would be closed due to resource closures. Long-term beneficial effects would result from the additional accommodations made for pedestrian use including more parking, a possible beach shuttle, and special use permits to shuttle the mobility impaired. Seashore visitors not using or relying on ORVs would not experience many, if any, adverse impacts from these closures or from other safety closures in areas managed under ML2 procedures where a pedestrian corridor would be provided, and those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise or visual disturbance could experience benefits from the ORV-free areas and restrictions on nighttime driving and reduced speed limits throughout the Seashore. These users would experience long-term moderate adverse impacts in those SMAs managed under ML1 procedures and closed or restricted during the breeding season, but would be able to obtain a non-ORV experience elsewhere at the Seashore during these times.

Because pedestrians and most other recreational opportunities could occur outside seasonal and other closures, as well as in pedestrian corridors in other seasonal closures, short-term minor adverse impacts would occur to these users. The implementation of an ORV permit system and carrying capacity would be viewed as a long-term benefit by those who would like to see a system in place with consequences for non-law abiding ORV users, as well as those who may perceive crowded conditions that impact their visitor use and experience. For other users, these elements would have a short- and long-term minor to moderate adverse impact as the permit system could be viewed as cumbersome and/or expensive, and short-term moderate to major impacts to those who may not be able to access a beach that has reached capacity. Elements that provide both weekly and 12-month permits would be long-term beneficial as the user had some flexibility and choice in regard to permit cost.

Elements that restrict the type of activities (such as kite flying) or the ability of Seashore users to have a campfire or bring pets could have long-term minor to moderate adverse impacts to specific user groups, with the addition of park-and-stay and SCV camping options providing a long-term benefit through new visitor experiences. Lights associated with ORV use would result in long-term negligible to minor adverse effects to those visitors wishing to experience the night sky during winter when night driving is permitted and long-term moderate adverse impacts from implementation of the park-and-stay option or not restricted, and there would be long-term benefits to night sky viewing during the summer season when night driving is prohibited.

Cumulative impacts would be long-term moderate to major adverse to ORV users, and long-term, beneficial for non-ORV users.

Impacts of Alternative F: Management Based on Advisory Committee Input

Under alternative F, input from the Committee was used to determine ORV routes and areas, with the goal of providing a wide variety of access opportunities for both ORV and non-ORV users. In general, alternative F evaluated re-opening some areas to ORV use earlier (after shorebird breeding activity has concluded) than other action alternatives, as well as the addition of a pedestrian access trail and additional enhancements to the interdunal road system.

ORV routes and areas would be established seasonally with ORV use prohibited in Rodanthe, Waves, Salvo, and Avon from May 15 to September 15; Frisco and Hatteras beaches from March 1 to November 30; and Ocracoke campground beach (0.5 mile northeast to 0.5 mile southwest of ramp 68) and the Ocracoke Day Use Area from April 1 to November 31. Although the different range of closure dates would not offer Seashore-wide uniformity, it would offer the visitor flexibility by making some beach and campground areas open earlier and some later in the season.

Bodie Island Spit, a popular visitor use area, would be seasonally closed to ORV use from March 15 to July 31 or two weeks after fledging, but would include a pedestrian corridor. Hatteras Inlet Spit and North Ocracoke Spit would be designated as non-ORV year-round, with interdunal roads to allow ORV users close access to the ocean beach, except when breeding closures are in effect. At Hatteras Inlet Spit, there would be soundside access to the inlet via the Spur Road. At Cape Point and South Point, an ORV access corridor would be allowed at the start of the breeding season, subject to resource closures.

Where ORV use areas are designated, new and/or improved ramps would be added to ensure access to these areas on the oceanside. Soundside access for ORV would be provided at current locations and would remain open with sufficient maintenance to provide clear passage. In addition, a new soundside access point (available by new pedestrian trail) would be provided on Ocracoke Island (approximately 0.65 mile south of ramp 72).

Interdunal roads available to ORV use under alternative A would remain, with the addition of providing additional pull-outs or widening where appropriate to provide safe passage. Additional interdunal routes or route changes would occur. On Hatteras Inlet Spit, the Pole Road would be re-routed toward the sound west of the Overwash Fan to provide a natural barrier to the bird nesting area south of the road and a new interdunal road would be established from the southern terminus of the Pole Road to provide access to the False Point and inlet. Another new interdunal road would be established on North Ocracoke Spit from ramp 59 for 0.3 mile northeast toward the inlet, with parking at the terminus.

Within the areas open to ORV use, if resource concerns are present the access route would be subject to closure using applicable buffer distances (see table 10, chapter 2). These buffer distances are greater than under the no-action alternatives. Also, under alternative F, the time of allowable ORV access would be regulated to eliminate night driving in locations of potential sea turtle nesting habitat (ocean intertidal zone, ocean backshore, and dunes) from May 1 to November 15 from one hour after sunset until the turtle patrol has checked the beach in the morning (approximately one-half hour after sunrise). Between September 16 and November 15, the areas that are closed to nighttime driving would be evaluated and those with low to no density of turtle nests may be reopened to ORV use, subject to the terms and conditions of the ORV permit.

The above seasonal closures provide flexibility and result in a range of dates during which village beaches would be open to ORV access, while providing some areas that are ORV free for much of the year as well. Certain high visitor use areas such as Cape Point and South Point, would be designated as year-round ORV areas, with the likelihood that ORV access would be temporarily restricted when breeding season closures are in effect. These seasonal closures, combined with the improvement of and establishment of new interdunal roads, would result in 29 miles designated for ORV use year-round, 23 miles designated for seasonal ORV use, and 16 miles designated as non-ORV year-round. Access provided by the designated ORV routes and areas under alternative F would have long-term minor to potentially major adverse impacts on ORV users, depending on the users' ability to reach a certain area and participate in the activities they desire. While there would be more areas closed to ORV use year-round than under some other alternatives, there is the potential that access would be provided to some of the popular visitor use areas during portions of the summer. The night-driving restrictions would have long-term minor to moderate adverse impacts, but the restriction could be for a shorter period than under

other action alternatives, as there would be an opportunity for night driving to resume in some areas come the fall.

Resource Closures. Resource closures for birds would continue to be implemented annually, based on recent breeding activity, with ORV corridors provided at the start of the breeding season in two SMAs under ML2 management procedures (Cape Point and South Point) and a pedestrian corridor at one SMA (Bodie Island Spit). All corridors at these locations would be subject to resource closures. In SMAs under ML1 management procedures (see table 10, chapter 2), pedestrian access would not be allowed during breeding season, including prenesting closures. No ORV access would be provided to Bodie Island Spit during breeding season, but a pedestrian corridor would be provided. Portions of Hatteras Inlet Spit would be designated as non-ORV year-round and closed to all visitor use when breeding season closures are in effect. If additional resource closures are necessary, ORV and/or pedestrian use of these access corridors may be temporarily closed. As noted under alternative A, the spits and points are of particular concern for visitors that wish to use these areas for fishing and other recreational pursuits such as walking and beachcombing, and these areas accounted for about 75% of total ramp usage (RTI pers. comm. 2009a). The seasonal ORV corridors under alternative F would allow ORV access for many oceanside ramp users, resulting in long-term minor adverse impacts as the entire area would not always be open, depending upon the location of resource closures. For ORV users that wish to reach Bodie Island Spit in the summer or Hatteras Inlet Spit year-round, impacts would be long-term moderate to major adverse because they would not be able to beach drive in that area, and they would need to walk from ORV parking areas or seek other areas open to ORV use, which may at times be limited. For users that desire a more solitude experience free of ORVs, the Bodie Island Spit and Hatteras Inlet Spit closures with pedestrian corridor would have long-term beneficial impacts.

Resource closures for American oystercatchers, colonial waterbirds, and sea turtles may also occur in other areas throughout the Seashore, and ORVs and other dispersed recreation users would generally negotiate around these smaller closures throughout the Seashore using alternate routes and access points. This would typically result in short-term negligible to minor adverse impacts because ORV accessibility would remain. Full beach closures due to turtle nesting would be lessened by the establishment of traffic detours behind nests, where appropriate. Under alternative F, turtle management activities would include creation of a “nest watch” program that would allow trained volunteers to watch nests that have reached their hatch windows to monitor hatchling emergence success. This would provide a new visitor experience, and one that is desired based on public comment, resulting in long-term beneficial impacts to visitors who seek to participate in such a program.

A temporary full-beach resource closure could occur in areas open to ORV use, but would be much less likely under alternative F than under the no-action alternatives since known breeding/hatching areas are within the SMAs and would generally already be closed to ORV use during the breeding season. As a result, the chance of a full beach closure in areas open to ORVs outside the SMAs is decreased, with the potential for long-term minor to moderate adverse impacts if temporary closures of these areas were to occur. The ORV or pedestrian access corridors, which would be allowed in the Bodie Island Spit, Cape Point, and South Point SMAs at the start of the breeding season under alternative F, would be subject to resource closures and would be likely to be closed to access for some portion of the breeding season, resulting in long-term moderate to major adverse impacts to visitors wanting to access those locations during that period.

Alternative F would provide for a special use permit, to be authorized by the Superintendent, which would allow temporary use of an ORV in a non-ORV use area, as described under alternative C. By providing for special use permits in these circumstances, long-term beneficial impacts would be realized by these user groups that would otherwise not be able to use an ORV in areas designated as non-ORV year-round or seasonally.

To further address and facilitate access into non-ORV use areas, alternative F would include new or expanded parking lots to support pedestrian access, as well as the consideration by the Seashore of applications for commercial use authorizations for a beach shuttle service. Alternative F also includes the establishment of two new pedestrian trails. These elements would provide long-term beneficial impacts and work to mitigate the long-term minor to moderate to major adverse impacts that some user groups may experience because alternative ways to reach the Seashore would be provided if ORV use is not permitted but pedestrian use is allowed.

Regarding time of use, under alternative F, the night-time restrictions offer additional protection of sea turtles. Vehicles would be prohibited from using the beach from one hour after sunset to approximately one-half hour after sunrise (after turtle patrols are complete) from May 1 to November 15, with the potential for some areas to reopen after September 15 if there are no to low density of turtle nests in certain areas of the Seashore, and permit terms and conditions are followed. Night driving would be allowed all other times of the year (November 16 to April 30). These restrictions would have long-term minor to moderate adverse impacts on visitors, depending on the desired visitor use and experience, but the flexibility of this alternative in regards to night driving may reduce some visitor impacts.

Safety Closures. Alternative F would establish specific criteria for implementation of a safety closure, as detailed under alternative C, but would add additional triggers, such as deep beach cuts, obstacles (e.g., stumps), severe beach slopes, and a high concentration of pedestrian users on a narrow beach (see table 8 in chapter 2 for details). No administrative closures would be established under this alternative. Although there is not an administrative closure at the Cape Point Lighthouse, no ORV route would be established in this area, thus ORVs would not be permitted and village beaches would be closed during the summer either designated as a seasonal ORV area and year-round non-ORV area. Alternative F would also implement additional pedestrian safety measures, including lowered speed limits when pedestrians are present and requiring ORVs to yield right-of-way to pedestrians, which would have long-term beneficial impacts as concerns related to safety would be reduced.

These areas include a total of approximately 29 miles that would be designated for ORV use year-round and 39 miles (16 miles designated as non-ORV year-round and 23 miles designated for seasonal ORV use), or approximately 60% the total beach mileage, that would be closed to ORVs during the summer season. These restrictions would cause minor to moderate adverse impacts to ORV users and be long-term beneficial for protecting visitor safety and those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise in more populated areas. Some areas that have been traditionally closed to ORV use year-round due to seasonal restrictions and safety closures, such as village beaches, would now be open seasonally to ORV use. ORV access to these previously closed areas would provide ORV users with a long-term benefit, but would result in long-term minor to moderate adverse impacts to pedestrians using these areas. Since pedestrians and ORVs would be present on the same portion of the beach during the winter/spring season, the noise and the sight of vehicles would continue to decrease the visitor experience for those visitors seeking solitude and a natural setting, with long-term minor to moderate adverse impacts to those users.

Alternative F would include improvements to ramp characteristics throughout the Seashore, as described under alternative C, with the additional goal of establishing an ORV ramp at either end of an ORV route. These improvements to ramps and the creation air down areas, would have long-term beneficial impacts to ORV users.

Permitting and Carrying Capacity Requirements. Alternative F would include permitting requirements for all ORV use (as detailed under alternative C) and could be viewed as a short-term minor to moderate adverse impact to visitor experience for most ORV users since it would result in paperwork and effort needed to get a permit. Alternative F would differ from alternative C in that both weekly and 12-month

permits would be available, with a lower fee for weekly permits than 12-month permits. This would provide flexibility to the visitor who may only be coming to the Seashore for a short period. Alternative F would also include an additional permit for night driving from September 16 to November 15.

As with alternative C, the educational and testing requirement under alternative F could be viewed by those seeking a permit as too cumbersome and would result in short-term minor to moderate adverse impacts to their experience. A fee would be charged to obtain a permit that would be based on cost recovery as described in the NPS Director's Order and Reference Manual 53. Depending on the level of fee, which would be different for type and length of permit, ORV users could experience long-term minor to moderate impacts, depending on if they feel the fee would prevent them from experiencing the Seashore; however, offering a weekly permit in addition to the 12-month permit would offer a lower cost option for short-term visitors. Although some users may feel adverse impacts from implementation of a permit system, other users may see long-term beneficial impacts as those visitors using ORV would be provided education and information with their permits that could influence their behavior and reduce potential for conflicts with non-ORV visitors. For law-abiding visitors, implementation of a permit system would provide the Seashore with a method to address those ORV users who violate Seashore policy, through revocation of permits. The permit system would give Seashore staff a system with "teeth" to revoke permits of regulatory offenders, which could beneficially affect the experience of visitors.

Alternative F would not dictate parking configurations on the beach, but would include formal carrying capacity provisions, including the enforcement of temporary closures of areas once these limits are reached or if disorderly conduct occurs and continues, which has occurred during busy weekends. The implementation of a defined carrying capacity, which is most likely to take effect for a few hours, over a few days, during peak use periods such as summer holiday weekends, may be viewed as a long-term benefit by those who feel that there are times when conditions are too crowded and that their visitor experience is impacted by these crowded conditions. Others would view implementation of a carrying capacity as a short-term moderate to major adverse impact if they are unable to get to their desired area because the capacity has been reached, especially if some of their preferred locations are closed (e.g., points and spits). As some visitors are only at the Seashore for a limited time during a vacation, not being able to participate in the planned recreational activity because capacity has been reached would result in a short- and long-term major adverse impact for that visitor group depending on the duration of time they cannot access an area. The determined carrying capacity would be subject to periodic review and may address these impacts if they arise.

Other Recreational Pursuits. Similar to alternative A, pedestrian based activities would be allowed outside of any resource closures. Unlike alternative A, ORV routes and non-ORV areas would be formally designated under alternative F. Seven SMAs under ML1 measures would be closed to recreation during the breeding season and three SMAs under ML2 measures would allow an ORV or pedestrian access corridor during the breeding season, subject to resource closures. In areas designated for ORV use, the defined ORV and pedestrian corridors would overlap or be the same, raising the possibility of conflict between ORV and non-ORV users and a diminished visitor experience for visitors seeking solitude and freedom from vehicular distractions. However, due to the amount of area open to only non-ORV uses under alternative F, these impacts would be expected to be long-term negligible adverse. Under alternative F, the speed limit would be lowered to 15 mph year-round, which would help reduce conflicts, both real and perceived, and accident potential, an issue of concern raised by the public during the scoping process.

Like alternative A, recreational pursuits, such as kite flying and Frisbee and ball throwing, would not be allowed within or above all bird closures. These restrictions would have long-term minor adverse impacts on visitor use since many other locations exist throughout the Seashore that accommodate these or similar activities. Also, similar to alternative A, there would be only short-term negligible adverse impacts to

ORV users participating in fishing tournaments because historical ORV access for tournament fishermen would continue.

Restrictions on pets would be the same as alternative C, except that pets would be prohibited in all designated breeding shorebird SMAs from March 15 to August 31, or two weeks after all shorebird breeding activities have ceased or chicks have fledged, whichever comes later. These restrictions would have long-term moderate adverse impacts on pet owners because of the limited areas that they would be able to go with their pets at the Seashore. In addition, restrictions would be placed on the use of horses at the Seashore, with a prohibition of horse use in SMAs. While this would be a long-term minor to moderate adverse impact, a long-term beneficial impact would also be realized by allowing horses use on village beaches from September 16 to May 14 each year.

Additional restrictions on beach fires would be implemented under alternative F with a non-fee educational permit required in order to have a beach fire. These permits would only be available for Coquina Beach, Rodanthe, Waves, Salvo, Avon, Buxton, Frisco, Hatteras Village, and Ocracoke Day Use Area from May 1 to November 15, during turtle nesting season. Visitors would also be prohibited from leaving belongings overnight at the Seashore, and items left for more than 24 hours may be removed. Seashore users may feel a short-term minor adverse impact from the requirement for a beach fire permit and being restricted to certain areas during the turtle nesting season, as well as requirements to remove their equipment from the beach each night.

Night Sky. Regarding the visitor experience of viewing the night sky, under alternative F, the restriction on night driving would occur from May 15 to November 15. This would eliminate impacts during that period from vehicle lights on the beach and lighting from parked vehicles where people are fishing, especially in areas away from the villages, resulting in long-term benefits for night sky experience. However, night driving would still occur under permit in the fall and during the remainder of the year, so impacts to night sky during those months would remain long-term negligible to minor adverse.

Overall Visitor Use Impacts. Those looking for an experience at the Seashore that includes ORV use would have long-term moderate adverse impacts as the designation of non-ORV areas and the establishment of SMAs would preclude ORV use, either seasonally or year-round, from some areas of the Seashore that are popular visitor use areas. Three SMAs under ML2 management procedures would provide either an ORV or pedestrian access corridor at the start of the breeding season, subject to resource closures, lessening the impacts to this user group. Additional access would be provided to the soundside under this alternative as well. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative F provides for year-round non-ORV areas as well as seasonal ORV closures in areas such as village beaches and some SMAs, and a new pedestrian trail. Since night driving would be seasonally restricted under alternative F, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.

Cumulative Impacts. Under alternative F, the same past, present, and planned future activities within the Seashore that have the potential to affect visitors and the recreational opportunities within the Seashore would occur, and impacts would be the same as described under alternative A.

Other actions, primarily construction-related, would have short-term minor impacts. The impacts of these actions, in combination with the mostly minor to moderate and potentially major impacts of alternative F, would result in long-term moderate to major adverse cumulative impacts to ORV users. However, the beneficial impacts of other actions and restrictions on ORV use under alternative F would provide long-term cumulative benefits for visitors who desire an experience free of motorized vehicle presence, disturbance, lights, or noise.

Conclusion. Designating ORV use areas and closures based on input from the Committee would result in long-term minor to moderate impacts as ORV access would be permitted during the summer months at some popular use SMAs (Cape Point and South Point), subject to resource closures, but due to Bodie Island Spit being designated as non-ORV during breeding season and Hatteras Inlet Spit and North Ocracoke Spit being designated non-ORV year-round, impacts to ORV users may be long-term moderate to major adverse because more than one of these areas could be closed at one time during the summer season due to resource closures. There would be long-term beneficial impacts from the additional accommodations made for pedestrian use including more parking, a possible beach shuttle, special use permits to shuttle the mobility impaired, and the addition of two new pedestrian trails. Seashore visitors not using or relying on ORVs would not experience many, if any, adverse impacts from these closures or from other safety closures where pedestrian corridors are provided, and those non-ORV users desiring a vehicle-free experience with more natural views and no vehicle-related noise or visual disturbance could experience long-term benefits from the ORV-free areas and restrictions on nighttime driving and reduced speed limits throughout the Seashore.

Because pedestrian use and most other recreational opportunities could occur outside seasonal and other closures, as well as in pedestrian corridors in other seasonal closures, short-term minor adverse impacts would occur to these users. The implementation of an ORV permit system and carrying capacity would be viewed as a long-term benefit by those who would like to see a system in place with consequences for non-law abiding ORV users, as well as those who may perceive crowded conditions that impact their visitor use and experience. For other ORV users, these elements would have a short- and long-term minor to major adverse impact as the permit system could be viewed as cumbersome and/or expensive, and short-term moderate to major impacts to those who may not be able to access a beach that has reached capacity. Elements that provide both weekly and 12-month permits would be beneficial as the user had some flexibility and choice in regard to permit cost.

Elements that restrict the type of activities (such as kite flying) or the ability of Seashore users to have a campfire or bring pets could have long-term minor to moderate adverse impacts to specific user groups. Lights associated with ORV use would result in long-term negligible to minor adverse effects to those visitors wishing to experience the night sky during winter when night driving is permitted or not restricted, and there would be short-term benefits to night sky viewing during the summer season when night driving is prohibited.

Cumulative impacts would be long-term moderate to major adverse to ORV users, and long-term beneficial for non-ORV users.

TABLE 60. SUMMARY OF IMPACTS TO VISITOR USE AND EXPERIENCE UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Those looking for an experience at the Seashore that includes ORV use would have long-term negligible to minor adverse impacts as some areas would be closed for resource protection, but alternative A would provide the most ORV access of any	Those looking for an experience at the Seashore that includes ORV use would have long-term moderate to major adverse impacts as one or more spit or point would be closed for an extended period of time during the breeding season. During the	Those looking for an experience at the Seashore that includes ORV use would have long-term moderate to major adverse impacts as the designation of non-ORV areas and the establishment of the SMAs would seasonally preclude ORV use	Those looking for an experience at the Seashore that includes ORV use would have long-term major adverse impacts as all SMAs and village beaches would be designated as non-ORV areas year-round, which would prohibit the	Those looking for an experience at the Seashore that includes ORV use would have long-term moderate adverse impacts as the designation of non-ORV areas and the establishment of the SMAs would preclude ORV use, either seasonally or year-round, from	Those looking for an experience at the Seashore that includes ORV use would have long-term moderate adverse impacts as the designation of non-ORV areas and the establishment of SMAs would preclude ORV use, either seasonally or

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
<p>alternative. Should there be extensive resource closures in a given year, the potential for long-term moderate impacts exists. Those looking for a non-ORV experience at the Seashore would experience long-term moderate adverse impacts as alternative A does not provide for a specific separation of uses or designation of non-ORV areas. Since night driving would be permitted under alternative A, there would be short-term minor adverse impacts to night skies.</p>	<p>remainder of the year, there would be negligible to minor adverse impacts to ORV users as limited areas would be closed for resource protection. Those looking for a non-ORV experience at the Seashore would experience long-term moderate adverse impacts as alternative B does not provide for a specific separation of uses outside of seasonal ORV closures of village beaches and no non-ORV areas would be designated. Since night driving would be seasonally restricted under alternative B, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.</p>	<p>from some areas of the Seashore that are popular ORV use areas. While three areas managed under ML2 procedures would have pedestrian access corridors, no ORV corridors would be provided in the SMAs, resulting in greater impacts to ORV users. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative C provides for pedestrian corridors in three SMAs under ML2 procedures, as well as providing additional non-ORV areas. Since night driving would be seasonally restricted under alternative C, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.</p>	<p>use of ORV in many popular visitor use areas. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative D provides for many designated non-ORV areas throughout the Seashore, although pedestrian access would be prohibited in the SMAs during the breeding season. Since night driving would be seasonally restricted under alternative D, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.</p>	<p>some areas of the Seashore that are popular visitor use areas. Three SMAs under ML2 management procedures would provide an ORV pass-through corridor at the start of the breeding season, subject to resource closures, lessening the impacts to this user group. Additional recreational opportunities such as park-and-stay and SCV camping would provide long-term benefits. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative E provides for designated year-round non-ORV use areas, as well as seasonal ORV closures in areas such as village beaches and some of the SMAs. Since night driving would be seasonally restricted, but allowed until 10:00 p.m., under alternative E, there would be long-term moderate adverse impacts to night skies due to the hours of night driving allowed, implementation of park-and-stay opportunities, with long-term beneficial impacts during times of seasonal night-driving restrictions.</p>	<p>year-round, from some areas of the Seashore that are popular visitor use areas. Three SMAs under ML2 management procedures would provide either an ORV or pedestrian access corridor at the start of the breeding season, subject to resource closures, lessening the impacts to this user group. Additional access would be provided to the soundside under this alternative as well. Those looking for a non-ORV experience at the Seashore would experience long-term benefits as alternative F provides for year-round non-ORV areas, as well as seasonal ORV closures in areas such as village beaches and some SMAs, and a new pedestrian trail. Since night driving would be seasonally restricted under alternative F, there would be long-term negligible to minor adverse impacts to night skies, with long-term beneficial impacts during times of seasonal night-driving restrictions.</p>

SOCIOECONOMIC IMPACTS

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

The alternatives were evaluated for their potential direct, indirect, and induced impacts on the local economy, small businesses, and preservation values (values held by the general public across the United States for the Seashore and its plant and animal communities that are unrelated to visitor use of the park, also known as existence value or nonuse value in the economics literature). Impacts on the economy and on small businesses were assessed using estimates of change in revenue from any change in visitation that might result from the alternative.

Variation in nesting patterns from year to year makes the socioeconomic impacts of the alternatives more difficult to forecast. Impacts could be low in years when beach closures are minimal or short lived. Impacts would be higher if beach closures are widespread and long lasting. Widespread closures for several years in a row may discourage some visitors from returning in future years, while a series of years with minimal impacts on beach access may invite larger crowds.

The total impact of the proposed alternatives would depend in part on the response of the affected individuals and businesses to the changes brought about by the proposed rule. To the extent that local businesses can provide alternate products and services, they may be able to reduce the impact on their profits. In addition, the effect of the alternatives would depend on the willingness and ability of individuals to visit substitute sites for recreation and of businesses to adapt to the available opportunities and changes in visitor use patterns under whichever alternative is selected. If individuals visit other sites outside the Seashore, then these regions would experience an increase in business while businesses in the ROI would experience a decrease.

Assumptions and Methodology

Business revenue within the ROI is influenced by the Seashore management decisions, in addition to a number of other unpredictable factors. A range of impacts on business revenue was forecast for each alternative to address uncertainty. Important unpredictable factors beyond the control of the Seashore contributing to the uncertainty of future business revenue include national and regional economic trends, national and regional demographic trends, meteorological and geological events such as storms and erosion, nesting patterns of birds and turtles, transportation costs, and visitor and business responses to these changes. Considering the dramatic changes in fuel prices, the housing market, and the national economy since 2006, projections based on recent short-term trends are unlikely to yield precise estimates.

A range of changes in business revenue was developed based on a business survey conducted of a sample of potentially impacted businesses and informed by visitation statistics for the last 10 years at the Seashore and other coastal national parks in North Carolina and other economic indicators (see “Business Survey” below for more information). Many businesses found it difficult to provide a quantitative estimate of the impact different features of the alternatives would have on their businesses because of the unpredictable factors discussed in the preceding paragraph. Currently, the analysis draws heavily from the business survey; however, data from an ongoing visitor survey will be used to supplement the business survey when the data are available in summer 2010.

Using both qualitative and quantitative information from these sources, a range of potential revenue changes was developed for four different business categories: commercial fishing in the Seashore, retail sporting goods in the Seashore villages (Ocracoke, Hatteras, Frisco, Avon, Buxton, Salvo, Waves, and Rodanthe), other tourism-related businesses in the Seashore villages, and the remaining tourism related business within the ROI. For each category, the range of revenue changes was applied to 2004 IMPLAN

data (Minnesota IMPLAN Group 2004b) for Dare and Hyde counties as described below. IMPLAN is an input-output (I/O) model that simulates how changes in sales and employment in one industry can affect other industries and the regional economy as a whole, and it is widely used by the NPS for economic analyses (see “IMPLAN” section below for more information). Table 61 lists the low, mid, and high estimates of the impact of each alternative on businesses in different categories (a description of the additional assumptions used to create this table is below).

TABLE 61. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS BY ALTERNATIVE, BUSINESS CATEGORY, AND AREA

Alternative	Estimate	The Seashore Villages			Rest of ROI
		Commercial Fishing	Sporting Goods	Other	All
A	Low	5%	5%	5%	1%
A	Mid	0%	0%	0%	0%
A	High	-5%	-5%	-5%	-1%
B	Low	0%	0%	0%	0%
B	Mid	-25%	-5%	-5%	-1%
B	High	-50%	-10%	-10%	-2%
C	Low	0%	0%	0%	0%
C	Mid	-25%	-5%	-5%	-1%
C	High	-50%	-10%	-10%	-2%
D	Low	0%	-20%	-15%	-2%
D	Mid	-25%	-30%	-20%	-4%
D	High	-50%	-40%	-25%	-6%
E	Low	0%	0%	0%	0%
E	Mid	-25%	-5%	-5%	-1%
E	High	-50%	-10%	-10%	-2%
F	Low	0%	0%	0%	0%
F	Mid	-25%	-5%	-5%	-1%
F	High	-50%	-10%	-10%	-2%

As discussed above, it is difficult to predict how visitors will change behavior over the long run in response to a particular alternative. The business community that caters to tourists has evolved over time as different activities rise and fall in popularity and as Seashore management affects the range of visitor experiences available. If the alternatives further shift the mix of visitors who come to the Seashore over the next decade, the mix of businesses in the community may change as well. In the short-term, as the adjustment takes place, particular business sectors may experience significant impacts. In the long-term, adaptation by the business community may mitigate long-term adverse impacts on the regional economy. In table 61, one of the scenarios for each alternative, except alternative D, includes no change (0% impact). The “no change” scenario, based in part on NPS visitation data, reflects the possibility that, while the visitor mix may change, the overall level of visitation does not, especially in the long run.

Another way to estimate the economic impacts is to start with a forecast of visitation under the no-action alternatives for different types of visitors, for example, ORV users and non-ORV users. For each of the

action alternatives, a range of assumptions about visitation change under the alternative for the different visitor groups would provide an estimate of the incremental change in visitation to the Seashore. Multiplying the incremental change in visitation by average visitor spending on different items would yield an estimate of the incremental change in revenue for different business categories under each alternative relative to the no-action alternatives. Unfortunately, the data on visitation, especially broken down by different types of Seashore visitors, are not complete enough to provide reliable estimates of baseline visitation. As a result, the data sources discussed below were used to estimate directly the change in revenue under the different alternatives without first estimating the change in visitation.

The following assumptions were used to generate the ranges in table 61 and baseline revenue for the impact analysis:

- **Commercial Fishing.** As of April 2009, 70 licenses had been issued for commercial fishing in the Seashore for FY 2009. To estimate the total revenue generated by commercial fishing in the Seashore, it was assumed that each license was associated with the mean revenue for nonemployer⁶ fishing establishments in Hyde County in 2004, \$56,000 (U.S. Census Bureau 2004), which is consistent with comments made during the business survey. Multiplying the number of fishermen by the mean revenue yielded an estimated \$3.9 million in total revenue generated by commercial fishing in the Seashore. This is likely an overestimate, as not all commercial fishing licenses issued are used; however, data on how many licenses go partially or fully unused are unavailable. In addition, not all fishermen received 100% of their revenue from fishing activities in the Seashore. Based on responses to the business survey, a range of possible direct impacts to commercial fishing was set for each alternative. The range is the same across all the alternatives. Commercial fishermen can access any part of the Seashore except lifeguarded beaches and when a full resource closure is in effect for breeding season, regardless of restrictions on recreational ORV use. Resource closures vary somewhat in length and location under the different alternatives depending on whether areas are managed under ML1 or ML2; however, the differences are not expected to be large enough to fall outside the range of direct impacts estimated from the business survey.
- **Tourism-Related Business Categories.** The IMPLAN 2004 estimate of economic output for Dare and Hyde counties was used to estimate economic impacts in the ROI. IMPLAN sectors were bridged to industries coded by the North American Industry Classification System (NAICS) (MIG 2004a). For the ROI, tourism-related business categories in IMPLAN include the following:
 - Real estate.
 - Hotels and motels.
 - Other amusement, gambling, and recreation industry.
 - Food services and drinking places.
 - Food and beverage stores.
 - Gasoline stations.
 - Sporting goods, hobby, book and music stores.
 - Other accommodations.

⁶ From <http://www.census.gov/econ/nonemployer/intro.htm>: “Nonemployers are typically self-employed individuals operating very small businesses, which may or may not be the owner’s principal source of income...Data are primarily comprised of sole proprietorship businesses filing IRS Form 1040, Schedule C, although some of the data are derived from filers of partnership and corporation tax returns that report no paid employees.”

- Adjustments to County-Level IMPLAN Data.** The smallest geographic unit for IMPLAN analysis is the county, but the ROI and the Seashore villages include only parts of Dare and Hyde counties. To estimate the portion of the economic output in Dare and Hyde counties generated in the ROI and, within the ROI, the amount generated in the Seashore villages for each business sector, the county level values were adjusted by the percentage of employment by business sector in the ROI and the Seashore villages using block group data from the 2000 Census. In table 62, the first two columns define the industry sector by name and NAICS codes. The third column lists the number of employees by sector in all of Dare and Hyde counties. The following four columns compare employment by sector in the ROI and in the Seashore Villages to the total for all of Dare and Hyde counties. Census block groups are smaller geographical units than counties, with the ROI and the Seashore villages composed of several blocks groups. Table 63 provides the total estimated economic output (based on the IMPLAN data). According to the data, the categories “Food service and drinking places” and “Real estate” are the largest areas of the economy that would be impacted by proposed alternatives. These two categories alone account for an estimated 15% of the economic output in Dare and Hyde counties, 16.5% of the economic output in the ROI, and 20.7% of the estimated output in the Seashore villages (table 63).
- Adjustments to the Real Estate Category.** In addition, the estimate of economic output in the “Real estate” category was adjusted to estimate more accurately the economic output of vacation rentals within the ROI. The vacation rental companies in the business survey included offices of real estate agents (NAICS 5312), a subset of real estate (NAICS 531). The 2002 ratio for Dare County of revenue generated by offices of real estate to the revenue generated by the real estate category as a whole (58.7%) was used to adjust the IMPLAN estimate of real estate economic output for the ROI (real estate data for Hyde County data were not disclosed in the 2002 Economic Census). Further, several offices of real estate agents (NAICS 5312) in the InfoUSA database (a geocoded database of businesses) and located within the ROI were not included in the business survey because they do not manage vacation rental properties. The estimated economic output from real estate was further adjusted by the ratio of sales by real estate agents included in the survey (those with vacation property management) to the total sales by real estate agents in the ROI (48.5%) (InfoUSA 2008). Thus, the economic output associated with vacation rentals is estimated to be 28.5% of the total real estate economic output within the ROI.

TABLE 62. EMPLOYMENT BY BUSINESS SECTOR AND AREA WITHIN DARE AND HYDE COUNTIES

Industry Sector	NAICS	Employment in Dare and Hyde Counties	Employment in ROI (number of employees)	Employment in ROI (percent of employees) ^a	Employment in the Seashore Villages (number of employees)	Employment in The Seashore Villages (percent of employees) ^a
Agriculture; forestry; fishing and hunting	11	889	491	55%	167	19%
Mining	21	4	4	100%	0	0%
Utilities	22	187	162	87%	63	34%
Construction	23	2,322	2,102	91%	308	13%
Manufacturing	31-33	933	764	82%	73	8%
Wholesale trade	42	486	414	85%	83	17%
Retail trade	44-45	2,532	2,296	91%	367	14%
Transportation and warehousing	48-49	466	365	78%	122	26%

Industry Sector	NAICS	Employment in Dare and Hyde Counties	Employment in ROI (number of employees)	Employment in ROI (percent of employees) ^a	Employment in the Seashore Villages (number of employees)	Employment in The Seashore Villages (percent of employees) ^a
Information	51	416	379	91%	25	6%
Finance and insurance	52	443	365	82%	19	4%
Real estate and rental and leasing	53	1,167	1,078	92%	196	17%
Professional; scientific; and technical services	54	695	688	99%	88	13%
Management of companies and enterprises	55	0	0	—	0	—
Administrative and support and waste management services	56	488	432	89%	60	12%
Educational services	61	1,147	986	86%	120	10%
Health care and social assistance	62	1,108	890	80%	145	13%
Arts; entertainment; and recreation	71	476	453	95%	53	11%
Accommodation and food services	72	1,955	1,857	95%	328	17%
Other services (except public administration)	81	818	714	87%	115	14%
Public administration	92	1,400	992	71%	67	5%
Total	—	17,932	15,432	86%	2,399	13%

Source: U.S. Census Bureau 2000a; generated by RTI International; using American FactFinder; "Census 2000 Summary File 3 (SF3) – Sample Data" <<http://factfinder.census.gov>>; (December 5, 2008).

^a Employment by sector in the ROI and Seashore Villages as a percent of total sector employment in all of Dare and Hyde counties.

TABLE 63. ESTIMATED TOTAL ECONOMIC OUTPUT OF AFFECTED INDUSTRIES BY AREA

Description	IMPLAN Codes	NAICS	Dare and Hyde Counties	ROI	The Seashore Villages
Fishing	16	11	\$29.9	\$16.5	\$3.1
Real estate (vacation property rental only) ^a	431	53	\$209.4	\$193.4	\$32.5
Hotels and motels, including casino hotels	479	72	\$38.8	\$36.9	\$6.2
Other amusement, gambling, and recreation	478	71	\$23.5	\$22.4	\$2.5
Food services and drinking places	481	72	\$258.9	\$245.9	\$41.3
Food and beverage stores	405	44-45	\$43.3	\$39.3	\$5.7
Gasoline stations	407	44-45	\$28.5	\$25.9	\$3.7
Sporting goods, hobby, book and music stores	409	44-45	\$19.0	\$17.3	\$2.5
Other accommodations	480	72	\$13.1	\$12.5	\$2.1
Totals	Total	—	\$3,094.4	\$2,663.0	\$356.3

Source: MIG 2004b

^a Real estate modified to reflect portion of output attributable to rental properties.

Business Survey. To provide information for the economic analysis, a survey was conducted by RTI, International of selected categories of potentially affected businesses. The results of this survey are currently being analyzed and will be addressed in the final plan/EIS. This survey took place between June and September 2009. Businesses in the following categories were interviewed: Rental Agencies; Lodging Other than Rental Homes; Recreational Supply and Activities; and Commercial Fishermen. The results from interviews with all the sectors, except commercial fishing, were used to generate the range of impacts for tourism-related businesses that were not part of the business survey such as food service, food and beverage stores, and gasoline stations. Table 64 shows the three-digit NAICS codes used to filter the InfoUSA database for these business categories.

TABLE 64. BUSINESS CATEGORIES BY THREE-DIGIT NAICS

Business Category	NAICS	NAICS Definition
Rental agencies	531	Real estate
Lodging other than rental homes	721	Accommodation
Recreational supply	451	Sporting goods, hobby, book and music stores
Recreational supply	487	Scenic and sightseeing transportation
Recreational supply	713	Amusement, gambling, and recreation industries

Lists of all businesses in the selected categories were compiled using the yellow pages, web sites such as outerbanks.org, input from members of the Committee, Seashore staff, and InfoUSA (InfoUSA 2008). The lists were then manually filtered using web searches to determine if the businesses fit the business category definitions and if the business was still active. Duplicates and additional locations were excluded to ensure one entry per entity. The Seashore provided the list of commercial fishermen with licenses to fish in the Seashore as of April 2009. From this list of businesses, the sample of businesses to be interviewed included all the Seashore commercial fishermen, all the relevant recreation businesses in the Seashore villages and all the rental agencies in the Seashore villages. Random samples of the remaining

business categories and regions were selected. Table 65 provides the sample size for each category and the response rate. All the businesses in the sample were contacted by telephone. Multiple attempts were made to contact businesses and arrange interviews.

TABLE 65. SAMPLE SIZE AND RESPONSE RATE BY BUSINESS CATEGORY

Location	Business Category	Sample Size	Response Rate
The Seashore Villages	Commercial Fishermen ^a	27	22%
	Recreational Supply	52	42%
	Realty	11	55%
	Lodging	42	52%
Rest of ROI	Recreational Supply	20	30%
	Realty	16	25%
	Lodging	23	26%

^a An additional 28 commercial fishermen with licenses to fish in the Seashore in 2009 had unlisted telephone numbers. They were mailed a letter about the survey with contact information, but no responses were received.

The business survey consisted of general questions regarding revenue and number of employees and how these numbers changed from 2007 to 2008 when the consent decree (alternative B) went into effect. At the time the survey was written, draft versions of alternatives D and E represented the two extremes of management. The major features of these two action alternatives were used as the basis for questions about the possible impact of the alternatives on revenue in the future relative to revenue in 2008. The questions were designed to capture the features of the alternatives that might have the biggest impact on visitation. The responses provided information for analysis of alternatives C and F because of their similarity to alternative E. The alternatives were not discussed in detail to keep the interview short enough to complete in a reasonable amount of time and reduce the burden on respondents.

Even businesses that reported no decrease or an increase in revenue in 2008 under the consent decree were concerned about the long-term impacts of the alternatives, even alternatives similar to the consent decree. These businesses cited reasons why they thought that revenue would decrease in the future including: visitors did not know about the closures when they came in 2008, visitors had made down payments for 2008 so they came despite the closures, the business increased prices, and the business changed their inventory. Although the survey questions asked respondents to forecast the possible impacts of the two alternatives relative to 2008, many businesses also discussed 2009. In some cases, businesses said that visitors came in 2008 not knowing about the beach closures and did not return in 2009. However, some businesses reported that while business in the spring was down, they were seeing increased bookings for the fall or expected business in the fall to increase. Some visitors may reschedule trips from the spring to the fall to visit areas likely to be closed in the spring and early summer. Because the business survey was conducted during the summer, businesses did not have information about revenue in the fall 2009.

Business owners were generally worried about the future impacts of the action alternatives. In addition, businesses who want to influence the debate over the alternatives have an incentive to exaggerate the expected impacts of more restrictive alternatives on their revenue. This possibility was recognized, and the survey included questions to probe for the reasoning behind answers to some questions.

Some respondents were hesitant to give specific numbers on possible changes in revenue that could be attributed to ORV management actions because of the many other factors affecting the economy in the

last few years, uncertainty about shorebird and turtle nesting patterns, and uncertainty about the long-term reactions of visitors to changes in visitor access to the Seashore. The ranges of possible impacts, which are large in some cases, reflect the uncertainty expressed by businesses and variation present in the survey data.

Publicly Available Data. According to NPS visitation statistics, visitation to the Seashore has remained relatively steady during implementation of the Interim Protected Species Management Strategy and the consent decree. In 2007, the year in which the Interim Protected Species Management Strategy was implemented, annual visitation was similar to the average annual visitation over the previous five years (within one standard deviation from the mean) and an increase of 5.3% over the 2006 visitation (NPS 2008e). Visitation in 2008 was 4.1% lower than 2007 visitation, but 1.0% higher than 2006 visitation (NPS 2008e). Through September in 2009, visitation is 10.7% higher than 2006, -0.3% lower than 2007, and 5.5% higher than 2008 (table 66).

While this does not provide information of what visitation might have been without the Interim Protected Species Management Strategy or consent decree or how the mix of visitor spending may have changed in that time, the information does not support projections of decreases in visitation under the no-action alternatives, and action alternatives with similar ORV restrictions. If the trends seen in the publicly available data continue, the economic impacts of the alternatives would likely occur in the lower range of projected impacts.

TABLE 66. VISITATION AT CAPE HATTERAS NATIONAL SEASHORE

Visitation	2002–2006 Average	2004–2006 Average	2007	2008	2009
Through September	2,021,046	1,812,343	1,943,264	1,835,599	1,936,738
Annual	2,435,650	2,197,941	2,237,378	2,146,392	NA

Source: NPS 2009I

Methodology

The following methods were used to assess impacts on the regional economy including the ROI and the Seashore villages, small businesses and preservation values.

- Regional economic impacts were calculated using the IMPLAN model as customized for the NPS (Michigan State University nd).
- Small business impacts were assessed using the range of forecast revenue changes in different industries and information on the size of local businesses. The assessment compares the impacts on small and large businesses.
- Preservation impacts were evaluated qualitatively and related back to the impact findings for threatened and endangered species.

IMPLAN

Economic impact analyses trace the flows of spending associated with the affected industries to identify changes in sales, income, jobs, and tax revenues resulting from a policy action. An economic impact analysis typically examines the effect of a change in policy on the economy of a particular region. Economic impact analysis differs from benefit-cost analysis, which focuses on the change in economic efficiency resulting from a change in policy and includes both market and nonmarket values.

To measure the economic impacts of the proposed alternatives, IMPLAN was used, an I/O model that simulates how changes in sales and employment in one industry can affect other industries and the regional economy as a whole. The process for generating the impacts in the I/O model is illustrated in figure 33. This process can be separated into three types of impact:

- **Direct Impacts**—the immediate consequences in industries that experience a change in sales.
- **Indirect Impacts**—responses in other industries to changes in the industries experiencing direct impacts.
- **Induced Impacts**—responses by households to the change in income received as the economy changes. Since wage payments adjust as the economy experiences impacts, households purchase more or less goods and services, which leads to greater expansion or contraction of the economy.

Note that the direct effects defined by the IMPLAN model do not imply that under NEPA the businesses would be considered directly regulated or impacted by the alternatives. The alternatives would directly regulate the activities of visitors and would indirectly impact businesses through changes in visitor behavior.

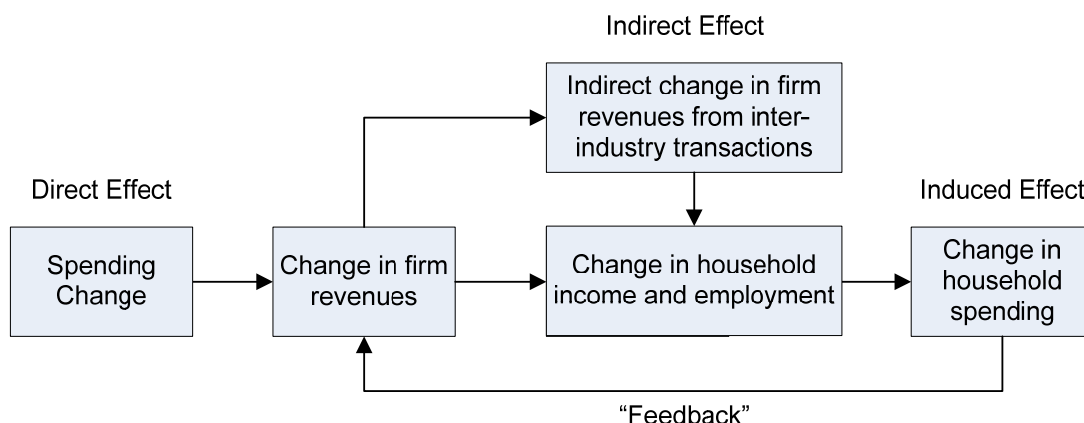


FIGURE 33. FEEDBACK PROCESS THAT GENERATES A PROGRAM'S TOTAL ECONOMIC IMPACT

For this analysis, 2004 I/O model of the economy of Dare and Hyde counties was used that was constructed using IMPLAN economic modeling software. IMPLAN was used because it is one of the most widely used I/O modeling software packages in economic impact analysis, and has been used frequently in economic impact studies for the NPS (see examples of applications of IMPLAN to National Parks at <http://web4.canr.msu.edu/mgm2/>).

To apply IMPLAN, the analyst must estimate the direct impacts of an economic activity or policy and provide them as input. IMPLAN contains a data file with information on the region of interest that provides information, such as ratios of jobs to sales for each sector, the proportion of spending by individuals and firms located within the region, the amount that is spent within the region, and the amount that each sector purchases from all the other sectors within the region per unit of output. Applying the multipliers generated from the data file allows the IMPLAN program to estimate the total regional impacts resulting from a given direct impact.

The economic database that IMPLAN uses comes from official government statistics (e.g., the National Income and Product Accounts [NIPA] published annually by the Bureau of Economic Analysis [BEA], the BEA I/O accounts for the United States, along with numerous other data sources). These data are

constructed to be internally consistent (i.e., county data sum to state totals and state data sum to national totals). In some cases, regional values are created where no data previously exist, and for other categories new values are calculated to replace existing data. Thus, IMPLAN contains comprehensive and consistent regional accounts but at the cost of making alterations to existing data and creating new data (Crihfield and Campbell 1991).

Small Business Impacts

The management of the Seashore would potentially affect the economic welfare of area businesses, organizations, and governmental jurisdictions, large and small through increases or reductions in revenue, taxes, and employment. However, small entities may experience larger impacts than large entities because of decreased flexibility to respond to changes. Small businesses, such as recreation equipment, lodging, and restaurants, comprise the majority of businesses relying directly on ORV users as a large source of revenue. These small businesses may not have the resources to respond to increased fluctuation in visitation from year to year, and they may be disproportionately affected relative to large businesses.

The Small Business Administration sets general size standard definitions by industry (defined by their NAICS code) based on a company's revenue or number of employees, as described in "Chapter 3: Affected Environment." In 2008, the ROI contained 768 establishments in affected industries, with 222 located in Hatteras villages (InfoUSA 2008). Assuming each location is an independent company, 95% of these could be small entities of the ROI, and 98% could be small entities in the Seashore villages (U.S. SBA 2008). Nationally, a lower percent of the businesses in the different businesses categories are small when compared to the ROI. Applying the national average of establishments operated by small entities in each business category would suggest that between 78%–84% of establishments are operated by small entities in the ROI and 80%–84% in the Seashore villages (SUSB 2002).

The threshold for impacts on small businesses is lower than for the regional economy. Some federal agencies use a 3% threshold for the cost to sales ratio of a regulation to identify what they define as significant impacts (major impacts under NEPA analysis). Alternatively, a major impact can be defined based on industry profit margins. Profit margins derived from 2005 tax data for the affected industries range in the ROI from 1.43% to 13.49% (IRS 2005), which would imply different thresholds for each affected industry. The impact analysis uses the 3% threshold, but includes qualitative discussion on where impacts might be larger or smaller.

Preservation Values

Individuals who hold preservation values for the plant and animal communities in the Seashore suffer adverse impacts when those communities are subject to adverse impacts. The impact on preservation values will be proportionate to the impact on protected species. Piping plover impacts were used as the benchmark for preservation values.

Preservation values can be assessed by examining willingness to pay, or the value that people place on goods not normally traded in the marketplace, i.e., what they are willing to pay for these goods, given their level of income. There are studies that have tried to quantify preservation values, particularly for protected species (see the discussion in Chapter 3); however, no studies have been done for the protected turtles and birds in the Seashore.

Additional Data Collection

Additional data are being collected that will be used to confirm or update the assumptions used for the economic analysis. First, a 12-month count of vehicle use of ocean beach access ramps and pedestrian use

of ocean beaches is being conducted and is expected to be completed in early 2010. The survey was designed to provide an estimate, with confidence intervals, of annual vehicle use of the beach access ramps and the number of visitors on different sections of beach. Second, a survey of ocean beach visitors is being conducted to gather information about the characteristics of visitors and trips, as well as reported visitation under scenarios based on alternatives D and E and is expected to be completed in 2010. To minimize burden on visitors selected for the survey, the survey was designed to be as short as possible while still collecting the needed information. The survey questions focused on alternatives D and E—the two most extreme action alternatives at the time the survey was written—and the features of these alternatives expected to have the greatest impact on the visitors' trips. The similarities between alternatives C, E, and F allow the use of the information gathered about alternative E to assess alternatives C and F as well. These surveys will provide data that will help Seashore managers better understand current and possible future use of the beaches in the Seashore. For the economic analysis, the data from the two surveys will be used to generate “bottom up” impact projections for tourism related industries in the ROI according to changes in visitation and types of visitors at the Seashore. When completed, these data will be compared with the “top down” impact projections in the current analysis.

Thresholds

The following thresholds for evaluating impacts on socioeconomic resources were defined.

Negligible: Regional Economic Impacts. The effect would not be detectable and would not change the socioeconomic environment, including individuals, businesses, and communities with economic linkages to the Seashore. An overall change in employment and personal income of less than 1%.

Small Business Impacts. No impact on small businesses.

Preservation Value Impacts. General population in Outer Banks and in U.S. unaware of changes.

Minor: Regional Economic Impacts. At the county level, the effects would be considered minor if there could be an overall change in employment and personal income of 1% to less than 6%.

Small Business Impacts. Very small impact on small businesses, ratio of change in revenue to total sales less than 1%. No business closures or disproportionate impacts on small businesses would result.

Preservation Value Impacts. Population aware of changes; however, they perceive that the changes would be minor.

Moderate: Regional Economic Impacts. At the county level, the effects would be considered moderate if there could be an overall change in employment and personal income greater than or equal to 6% but less than 10%.

Small Business Impacts. Noticeable impact on small businesses, ratio of change in revenue to total sales between 1% and 3% (based on standards used by some federal agencies for small business impact analysis under the *Regulatory Flexibility Act of 1980*, as amended in 1996). No business closures or disproportionate impacts on small businesses would result.

Preservation Value Impacts. Population aware of changes and perceive possibility of moderate impacts on Seashore resources.

Major: Regional Economic Impacts. The effect would be substantial, highly noticeable, potentially permanent influence on the socioeconomic environment. At the county level, the effects would be considered major if there could be an overall change in employment and personal income of greater than 10%.

Small Business Impacts. Significant impact on substantial number of small businesses, ratio of change in revenue to total sales over 3% (based on standards used by some federal agencies for small business impact analysis under the *Regulatory Flexibility Act*). Business closures or disproportionate impacts on small businesses are possible.

Preservation Value Impacts. Population aware of changes and perceive possibility of major impacts on Seashore resources.

Duration: Short-term: Temporary and typically transitional impacts associated with implementation of an action.

Long-term: Permanent impacts on the social and economic environments.

Impacts of Alternative A: No Action—Continuation of Management under the Interim Protected Species Management Strategy

Regional Economic Impacts. The impacts of alternative A depend on how the alternative would affect the number of visitors to the Seashore over the next 10 years and the activities these visitors would pursue. Using the experience with alternative A in 2007 to forecast future visitation trends as a result of alternative A in isolation is difficult because of the many other factors that influence visitation from year to year. However, alternative A would allow the most potential for access to the Seashore by ORVs compared to the other alternatives.

Beach closure to ORVs would be contingent upon bird and turtle nesting behavior except for prenesting closures at the points and spits and administrative and safety closures. As discussed in “Visitor Use and Experience,” restrictions on large areas of each of the spits would likely begin in April as a result of prenesting closures for shorebirds, but ORV corridors and pedestrian paths to the spits and Cape Point would most likely remain open throughout the early parts of the spring and summer. Full-beach closures are most likely to occur in July or August and could last from 3 to 5 weeks at the spit and point areas and a few other areas of the beach, based on past shorebird breeding seasons. ORV users and, in many cases, pedestrians would not be able to reach these areas for fishing or other recreational pursuits unless alternate access were available via an existing interdunal road or bypass.

Turtle nests can cause partial and full-beach closures anywhere along Seashore beaches throughout the summer and fall months. Full beach closures would be unlikely because using alternative routes or applying the identified bypass criteria, when appropriate, would increase the chances that ORV and pedestrian access would continue to the spits, Cape Point, and South Beach.

Under alternative A, the amount of beach ORV users and pedestrians can access would change from year to year. In 2007, the year in which the Interim Protected Management Strategy was implemented, annual visitation was similar to the average annual visitation over the previous five years (within one standard deviation from the mean) and an increase of 5.3% over the 2006 visitation (NPS 2008e). While visitation did not decrease in 2007, implementation of alternative A could lead to decreases in visitation in future years if there were wide-spread and/or long-lasting closures due to changes in the nesting behavior of shorebirds and turtles. Visitor uncertainty about which areas of the Seashore would be open for ORV use may also deter potential ORV users from planning trips in advance. Conversely, several years with shorter closures due to changes in breeding/nesting behavior could lead to increases in visitation. Visitors who enjoy using beaches without ORVs may also increase their visitation to the area. The true effect on visitation may lag the implementation and would depend on breeding/nesting patterns in the future as visitors incorporate the uncertainty of beach closure into their decision to visit.

The impact of alternative A on commercial fishermen would be less than for recreational ORV users. Commercial fishermen have access to Seashore beaches except during full resource closures for breeding and at lifeguarded beaches.

As shown in table 67, the range of forecast revenue impacts by business category over the next 10 years under alternative A would vary from an increase of 5% to a decrease of 5% in the Seashore villages (the villages bordering the Seashore), and an increase of 1% to a decrease of 1% in the rest of the ROI. The low impact end of the range, an increase in revenue of 5% in the Seashore villages (1% in the rest of the ROI), reflects the 5% increase in visitation in 2007 versus 2006 and the possibility that non-ORV recreation could increase in the future as a result of the ORV management changes. The mid value for the impacts was set at 0% or no change based on feedback from the businesses that responded to the business survey, who reported little or no impact from implementation of the Interim Protected Management Strategy in 2007. The high end of the range, a 5% decrease in revenue in the Seashore villages (or 1% in the rest of the ROI), captures the possibility that 2007 was not a typical year for nesting-related beach closures and that in future years closures could be more widespread and longer lasting, which would reduce visitation.

TABLE 67. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS FOR ALTERNATIVE A BY BUSINESS CATEGORY AND AREA

	The Seashore Villages			Rest of ROI
Revenue Impact Estimate	Commercial Fishing	Sporting Goods	Other	All
Low	5%	5%	5%	1%
Mid	0%	0%	0%	0%
High	-5%	-5%	-5%	-1%

The changes in revenue were input into IMPLAN to calculate the direct, indirect, and induced changes in economic output and employment. Table 68 presents the direct impacts, the total impacts (the sum of direct, indirect, and induced impacts) on output and employment and the impacts as a percent of total economic output and employment in Dare and Hyde counties. The Seashore villages would experience

the majority of the direct impacts (the direct changes in revenue from changes in visitation). The direct impacts range from a 0.4% (\$10 million) increase to a 0.4% decrease in total economic output, and a gain or loss of 0.5% of employment (135 employees) in the ROI. Total impacts in Dare and Hyde counties, which include direct, indirect, and induced impacts, are a 0.5% (\$13.5 million) increase or decrease to economic output, and a gain or loss of 0.4% (170) in employment.

TABLE 68. ECONOMIC IMPACT SUMMARY ESTIMATED BY IMPLAN

Revenue Impact Estimate	Direct Output Impact (in millions of dollars) ^a	Total Output Impact (in millions of dollars)	Impact as a percent of total for Dare and Hyde Counties	Direct Employment Impact ^a	Total Employment Impact	Impact as a percent of total for Dare and Hyde Counties
Low	\$9.99	\$13.48	0.4%	135	170	0.5%
Mid	\$0.00	\$0.00	0.0%	0	0	0.0%
High	-\$9.99	-\$13.48	-0.4%	-135	-170	-0.5%

^a Fifty percent of the direct impacts are expected to occur in the Seashore villages.

The economic impact of alternative A would likely vary from year to year with varying breeding/nesting behavior resulting in different areas of the Seashore being available to ORV and pedestrian use. The regional economy may experience long-term negligible adverse or beneficial impacts depending on breeding/nesting patterns. It is possible that in a year when there are long, widespread beach closures there could be bigger declines in visitation causing larger, but short-term adverse impacts. On the other hand, in years when closures are fewer, visitation increases could be larger, causing larger, but short-term beneficial impacts.

Small Business Impacts. Under alternative A, small businesses would experience long-term negligible to minor adverse impacts or beneficial impacts over the next 10 years. The thresholds for impacts on small businesses are much lower than for the regional economy (see methodology section above). Small businesses may not have the resources to adjust to changes or new regulations compared to larger businesses, so impacts may have a larger effect on small businesses. From table 68, a 0.5% decrease would be a minor impact for small businesses, but only a negligible impact for the regional economy. As with the regional economy, negligible adverse or even beneficial impacts would occur if alternative A resulted in no change or an increase in visitation, which would be consistent with the 2007 visitation data. However, a minor adverse impact would occur if visitation declined during or after years in which there were more widespread and long lasting beach closures from nesting. In addition, small businesses may suffer larger, short-term impacts if breeding/nesting patterns resulted in widespread and extended beach closures for ORVs and pedestrians that reduced visitation or changed the composition of visitors in a way that reduced revenue for particular small businesses. Businesses that depend on visitors using specific beach access ramps, in particular fishing supply and some food service businesses may experience localized impacts that could be larger or smaller than small businesses in the rest of the ROI depending on year to year variation in breeding/nesting by shorebirds and turtles at specific ramps.

Preservation Value Impacts. The impact of alternative A on preservation values depends on the impact alternative A has on protected species. For piping plover, alternative A would result in long-term minor to moderate adverse impacts from resources management activities and long-term moderate to major adverse from ORV and other recreational use. This implies that under alternative A, the overall impact on preservation values for the United States as a whole could be long-term moderate adverse.

Cumulative Impacts. Other past, present and future trends and activities could affect the socioeconomic resources in the region. Because the economic health of the area depends on tourism, the trends and actions, beneficial and adverse, discussed in “Visitor Use and Experience” would have an impact on the economy of the ROI.

In the future, a number of Seashore initiatives would likely affect visitation and the local economy. Based on “Visitor Use and Experience,” future actions that result in an increase in Seashore visitors should also have positive impacts on the local economy, while actions that decrease visitation could have negative impacts. Other planning actions in the area include the development of Cape Lookout National Seashore ORV Management Plan/EIS, the Corridor Management Plan for the Outer Banks Scenic Byway, and the Land Use Development Plans for Dare and Hyde counties. The implementation of these plans would affect visitor use in the ROI, with long-term benefits from improved access, but indeterminate beneficial or adverse impacts relating to limits placed on ORV use and land development under county plan revisions if they further restrict or encourage ORV use, or provide any new visitor opportunities. The extent of the impacts would depend on the final plans. Other actions planned for the region that would also affect visitation and the local economy include the Bonner Bridge replacement, continued maintenance of NC-12 and NC-12 improvements on Bodie Island, all of which should have very short-term negligible adverse impacts on tourism numbers due to construction delays or inconveniences, short-term beneficial impacts related to employment during construction, and long-term benefits because of the provision of reliable and continued access for tourists and local businesses.

Storms can affect visitation and the local economy. In recent years, hurricanes and storms and the subsequent recovery time required following these events have adversely affected visitor attendance, resulting in short-term minor to major adverse impacts on tourism and fishing and associated businesses.

In addition, current and future national economic conditions would affect the ROI as they affect the entire United States. Tourism is sensitive to the cost of fuel, and gasoline prices increased to more than \$4.00 per gallon during summer 2008. In 2008, Dare County had the 5th highest rate of foreclosures for counties in North Carolina. For June 2009, the North Carolina (seasonally unadjusted) unemployment rate rose to 11.1%, higher than Dare and Hyde counties (6.7% and 5.5%, respectively). These monthly rates are elevated relative to the June 2004–2006 average (“Chapter 3: Affected Environment”). Analysts do not expect the economy to recover until late 2009 at the earliest. The effects of national economic conditions would vary over time, but those similar to what has been experienced in 2008–2009 are expected to have a long-term minor to moderate adverse impact on the ROI.

In the long-term, cumulative impacts from all other actions affecting the regional economy would be beneficial based on economic growth despite storms and plans that would improve visitor access to the beaches in the future. However, a continued economic recession at the national level could cause long-term minor to moderate adverse impacts. These impacts, combined with the potential long-term negligible adverse or beneficial impacts associated with the actions under alternative A, would have long-term negligible to minor adverse or beneficial cumulative impacts in the ROI due to the normal and uncertain fluctuation in Seashore visitation and depending on national economic conditions.

Conclusion. Businesses linked to ORV use at the Seashore would experience uncertain impacts based on protected wildlife nesting behavior changes from year to year. The impact on these businesses, either positive or negative, may ripple through the economy on the Outer Banks as a whole. This uncertainty may impact small businesses disproportionately. Overall, it is expected that the regional economy would experience long-term negligible adverse or beneficial impacts depending on the extent of beach closures. The Seashore villages would experience the majority of the impacts with the potential for larger short-term impacts to specific businesses that cater most directly to ORV users. Small businesses could

experience long-term negligible to minor adverse impacts or long-term beneficial impacts over the next 10 years.

The long-term impact of alternative A would depend in part on how current and future visitors adjust their trips and spending in response to the management changes and the adaptations made by the business community to these changes. To the extent that businesses adapt to changing visitation patterns, the long-term impacts on the overall economy would be lessened. The impact on individual businesses would vary more than the impacts on the regional economy as a whole if the mix of visitors changes. Some businesses may experience a long-term decrease in customers, while others may experience no change or a long-term increase.

Preservation value impacts would depend on the success of alternative A in protecting the environment and threatened and endangered species, but are expected to be long-term moderate adverse.

Cumulative impacts could be long-term negligible to minor adverse or beneficial, depending on national economic conditions.

Impacts of Alternative B: No Action—Continuation of Management under Terms of the Consent Decree

Regional Economic Impacts. Alternative B would allow less ORV access to the Seashore than alternative A, due to restrictions on night driving and an increased probability of beach closures due to overall increased buffer distances and mandated increases in buffers that occur when resource closures have been violated.

Beach closure to ORVs and pedestrians would be contingent upon bird and turtle nesting behavior and would not follow a pre-determined closure pattern, except for administrative and safety closures, as described under alternative A, with prenesting closures beginning 15 days earlier than alternative A for both piping plovers and American oystercatchers. Under alternative B, there would be potential for full-beach closures in April to August that could last several months, with past closures lasting as long as 3.5 months at Cape Point. Due to increased buffers under alternative B, the chance of a full-beach closure is greater than under alternative A. The potential for beach closures from turtle nests under alternative B would be slightly higher than under alternative A. The impact of these closures would be a potential change in visitation by those who come to the Seashore to visit but cannot reach their desired destination because the beaches are closed in popular visitor use areas (decreased visitation) and visitors who want an ORV-free experience (increased visitation), the direct impact of their change in spending in the region, and the subsequent indirect and induced impacts on the regional economy.

The amount of beach that ORV users can access would change from year to year under alternative B, as would occur under alternative A. In 2008, the year in which the consent decree was implemented, annual visitation was similar to the average annual visitation over the previous five years (within one standard deviation from the mean). Visitation in 2008 was 4.1% lower than 2007 visitation, but 1.0% higher than 2006 visitation (NPS 2008e). Uncertainty about visitor experience and which areas of the Seashore would be open for ORV use may deter potential ORV users from planning trips in advance. At the same time, visitors who enjoy using beaches without ORVs may increase their visitation to the area. The true effect on visitation may lag the implementation and would depend on breeding/nesting patterns in the future as visitors incorporate the uncertainty of beach closure into their decision to visit.

The seasonal night-driving restrictions in alternative B, which are not present in alternative A, would impact commercial and recreational anglers who would otherwise fish for longer hours (in 2009 the consent decree was modified to allow commercial fishermen to access the Seashore beaches at 5:00 a.m.

rather than 6:00 a.m. when the general public is allowed back on the beach). Commercial fishermen raised this concern during the business survey. The night-driving restrictions may also deter potential recreational anglers from visiting the Seashore, resulting in a direct loss of their spending on regional businesses, and the subsequent indirect and induced impacts on the regional economy

The impact of alternative B on commercial fishermen would be less than for recreational ORV users. Commercial fishermen have access to Seashore beaches except during full resource closures for breeding and at lifeguarded beaches, so they would not be substantially affected by the longer seasonal closures. In areas outside of existing resource closures, the Superintendent would be able to modify the night-driving restrictions (by allowing access at 5:00 a.m. rather than 6:00 a.m.), subject to terms and conditions of the fishing permit, for commercial fishermen who are actively engaged in authorized commercial fishing activity and can produce fish house receipts from the past 30 days. Such modifications would be subject to review, but would not have systematic periodic review, as under the action alternatives.

As presented in table 69, the range of direct impacts by business category would be projected to vary from 0% to a 50% decrease for commercial fishermen, from 0% to a 10% decrease for other businesses in the Seashore villages, and from 0% to a 2% decrease in the rest of the ROI under alternative B over the next 10 years.

TABLE 69. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS FOR ALTERNATIVE B BY BUSINESS CATEGORY AND AREA

	The Seashore Villages			Rest of ROI
Revenue Impact Estimate	Commercial Fishing	Sporting Goods	Other	All
Low	0%	0%	0%	0%
Mid	-25%	-5%	-5%	-1%
High	-50%	-10%	-10%	-2%

The low impact of no change (0% increase or decrease) reflects the visitor statistics for 2008, which were within normal yearly variation. Under the low impact assumptions, visitation changes during 2008 are assumed to be mostly the result from an increase in fuel prices and national economic conditions. The low impact scenario also assumes there may be fewer closures in years to come, and that visitors, businesses, and commercial fishermen would adjust to changes in beach access. Isolated businesses may experience adverse impacts, but the number of affected businesses would be too low to have an impact on the regional economy.

The mid scenario reflects a decline in revenue across all sectors and areas of the ROI. The percent impacts reflect responses from the business survey and a comparison between 2007 and 2008 visitation data. For commercial fishermen, the mid scenario reflects a situation in which closures are longer and the night-driving restrictions have a bigger impact.

The high impact scenario forecasts larger losses in revenue. The scenario incorporates the upper end of revenue changes mentioned in the business survey. It assumes that after 2008, as visitors became aware of the ORV restrictions, visitation would decline further and would not recover. The high impact scenario could also occur if there were widespread and long-lasting resource closures based on nesting patterns that lasted several years. Longer closures could have a bigger impact on visitation and the ability of commercial fishermen to access the beach.

The distribution of economic impact estimates across different economic sectors for alternative B are presented by sector in table 70.⁷ The values in table 70 represent the mid estimates from table 69 for changes in output in millions of dollars and changes in employment in full and part time jobs estimated by IMPLAN by sector. The range of economic impacts for output and employment under alternative B are provided in table 71.

⁷ Because the mid estimate of change for alternative A was 0%, a more detailed table for alternative A was not prepared. However, the pattern of impacts across different sectors of the economy predicted for alternative B would be similar under alternative A.

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TABLE 70. ECONOMIC IMPACTS OF THE MID REVENUE IMPACT FOR ALTERNATIVE B BY INDUSTRY ESTIMATED BY IMPLAN (\$2008)

NAICS		Direct Output Impacts (in millions of dollars)	Indirect Output Impacts (in millions of dollars)	Induced Output Impacts	Total Output Impacts	% of NAICS Output in Dare and Hyde Counties	Direct Employment Impacts	Indirect Employment Impacts	Induced Employment Impacts	Employment Total	% of NAICS Employment in Dare and Hyde Counties
11	Agriculture, forestry, fishing and hunting	-\$0.98	-\$0.03	\$0.00	-\$1.01	-1.0%	-30	0	0	-30	-2.1%
21	Mining	\$0.00	\$0.00	\$0.00	\$0.00	—	0	0	0	0	—
22	Utilities	\$0.00	-\$0.14	-\$0.05	-\$0.18	-0.4%	0	0	0	0	0.0%
23	Construction	\$0.00	-\$0.24	-\$0.02	-\$0.25	-0.1%	0	-5	0	-5	-0.1%
31-33	Manufacturing	\$0.00	-\$0.08	-\$0.02	-\$0.10	-0.1%	0	0	0	0	0.0%
42	Wholesale trade	\$0.00	-\$0.15	-\$0.07	-\$0.22	-0.4%	0	0	0	0	0.0%
44-45	Retail trade	-\$1.30	-\$0.12	-\$0.30	-\$1.72	-0.6%	-20	0	-5	-25	-0.7%
48-49	Transportation and warehousing	\$0.00	-\$0.09	-\$0.02	-\$0.11	-0.5%	0	0	0	0	0.0%
51	Information	\$0.00	-\$0.17	-\$0.07	-\$0.24	-0.4%	0	0	0	0	0.0%
52	Finance and insurance	\$0.00	-\$0.14	-\$0.11	-\$0.25	-0.2%	0	0	0	0	0.0%
53	Real estate and rental and leasing	-\$3.23	-\$0.45	-\$0.12	-\$3.81	-0.5%	-25	-5	0	-30	-0.5%
54	Professional, scientific, and technical services	\$0.00	-\$0.17	-\$0.05	-\$0.22	-0.3%	0	0	0	0	0.0%
55	Management of companies and enterprises	\$0.00	-\$0.01	\$0.00	-\$0.01	-0.5%	0	0	0	0	0.0%
56	Administrative and support and waste management and remediation services	\$0.00	-\$0.14	-\$0.02	-\$0.16	-0.2%	0	-5	0	-5	-0.3%

NAICS		Direct Output Impacts (in millions of dollars)	Indirect Output Impacts (in millions of dollars)	Induced Output Impacts	Total Output Impacts	% of NAICS Output in Dare and Hyde Counties	Direct Employment Impacts	Indirect Employment Impacts	Induced Employment Impacts	Employment Total	% of NAICS Employment in Dare and Hyde Counties
61	Education services	\$0.00	\$0.00	-\$0.01	-\$0.01	-0.3%	0	0	0	0	0.0%
62	Health care and social assistance	\$0.00	\$0.00	-\$0.20	-\$0.20	-0.3%	0	0	-5	-5	-0.5%
71	Arts, entertainment, and recreation	-\$0.32	-\$0.03	-\$0.04	-\$0.40	-1.0%	-5	0	0	-5	-0.6%
72	Accommodation and food services	-\$4.93	-\$0.07	-\$0.17	-\$5.18	-1.7%	-85	0	-5	-90	-1.7%
81	Other services (except public administration)	\$0.00	-\$0.06	-\$0.11	-\$0.16	-0.2%	0	0	0	-5	-0.3%
Other	Misc. industries (including public administration)	\$0.00	-\$0.07	-\$0.39	-\$0.47	-0.1%	0	0	0	0	0.0%
Total		-\$10.77	-\$2.16	-\$1.77	-\$14.70	-0.5%	-160	-20	-15	-200	-0.6%

TABLE 71. RANGE OF ECONOMIC IMPACTS OF ALTERNATIVE B ESTIMATED BY IMPLAN (\$2008)

Revenue Impact Estimate	Direct Output Impact (in millions of dollars)	Total Output Impact (in millions of dollars)	Impact as a Percent of Total for Dare and Hyde Counties	Direct Employment Impact	Total Employment Impact	Impact as a Percent of Total for Dare and Hyde Counties
Low	\$0.00	\$0.00	0.0%	0	0	0.0%
Mid	-\$10.77	-\$14.70	-0.5%	-160	-200	-0.6%
High	-\$21.54	-\$29.40	-1.0%	-320	-400	-1.2%

^a Fifty-four percent of the direct impacts are expected to occur in the Seashore villages.

Adverse direct impacts of the mid revenue scenario for alternative B are expected to occur in retail, recreation, lodging and food service and real estate businesses, as well as the fishing industry if unpredictability in beach closures reduces Seashore visitation. Most industries may face some decrease in output through indirect impacts, totaling \$2.16 million lost. The waste management, real estate, and construction industries would also experience adverse indirect employment impacts amounting approximately 20 jobs lost. While many industries may face some reduction in output through induced impacts, only the retail, healthcare and accommodation and food service industries are predicted to experience additional job loss due to reduced spending.

The greatest total adverse effects under the mid revenue scenario on output and employment are estimated to occur in the accommodation and food services industry, with a \$5.18 million reduction in output and the loss of 90 jobs estimated under the middle scenario. Real estate, retail, and fishing in Dare and Hyde counties are also estimated to have output losses of \$1 million or more.

The projected range of business impacts for alternative B across the three scenarios, presented in table 71, is estimated to result in direct impacts of between no change and a 0.8% (\$21.54 million) decrease to economic output, and no change to a loss of 1.1% in employment (320 employees) in the ROI. Total impacts resulting from the direct impacts, which include indirect and induced impacts, would be between a no change and \$29.4 million decrease to economic output, and no change to a loss of 400 employees. These total impacts would represent no change to a 1% decrease relative to the total economic output in Dare and Hyde counties and no change to a 1.2% loss of employment.

The economic impact of alternative B would likely vary from year to year with the nesting behavior of protected species. The ROI may experience long-term negligible to minor adverse economic impacts and Seashore villages may experience larger short-term adverse impacts if there are years with long-lasting and widespread beach closures or larger short-term beneficial impacts in years with minimal closures.

Small Business Impacts. Under alternative B, small businesses would experience long-term negligible to moderate adverse impacts. The night-driving restrictions and higher probability of beach and/or ramp closures due to larger required buffers would result in an upper end of moderate adverse impacts compared to minor adverse impacts in the high impact scenario for alternative A. Based on current visitation statistics there is a greater likelihood of negligible or minor impacts.

Preservation Value Impacts. The increased required buffers and introduction of seasonal night-driving restrictions under alternative B would lessen the impacts to preservation values relative to alternative A with long-term minor to moderate adverse impacts from resources management activities and long-term moderate adverse impacts from ORV and other recreational use to piping plovers. Based on the impacts

predicted for piping plovers, the impacts to preservation value would be long-term minor to moderate adverse.

Cumulative Impacts. Socioeconomic impacts of cumulative actions unrelated to ORV management under alternative B would be the same as those under alternative A. In the long-term, cumulative actions affecting the regional economy would be negligible to minor and beneficial based on economic growth despite storms and plans that would improve visitor access to the beaches in the future. However, a continued economic recession at the national level could cause long-term minor to moderate adverse impacts. These impacts, combined with the potential long-term negligible to minor adverse impacts to the regional economy of the ROI associated with the actions under alternative B, would have long-term negligible to minor adverse or beneficial cumulative impacts in the ROI, depending on national economic conditions.

Conclusion. Businesses linked to ORV use at the Seashore would experience variable impacts based on the location and extent of species closures from year to year. The impact on these businesses may ripple through the economy on the Outer Banks as a whole. This uncertainty may impact small businesses disproportionately.

Overall, it is expected that businesses in the ROI would experience long-term negligible to minor adverse impacts, with the potential for larger impacts on individual businesses located in the Seashore villages that are tied most directly to ORV users and to traffic at vehicle access ramps. Small businesses are expected to experience long-term negligible to moderate adverse impacts. Based on the visitation statistics, the probability of negligible to minor impacts is greater than the probability of moderate adverse impacts.

The long-term impact of alternative B would depend in part on how current and new visitors adjust their trips and spending in response to the proposed management changes and the adaptations made by the business community to these changes. To the extent that businesses adapt to changing visitation patterns, the long-term impacts on the overall economy would be lessened. The impact on individual businesses would vary more than the impacts on the regional economy as a whole if the mix of visitors changes. Some businesses may experience a long-term decrease in customers, while others may experience no change or a long-term increase.

Preservation value impacts would depend on the success of alternative B in protecting the environment and threatened and endangered species, but could be long-term minor adverse.

Cumulative impacts could be long-term negligible to minor adverse or beneficial, depending on national economic conditions.

Impacts of Alternative C: Seasonal Management

Regional Economic Impacts. Similar to other alternatives, under alternative C, the local economy would be impacted primarily through a change in the trend of the number of visitors to the region or a change in the activities visitors participate in while in the region. This alternative would provide for less ORV access to the Seashore than the no-action alternatives, due to designated year-round non-ORV areas (SMAs) and the specified seasonal closures that would be larger in area and duration than alternatives A and B.

Under alternative C, areas of high resource sensitivity, e.g., points and spits, and areas of high visitor use, e.g., village beaches, would be closed to ORVs from March 15 to October 14. For areas of high resource sensitivity, this alternative would impose prenesting bird closures in the spring similar to the those under

alternative B. ORV closures, however, would be more restrictive under alternative C than the no-action alternatives in the fall months, with closures extending to October 14. This may affect the extent to which visitors who cancel their spring trips to the Seashore decide to reschedule their trips to the fall. Peak-use limits on the number of vehicles parked in a location might limit visitation by ORV users on holiday or crowded summer weekends for a short period of time, but would improve the visitor experience for those who were on the beaches because of the decrease in crowding.

Other areas and pedestrian use of the Seashore would not be managed similarly to the no-action alternatives as buffers for protected species would be larger and ramp 27-30 would be an SMA. Pedestrian access corridors at Bodie Island Spit, Cape Point, and South Point, as well as the construction and relocation of ORV access ramps, would improve access to open beaches relative to the no-action alternatives, particularly alternative B. Alternative C would also require users to purchase an ORV use permit, the fee of which would be based on NPS guidelines for cost recovery. For visitors who prefer beaches without ORVs, alternative C provides more vehicle-free beach than alternative B.

Reduced ORV access to areas of high resource sensitivity in the fall and areas of high visitor use in the spring and fall, as well as the addition of the ORV permit system, would adversely affect visitation by ORV users relative to the no-action alternatives because of reduced vehicular access and the introduction of a new cost associated with the ORV permit. The addition of pedestrian access corridors and construction and relocation of ORV access ramps, as well as increased predictability of ORV access, could beneficially impact visitation relative to alternative B, but likely less than alternative A, which provided for pedestrian access throughout the Seashore. The net impacts of these actions relative to the no-action alternatives are uncertain.

The seasonal night-driving restrictions in alternative C relative to alternative A, and even alternative B, would impact commercial and recreational anglers who would otherwise fish for longer hours, since the restrictions would be from 7:00 p.m. to 7:00 a.m. from May 1 to November 15, with the option to modify (reduce) the restricted hours for commercial fishermen. Commercial fishermen raised this concern during the business survey. The night-driving restrictions may also deter potential recreational anglers from visiting the Seashore, resulting in a direct loss of their spending on regional businesses, and the subsequent indirect and induced impacts on the regional economy.

The impact of alternative C on commercial fishermen would be less than for recreational ORV users. Commercial fishermen have access to Seashore beaches except during full resource closures for protected species and at lifeguarded beaches, so they would not be affected by the longer seasonal closures. Commercial fishermen would not be required to obtain the ORV permit that would be required for recreational ORVs. In areas outside of existing resource closures, the Superintendent would be able to modify the night-driving restrictions, subject to terms and conditions of the fishing permit, for commercial fishermen who are actively engaged in authorized commercial fishing activity and can produce fish house receipts from the past 30 days. Such modifications would be subject to periodic review.

Similar to alternative B, the range of direct impacts by business category is projected to vary from 0% to -50% for commercial fishermen, 0% to -10% for other businesses in the Seashore villages, and 0% to -2% in the rest of the ROI under alternative C (table 72). The longer seasonal closures make the probability of higher impacts greater under alternative C than compared to alternatives A and B for the reasons discussed above.

TABLE 72. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS FOR ALTERNATIVE C BY BUSINESS CATEGORY AND AREA

	The Seashore Villages			Rest of ROI
Revenue Impact Estimate	Commercial Fishing	Sporting Goods	Other	All
Low	0%	0%	0%	0%
Mid	-25%	-5%	-5%	-1%
High	-50%	-10%	-10%	-2%

The projected range of business impacts for alternative C is estimated by IMPLAN to result in direct impacts of between no change and a 0.8% (\$21.54 million) decrease to economic output, and no change to a loss of 1.1% in employment (320 employees) in the ROI (table 73). Total impacts resulting from the direct impacts, which would include indirect and induced impacts, would be between a no change and \$29.4 million decrease to economic output, and no change to a loss of 400 employees. These total impacts would represent no change to a 1% decrease relative to the total economic output in Dare and Hyde counties and no change to a 1.2% loss of employment.

TABLE 73. RANGE OF ECONOMIC IMPACTS OF ALTERNATIVE C ESTIMATED BY IMPLAN (\$2008)

Revenue Impact Estimate	Direct Output Impact (in millions of dollars)	Total Output Impact (in millions of dollars)	Impact as a Percent of Total for Dare and Hyde Counties	Direct Employment Impact	Total Employment Impact	Impact as a percent of total for Dare and Hyde Counties
Low	\$0.00	\$0.00	0.0%	0	0	0.0%
Mid	-\$10.77	-\$14.70	-0.5%	-160	-200	-0.6%
High	-\$21.54	-\$29.40	-1.0%	-320	-400	-1.2%

^a Fifty-four percent of the direct impacts are expected to occur in the Seashore villages.

Similar to alternative B, the economy could experience long-term negligible to minor adverse impacts, and the Seashore villages may experience larger short-term adverse impacts if there are longer, more widespread closures or beneficial short-term impacts if closures are less wide-spread. However, due to increased fall ORV closures, larger adverse impacts would be more likely under alternative C than alternatives A or B.

Small Business Impacts. Similar to alternative B, under alternative C, it is expected that small businesses would experience long-term negligible to moderate adverse impacts.

Preservation Value Impacts. Alternative C would provide benefits to piping plovers relative to A and B due to more protective resources management measures, as well as long-term minor adverse impacts from ORV and other recreational use. Adverse impacts to preservation values would be less under alternative C, relative to alternatives A and B, and overall impacts to preservation values would be long-term minor adverse, with long-term beneficial impacts from the measures taken to protect sensitive species at the Seashore. The increased seasonal night-driving restrictions under alternative C would increase the probability of beneficial impacts to preservation values relative to alternative A or B.

Cumulative Impacts. Socioeconomic impacts of cumulative actions unrelated to ORV management under alternative C would be the same as those under alternative A. In the long-term, the impact of

cumulative actions affecting the regional economy would be beneficial based on economic growth despite storms and plans that would improve visitor access to the beaches in the future. However, a continued economic recession at the national level could cause long-term minor to moderate adverse impacts. These cumulative actions, when combined with the potential long-term negligible to minor adverse impacts to the regional economy of the ROI associated with the actions under alternative C, would have long-term negligible to minor adverse or beneficial cumulative impacts in the ROI, depending on national economic conditions.

Conclusion. Businesses linked to ORV use at the Seashore would experience uncertain adverse impacts based on protected animal nesting behavior changes from year to year. The impact on these businesses may ripple through the economy on the Outer Banks as a whole; however, the economy would likely adapt over time to the implementation of this alternative. This uncertainty may impact small businesses disproportionately.

Overall, it is expected that the regional economy of the ROI would experience long-term negligible to minor adverse impacts, with the potential for larger short-term impacts in the Seashore villages. Efforts to improve access through pedestrian corridors, when compared to alternative B, and changes to access ramps would decrease the impacts on businesses that rely on visitors using the beaches affected by the new corridors and ramps relative to alternative B. However, the longer ORV closure in the fall months may reduce visitation under alternative C relative to B and make the mid to high impact scenarios more likely. Small businesses are expected to experience long-term negligible to moderate adverse impacts.

The long run impact of the alternative would depend in part on how current and new visitors adjust their trips and spending in response to the management changes and the adaptations made by the business community to these changes. To the extent that businesses adapt to changing visitation patterns, the long-term impacts on the overall economy would be lessened. The impact on individual businesses would vary more than the impacts on the regional economy as a whole if the mix of visitors changes. Some businesses may experience a long-term decrease in customers, while others may experience no change or a long-term increase.

Adverse impacts to preservation values would be less under alternative C, relative to alternatives A and B, and overall impacts to preservation values would be long-term minor adverse, with long-term beneficial impacts from the measures taken to protect sensitive species at the Seashore. The increased seasonal night-driving restrictions under alternative C would increase the probability of beneficial impacts to preservation values relative to alternative A or B.

Cumulative impacts in the ROI could be long-term negligible to minor adverse or beneficial, depending on national economic conditions.

Impacts of Alternative D: Increased Predictability and Simplified Management

Regional Economic Impacts. Similar to other alternatives, under alternative D, the local economy would be impacted primarily through a change in the trend of the number of visitors to the region or a change in the activities visitors participate in while in the region. This alternative would provide for the least ORV access to the Seashore relative to the other alternatives, as well as reduced access for pedestrians as all SMAs would be under ML1 management measures and would be seasonally closed to pedestrians until protected species breeding activity ceases.

Under alternative D, areas of high resource sensitivity and visitor use would not be designated as ORV routes and would be managed under ML1 measures during the breeding season. This would result in all points and spits at the Seashore being closed year-round to ORV use and closed during the breeding

season to pedestrian use. Similar to the alternative B, beaches open to ORV use would still be subject to temporary resources closures according to protected species behavior, which could result in larger areas of resource closure when compared to alternative A. Relative to the other action alternatives, alternative D would have the most certainty and least costly ORV permits. This alternative would decrease visitation by ORV users relative to the other alternatives.

Seasonal night-driving restrictions in alternative D, relative to alternatives A and B, would impact commercial and recreational anglers who would otherwise fish for longer hours, since the restrictions would be from 7:00 p.m. to 7:00 a.m. from May 1 to November 15. Commercial fishermen raised this concern during the business survey. The night-driving restrictions may also deter potential recreational anglers from visiting the Seashore, resulting in a direct loss of their spending on regional businesses, and the subsequent indirect and induced impacts on the regional economy. However, as alternative D would close all points and spits year-round to ORV use, the impacts of night driving under this alternative would be secondary compared to the impacts from the establishment of year-round SMAs at all points and spits under ML1 management procedures.

The impact of alternative D on commercial fishermen would be less than for recreational ORV users. Commercial fishermen have access to Seashore beaches except during full resource closures and at lifeguarded beaches, so they would not be affected by the year-round closures. Commercial fishermen would not be required to obtain an ORV permit that would be required for recreational ORVs, but would be managed under the commercial fishing special use permit. In areas outside of existing resource closures, the Superintendent would be able to modify the night-driving restrictions, subject to terms and conditions of the fishing permit, for commercial fishermen who are actively engaged in authorized commercial fishing activity and can produce fish house receipts from the past 30 days. Such modifications would be subject to periodic review.

The range of direct impacts by business category is projected to vary from no change to a decrease of 50% for commercial fishermen, a decrease of 15% to a decrease of 40% for businesses in the Seashore villages, and a decrease of 2% to a decrease of 6% in the rest of the ROI under alternative D (table 74). The impacts on individual businesses that depend on visitors to SMAs could be larger. The impacts on revenue from alternative D would depend on how visitors react to the closure of SMAs to ORVs year-round and how visitors and potential visitors adjust to the new conditions over time. With year-round ORV closures, there are no opportunities for visitors to reschedule their trips to the fall as in the other alternatives.

TABLE 74. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS FOR ALTERNATIVE D BY BUSINESS CATEGORY AND AREA

	The Seashore Villages			Rest of ROI
Revenue Impact Estimate	Commercial Fishing	Sporting Goods	Other	All
Low	0%	-20%	-15%	-2%
Mid	-25%	-30%	-20%	-4%
High	-50%	-40%	-25%	-6%

The economic impact estimates for the mid value of revenue impacts from table 74 for different industry sectors under alternative D are presented in table 75. The values in table 75 represent the mid estimates for changes in output in millions of dollars and changes in employment in full and part time jobs estimated in IMPLAN. The range of economic impacts for output and employment under alternative D are provided in table 76.

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TABLE 75. ECONOMIC IMPACTS OF ALTERNATIVE D FOR MID RANGE REVENUE IMPACTS BY INDUSTRY ESTIMATED BY IMPLAN (\$2008)

NAICS		Direct Output Impacts (in millions of dollars)	Indirect Output (in millions of dollars)	Induced Output Impacts	Total Output Impacts	% of NAICS Output in Dare and Hyde Counties	Direct Employment Impacts	Indirect Employment Impacts	Induced Employment Impacts	Employment Total	% of NAICS Employment in Dare and Hyde Counties
11	Agriculture, forestry, fishing and hunting	-\$0.98	-\$0.11	-\$0.01	-\$1.10	-1.1%	-30	-5	0	-35	-2.4%
21	Mining	\$0.00	\$0.00	\$0.00	\$0.00	—	0	0	0	0	—
22	Utilities	\$0.00	-\$0.56	-\$0.17	-\$0.72	-1.6%	0	0	0	0	0.0%
23	Construction	\$0.00	-\$0.53	-\$0.06	-\$0.58	-0.1%	0	-5	0	-5	-0.1%
31-33	Manufacturing	\$0.00	-\$0.33	-\$0.07	-\$0.39	-0.2%	0	0	0	0	0.0%
42	Wholesale trade	\$0.00	-\$0.44	-\$0.25	-\$0.69	-1.2%	0	-5	-5	-5	-0.9%
44-45	Retail trade	-\$5.46	-\$0.42	-\$1.09	-\$6.97	-2.4%	-80	-5	-15	-100	-2.6%
48-49	Transportation and warehousing	\$0.00	-\$0.23	-\$0.07	-\$0.30	-1.3%	0	-5	0	-5	-1.4%
51	Information	\$0.00	-\$0.68	-\$0.24	-\$0.92	-1.4%	0	-5	0	-5	-1.8%
52	Finance and insurance	\$0.00	-\$0.54	-\$0.40	-\$0.94	-0.8%	0	0	0	-5	-0.8%
53	Real estate and rental and leasing	-\$12.93	-\$1.76	-\$0.46	-\$15.15	-2.0%	-95	-15	-5	-110	-2.0%
54	Professional, scientific, and technical services	\$0.00	-\$0.66	-\$0.19	-\$0.85	-1.1%	0	-5	0	-10	-1.2%
55	Management of companies and enterprises	\$0.00	-\$0.02	\$0.00	-\$0.02	-1.8%	0	0	0	0	0.0%
56	Administrative and support and waste management and remediation services	\$0.00	-\$0.54	-\$0.09	-\$0.63	-0.9%	0	-15	0	-15	-0.9%

NAICS		Direct Output Impacts (in millions of dollars)	Indirect Output (in millions of dollars)	Induced Output Impacts	Total Output Impacts	% of NAICS Output in Dare and Hyde Counties	Direct Employment Impacts	Indirect Employment Impacts	Induced Employment Impacts	Employment Total	% of NAICS Employment in Dare and Hyde Counties
61	Education services	\$0.00	\$0.00	-\$0.03	-\$0.03	-1.0%	0	0	0	0	0.0%
62	Health care and social assistance	\$0.00	\$0.00	-\$0.74	-\$0.74	-1.0%	0	0	-10	-10	-1.1%
71	Arts, entertainment, and recreation	-\$1.29	-\$0.11	-\$0.15	-\$1.55	-3.8%	-15	-5	-5	-20	-2.5%
72	Accommodation and food services	-\$19.74	-\$0.29	-\$0.64	-\$20.66	-6.6%	-335	-5	-10	-355	-6.7%
81	Other services (except public administration)	\$0.00	-\$0.22	-\$0.40	-\$0.62	-0.7%	0	-5	-10	-10	-0.6%
Other	Misc. industries (including public administration)	\$0.00	-\$0.23	-\$1.45	-\$1.69	-0.5%	0	0	0	0	0.0%
Total		-\$40.40	-\$7.65	-\$6.52	-\$54.57	-1.8%	-560	-75	-65	-700	-2.1%

TABLE 76. RANGE OF ECONOMIC IMPACTS OF ALTERNATIVE D (\$2008)

Revenue Impact Estimate	Direct Output Impact (in millions of dollars)	Total Output Impact (in millions of dollars)	Impact as a percent of total for Dare and Hyde Counties	Direct Employment Impact	Total Employment Impact	Impact as a percent of total for Dare and Hyde Counties
Low	-\$24.53	-\$33.01	-1.1%	-330	-415	-1.3%
Mid	-\$40.40	-\$54.57	-1.8%	-560	-700	-2.1%
High	-\$56.27	-\$76.13	-2.5%	-790	-985	-3.0%

^a Between 47-59% of the direct impacts are expected to occur in the Seashore villages.

Adverse direct impacts of alternative D are expected to occur in largest in retail, recreation, lodging and food service and real estate businesses, as well as the fishing industry. Most industries may face some decrease in output and employment through indirect and induced impacts, totaling \$14.17 million and 140 jobs lost.

The greatest total adverse effects on output and employment are estimated to occur in the accommodation and food services industry, with a \$20.66 million reduction in output and the loss of 355 jobs estimated under the mid scenario. Real estate and retail in Dare and Hyde counties are also estimated to have output losses of \$15 and \$7 million, respectively.

This projected range of business impacts for alternative D is estimated to result in direct impacts of between a 0.9% (\$24.53 million) and a 2.1% (\$56.27 million) decrease to economic output, and a loss of 1.2% of employment (330 employees) to a loss of 2.8% of employment (790 employees) in the ROI. Total impacts resulting from the direct impacts, which include induced impacts, would be between a \$33.01 million to \$76.13 million decrease to economic output, and between a 415 and 985 loss of employees. These total impacts would represent a 1.1% to a 2.5% decrease relative to the total economic output in Dare and Hyde counties and a 1.3% to a 3.0% loss of employment. Compared to alternative A, the mid value of the range of losses is 1.8% (\$54.57 million) larger for alternative D. The regional economic impact of alternative D is expected to be long-term minor adverse in the ROI. Seashore villages could experience larger short-term adverse impacts.

Small Business Impacts. Under alternative D, it is expected that small businesses would experience long-term moderate to major adverse impacts.

Preservation Value Impacts. Alternative D would provide enhanced long-term protection for the plant and animal communities with the year-round closure of sensitive areas to ORV use in the Seashore. The impact on preservation values would be long-term beneficial for the United States as a whole as a result of more extensive resources management measures. Adverse impacts to preservation values would be less under alternative D, relative to alternatives A and B, and the overall impact to preservation values would be long-term minor adverse, with the closure of sensitive areas to ORVs under alternative D year-round substantially increasing the probability of long-term beneficial impacts relative to all other alternatives.

Cumulative Impacts. Socioeconomic impacts of cumulative actions unrelated to ORV management under alternative D would be the same as those under alternative A. In the long-term, cumulative actions affecting the regional economy would be beneficial based on economic growth despite storms and plans that would improve visitor access to the beaches in the future. However, a continued economic recession at the national level could cause long-term minor to moderate adverse impacts. These cumulative actions, in addition to the potential long-term minor adverse impacts to the regional economy of the ROI

associated with the actions under alternative D, would have long-term negligible to minor adverse or beneficial cumulative impacts on the ROI, depending on national economic conditions.

Conclusion. Businesses linked to ORV use at the Seashore would experience adverse impacts under alternative D. The impact on these businesses would ripple through the economy on the Outer Banks as a whole. Overall, it is expected that the ROI could experience long-term minor adverse impacts. Under alternative D, it is expected that small businesses would experience long-term moderate to major adverse impacts.

The long run impact of alternative D would depend in part on how current and new visitors adjust their trips and spending in response to the management changes and the adaptations made by the business community to these changes. To the extent that businesses adapt to changing visitation patterns, the long-term impacts on the overall economy would be lessened. The impact on individual businesses would vary more than the impacts on the regional economy as a whole if the mix of visitors changes. Some businesses may experience a long-term decrease in customers, while others may experience no change or a long-term increase.

Adverse impacts to preservation values would be less under alternative D, relative to alternatives A and B, and the overall impact to preservation values would be long-term minor adverse, with the closure of sensitive areas to ORVs under alternative D year-round substantially increasing the probability of long-term beneficial impacts relative to all other alternatives.

Cumulative impacts in the ROI could be long-term negligible to minor adverse or beneficial depending on national economic conditions.

Impacts of Alternative E: Variable Access and Maximum Management

Regional Economic Impacts. Similar to other alternatives, under alternative E, the local economy would be impacted primarily through a change in the trend of the number of visitors to the region or a change in the activities visitors participate in while in the region. Alternative E would provide similar ORV and pedestrian access to the Seashore as alternative B, by providing flexibility in what areas are opened or closed seasonally and providing a wide range of experiences for Seashore users year-round.

Under alternative E, beach closure to ORVs and pedestrians would be contingent upon protected species breeding/nesting behavior, as well as by pre-determined seasonal closures. Areas of high resource sensitivity would follow seasonal ORV closures from March 15 to August 31 under designated SMAs; however, additional pedestrian and ORV access would be facilitated by construction and relocation of access ramps, designation of ORV pass-through zones, and the promotion of water taxi service to popular areas. Areas of high visitor use (outside of SMAs) would either be open to ORVs seasonally from November 1 to March 31 or closed to ORVs. Similar to the no-action alternatives, beaches open to ORV use would still be subject to temporary resources closures according to protected species behavior, with the potential for a full beach closure greater than under alternative A.

The seasonal night-driving restrictions in alternative E would be similar to those under alternative B and would impact commercial and recreational anglers who would otherwise fish for longer hours. Commercial fishermen raised this concern during the business survey. The night-driving restrictions may also deter potential recreational anglers from visiting the Seashore, resulting in a direct loss of their spending on regional businesses, and the subsequent indirect and induced impacts on the regional economy

Alternative E would include implementation of an ORV permit system, with the fee based on cost recovery per NPS guidelines. The addition of the ORV permit system would adversely affect visitation by ORV users relative to the no-action alternatives because of the introduction of a new costs associated with ORV use in the Seashore. The addition of pedestrian access corridors, construction, and relocation of ORV access ramps, other efforts to improve beach access would beneficially impact visitation relative to the no-action alternatives.

The impact of alternative E on commercial fishermen would be less than for recreational ORV users. Commercial fishermen would have access to Seashore beaches except during full resource closures for breeding and at lifeguarded beaches, so they would not be affected by the ORV-specific closures. Commercial fishermen would not be required to obtain an ORV permit that would be required for recreational ORVs. In areas outside of existing resource closures, the Superintendent would be able to modify the night-driving restrictions, subject to terms and conditions of the fishing permit, for commercial fishermen who are actively engaged in authorized commercial fishing activity and can produce fish house receipts from the past 30 days. Such modifications would be subject to periodic review.

Similar to alternative B, the range of direct impacts on revenue by business category is projected to vary from 0% to a decrease of 50% for commercial fishermen, 0% to a decrease of 10% for other businesses in the Seashore villages, and 0% to a decrease of 2% in the rest of the ROI under alternative E (table 77). The range of revenue impacts is the same as alternatives B and C. Compared to alternative C and D, alternative E provides for more ORV access and the impacts would likely be on the lower end of the range.

TABLE 77. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS FOR ALTERNATIVE E BY BUSINESS CATEGORY AND AREA

Revenue Impact Estimate	The Seashore Villages			Rest of ROI
	Commercial Fishing	Sporting Goods	Other	All
Low	0%	0%	0%	0%
Mid	-25%	-5%	-5%	-1%
High	-50%	-10%	-10%	-2%

This projected range of business impacts for alternative E is estimated to result in direct impacts of between no change and a 0.8% (\$21.54 million) decrease to economic output, and no change to a loss of 1.1% of employment (320 employees) in the ROI (table 78). Total impacts resulting from these direct impacts, which include indirect and induced impacts, are between a no change and \$29.4 million decrease to economic output, and no change to a loss of 400 employees. These total impacts represent no change to a 1% decrease relative to the total economic output in Dare and Hyde counties and no change to a 1.2% loss of employment. The detailed breakdown of impacts by industry sector would be the same as alternative B (table 70). Similar to alternative B, the economy may experience long-term negligible to minor adverse impacts while Seashore villages may experience larger short-term adverse impacts.

TABLE 78. RANGE OF ECONOMIC IMPACTS OF ALTERNATIVE E ESTIMATED BY IMPLAN (\$2008)

Revenue Impact Estimate	Direct Output Impact (in millions of dollars)	Total Output Impact (in millions of dollars)	Impact as a Percent of Total for Dare and Hyde Counties	Direct Employment Impact	Total Employment Impact	Impact as a Percent of Total for Dare and Hyde Counties
Low	\$0.00	\$0.00	0.0%	0	0	0.0%
Mid	-\$10.77	-\$14.70	-0.5%	-160	-200	-0.6%
High	-\$21.54	-\$29.40	-1.0%	-320	-400	-1.2%

^a Fifty-four percent of the direct impacts are expected to occur in the Seashore villages.

Small Business Impacts. Under alternative E, it is expected that small businesses would experience long-term negligible to moderate adverse impacts. The impacts would be similar to alternative B, but would be larger than the impacts under alternative A. The ORV corridors with pass-through zones and modification to vehicle access ramps would increase the probability that impacts would be lower under alternative E than under alternative B.

Preservation Value Impacts. Alternative E would provide long-term benefits to piping plovers relative to A and B from resources management activities. However, continued ORV and other recreational use would have long-term minor to moderate adverse impacts to the piping plover population. The seasonal night-driving restrictions under alternative E would increase the probability of beneficial impacts to preservation values relative to alternative A. More beach access by ORVs compared to alternatives C and D would increase the probability of lower benefits for alternative E. Adverse impacts to preservation values would be less under alternative E, relative to alternatives A and B, and overall preservation values would be long-term minor to moderate adverse, with long-term beneficial impacts from the measures taken by the Seashore to protect threatened and endangered, as well as special status, species.

Cumulative Impacts. Socioeconomic impacts of cumulative actions unrelated to ORV management under alternative E would be the same as those under alternative A. In the long-term, cumulative actions affecting the regional economy would have negligible to minor adverse or beneficial based on economic growth despite storms and plans that would improve visitor access to the beaches in the future. However, a continued economic recession at the national level could cause long-term minor to moderate adverse impacts. These impacts, combined with the potential long-term negligible to minor adverse impacts to the regional economy of the ROI associated with the actions under alternative E, would have long-term negligible to minor adverse or beneficial cumulative impacts on the ROI, depending on national economic conditions.

Conclusion. Businesses linked to ORV use at the Seashore would experience uncertain adverse impacts based on protected species nesting behavior changes from year to year. The impact on these businesses may ripple through the economy on the Outer Banks as a whole; however, the economy would likely adapt over time to the implementation of this alternative. This uncertainty may impact small businesses disproportionately. Overall, it is expected that the ROI would experience long-term negligible to minor adverse impacts and the Seashore village businesses would experience long-term negligible to moderate adverse impacts, with the potential for larger short-term impacts especially for businesses that cater directly to ORV users in the Seashore villages. Alternative E is more structured and predictable and with the establishment of SMAs would be more protective of resources than alternative B, but is similar in some respects to alternative B. Based on the visitation statistics for 2008, the probability of negligible

impacts is greater than the probability of minor adverse impacts. Small businesses are expected to experience long-term negligible to moderate adverse impacts.

The long run impact of the alternative would depend in part on how current and new visitors adjust their trips and spending in response to the management changes and the adaptations made by the business community to these changes. To the extent that businesses adapt to changing visitation patterns, the long-term impacts on the overall economy would be lessened. The impact on individual businesses would vary more than the impacts on the regional economy as a whole if the mix of visitors changes. Some businesses may experience a long-term decrease in customers, while others may experience no change or a long-term increase.

Adverse impacts to preservation values would be less under alternative E, relative to alternatives A and B, and overall preservation values would be long-term minor to moderate adverse, with long-term beneficial impacts from the measures taken by the Seashore to protect threatened and endangered, as well as special status, species.

Cumulative impacts in the ROI could be long-term negligible to minor adverse or beneficial depending on national economic conditions.

Impacts of Alternative F: Management Based on Advisory Committee Input

Regional Economic Impacts. Similar to the no-action alternatives, beach closure to ORVs and pedestrians would be contingent upon protected species breeding/nesting behavior, but unlike the no-action alternatives, would implement SMAs. However, additional pedestrian and ORV access would be facilitated by construction and relocation of access ramps, and the designation of ORV access corridors at Cape Point and South Point. Areas of high visitor use (outside of SMAs) would be open to ORVs seasonally from November 1 to March 31, September 16 to May 14, or closed to ORVs year-round. Cape Point and South Point would have an ORV corridor, subject to resource closures, to provide limited access in the summer (through July 31 or end of fledging), but some of the points and spits would be closed to ORVs year-round (Hatteras Inlet Spit, North Ocracoke Spit) and Bodie Island Spit would be closed to ORVs in the summer months, but with a pedestrian access corridor. Similar to alternative B and the other action alternatives, beaches open to ORV use would still be subject to temporary resources closures according to protected species behavior.

The length seasonal night-driving restrictions in alternative F fall between the other alternatives. Night-driving restrictions would be in effect between May 1 and September 15 and would prohibit ORV use from one hour after sunset until a turtle patrol has checked the area in the morning (approximately half an hour after sunrise). Night-driving restrictions would impact commercial and recreational anglers who would otherwise fish for longer hours. Commercial fishermen raised this concern during the business survey. The night-driving restrictions may also deter potential recreational anglers from visiting the Seashore resulting in a direct loss of their spending on regional businesses, and the subsequent indirect and induced impacts on the regional economy. Under alternative F, restricted hours and fall restrictions would be based on the hours of darkness or presence of turtle nests in the fall as opposed to set times, which may allow for more flexibility.

The addition of the ORV permit system would potentially reduce visitation by ORV users relative to the no-action alternatives because of the introduction of a new cost associated with ORV use in the Seashore. The addition of pedestrian access corridors, construction, and relocation of ORV access ramps, other efforts to improve beach access and the addition of pedestrian trails would beneficially impact visitation relative to the no-action alternatives. Peak use limits for ORVs on busy holiday and summer weekends

could limit visitation for short periods of time, but would also improve the experience for ORVs using the restricted areas.

The impact of alternative F on commercial fishermen would be less than for recreational ORV users. Commercial fishermen have access to Seashore beaches except during full resource closures for breeding and at lifeguarded beaches, so they would not be affected by the longer seasonal closures. Commercial fishermen would not be required to obtain an ORV permit that would be required for recreational ORVs, and would continue to be managed by the commercial fishing special use permit. In areas outside of existing resource closures, the Superintendent would be able to modify the night-driving restrictions, subject to terms and conditions of the fishing permit, for commercial fishermen who are actively engaged in authorized commercial fishing activity and can produce fish house receipts from the past 30 days. Such modifications would be subject to periodic review.

The range of direct impacts by business category is projected to vary from 0% to a decrease of 50% for commercial fishermen, 0% to a decrease of 10% for other businesses in the Seashore villages, and 0% to a decrease of 2% in the rest of the ROI under alternative F (table 79). Alternative F provides less access by ORVs to the beach compared to alternatives A or B, especially in SMAs, and has more restricted SMAs than alternative E. However, some popular ORV areas open sooner in the late summer than alternative E and allow for an ORV corridor instead of just pass-through access at Cape Point and South Point. There are more vehicle-free areas for pedestrians because of the closures, as well as increased parking. Compared to the no-action alternatives, these measures could increase visitation and increase the probability that revenue impacts would be at the low end of the estimated range rather than the high end.

TABLE 79. RANGE OF PROJECTED ANNUAL BUSINESS REVENUE IMPACTS FOR ALTERNATIVE F BY BUSINESS CATEGORY AND AREA

Revenue Impact Estimate	The Seashore Villages			Rest of ROI
	Commercial Fishing	Sporting Goods	Other	All
Low	0%	0%	0%	0%
Mid	-25%	-5%	-5%	-1%
High	-50%	-10%	-10%	-2%

The projected range of business impacts for alternative F is estimated to result in direct impacts of between no change and a 0.8% (\$21.54 million) decrease to economic output, and no change to a loss of 1.1% of employment (320 employees) in the ROI (table 80). Total impacts, which include direct, indirect, and induced impacts, are between no change and a \$29.4 million decrease to economic output, and no change to a loss of 400 employees. These total impacts represent no change to a 1% decrease relative to the total economic output and no change to a 1.2% loss of employees in Dare and Hyde counties. Again, the detailed changes by industry would be similar to alternative B (table 70). Similar to alternative B, the economy may experience long-term negligible to minor adverse impacts, while the Seashore villages may experience larger short-term adverse impacts.

TABLE 80. RANGE OF ECONOMIC IMPACTS OF ALTERNATIVE F ESTIMATED BY IMPLAN (\$2008)

Revenue Impact Estimate	Direct Output Impact (in millions of dollars)	Total Output Impact (in millions of dollars)	Impact as a Percent of Total for Dare and Hyde Counties	Direct Employment Impact	Total Employment Impact	Impact as a Percent of Total for Dare and Hyde Counties
Low	\$0.00	\$0.00	0.0%	0	0	0.0%
Mid	-\$10.77	-\$14.70	-0.5%	-160	-200	-0.6%
High	-\$21.54	-\$29.40	-1.0%	-320	-400	-1.2%

^a Fifty-four percent of the direct impacts are expected to occur in the Seashore villages.

Small Business Impacts. Under alternative F, it is expected that small businesses would experience long-term negligible to moderate adverse impacts. The extra efforts to increase ORV access and pedestrian access should increase the probability that the impacts are low rather than high compared to alternatives D and E.

Preservation Value Impacts. Alternative F would provide long-term benefits to piping plover relative to alternative A. However, continued ORV and other recreational use would result in long-term minor to moderate adverse impacts to the piping plover population. The increased seasonal night-driving restrictions under alternative F would increase the probability of beneficial impacts to preservation values relative to alternatives A and B. More beach access by ORVs compared to alternatives C and D would increase the probability of lower benefits for preservation under alternative F. Adverse impacts to preservation values would be less under alternative F, relative to alternatives A and B, and overall preservation values would be long-term minor to moderate adverse, with long-term beneficial impacts from the measures taken by the Seashore to protect threatened and endangered, as well as special status, species.

Cumulative Impacts. Socioeconomic impacts of cumulative actions unrelated to ORV management under alternative F would be the same as those under alternative A. In the long-term, cumulative actions affecting the regional economy would be negligible to minor and beneficial based on economic growth despite storms and plans that would improve visitor access to the beaches in the future. However, a continued economic recession at the national level could cause long-term minor to moderate adverse impacts. These actions, combined with the potential long-term negligible to minor adverse impacts to the regional economy of the ROI associated with the actions under alternative F, would have long-term negligible to minor adverse or beneficial cumulative impacts to the ROI, depending on national economic conditions.

Conclusion. Businesses linked to ORV use at the Seashore would experience uncertain adverse impacts based on protected animal nesting behavior changes from year to year. The impact on these businesses may ripple through the economy on the Outer Banks as a whole; however, the economy would likely adapt over to the implementation of this alternative. This uncertainty may impact small businesses disproportionately.

Overall it is expected that the ROI could experience long-term negligible to minor adverse impacts, and Seashore villages could experience larger short-term impacts especially for businesses that cater directly to ORV users in the Seashore villages. Alternative F is more structured and predictable and with the establishment of SMAs would be more protective of resources than alternative B, but is similar in some respects to alternative B. Based on the visitation statistics from 2008, the probability of negligible impacts

is greater than the probability of minor adverse impacts. Small businesses are expected to experience long-term negligible to moderate adverse impacts.

The long run impact of the alternative would depend in part on how current and new visitors adjust their trips and spending in response to the management changes and the adaptations made by the business community to these changes. To the extent that businesses adapt to changing visitation patterns, the long-term impacts on the overall economy would be lessened. The impact on individual businesses would vary more than the impacts on the regional economy as a whole if the mix of visitors changes. Some businesses may experience a long-term decrease in customers, while others may experience no change or a long-term increase.

Adverse impacts to preservation values would be less under alternative F, relative to alternatives A and B, and overall preservation values would be long-term minor to moderate adverse, with long-term beneficial impacts from the measures taken by the Seashore to protect threatened and endangered, as well as special status, species.

Cumulative impacts in the ROI could be long-term negligible to minor adverse or beneficial depending on national economic conditions.

TABLE 81. SUMMARY OF IMPACTS TO SOCIOECONOMICS UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Region of Influence					
The ROI is expected to experience long-term negligible adverse impacts or long-term beneficial impacts depending on the extent of beach closures. The Seashore villages (the villages bordering the Seashore) would experience the majority of the impacts with the potential for larger short-term impacts to specific businesses that cater most directly to ORV users.	The ROI is expected to experience long-term negligible to minor adverse impacts depending on the extent of beach closures. The Seashore villages would experience the majority of the impacts with the potential for larger short-term impacts to specific businesses that cater most directly to ORV users. Based on the current visitation statistics, the probability of negligible impacts is greater than the probability of minor adverse impacts.	The ROI is expected to experience long-term negligible to minor adverse impacts. The Seashore villages would experience the majority of the impacts with the potential for larger short-term impacts to specific businesses that cater most directly to ORV users. Efforts to improve access through pedestrian corridors, when compared to the no-action alternatives, and changes to access ramps would decrease the impacts on businesses that rely on visitors using the beaches affected by the new corridors and ramps relative to the no-action alternatives. However, the longer ORV closures in the fall months may reduce visitation under alternative C relative to the no-action alternatives and make the mid to high impact scenarios more likely.	The ROI is expected to experience long-term minor adverse impacts. The Seashore villages would experience the majority of the impacts with the potential for larger short-term impacts to specific businesses that cater most directly to ORV users. Compared to the other alternatives, alternative D provides the least access to the beach by Or's, resulting in larger projected adverse impacts.	The ROI is expected to experience long-term negligible to minor adverse impacts. Based on the visitation statistics for 2008, the probability of negligible impacts is greater than the probability of minor adverse impacts. The Seashore villages would experience the majority of the impacts. Like alternative B, alternative E provides for more ORV access and the impacts would likely be on the lower end of the range compared to alternatives C and D.	The ROI is expected to experience long-term negligible to minor adverse impacts. The Seashore villages would experience the majority of the impacts with the potential for larger short-term impacts to specific businesses that cater most directly to ORV users. Alternative F provides less access by ORVs to the beach compared to the no-action alternatives, especially in SMAs, and has more restricted SMAs than alternative E. However, some popular ORV areas open sooner in the late summer than alternative E and allow for an ORV corridor instead of just pass-through access at Cape Point and South Point. There are more vehicle-free areas for pedestrians because of the closures as well as increased parking. Compared to the no-action alternatives, these measures could increase visitation and increase the probability that revenue impacts would be at the low end of the estimated range rather than the high end.

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Small Business					
Small businesses may experience long-term negligible to minor adverse impacts or long-term beneficial impacts depending on the extent of beach closures. Based on visitation statistics in 2007, there is a greater likelihood of negligible impacts.	Small businesses may experience long-term negligible to moderate adverse impacts depending on the extent of beach closures. Based on current visitation statistics there is a greater likelihood of negligible or minor impacts.	Small businesses may experience long-term negligible to moderate adverse impacts, with a greater likelihood of adverse impacts relative to the no-action alternatives due to increased fall ORV closures.	Small businesses may experience long-term moderate to major adverse impacts. The adverse impacts are projected to be larger relative to the other alternatives because of the limits on beach access for ORVs.	Small businesses may experience long-term negligible to moderate adverse impacts, with a likelihood of adverse impacts in the lower end of the range relative to alternatives C and D due to increased ORV access closures.	Small businesses would experience long-term negligible to moderate adverse impacts. The extra efforts to increase ORV access and pedestrian access should increase the probability that the impacts are on the low rather than high end of the range.
Preservation Value Impacts					
As a result of the long-term minor to major impacts to protected species, impacts to preservation values would be long-term moderate adverse.	As a result of the long-term minor to moderate impacts to protected species, and addition of protection from seasonal night-driving restrictions, impacts to preservation values would be long-term minor to moderate adverse.	Adverse impacts to preservation values would be less under alternative C, relative to alternatives A and B, and overall impacts to preservation values would be long-term minor adverse with long-term beneficial impacts from the measures taken to protect sensitive species at the Seashore.	Adverse impacts to preservation values would be less under alternative D, relative to alternatives A and B, and the overall impact to preservation values would be long-term minor adverse, with the closure of sensitive areas to ORVs under alternative D year-round substantially increasing the probability of long-term beneficial impacts relative to all other alternatives.	Adverse impacts to preservation values would be less under alternative E, relative to alternatives A and B, and overall preservation values would be long-term minor to moderate adverse with long-term beneficial impacts from the measures taken by the Seashore to protect threatened and endangered, as well as special status, species.	Adverse impacts to preservation values would be less under alternative F, relative to alternatives A and B, and overall preservation values would be long-term minor to moderate adverse, with long-term beneficial impacts from the measures taken by the Seashore to protect threatened and endangered, as well as special status, species.

SEASHORE MANAGEMENT AND OPERATIONS

GUIDING REGULATIONS AND POLICIES

Direction for management and operations at the Seashore is set forth in the *Organic Act*, the Seashore's enabling legislation, General Management Plan (NPS 1984), Strategic Plan (NPS 2005b), and the current Superintendent's Compendium. Specifically, related to the ORV management plan/EIS, the General Management Plan includes the following management objectives for the Interpretation and Resources Management divisions (NPS 1984):

- foster awareness, appreciation, and understanding of the natural and cultural resources of the Outer Banks and their interrelationships;
- make visitors aware of the hazards associated with living and recreating in a coastal environment;
- encourage visitors to safely pursue only those recreational activities that are compatible with and not detrimental to the natural and cultural resources;
- provide, through an active education program, for the no consumptive use of the Seashore as an outdoor classroom by educational organizations;
- strengthen within visitors and Seashore employees an environmental ethic;
- promote understanding of and support for NPS goals and policies; and
- preserve the dynamic physiography and characteristic ecological communities of the Outer banks.

The General Management Plan also states that the Seashore would review and update as necessary an existing "action plan" regulating ORV use to reduce visitor conflicts and to protect dunes, vegetation, wildlife, and cultural resources. The "action plan" would designate ORV routes as well as sensitive resource areas periodically closed to ORV use. It is believed that the "action plan" mentioned in the GMP referred to the 1978 draft interim ORV management plan, which was never finalized or issued as a special regulation.

The Strategic Plan identified the following goals in relation to the ORV management plan/EIS (NPS 2005a):

- identify and assess native plant and animal species of management concern (SMC) populations and identify needed management actions to sustain the populations;
- ensure that 85% of the 2005 species habitat protection protocols are in place;
- continue to make progress on an ORV management plan to ensure species breeding/germination habitats are able to function under natural processes; and
- ensure Seashore visitor satisfaction with the appropriate Seashore facilities, services, and recreational opportunities.

The Superintendent's Compendium: Closures, Permit Requirements, and Other Restrictions (NPS 2009f) sets forth the closure and public use limits that the Seashore staff are required to enforce, thus determining levels of Seashore operations. For the purposes of this plan/EIS, applicable sections of Title 36 CFR include but are not limited to the following:

- Section 1.1: Purpose
- Section 1.2: Applicability and Scope
- Section 1.3: Penalties
- Section 1.4: Terms
- Section 1.5: Closure and Public Use Limits
- Section 1.6: Permits
- Section 2.1: Preservation of natural, cultural, and archeological resources
- Section 2.2: Wildlife Protection
- Section 2.3: Fishing
- Section 2.4: Fires
- Section 2.15: Pets
- Section 2.22: Property
- Section 2.30: Misappropriation of Property and Services
- Section 2.31: Trespassing, tampering, vandalism
- Section 2.32: Interfering with agency functions
- Section 2.33: Report of injury or damage
- Section 2.34: Disorderly conduct
- Section 2.35: Alcoholic beverage and controlled substances
- Section 4.2: State Law Applicable (regarding vehicles and traffic safety)
- Section 4.10: Travel on Roads and Designated Routes
- Section 4.15: Safety belts
- Section 4.21: Speed Limits
- Section 4.22 Unsafe operation
- Section 4.23: Operating under the influence of alcohol or drugs

ASSUMPTIONS, METHODOLOGY, AND IMPACT THRESHOLDS

Seashore management and operations, for the purpose of this analysis, refer to the quality and effectiveness of Seashore staff to maintain and administer Seashore resources and provide for an appropriate visitor experience. This includes an analysis of the projected need for staff time and materials in relationship to ORV management under each of the alternatives, as well as the various funding mechanisms available to implement these alternatives. The analysis also considers trade-offs for staff time or the budgetary needs required to accomplish the proposed alternatives and discusses each alternative in terms of its impacts to Seashore Management (the superintendent's staff), and the divisions of Administration, Interpretation, Resource Management, Facility Management (Maintenance), and Visitor Protection at the Seashore. Seashore staff from each of the divisions were members of the interdisciplinary team and were consulted regarding expected staffing and funding needs under each alternative. The impact analysis is based on the current description of Seashore operations presented in "Chapter 3: Affected Environment" of this document. The required level of effort is discussed in terms of "full-time equivalents" or FTE, which represent the hours worked by staff. One FTE equals 2080 hours, the equivalent of one person working full-time year-round, or two part-time staff each working 6 months of the year.

The following thresholds for evaluating impacts on Seashore management and operations were defined and applied to adverse impacts.

Negligible: Seashore or agency operations would not be impacted or the impact would not have a noticeable or measurable impact on Seashore or agency operations.

Minor: Impacts would be noticeable and would result in a measurable, but small, change in Seashore or agency operations. Any required changes in Seashore staffing and funding could be accommodated within normal budget cycles and expected annual funding without appreciably affecting other operations within the Seashore. Current levels of funding and staffing would not be reduced or increased, but priorities may need to be changed.

Moderate: Impacts would be readily apparent and would result in a substantial change in Seashore or agency operations that would be noticeable to staff and the public. Required changes in Seashore staffing and/or funding could not be accommodated within expected annual funding and would measurably affect other operations within the Seashore by shifting staff and funding levels between operational divisions. Increases or decreases in staff and funding would be needed or other Seashore operations would have to be reduced and/or priorities changed.

Major: Impacts would be readily apparent and would result in a substantial change in Seashore operations that would be noticeable to staff and the public and would be markedly different from existing operations. These changes in Seashore staffing and/or funding could not be accommodated by expected annual funding and would require the Seashore to readdress its ability to sustain current Seashore operations. Increases or decreases in staff and funding would be needed and/or other Seashore programs would have to be substantially changed or eliminated.

Duration: Short-term effects would be one fiscal year.

Long-term effects would continue beyond one fiscal year indefinitely into the future.

Study Area

The study area for Seashore management and operations is the units of the Outer Banks Group: Cape Hatteras National Seashore, Wright Brothers National Memorial, and Fort Raleigh National Historic Site. All units were considered because of shared staff and funding sources.

Impacts of Alternative A: No-action—Continuation of Management under the Interim Protected Species Management Strategy

Table 82 provides the total staffing and funding needs under alternative A.

TABLE 82. STAFFING AND FUNDING—ALTERNATIVE A

Division	Assumptions	Annual Costs
Seashore Management / Administration	4.75 FTE would be required to account for overhead costs to provide overall program support. No materials would be required.	Staff = \$428,750 Supplemental Costs = \$0 Total Annual Costs = \$428,750
Visitor Protection	13.0 FTE for 13 law enforcement rangers would be required, as well as vehicles to support this staff. No other equipment or materials would be required.	Staff = \$1,047,500 Supplemental Costs = \$100,000 Total Annual Costs = \$1,147,500
Resources Management	9.5 FTE would be needed, which could include one full-time wildlife biologist, seasonal biological technicians, and administrative support. Vehicles, signs, and field gear would be required to support these staff.	Staff = \$423,500 Supplemental Costs = \$85,000 Total Annual Costs = \$508,500
Facility Management	0.6 FTE would be needed, which could include the facility manager, heavy equipment operators, mechanics, and other maintenance workers.	Staff = \$45,600 Supplemental Costs = \$10,000 Total Annual Costs = \$55,600
Interpretation	1.5 FTE would be needed, which could include the division chief, interpretive rangers, and a visual information specialist. Other costs would include printing and distributing informational materials.	Staff = \$58,500 Supplemental Costs = \$10,000 Total Annual Costs = \$68,500
Total Staffing and Annual Costs	29.35 FTE	Total Staff Costs = \$2,003,850 Total Supplemental Costs = \$205,000 Total Annual Costs = \$2,208,850

Seashore Management / Administration. Under alternative A, Seashore management staff would be directly involved in ORV management activities and all divisions would require administrative support. This support reflects overhead costs such as payroll, human resource functions, involvement of the superintendent, and other similar costs. Support would also include assisting in distributing weekly updates of ORV access areas during the spring and summer months. Actions under alternative A would require approximate 4.75 FTE, or almost five full-time staff, to support field operations related to ORV management. Total approximate costs of these staff would be \$428,750 with no additional materials required. Under alternative A, Seashore management and administrative functions related to ORV management would be accomplished within the existing Seashore budget, resulting in long-term negligible adverse impacts to Seashore management and administrative operations at the Seashore.

Visitor Protection. Under alternative A, Seashore law enforcement rangers would be responsible for enforcing visitor compliance with ORV regulations and resource closures. Law enforcement staff would perform routine patrols of beach areas, respond to violations, conduct investigations, and assist in public education through visitor contacts.

No restrictions on night driving would occur; however, 24-hour coverage would not be provided. Resource closures under alternative A would be subject to change on a regular basis, and the areas open to ORV use would be unpredictable, resulting in a need for a high level of enforcement related to ORV management. All recreational users would have access to this area, and there would be variation in the areas available for ORV use, resulting in some users not having advance notice of what areas are open or closed. Under this alternative, the opportunity for resource closure violations would be relatively high due

to this unpredictability. Law enforcement would also continue existing resource protection activities such as fielding violation calls and responding to violation incidents.

In order to accomplish the above activities, as well as enforce all applicable regulations at the Seashore, 13 FTE would be required, which would be filled by law enforcement rangers. Total approximate labor for these positions would equal \$1,047,500 a year with an additional \$100,000 needed for materials (vehicles, travel, field supplies, fuel, radio support, and training costs) for these rangers, for a total approximate annual cost to the law enforcement division of \$1,147,500. The Seashore would use currently available funding to fill the 13 field law enforcement positions, which would be able to address all needs related to ORV management under alternative A.

Under alternative A, visitor protection functions related to ORV management would be accomplished within the existing Seashore budget, resulting in long-term negligible adverse impacts to visitor protection operations at the Seashore.

Resources Management. Under alternative A, resources management staff would be responsible for all monitoring and establishment of buffers for protected birds, turtles, and seabeach amaranth. Resources management staff would also be responsible for determining monitoring requirements, hiring, training and supervising field staff, and conducting all field surveys. These staff would also provide input into the weekly resources management report updates and access updates that are provided to the public.

For birds, resources management staff would be responsible for conducting an annual habitat assessment in February or March of each year and establish prenesting resource closures based on this assessment and the known breeding habitat over the past three years. While these prenesting closures may be used by any species, they would be based on the data and habitat for piping plover only. Surveying of piping plover by resources management staff would begin by March 15 and occur at least once a week, and increase to three times a week on April 1. Other species would be observed twice a week. If no bird activity is observed by July 15, or after the area has been abandoned for a two-week period, whichever comes later, the prenesting closures would be reopened by resources management staff.

After prenesting, surveying requirements of the resources management staff would vary based on the species and the life stage of the species and range from observing unfledged piping plover chicks continuously during daylight hours for the first week, to observing three times a week for courtship and mating behavior (for all bird species). In addition to observations, resources management staff would establish buffers for protection of these bird species, again with the size and adjustments of these closures related to the bird species in question, as well as the life stage of the bird species. These buffers could be relatively stable once established, such as the 150-foot buffer established for nesting piping plovers, or highly variable, such as buffers for nesting American oystercatchers, which would be based on bird disturbance and behavior.

Resources management staff under alternative A would also be responsible for conducting daily surveys for sea turtles nesting from May 1 to September 15 each year, with periodic surveys (e.g., every two to three days) extending to November 15 in areas of high visitation. Once a nest is found, resources management staff would establish a 30-foot by 30-foot buffer around the nest, and expand this closure to the shoreline approximately 50 to 55 days into incubation. Some nest relocation occurs by resources management staff, following the guidance in the NCWRC handbook.

Surveying requirements for seabeach amaranth would occur starting April 1 of each year and would be done during surveying for other species, with an annual survey of potential habitat occurring in August. If a plant is found, resources management staff is responsible for establishing a 30-foot by 30-foot (9.1-meter by 9.1-meter) buffer around the plant.

In addition to regular surveying, monitoring, and establishment of closures, resources management staff would also dedicate time to predator management under alternative A.

In order to accomplish the above activities, the resources management division would require approximately 9.50 FTE, which could include the chief of resources management, a wildlife biologist, seasonal or full-time biological technicians, a GIS specialist, and seasonal administrative assistant support. These positions would equal approximately \$423,500 in labor costs. In order to support these positions, overhead costs, computers, uniforms, vehicles, and other equipment (e.g., signs, field gear, UTVs) would be needed, resulting in approximately \$85,000 in support costs. The total approximate cost of implementing alternative A to the resources management division would be \$508,500.

Under alternative A, resources management functions related to ORV management would be accomplished within the existing Seashore budget, resulting in long-term negligible adverse impacts to resources management operations at the Seashore.

Facility Management. The facility management division at the Seashore would be responsible for all maintenance activities related to ORV management. Facility management personnel would provide routine maintenance and emergency repairs of beach ramps and parking lots and would also be responsible for maintaining the vehicles used by law enforcement, resources management and other staff associated with ORV management related activities. Approximately 0.60 FTE of facility management time would be needed to carry out ORV management activities, equaling approximately \$45,600 of labor. In addition to the labor, approximately \$10,000 of supplies would be required that could include ramp fill material, vehicle parts, and vehicle maintenance supplies. Total annual costs for facilities management staff related to ORV management would be approximately \$55,600.

Under alternative A, facility management functions related to ORV management would be accomplished within the existing Seashore budget, and no other divisions would be impacted by those activities. Impacts to facility management operations at the Seashore would be long-term negligible adverse.

Interpretation. Under alternative A, staff in the interpretation division would provide materials to Seashore visitors related to ORV use, as well as species management. Staff time would be required to develop these materials, as well as funds to print and distribute the materials. Interpretive staff under alternative A could include the division chief, park rangers to provide interpretive programs and manage volunteer programs, and a visual resource specialist to produce articles, displays, brochures, and exhibits. In order to carry out these functions, alternative A would require approximately 1.50 FTE of staff time, equaling approximately \$58,500. Printing and other supporting costs would be approximately \$10,000, resulting in total approximate annual costs of \$68,500 to the interpretive division.

Under alternative A, the Seashore would be able to conduct interpretive activities related to ORV use and species protection within existing funding sources, and no other divisions of the Seashore would be impacted by these operations. Because there would be no change to Seashore operations, there would be long-term negligible adverse impacts to interpretive activities at the Seashore.

Overall Impacts to Seashore Operations. Overall, each division could accomplish actions related to ORV management under this alternative within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts to all areas of Seashore operations.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative A would include implementation of the existing General Management Plan and development of the General Management Plan revision, development of the

predator management plan, implementation of the long-range interpretive plan, implementation of the resources management plan, development of the Interim Strategy, and the implementation of the consent decree modifying the interim protected species management strategy. The creation of these plans and their implementation would require varying levels of staff time. For example, the current implementation of the General Management Plan would have negligible impacts to staff time since this document is dated and much of the management has been replaced by more updated planning documents. The expected revision of the General Management Plan could have minor to moderate impacts to staff resources, depending on the amount of time and resources devoted to this plan/EIS and whether this planning effort detracts from other efforts at the Seashore. The implementation of the consent decree is a current effort that could also have up to moderate impacts to Seashore management and operations since it required additional staff resources from the document it modified. In general, depending on the amount of staff time needed and the number of these efforts occurring at the same time, these planning efforts and their implementation would have long-term negligible to moderate cumulative impacts to Seashore operations and management since it would be expected that existing and future funding sources would provide the required staff for these activities, and in rare instances, staff may be redirected from one activity to another to develop and implement these plans.

Certain ongoing activities within the Seashore also contribute to cumulative impacts including commercial fishing, response to storms and other weather events (including hurricane recovery), and ongoing Seashore operations for law enforcement, research studies, maintenance, and visitor center operations. These activities are generally all accounted for in the current staff and budget of the Seashore and represent negligible adverse impacts to Seashore operations and management. Storms and other weather-related events, including hurricanes, are not regularly scheduled and planned for, and the preparation for and recovery from these events can have short-term moderate to major impacts to Seashore operations since certain functions of Seashore staff may cease while preparation and recovery occurring. As soon as these events and the staff commitment associated with them have passed, there are long-term negligible adverse impacts to Seashore operations.

Past, present, and reasonably foreseeable future construction projects that would have cumulative impacts with alternative A include ongoing dredging of the federally authorized navigation channel at Oregon Inlet and the replacement of Bonner Bridge. Projects being implemented by the NPS (NC-12 improvements and campground upgrades) would require staff time during the planning, implementation, and maintenance, which would be expected to be within the regular duties of Seashore staff, resulting in long-term negligible impacts since additional funding would not be needed and Seashore staff would be able to address regular operations. Those projects being implemented by other agencies in the area would require Seashore staff to coordinate with these agencies; this coordination would be expected to be within the regular duties of Seashore staff, resulting in long-term negligible impacts.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the long-term negligible impacts of alternative A, are expected to have long-term negligible adverse cumulative impacts to Seashore operations and management.

Conclusion. Implementation of alternative A would require approximately 29.35 FTE across Seashore management/administration, visitor protection, resources management, facility management, and interpretation divisions. Staff costs would equal approximately \$2,003,850, with an additional \$205,000 in support costs (e.g., signs, vehicles, materials). Total approximate cost to implement alternative A would be \$2,208,850. All staff and equipment requirements in all divisions would be accommodated by existing funding sources and would not require the Seashore to remove any activities or shift resources around to accommodate ORV management-related activities in these divisions, resulting in long-term negligible impacts to all Seashore operations and management. Cumulative impacts to Seashore operations and management under alternative A would be long-term negligible adverse.

Impacts of Alternative B: No-action—Continuation of Management under Terms of the Consent Decree

Table 83 provides the total staffing and funding needs under alternative B, Continuation of Management under the Consent Decree.

Seashore Management / Administration. Under alternative B, Seashore management staff would be routinely involved in ORV management activities and all divisions would require administrative support. This support reflects overhead costs, such as payroll, human resource functions, involvement of the superintendent, and other similar costs. Support would also include assisting in distributing weekly updates of ORV access areas during the spring and summer months. Actions under alternative B would require approximate 5.35 FTE, or over five full-time Seashore management and administrative staff, to support field operations related to ORV management activities. The total approximate cost of these staff would be \$480,950, with \$3,000 of additional materials required for a total of \$483,950. This increase from alternative A would occur due to the varying requirements for when and how buffers are established. Under alternative B, these buffers are larger and subject to more frequent changes—such as when violations occur—and additional updates completed by management staff would be required. Further administrative effort would be required due to the addition of a nighttime driving permit. Although this permit can be obtained online and at no cost, minimal administrative support would be needed for the hardcopy production and provision to visitors of this permit. Under alternative B, administrative functions related to ORV management would be accomplished within the existing Seashore budget, but would require re-prioritizing work and re-allocating staff time away from other activities, resulting in long-term moderate adverse impacts to Seashore management and administrative operations at the Seashore. These same impacts would be applicable to the administration of the consent decree prior to June 2008, when it was modified.

Visitor Protection. Under alternative B, Seashore law enforcement rangers would be responsible for enforcing visitor compliance with ORV regulations and resource closures. Law enforcement staff would perform routine patrols of beach areas, respond to violations, conduct investigations, and assist in public education through visitor contacts.

Resource closures under alternative B would be larger than those provided under alternative A and would be subject to change on a regular basis, such as when new shorebird breeding is observed or when closures are expanded as a result of deliberate violations or vandalism, resulting in a need for a high level of enforcement related to ORV management. The prohibition of night driving from May 1 through September 15, along with the night driving permit from September 16 through November 15, would require enforcement effort to ensure compliance but would also allow the law enforcement staff to focus its patrol efforts on the hours of allowable use. All recreational users would have access to areas adjacent to resource closures, and there would be variation in the areas available for ORV use, resulting in some users not knowing in advance what areas are open or closed. Under this alternative, the opportunity for resource closure violations would be relatively high due to this unpredictability. Law enforcement would also continue existing resource protection activities such as fielding violation calls and responding to violation incidents.

In order to accomplish the above activities, as well as enforce all applicable regulations at the Seashore, 16.50 FTE would be required, which would be filled by law enforcement rangers. Total approximate labor for these positions would equal \$1,321,500 a year with an additional \$160,000 needed for materials (e.g., vehicles, travel, field supplies, fuel, radio support, and training costs) for these rangers, for a total approximate annual cost to the law enforcement division of \$1,481,500. The increase in effort for law enforcement would be primarily related to the variability of the protected species buffers and secondarily to the implementation of night-driving restrictions, as described above.

TABLE 83. STAFFING AND FUNDING—ALTERNATIVE B

Division	Assumptions	Annual Costs
Seashore Management / Administration	5.35 FTE would be required to account for overhead costs to provide overall program support. No materials would be required.	Staff = \$480,950 Supplemental Costs = \$3,000 Total Annual Costs = \$483,950
Visitor Protection	16.5 FTE would be required, as well as support materials for law enforcement staff such as vehicles, travel, field supplies, fuel, radio support and training.	Staff = \$1,321,500.00 Supplemental Costs = \$160,000 Total Annual Costs = \$1,481,500
Resources Management	15.0 FTE would be needed, which could include one full-time wildlife biologist, full-time and seasonal biological technicians, and administrative support. Vehicles, signs, and field gear would be required to support these staff.	Staff = \$778,000 Supplemental Costs = \$35,000 Total Annual Costs = \$813,000
Facility Management	3.6 FTE would be needed, which could include the facility manager, heavy equipment operators, mechanics, and other maintenance workers.	Staff = \$158,600 Supplemental Costs = \$20,000 Total Annual Costs = \$178,600
Interpretation	3.0 FTE would be needed, which could include the division chief, interpretive rangers, and a visual information specialist. Other costs would include printing and distributing informational materials.	Staff = \$181,500 Supplemental Costs = \$12,000 Total Annual Costs = \$193,500
Total Staffing and Annual Costs	43.45 FTE	Total Staff Costs = \$2,920,550 Total Supplemental Costs = \$230,000 Total Annual Costs = \$3,150,550

The Seashore would use currently available funding to fulfill the 16.5 law enforcement positions, and would be able to address all needs related to ORV management under alternative B, but would require re-prioritizing work and re-allocating staff time away from other activities. With this level of funding and staffing, most field law enforcement staff would spend the majority of their time focused on ORV-management related activities and spend less time patrolling other portions of the Seashore such as roads, campgrounds, and parking areas, resulting in long-term moderate adverse impacts to law enforcement operations under alternative B. These same impacts would be applicable to the administration of the consent decree prior to June 2008, when it was modified.

Resources Management. Under alternative B, resources management staff would be responsible for all monitoring and establishment of buffers for protected birds, turtles, and seabeach amaranth. Resources management staff would also be responsible for determining monitoring requirements, hiring, training and supervising field staff, and conducting all field surveys. These staff would also provide input into the weekly resources management report updates and access updates that are provided to the public.

For birds, the responsibilities of the resources management staff would be the same as those under alternative A, except that for certain species, such as American oystercatchers and breeding colonial waterbirds, buffer distances would be those used under the consent decree, rather than based on best professional judgment. These buffers would continue to vary with the life cycle of the species and would be expanded if violations of the closures are noted. Resources management responsibilities for turtles and seabeach amaranth would be the same under alternative B as under alternative A.

In addition to regular surveying, monitoring, and establishment of closures, resources management staff would also dedicate time to predator management under alternative B.

In order to accomplish the above activities, the resources management division would require approximately 15.0 FTE, which could include the chief of resources management, a wildlife biologist, seasonal or full-time biological technicians, a GIS specialist, and seasonal administrative assistant support. These positions would equal approximately \$778,000 in labor costs. In order to support these positions, overhead costs, computers, uniforms, vehicles, and other equipment (e.g., signs, field gear, UTVs) would be needed, resulting in approximately \$35,000 in support costs. The total approximate cost of implementing alternative B to the resources management division would be \$813,000. The addition of 5.5 FTE under alternative B, when compared to alternative A, results primarily from the need to establish prenesting closures at an earlier date (two weeks earlier for most species) and monitor prenesting areas more frequently than under alternative A, as well as the need to frequently install or modify resource protection areas once shorebird breeding activity is observed. Additional effort would be needed for resources management staff to react to the more variable nature of the resource closures (i.e., expanding buffers for resource violations) and to expand buffers if disturbance to species is noted, per the consent decree. Resources management staff would also have additional responsibilities under alternative B from requirements that direct staff to establish appropriate buffers within eight daylight hours if prenesting and/or breeding behavior is observed for piping plover, American oystercatchers, or colonial waterbirds, as well as enhanced reporting requirements for resources management staff.

Under alternative B, the Seashore would have noticeable changes in staffing of the resources management division and would require re-prioritizing work and re-allocating staff time away from other activities. With this level of funding and staffing, most resources management field staff would spend the majority of their time focused on ORV management-related species management activities and would have little time to address other field resources management needs, resulting in long-term moderate adverse impacts to resources management activities in the Seashore. These same impacts would be applicable to the administration of the consent decree prior to June 2008, when it was modified.

Facility Management. The facility management division at the Seashore would be responsible for all maintenance activities related to ORV management. Facility management personnel would provide routine maintenance and emergency repairs of beach ramps and parking lots and be responsible for maintaining the vehicles used by law enforcement, resources management and other staff associated with ORV management-related activities. Approximately 3.6 FTE of facility management time would be needed to carry out ORV management related activities, equaling approximately \$158,600 of labor. In addition to the labor, approximately \$20,000 of supplies would be required that could include ramp fill material, vehicle parts, and vehicle maintenance supplies. Total annual costs for facility management staff related to ORV management would be approximately \$178,600. Under alternative B, the increase in maintenance responsibilities, when compared to alternative A, would be primarily related increased maintenance of ramps and interdunal roads in high ORV use areas.

Under alternative B, the Seashore would be able to conduct facility management activities related to ORV use within existing funding sources, and no other divisions of the Seashore would be impacted by these operations. Because there would be no significant change to Seashore facility management activities, impacts to facility management operations at the Seashore would be long-term negligible adverse. These same impacts would be applicable to the administration of the consent decree prior to June 2008, when it was modified.

Interpretation. Under alternative B, staff in the interpretation division would provide materials to Seashore visitors related to ORV use, as well as species management. Staff time would be required to develop these materials, as well as funds to print and distribute the materials. Interpretive staff under

alternative B could include the division chief, park rangers to provide interpretive programs and manage volunteer programs, and a visual resource specialist to produce articles, displays, brochures, and exhibits. In order to carry out these functions, alternative B would require approximately 3.0 FTE of staff time, equaling approximately \$181,500. Printing and other supporting costs would be approximately \$12,000, resulting in total approximate annual costs of \$193,500 to the interpretive division. Compared to alternative A, specific activities that would require additional staff under alternative B would include assisting in preparing the educational materials that are related to restrictions on nighttime driving, providing additional educational materials on species management and any associated user restrictions, providing protected species information at ORV access points, redesigning and updating the beach access brochure, and continually updating the park's website with access information.

Under alternative B, interpretive functions related to ORV management would be accomplished within the existing Seashore budget, resulting in long-term negligible adverse impacts to interpretive operations at the Seashore. These same impacts would be applicable to the administration of the consent decree prior to June 2008, when it was modified.

Overall Impacts to Seashore Operations. Overall, there would be an increase in duties related to ORV management for staff in the Seashore management/administration, visitor protection, and resources management divisions. Although these staff could accomplish these duties with existing budgets, it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the park outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the facility management and interpretation divisions would not see a large change in operations and would be able to accomplish ORV management related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts to these two divisions.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative B would be the same as those under alternative A and would include the implementation of various plans and policies, which would require varying levels of staff time for plan production and implementation.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the long-term negligible to moderate impacts of alternative B, are expected to have long-term negligible to minor adverse cumulative impacts to Seashore operations and management.

Conclusion. Implementation of alternative B would require approximately 43.45 FTE across the Seashore management, administration, visitor protection, resources management, facilities management, and interpretation divisions. Staff costs would equal approximately \$2,920,950, with an additional \$230,000 in support costs (e.g., signs, vehicles, materials). Total approximate cost to implement alternative B would be \$3,150,550. All staff and equipment requirements in all divisions would be accommodated by existing and expected funding sources; however, alternative B would require that some divisions re-prioritize work and re-allocate staff time away from other activities in order to accommodate ORV management related activities. Overall, impacts to Seashore operations would be long-term moderate adverse.

Cumulative impacts to Seashore operations and management under alternative B would be long-term negligible to minor adverse impacts.

Impacts of Alternative C: Seasonal Management

Table 84 provides the total staffing and funding needs under alternative C, Seasonal Management.

TABLE 84. STAFFING AND FUNDING—ALTERNATIVE C

Division	Assumptions	Annual Costs
Seashore Management / Administration	4.60 FTE would be required, as well as materials, to account for overhead costs to provide overall program support.	Staff = \$363,200 Supplemental Costs = \$16,900 Total Annual Costs = \$380,100
Visitor Protection	21.7 FTE would be required for law enforcement and visitor use assistant (VUA) staff, as well as support materials for this staff such as vehicles, travel, field supplies, fuel, radio support and training.	Staff = \$1,529,900 Supplemental Costs = \$177,000 Total Annual Costs = \$1,706,900
Resources Management	12.6 FTE would be needed, which could include one full-time wildlife biologist, full-time and seasonal biological technicians, and administrative support. Vehicles, signs, and field gear would be required to support these staff.	Staff = \$645,000 Supplemental Costs = \$59,000 Total Annual Costs = \$704,000
Facility Management	3.80 FTE would be needed, which could include the facility manager, heavy equipment operators, mechanics, and other maintenance workers.	Staff = \$173,800 Supplemental Costs = \$25,000 Total Annual Costs = \$198,800
Interpretation	3.00 FTE would be needed, which could include the division chief, interpretive rangers, and a visual information specialist. Other costs would include printing and distributing informational materials.	Staff = \$181,500 Supplemental Costs = \$12,000 Total Annual Costs = \$193,500
Total Staffing and Annual Costs	45.7 FTE	Total Staff Costs = \$2,893,400 Total Supplemental Costs = \$289,900 Total Annual Costs = \$3,183,300

Seashore Management / Administration. Under alternative C, park management staff would be routinely involved in ORV management activities and all divisions would require administrative support. This support reflects overhead costs, such as payroll, human resource functions, involvement of the superintendent, and other similar costs. Support would also include assisting in distributing weekly updates of ORV access areas during the spring and summer months, as well as assisting in the administration of the ORV permit system. Actions under alternative C would require approximately 4.60 FTE, or approximately four and a half full-time Seashore management and administrative staff, to support field operations related to ORV management. The total approximate cost of these staff would be \$363,200, with an additional \$16,900 required for materials. This increase over the no-action alternatives would occur related to the various new programs requiring administrative assistance that would be implemented under alternative C. One such program is the ORV permit, which has a fee subject to cost recovery, that would be distributed in-person or online. Development and administration of the ORV permit system would require Seashore management and administrative staff support. This permit system would also include an educational component requiring the user to pass a basic knowledge test, the administration of which would require support from administrative staff.

Alternative C also includes the potential for alternative transportation, such as a beach shuttle, through the consideration of a commercial use authorization, which is a type of permit. Seashore management support would be required to process and follow up with these permit applications. A requirement for a beach fire permit under alternative C would also require administrative support. In addition to these new requirements, administrative staff would continue to assist with the distribution of weekly resources

closure and ORV access updates during the summer breeding season, which may be more consistent since alternative C includes the use of seasonal ORV restrictions in all SMAs, rather than just buffers that vary based on bird behavior.

Under alternative C, the above-described Seashore management and administrative functions related to ORV management would be accomplished within the existing Seashore budget, but would require re-prioritizing work and re-allocating staff time away from other activities, resulting in long-term minor adverse impacts to Seashore management and administrative operations at the Seashore.

Visitor Protection. Under alternative C, Seashore law enforcement rangers would be responsible for enforcing visitor compliance with ORV regulations and resource closures. Law enforcement staff would perform routine patrols of beach areas, respond to violations, conduct investigations, and assist in public education through visitor contacts. Alternative C would expand the responsibilities of law enforcement staff since new regulations would be implemented, as described further below.

Under alternative C, resource closures would be implemented on a seasonal basis and remain constant. With more consistency, it would be expected that the number of resource violations would decline from current levels since Seashore users would know what to expect, and accidental resource violations related to not being aware of their location would, in turn, be less. This would reduce the level of effort required by law enforcement staff related to resource violations under alternative C.

Alternative C would implement additional or new Seashore regulations such as requiring an ORV use permit, lowering the speed limit, adding restrictions related to pets and horses, requiring a beach fire permit, monitoring possible beach shuttle permittees, and establishing vehicle characteristic and equipment requirements. These additional responsibilities would require law enforcement staff involvement to ensure compliance with these policies and to contact violators as needed, and would include the authority to revoke ORV use permits. The level of effort related to implementing these new policies would be expected to be greater when they are first implemented, while they would become less time-consuming as Seashore visitors become accustomed to them. In addition, law enforcement staff would continue to perform their existing resource protection activities, such as fielding resource violation calls and responding to violation incidents.

Alternative C would also include seasonally prohibiting night driving from 7:00 p.m. to 7:00 a.m. from May 1 to November 15. This change would be a long-term benefit for law enforcement staff since during those dates it would allow the Seashore to focus law enforcement coverage on peak use periods during daylight hours. Additional law enforcement effort under alternative C would be required to enforce carrying capacity within each ranger district when the “peak use limit” is reached, as detailed in table 13 in chapter 2. Law enforcement rangers would also be responsible for identifying and implementing the established standards for safety closures under alternative C, resulting in more staff time when these situations are identified.

The implementation of the ORV permit system would require the establishment of a web-based permit issuing process, as well as local permit issuing stations staffed with sufficient VUAs to provide coverage seven days a week year-round.

In order to accomplish the above activities, which includes enforcing all applicable regulations at the Seashore, as well as implementing the ORV permit system, 21.7 FTE would be required and would be filled primarily by law enforcement rangers and VUAs. Total approximate labor for these positions would equal \$1,529,900 a year with an additional \$177,000 needed for materials (e.g., vehicles, travel, field supplies, fuel, radio support, and training costs) for these rangers, for a total approximate annual cost to the law enforcement division of \$1,706,900. The increase in effort for visitor protection would be

primarily related to the implementation and enforcement of new regulations and policies at the Seashore, as well as implementation of an ORV permit system, as described above.

The additional demand on Seashore law enforcement staff would be noticeable and require the re-prioritization of work and the re-allocation of staff time away from other activities. The establishment of year-round VUA staffing to implement the ORV permit system would be an additional new program to administer under alternative C. The Seashore would use currently available funding and expected revenues from ORV permit fees, which would be based on cost recovery, to provide the 21.7 FTEs needed to address these ORV management responsibilities. With this level of funding and staffing, most field law enforcement staff would spend the majority of their time focused on ORV-management related activities and spend less time patrolling other portions of the Seashore such as roads, campgrounds, and parking areas, resulting in long-term moderate adverse impacts to law enforcement operations under alternative C.

Resources Management. Under alternative C, resources management staff would be responsible for all monitoring and establishment of buffers for protected birds, turtles, and seabeach amaranth. Resources management staff would also be responsible for determining monitoring requirements, hiring, training and supervising field staff, and conducting all field surveys. These staff would also provide input into the weekly resources management report updates and access updates that are provided to the public. Resources management under alternative C would have elements related to seasonal closures, which would reduce the need to move resource closures around in response to species behavior and reduce the amount of effort needed by resources management staff when compared to management under alternative B. By seasonally closing some areas of known habitat to ORV use such as Bodie Island Spit, Cape Point, Hatteras Inlet Spit, and South Point, resources management staff would need to install, modify and remove resource closures much less frequently than under alternatives A or B.

Beyond more predictable resource closures, resources management staff would continue to have monitoring responsibilities. Areas that are designated for the use of ML2 measures under alternative C—such as Bodie Island Spit, Cape Point, and South Point—would require daily monitoring when pedestrians are allowed to access these areas, even during the seasonal closure to ORV. Areas subject to ML1 measures—the remaining areas closed to ORV and pedestrian use—would be surveyed at least three times a week. While resources management staff would have fewer demands from moving/adjusting closures under alternative C, efforts related to monitoring, particularly those areas designated for ML2 measures would generally increase. NPS resources management staff would also have additional responsibilities related to collecting data to evaluate the action in relation to the adaptive management strategy. Areas that would be studied are detailed in table 10 in chapter 2. Sea turtle and seabeach amaranth management activities under alternative C would be similar to those under the no-action alternatives and would not be expected to change the level of effort spent by resources management staff on these activities.

In addition to regular surveying, monitoring, and establishment of closures, resources management staff would also dedicate time to predator management under alternative C.

In order to accomplish the above activities, the resources management division would require approximately 12.6 FTE, which could include the chief of resources management, a wildlife biologist, seasonal or full-time biological technicians, a GIS specialist, and seasonal administrative assist support. These positions would equal approximately \$645,000 in labor costs. In order to support these positions, overhead costs, computers, uniforms, vehicles, and other equipment (e.g., signs, field gear, ATVs/UTVs) would be needed, resulting in approximately \$59,000 in support costs. The total approximate cost of implementing alternative C to the resources management division would be \$704,000. When compared to the no-action alternatives, alternative C would require more FTE than alternative A, due to more intensive

monitoring requirements, but less FTE than alternative B, primarily due to the decrease in staff time related to adjusting resource closures.

Under alternative C, the Seashore would not have a substantial change in staffing in the resources management division and would be able to accommodate staffing needs using existing or expected funding. With this level of funding and staffing, most resources management field staff would spend the majority of their time focused on ORV-management related species management activities and would have little time to address other field resources management needs, resulting in long-term negligible to minor adverse impacts to resources management activities in the Seashore.

Facility Management. The facility management division at the Seashore would be responsible for all maintenance activities under alternative C related to ORV management. Facility management personnel would provide routine maintenance and emergency repairs of beach ramps and parking lots and also be responsible for maintaining the vehicles used by law enforcement, resources management and other staff associated with ORV management related activities.

Under alternative C, parking lots would be added at certain areas to provide additional access for pedestrian use, which would require additional staff time by facilities management to establish and maintain. Additional toilet facilities and trash receptacles in high-use locations would also require frequent maintenance that would add to the responsibilities of facility management staff. Alternative C would establish a system for providing additional maintenance to interdunal roads, as well as specifications for the width and condition of ramps to the beach, which would require more time for the maintenance division to carry out the interdunal road maintenance and ensure all ramps meet the new standard. Likewise, the extension of the South Beach interdunal road called for under alternative C would require additional staff time for the actual extension, as well as the maintenance of this area.

Approximately 3.8 FTE of facility management time would be needed to carry out ORV management related activities, equaling approximately \$173,800 of labor. In addition to the labor, approximately \$25,000 of supplies would be required that could include ramp fill material, vehicle parts, and vehicle maintenance supplies. Total annual costs for facility management staff related to ORV management would be approximately \$198,800. Under alternative C, the increase in maintenance responsibilities, when compared to no-action alternatives, would be primarily related to the expanded maintenance requirements for ramps and interdunal roads.

Under alternative C, the Seashore would generally be able to conduct facility management activities related to ORV management within existing and expected funding sources, but would require re-prioritizing work and re-allocating staff time from other maintenance activities. No other divisions of the Seashore would be significantly impacted by these operations although there would be some noticeable changes to facilities management operations. Impacts to facility management operations at the Seashore would be long-term minor adverse.

Interpretation. Under alternative C, interpretation division staff responsibilities would be the same as those detailed under alternative B. In order to carry out these functions, alternative C would require approximately 3.0 FTE of staff time, equaling approximately \$181,500. Printing and other supporting costs would be approximately \$12,000, resulting in total approximate annual costs of \$193,500 to the interpretive division. Compared to alternative A, specific activities that would require additional staff under alternative C would include assisting in preparing the educational materials that are related to restrictions on nighttime driving, and providing additional educational materials on species management and any associated user restrictions.

Under alternative C, the Seashore would generally be able to conduct interpretive activities related to ORV use and species protection within existing funding sources and no other divisions of the Seashore would be impacted by these operations. Impacts to interpretive activities at the Seashore would be long-term negligible adverse.

Overall Impacts to Seashore Operations. Overall, there would be an increase in duties related to ORV management for staff in the Seashore management/administration, resources management, and facility management divisions that could result in some re-prioritization of work, but would not be expected to impact overall duties, resulting in long-term minor adverse impacts. In the visitor protection division, staff could accomplish their duties with existing budgets, but it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the interpretation division would not see a large change in operations and would be able to accomplish ORV related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative C would be the same as those under alternative A and would include the implementation of various plans and policies that would require varying levels of staff time for plan production and implementation.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the long-term negligible to moderate impacts of alternative C, are expected to have long-term minor to moderate adverse cumulative impacts to Seashore operations and management.

Conclusion. Implementation of alternative C would require approximately 45.70 FTE across the Seashore management/administration, visitor protection, resources management, facility management, and interpretation divisions. Staff costs would equal approximately \$2,893,400, with an additional \$289,900 in support costs (e.g., signs, vehicles, materials). Total approximate cost to implement alternative C would be \$3,183,300. All staff and equipment requirements in all divisions would be accommodated by existing and expected funding sources including ORV permit revenue, and would require that some divisions re-prioritize work and re-allocate staff time to accommodate ORV management activities. Overall, impacts to Seashore operations would be long-term minor to moderate (but mostly minor) adverse.

Cumulative impacts to Seashore operations and management under alternative C would be long-term minor to moderate adverse.

Impacts of Alternative D: Increased Predictability and Simplified Management

Table 85 provides the total staffing and funding needs under alternative D, Increased Predictability and Simplified Management.

TABLE 85. STAFFING AND FUNDING—ALTERNATIVE D

Division	Assumptions	Annual Costs
Seashore Management / Administration	4.35 FTE would be required, as well as materials, to account for overhead costs to provide overall program support.	Staff = \$343,950 Supplemental Costs = \$16,900 Total Annual Costs = \$360,850
Visitor Protection	22.5 FTE would be required for law enforcement and VUA staff, as well as support materials for this staff such as vehicles, travel, field supplies, fuel, radio support and training.	Staff = \$1,591,500 Supplemental Costs = \$177,000 Total Annual Costs = \$1,768,500
Resources Management	11.0 FTE would be needed, which could include one full-time wildlife biologist, full-time and seasonal biological technicians, and administrative support. Vehicles, signs, and field gear would be required to support these staff.	Staff = \$586,500 Supplemental Costs = \$63,000 Total Annual Costs = \$649,500
Facility Management	3.60 FTE would be needed, which could include the facility manager, heavy equipment operators, mechanics, and other maintenance workers.	Staff = \$158,600 Supplemental Costs = \$20,000 Total Annual Costs = \$178,600
Interpretation	3.00 FTE would be needed, which could include the division chief, interpretive rangers, and a visual information specialist. Other costs would include printing and distributing informational materials.	Staff = \$181,500 Supplemental Costs = \$12,000 Total Annual Costs = \$193,500
Total Staffing and Annual Costs	44.55 FTE	Total Staff Costs = \$2,862,050 Total Supplemental Costs = \$288,900 Total Annual Costs = \$3,150,950

Seashore Management / Administration. Under alternative D, Seashore management staff would be periodically involved in ORV management activities and all divisions would require administrative support. This support reflects overhead costs, such as payroll, human resource functions, involvement of the superintendent, and other similar costs. Support would also include assisting in distributing weekly updates of ORV access areas during the spring and summer months, as well as assisting in the development and administration of the ORV permit system. Alternative D would not include the consideration of commercial use permits for alternative transportation—such as a beach shuttle—or beach fire permits, and therefore there would be no responsibilities for the administrative division related to these activities.

Actions under alternative D would require approximate 4.35 FTE, or approximately four and a third full-time administrative staff, to support field operations related to ORV management. Total approximate costs of these staff would be \$343,950, with additional \$16,900 required for materials. This increase over the no-action alternatives would be related to the various new programs requiring administrative assistance that would be implemented under alternative D. One such program is the ORV permit, which has a fee subject to cost recovery, that would be distributed in-person or online. Cost-recovery would be expected to be lower than other alternatives as the permit program would be less involved. Production and distribution of this permit would require administrative staff support. This permit system would be relatively simple to administer since there would be no testing component, only a requirement that the recipient read the rules and sign a statement that they understand the conditions of the permit.

In addition to these new requirements, Seashore management and administrative staff would continue to assist with the distribution of weekly resources closure and ORV access updates during the summer breeding season. Closure and access would be more consistent since alternative D focuses on simplified management that leaves sensitive resource areas closed to ORV use year-round, rather than on buffers that vary based on bird behavior or seasonal management. Night driving would be restricted from 7:00 p.m. to 7:00 a.m. under alternative D, but would not require a separate permit that would necessitate administrative support, and would not undergo periodic review that would require administrative time of the superintendent.

The year-round designation of ORV areas and non-ORV areas would result in fewer changes to beach access status and simplify the public information function compared to other alternatives, though this would not necessarily affect other administrative functions. The Seashore would use currently available funding and expected revenues from ORV permit fees, which would be based on cost recovery, to provide the 4.35 FTE needed to address these ORV management responsibilities, resulting in long-term negligible adverse impacts to Seashore management and administrative operations at the Seashore.

Visitor Protection. Under alternative D, Seashore law enforcement rangers would be responsible for enforcing visitor compliance with ORV regulations and resource closures, many of which would occur year-round in resources management areas known as SMAs. Law enforcement staff would perform routine patrols of beach areas, respond to violations, conduct investigations, and assist in public education through visitor contacts. Alternative D would expand some of the responsibilities of law enforcement staff since a few additional regulations would be implemented; however, the year-round designation of ORV areas and non-ORV areas would simplify and reduce the overall law enforcement workload, as described further below.

Under alternative D, resource protection would be simplified and remain constant, in part, through the year-round designation of SMAs as non-ORV areas. With more consistency, it would be expected that the number of resource violations would decline from current levels since Seashore users would know what to expect, and accidental resource violations related to not being aware of their location would in turn be less. This would reduce the level of effort required by law enforcement staff related to violator contacts under alternative D. Implementation of law enforcement duties would further be simplified by eliminating designations for safety or administrative closures, which law enforcement previously would have had to implement.

Alternative D would implement additional or new regulations such as requiring an ORV use permit, lowering the speed limit, adding restrictions related to pets (but not horses), and implementing vehicle characteristic and equipment requirements. These additional responsibilities would require law enforcement staff involvement in ensuring that these policies are being adhered to and contacting violators when necessary, and would include the authority to revoke ORV use permits. The level of effort related to implementing these new policies would be expected to be greater when they are first implemented, while they would become less time-consuming as Seashore users become accustomed to them. In addition, law enforcement would also continue existing resources management related activities such as fielding violation calls and responding to violation incidents.

Alternative D would also include seasonally prohibiting night driving from 7:00 p.m. to 7:00 a.m. from May 1 to November 15. This change would be a long-term benefit for law enforcement staff since during those dates it would allow the Seashore to focus law enforcement coverage on peak use periods during daylight hours. Additional law enforcement effort under alternative D would also be required to enforce the single row parking limitation when necessary, as detailed in table 13 in chapter 2.

The implementation of the ORV permit system would require the establishment of a web-based permit issuing process, as well as local permit issuing stations staffed with sufficient VUAs to provide coverage seven days a week year-round.

In order to accomplish the above activities, as well as enforce all applicable regulations at the Seashore, 22.5 FTE would be required, which would be filled by law enforcement rangers and VUAs. Total approximate labor for these positions would equal \$1,591,500 a year with an additional \$177,000 needed for materials (e.g., vehicles, travel, field supplies, fuel, radio support, and training costs) for these rangers, for a total approximate annual cost to the visitor protection division of \$1,768,500. The increase in visitor protection effort would be primarily related to the implementation and enforcement of new ORV regulations and policies at the Seashore, as well as implementation of an ORV permit system, as described above.

The year-round designation of ORV areas and non-ORV areas would simplify law enforcement operations and the establishment of year-round VUA staffing to implement the ORV permit system would be an additional new program to administer under alternative D. The Seashore would use currently available funding and expected revenues from ORV permit fees, which would be based on cost recovery, to provide the 22.5 FTE needed to address these ORV management responsibilities. With this level of funding and staffing, impacts to visitor protection operations under alternative D would be long-term negligible adverse.

Resources Management. Under alternative D, resources management staff would be responsible for all monitoring and establishment of buffers for protected birds, turtles, and seabeach amaranth. Resources management staff would also be responsible for determining monitoring requirements, hiring, training and supervising field staff, and conducting all field surveys. These staff would also provide input into the weekly resources management report updates and access updates that are provided to the public. Resources management effort under alternative D would be centered on monitoring throughout the Seashore. All SMAs would be designated as non-ORV areas year-round and would all be managed using the ML1 measures during the breeding season, which would result in less frequent monitoring compared to ML2 measures for some SMAs under alternative C. Survey frequency would be reduced under ML1 measures in the SMAs, because with the year-round non-ORV designation, the potential for impacts to the species from human disturbance would be decreased and the need to survey daily would be decreased. Examples of this reduced level of staffing required can be seen in the observation of unfledged chicks. In areas using ML1 measures, piping plover broods would be observed once a day, whereas in area subject to management under the ML2 measures, they would be observed at least one hour each in the a.m. and p.m. daily. Similarly for American oystercatcher broods, under alternative D they would be observed every other day, rather than once daily for at least a half hour. This reduction in monitoring effort in the SMAs during the breeding season would occur for resources management staff across all species. The year-round designation of all SMAs as year-round non-ORV areas would also significantly reduce the number and frequency of resource closures that the resources management staff would need to install, modify, and maintain.

Resources management staff would have additional responsibilities related to collecting data to evaluate the action in relation to the adaptive management strategy. Areas that would be studied are detailed in table 10 in chapter 2. Sea turtle and seabeach amaranth management activities under alternative D would be similar to those under the no-action alternatives and would not be expected to change the level of effort spent by resources management staff on these activities.

In addition to regular surveying, monitoring, and establishment of closures, resources management staff would also dedicate time to predator management under alternative D.

In order to accomplish the above activities, the resources management division would require approximately 11.1 FTE, which could include the chief of resources management, a wildlife biologist, seasonal or full-time biological technicians, a GIS specialist, and seasonal administrative assistant support. These positions would equal approximately \$586,500 in labor costs. In order to support these positions, overhead costs, computers, uniforms, vehicles, and other equipment (e.g., signs, field gear, ATVs/UTVs) would be needed, resulting in approximately \$63,000 in support costs. The total approximate cost of implementing alternative D to the resources management division would be \$649,500. When compared to the no-action alternatives, alternative D would require more FTE than alternative A, but less FTE than alternative B, primarily due to the decrease in staff time related to adjusting resource closures.

Under alternative D, the Seashore would not have a noticeable change to staffing in the resources management division and would be able to accommodate staffing needs using existing or expected funding. Because any change to Seashore operations of the resources management division could be accommodated with expected funding and noticeable changes are not expected, impacts to resources management activities at the Seashore would be long-term negligible adverse.

Facility Management. The facility management division at the Seashore would be responsible for all maintenance activities under alternative D related to ORV management. Facility management personnel would provide routine maintenance and emergency repairs of beach ramps and parking lots and would also be responsible for maintaining the vehicles used by law enforcement, resources management and other staff associated with ORV management-related activities.

Under alternative D, parking lots would be added at certain areas to provide additional access for pedestrian use, which would require additional staff time by facility management to establish and maintain. Additional toilet facilities and trash receptacles in high-use locations would also require frequent maintenance that would add to the responsibilities of facility management staff. Alternative D would not include a system for providing additional maintenance to interdunal roads but would establish specifications for the width and condition of ramps to the beach, which would require more time for the facility management division to ensure all ramps meet the new standard. No interdunal roads would be extended under alternative D, and no requirements would be added to this division.

Approximately 3.6 FTE of facility management time would be needed to carry out ORV management activities, equaling approximately \$156,600 of labor. In addition to the labor, approximately \$20,000 of supplies would be required that could include ramp fill material, vehicle parts, and vehicle maintenance supplies. Total annual costs for facility management staff related to ORV management would be approximately \$176,600. Under alternative D, the increase in maintenance responsibilities, when compared to no-action alternatives, would be primarily related to the expanded maintenance requirements for ramps. Since there would be no program for maintenance of the interdunal road, or establishment of new interdunal roads, there would be a slight reduction on the demand to facility maintenance staff when compared to other alternatives.

Under alternative D, the Seashore would be able to conduct facility management activities related to ORV use within existing funding sources, and no other divisions of the Seashore would be impacted by these operations. Because there would be no change to Seashore operations, impacts to facility management operations at the Seashore would be long-term negligible adverse.

Interpretation. Under alternative D, interpretation division staff responsibilities would be the same as those detailed under alternative B. In order to carry out these functions, alternative D would require approximately 3.0 FTE of staff time, equaling approximately \$181,500. Printing and other supporting costs would be approximately \$12,000, resulting in total approximate annual costs of \$193,500 to the

interpretive division. Compared to alternative A, specific activities that would require additional staff under alternative D would include assisting in preparing the educational materials that are related to restrictions on nighttime driving, and providing additional educational materials on species management and any associated user restrictions. Alternative D would also include preparing materials for the simplified permit system, and the resources management staff would contribute to the materials provided to ORV users.

Under alternative D, the Seashore would be able to conduct interpretive activities related to ORV use and species protection within existing funding sources, and no other divisions of the Seashore would be impacted by these activities. Impacts to interpretive operations at the Seashore would be long-term negligible adverse.

Overall Impacts to Seashore Operations. Overall, there would long-term negligible adverse impacts to all divisions as each division would be expected to execute their duties from existing, or expected, funding sources, without having to re-prioritize staff. These impacts are due, in part, to the expected cost recovery under the proposed permit program.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative D would be the same as those under alternative A and would include the implementation of various plans and policies that would require varying levels of staff time for plan production and implementation.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the long-term negligible impacts of alternative D, are expected to have long-term negligible adverse cumulative impacts to Seashore operations and management.

Conclusion. Implementation of alternative D would require approximately 44.55 FTE across the Seashore management/administration, visitor protection, resources management, facility management, and interpretation divisions. Staff costs would equal approximately \$2,862,050, with an additional \$288,900 in support costs (e.g., signs, vehicles, materials). Total approximate costs to implement alternative D would be \$3,150,950. Staff and equipment requirements in all divisions would be accommodated by existing and expected funding sources and would not require the Seashore to remove any activities or shift resources around to accommodate ORV management activities, resulting in long-term negligible adverse impacts.

Cumulative impacts to Seashore operations and management under alternative D would be long-term negligible adverse.

Impacts of Alternative E: Variable Access and Maximum Management

Table 86 provides the total staffing and funding needs under alternative E, Variable Access and Maximum Management.

TABLE 86. STAFFING AND FUNDING—ALTERNATIVE E

Division	Assumptions	Annual Costs
Seashore Management / Administration	4.60 FTE would be required, as well as materials, to account for overhead costs to provide overall program support.	Staff = \$363,200 Supplemental Costs = \$19,900 Total Annual Costs = \$383,100
Visitor Protection	27.4 FTE would be required for law enforcement and VUA staff, as well as support materials for this staff such as vehicles, travel, field supplies, fuel, radio support and training.	Staff = \$1,970,300 Supplemental Costs = \$234,400 Total Annual Costs = \$2,204,700
Resources Management	16.4 FTE would be needed, which could include one full-time wildlife biologist, full-time and seasonal biological technicians, and administrative support. Vehicles, signs, and field gear would be required to support these staff.	Staff = \$854,200 Supplemental Costs = \$70,000 Total Annual Costs = \$924,200
Facility Management	3.90 FTE would be needed, which could include the facility manager, heavy equipment operators, mechanics, and other maintenance workers.	Staff = \$181,400 Supplemental Costs = \$30,000 Total Annual Costs = \$211,400
Interpretation	3.00 FTE would be needed, which could include the division chief, interpretive rangers, and a visual information specialist. Other costs would include printing and distributing informational materials.	Staff = \$181,500 Supplemental Costs = \$12,000 Total Annual Costs = \$193,500
Total staffing and Annual Costs	55.3 FTE	Total Staff Costs = \$3,550,600 Total Supplemental Costs = \$365,900 Total Annual Costs = \$3,916,500

Seashore Management / Administration. Under alternative E, Seashore management staff would be routinely involved in ORV management activities and all divisions would require administrative support. This support reflects overhead costs, such as payroll, human resource functions, involvement of the superintendent, and other similar costs. Support would also include assisting in distributing weekly updates of ORV access areas during the spring and summer months, as well as assisting in the administration of the ORV permit system and administration of permits for any new proposed alternative transportation, such as a beach shuttle. Actions under alternative E would require approximately 4.60 FTE, or approximately four and a half full-time Seashore management and administrative staff, to support field operations related to ORV management. Total approximate costs of these staff would be \$363,200, with additional \$19,900 required for materials. This increase over the no-action alternatives would be related to the various new programs requiring Seashore management involvement or administrative assistance that would be implemented under alternative E.

Closures and access may be more consistent than in the no-action alternatives, but would still be variable since pass-through corridors would be located in areas subject to ML2 measures, and these areas would be subject to closure when species are present. Night driving would be restricted from 10:00 p.m. to 6:00 a.m. under alternative E, as currently occurs under alternative B.

New programs, such as a variety of permits, would increase the complexity of ORV management program and increase the need for public information updates. Permits would include an annual and a weekly ORV permit, which has a fee subject to cost recovery, that would be distributed in-person or on-

line. This permit system would also include an educational component requiring the user to pass a basic knowledge test, which would require support from administrative staff. In addition to the ORV permits, this alternative would include permits to park-and-stay overnight at designated locations during the breeding season, permits for off-season SCV camping, beach fire permits, and the potential for commercial use authorizations (a type of permit), for alternative transportation such as a water taxi service to designated locations. Development and administration of the various permit systems, as well as providing information and updates to the public would require frequent Seashore management involvement and periodic administrative staff support, which would increase the workloads of the respective staff.

Under alternative E, the above-described Seashore management and administrative functions related to ORV management would be accomplished within the existing Seashore budget, but would require re-prioritizing work and re-allocating staff time from other activities, resulting in long-term minor to moderate adverse impacts to Seashore management and administrative operations at the Seashore.

Law Enforcement. Under alternative E, Seashore law enforcement rangers would be responsible for enforcing visitor compliance with ORV regulations and resource closures. Law enforcement staff would perform routine patrols of beach areas, respond to violations, conduct investigations, and assist in public education through visitor contacts. Alternative E would considerably expand the responsibilities of law enforcement staff since new regulations would be implemented, a variety of permits would be issued that require field monitoring and enforcement, pass-through corridors would be utilized during the breeding season at some resource sensitive locations, and the hours of allowable night driving during the breeding season would expand compared to alternatives C and D, as described further below. Under alternative E, certain responsibilities related to law enforcement would be the same as those under alternative C, including new policies requiring beach fire permits, restrictions on horses and pets, implementation of an ORV permit system with a testing requirement and a provision that the permit can be revoked by for a violations of the permit terms and conditions, and implementation of vehicle and equipment requirements for ORV drivers. Alternative E would add additional policy elements that the law enforcement staff would be responsible for implementing, including a prohibition on motorcycle use on the beach.

Alternative E would include seasonally prohibiting night driving from 10:00 p.m. to 6:00 a.m. from May 15 to November 15. Starting November 15, selected ORV routes with low density or no turtle nests would reopen to nighttime use. The nighttime restrictions would not result in additional law enforcement efforts when compared to alternative B since the hours of the restriction are the same; however, additional effort could be required to patrol those areas that are, or are not, open to use after November 15.

Under alternative E, resource closures would be implemented on a seasonal basis at high use areas such as Bodie Island Spit, Cape Point, Hatteras Inlet Spit, and South Point, with ORV use allowed in a corridor in ML2 areas. This ORV corridor would be subject to closures in response to observed species breeding and/or fledging activities. Village beaches that permit ORV use in the winter would require a minimum beach width of 65.6 feet (20 meters) or the village beach would not be available for ORV use. While this strategy would provide for maximum flexibility, based on past and current conditions of these beaches, it is expected that some of the village beaches would not meet the criteria to be opened; therefore, this strategy could result in unpredictability regarding which ORV routes and areas would be open for use at any given time. A lack of consistency would be expected to lead to more visitors entering resource closures accidentally because of lack of knowledge regarding which areas are open and which areas are not. This would be expected to lead to an increased effort by law enforcement staff to inform visitors of what areas are open, and to patrol the closures to ensure violations are not occurring. In addition, law enforcement staff would also continue to field violation calls and respond to violation incidents.

Additional law enforcement effort under alternative E would also be required to enforce carrying capacity within each ranger district when the “peak use limit” is reached, as detailed in table 13 in chapter 2. Law enforcement rangers would also be responsible for identifying and implementing the established standards for safety closures under alternative E, resulting in more staff time when these situations are identified.

Alternative E includes new corridors and closures that would be patrolled by law enforcement staff. These areas include the ORV corridor in areas managed using the ML2 measures and the closure of soundside ramps where there is no boat launch access.

Alternative E would also include the establishment of designated overnight park-and-stay areas during the breeding season and SCV use areas during the off-season, each with its own permitting requirements. The patrol of these areas and the enforcement of the related terms and conditions that apply to these two new special use areas would be added to the responsibilities of the law enforcement staff.

Under alternative E, multiple types of permits would be available at the Seashore including annual and weekly ORV permits, beach fire permits, permits to park-and-stay overnight at designated locations during the breeding season, and permits for SCV camping during the off-season. The implementation of the ORV permit system would require the establishment of a web-based permit issuing process, as well as local permit issuing stations staffed with sufficient VUAs to provide coverage seven days a week year-round. The permit stations would also distribute the other kinds of permits called for in alternative E, except for commercial use authorizations.

In order to accomplish the above activities, which includes enforcing all applicable regulations at the Seashore as well as implementing the ORV permit system and distributing the various kinds of permits, 27.4 FTE would be required, which would be filled primarily by law enforcement rangers and VUAs, which would represent 10.9 to 14.4 more positions than under the no-action alternatives. Total approximate labor for these positions would equal \$1,970,300 year with an additional \$234,400 needed for materials (e.g., vehicles, travel, field supplies, fuel, radio support, and training costs) for these rangers, for a total approximate annual cost to the visitor protection division of \$2,204,700. The increase in effort for visitor protection would be primarily related to the implementation and enforcement of new ORV regulations and policies at the Seashore, as well as implementation of an ORV permit system and new closure/corridor areas, as described above.

The additional demand on Seashore visitor protection staff under alternative E would be readily apparent, including the establishment of year-round VUA staffing to issue ORV and related permits. The Seashore would use currently available funding and expected revenues from ORV permits fees, which would be based on cost recovery, to provide the 27.4 FTE needed to address these ORV management responsibilities, but this alternative would also require re-prioritizing work and re-allocating staff time away from other activities. With this level of funding and staffing, most field law enforcement staff would spend the majority of their time focused on ORV-management related activities and would spend less time patrolling other portions of the Seashore such as roads, campgrounds, and parking areas, resulting in long-term moderate adverse impacts to visitor protection operations.

Resources Management. Under alternative E, resources management staff would be responsible for all monitoring and establishment of buffers for protected birds, turtles, and seabeach amaranth. Resources management staff would also be responsible for determining monitoring requirements, hiring, training and supervising field staff, and conducting all field surveys. These staff would also provide input into the weekly resources management report updates and access updates that are provided to the public. Resources management under alternative E would more complex than under alternatives C or D due, in part, to providing an ORV or pedestrian corridor in areas under ML2 procedures during the breeding season if resource conditions allow it.

Alternative E would require more frequent monitoring and more frequent fencing changes when breeding activity is observed than alternatives C or D. Areas under ML2 procedures under alternative E—such as Bodie Island Spit, Cape Point, and South Point—would generally require daily monitoring once shorebird breeding activity is observed. Although this alternative provides the visitor with flexibility, the continual monitoring and implementation of resource closures as needed would require additional resources management staff to implement.

NPS resources management staff would also have additional responsibilities related to collecting data to evaluate the action in relation to the adaptive management strategy. Areas that would be studied are detailed in table 10 in chapter 2. Sea turtle and seabeach amaranth management activities under alternative E would be similar to those under the no-action alternatives and would not be expected to change the level of effort spent by resources management staff on these activities.

In addition to regular surveying, monitoring, and establishment of closures, resources management staff would also dedicate time to predator management under alternative E.

In order to accomplish the above activities, the resources management division would require approximately 16.4 FTE, which could include the chief of resources management, a wildlife biologist, additional seasonal or full-time biological technicians, a GIS specialist, and seasonal administrative assist support. These positions would equal approximately \$854,200 in labor costs. In order to support these positions, overhead costs, computers, uniforms, vehicles and other equipment (e.g., signs, field gear, ATVs/UTVs) would be needed, resulting in approximately \$70,000 in support costs. The total approximate cost of implementing alternative E to the resources management division would be \$924,200. Alternative E would require more FTE to implement than alternatives A, B, C, or D due to the increased monitoring and the number of fencing changes required to provide increased flexibility in visitor access.

The additional demand on Seashore resources management staff under alternative E would be readily apparent. The Seashore would use currently available funding and expected revenues from ORV permits fees, which would be based on cost recovery, to provide the 16.4 FTE needed to address these ORV management responsibilities, but this alternative would also require re-prioritizing work and re-allocating staff time away from other activities. With this level of funding and staffing, most field resources management staff would spend the majority of their time focused on ORV management-related activities and would have little time to address other field resources management needs, resulting in long-term moderate adverse impacts to resources management operations at the Seashore.

Facility Management. The facility management division at the Seashore would be responsible for all maintenance activities under alternative E. Related to ORV management, facility management personnel would provide routine maintenance and emergency repairs of beach ramps and parking lots and would also be responsible for maintaining the vehicles used by law enforcement, resources management and other staff associated with ORV management activities. As with alternative C, staff would also be responsible for the establishment and maintenance of parking lots in pedestrian areas, additional toilet facilities, and trash receptacles in high-use areas, the expansion of and establishment of interdunal roads, and the implementation of a system to improve the interdunal roads.

Under alternative E, additional facility management time would be required to maintain the SCV areas during the off-season, as well as maintain the soundside parking and access points that would be implemented.

Approximately 3.9 FTE of facility management time would be needed to carry out ORV management activities, equaling approximately \$181,400 of labor. In addition to the labor, approximately \$30,000 of

supplies would be required that could include ramp fill material, vehicle parts, and vehicle maintenance supplies. Total annual costs for facility management staff related to ORV management would be approximately \$211,400. Under alternative E, the increase in maintenance responsibilities, when compared to the no-action alternatives, would be primarily related to the expanded maintenance requirements for ramps and interdunal roads, parking areas, and other new uses such as the SCV areas.

Under alternative E, the Seashore would generally be able to conduct facility management activities related to ORV management within existing and expected funding sources, but would require re-prioritizing work and re-allocating staff time from other maintenance activities. No other divisions of the Seashore would be significantly impacted by these operations. Although there would be some noticeable changes to the division's activities, impacts to facility management operations at the Seashore would be long-term minor adverse.

Interpretation. Under alternative E, interpretation division staff responsibilities would be the same as those detailed under alternative B. In order to carry out these functions, alternative E would require approximately 3.0 FTE of staff time, equaling approximately \$181,500. Printing and other supporting costs would be approximately \$12,000, resulting in total approximate annual costs of \$193,500 to the interpretation division. Compared to alternative A, specific activities that would require additional staff under alternative E would include assisting in preparing the educational materials that are related to restrictions on nighttime driving and providing additional educational materials on species management and any associated user restrictions.

Under alternative E, the Seashore would generally be able to conduct interpretive activities related to ORV use and species protection within existing and expected funding sources and no other divisions of the Seashore would be impacted by these operations. Although there would be some changes to division activities, impacts to interpretive operations at the Seashore would be long-term negligible adverse.

Overall Impacts to Seashore Operations. Overall, there would be an increase in duties related to ORV management for staff in the facility management division that could result in some re-prioritization of work, but would not be expected to impact overall duties, resulting in long-term minor adverse impacts. In the Seashore management/administration division, the increase in ORV-related responsibilities would be similar, but slightly greater with long-term minor to moderate adverse impacts. In the visitor protection and resources management divisions, staff could accomplish their duties with existing budgets, but it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the interpretation division would not see a large change in operations and would be able to accomplish ORV-related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative E would be the same as those under alternative A and would include the implementation of various plans and policies that would require varying levels of staff time for plan production and implementation.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the long-term negligible to moderate impacts of alternative E, are expected to have long-term minor to moderate adverse cumulative impacts to Seashore operations and management.

Conclusion. Implementation of alternative E would require approximately 55.3 FTE across the Seashore management, administrative, visitor protection, resources management, facilities management, and interpretation divisions. Staff costs would equal approximately \$3,550,600, with an additional \$365,900

in support costs (e.g., signs, vehicles, materials). Total approximate cost to implement alternative E would be \$3,916,500. Not all staffing and equipment requirements needed to implement alternative E would be accommodated by existing and expected funding sources, and could require re-prioritization in some divisions, with funding needs being partially off-set by ORV permit fee revenues. Overall impacts to Seashore operations would be long-term moderate adverse.

Cumulative impacts to Seashore operations and management under alternative E would be long-term minor to moderate adverse.

Impacts of Alternative F: Management Based on Advisory Committee Input

Table 87 provides the total staffing and funding needs under alternative F, Management Based on Advisory Committee Input.

TABLE 87. STAFFING AND FUNDING—ALTERNATIVE F

Division	Assumptions	Annual Costs
Seashore Management / Administration	4.60 FTE would be required, as well as materials, to account for overhead costs to provide overall program support.	Staff = \$363,200 Supplemental Costs = \$19,900 Total Annual Costs = \$383,100
Visitor Protection	25.9 FTE would be required for law enforcement and VUA staff, as well as support materials for this staff such as vehicles, travel, field supplies, fuel, radio support and training.	Staff = \$1,853,300 Supplemental Costs = \$225,000 Total Annual Costs = \$2,078,300
Resources Management	14.70 FTE would be needed, which could include one full-time wildlife biologist, full-time and seasonal biological technicians, and administrative support. Vehicles, signs, and field gear would be required to support these staff.	Staff = \$785,700 Supplemental Costs = \$65,000 Total Annual Costs = \$850,700
Facility Management	3.90 FTE would be needed, which could include the facility manager, heavy equipment operators, mechanics, and other maintenance workers.	Staff = \$181,400 Supplemental Costs = \$30,000 Total Annual Costs = \$211,400
Interpretation	3.00 FTE would be needed, which could include the division chief, interpretive rangers, and a visual information specialist. Other costs would include printing and distributing informational materials.	Staff = \$181,500 Supplemental Costs = \$12,000 Total Annual Costs = \$193,500
Total Staffing and Annual Costs	52.1 FTE	Total Staff Costs = \$3,365,100 Total Supplemental Costs = \$351,900 Total Annual Costs = \$3,717,000

Seashore Management / Administration. Under alternative F, Seashore management staff would be routinely involved in ORV management activities and all divisions would require administrative support. This support reflects overhead costs, such as payroll, human resource functions, involvement of the superintendent, and other similar costs. Support would also include assisting in distributing weekly updates of ORV access areas during the spring and summer months, as well as assisting in the administration of the ORV permit. Actions under alternative E would require approximately 4.60 FTE, or approximately four and a half full-time Seashore management and administrative staff, to support field

operations related to ORV management. Total approximate costs of these staff would be \$363,200, with additional \$19,900 required for materials. This increase over the no-action alternatives would be related to the various new programs requiring Seashore management involvement or administrative assistance that would be implemented under alternative F.

Closures and access may be more consistent than in the no-action alternatives, but would still be variable since ORV access corridors would be located two of the three areas under ML2 procedures, (with the third area containing a pedestrian corridor), and these areas would be subject to resource closures. Night driving would be seasonally restricted from one hour after sunset until turtle patrol has checked the beach in the morning (approximately one-half after sunrise) under alternative F, which would require a higher level of management for all divisions due to the variability of the closure.

New programs, such as a variety of ORV permits, would increase the complexity of the ORV management program and increase the need for public information updates. Permits would include an annual and a weekly ORV permit, which has a fee subject to cost recovery, that would be distributed in person or online. This permit system would also include an educational component requiring the user to pass a basic knowledge test, which would require support from administrative staff. Development and administration of the permit system, as well as providing information and updates to the public, would require frequent Seashore management involvement and periodic administrative staff support, which would increase the workloads of the respective staff.

Under alternative F, the above-described Seashore management and administrative functions related to ORV management would be accomplished within the existing Seashore budget, but would require re-prioritizing work and re-allocating staff time from other activities that would likely not be noticeable, resulting in long-term minor adverse impacts to Seashore management and administrative operations at the Seashore.

Visitor Protection. Under alternative F, Seashore law enforcement rangers would be responsible for enforcing visitor compliance with ORV regulations and resource closures. Law enforcement staff would perform routine patrols of beach areas, respond to violations, conduct investigations, and assist in public education through visitor contacts. Alternative F would considerably expand the responsibilities of law enforcement staff since new regulations would be implemented, permits would be issued that require field monitoring and enforcement, ORV access corridors utilized during the breeding season at some resource sensitive locations, and the hours of allowable night driving during the breeding season would be variable based on sunset and turtle patrol activities, as described further below. Under alternative F, certain responsibilities related to law enforcement would be the same as those under alternative C, including new policies requiring beach fire permits, restrictions on horses and pets, implementation of an ORV permit system with a testing requirement and a provision that the permit can be revoked by for a violations of the permit terms and conditions, and implementation of vehicle and equipment requirements for ORV drivers. When compared to alternative E, less resources would be needed since there would be no special provisions for ORV night access during the breeding season (park-and-stay) or for off-season SCV camping under alternative F.

Alternative F would include seasonally prohibiting night driving from one hour after sunset until turtle patrol has checked the beach in the morning (approximately one-half after sunrise) from May 1 to November 15. Starting November 15, selected ORV routes with low or no density turtle nests would reopen to nighttime use. The nighttime restrictions would not result in additional law enforcement efforts when compared to alternative B since the hours of the restriction are the similar; however, additional effort could be required to patrol those areas that are, or are not, open to use after November 15, as described under alternative E.

Under alternative E, resource closures would be implemented on a seasonal basis at high use areas such as Bodie Island Spit, Cape Point, and South Point, with ORV use allowed in a corridor under ML2 management at Cape Point and South Point, with a pedestrian access corridor at Bodie Island Spit. The ORV corridor would be subject to closures in response to observed species breeding and/or fledging activities. While alternative F, like alternative E, would provide for maximum flexibility, most areas that are open have conditions that could result in their closure; therefore, this strategy could result in unpredictability regarding which ORV routes and areas would be open for use at any given time. A lack of consistency would be expected to lead to more visitors entering resource closures accidentally because of the lack of knowledge regarding which areas are open and which areas are not. This would be expected to lead to an increased effort by law enforcement staff to inform visitors of what areas are open, and to patrol the areas that are not to ensure violations are not occurring. In addition, law enforcement would also continue to field violation calls and respond to violation incidents.

Additional law enforcement effort under alternative F would also be required to enforce carrying capacity within each ranger district when the “peak use limit” is reached, as detailed in table 13 in chapter 2. Law enforcement rangers would also be responsible for identifying and implementing the established standards for safety closures under alternative F, resulting in more staff time when these situations are identified.

Alternative F includes new access to the soundside, which would be patrolled by law enforcement staff, including on Ocracoke.

In order to accomplish the above activities, which includes enforcing all applicable regulations at the Seashore, as well as implementing the ORV permit system and distributing the various kinds of permits, 25.9 FTE would be required, which would be filled primarily by law enforcement rangers and VUAs, which would represent 12.9 to 9.4 more positions than under the no-action alternatives. Total approximate labor for these positions would equal \$1,853,300 year with an additional \$225,000 needed for materials (e.g., vehicles, travel, field supplies, fuel, radio support, and training costs) for these rangers, for a total approximate annual cost to the law enforcement division of \$2,078,000. The increase in effort for visitor protection would be primarily related to the implementation and enforcement of new ORV regulations and policies at the Seashore, as well as implementation of an ORV permit system and new closure/corridor areas, as described above.

The additional demand on Seashore visitor protection staff under alternative F would be readily apparent, including the establishment of year-round VUA staffing to issue ORV permits. The Seashore would use currently available funding and expected revenues from ORV permits fees, which would be based on cost recovery, to provide the 25.9 FTE needed to address these ORV management responsibilities, but this alternative would also require re-prioritizing work and re-allocating staff time away from other activities to some degree. With this level of funding and staffing, most field law enforcement staff would spend the majority of their time focused on ORV management-related activities and would spend less time patrolling other portions of the Seashore such as roads, campgrounds, and parking areas but would be expected to have more time for these activities than under alternative E, resulting in long-term minor to moderate adverse impacts to visitor protection operations.

Resources Management. Under alternative F, resources management staff would be responsible for all monitoring and establishment of buffers for protected birds, turtles, and seabeach amaranth. Resources management staff would also be responsible for determining monitoring requirements, hiring, training and supervising field staff, and conducting all field surveys. These staff would also provide input into the weekly resources management report updates and access updates that are provided to the public. Resources management under alternative F would more complex than under alternatives C or D due, in part, to providing an ORV or pedestrian corridor areas under ML2 procedures during the breeding season

if resource conditions allow it, but would be slightly less complex than alternative E, which provides more access for visitors.

Alternative F would require more frequent monitoring and more frequent fencing changes when breeding activity is observed than alternatives C or D. Areas that are under ML2 procedures—such as Bodie Island Spit, Cape Point, and South Point—would generally require daily monitoring once shorebird breeding activity is observed. Although this alternative provides the visitor with flexibility, the continual monitoring and implementation of resource closures as needed would require additional resources management staff to implement.

NPS resources management staff would also have additional responsibilities related to collecting data to evaluate the action in relation to the adaptive management strategy. Areas that would be studied are detailed in table 10 in chapter 2. Sea turtle and seabeach amaranth management activities under alternative F would be similar to those under the no-action alternatives and would not be expected to change the level of effort spent by resources management staff on these activities.

In addition to regular surveying, monitoring, and establishment of closures, resources management staff would also dedicate time to predator management under alternative F.

In order to accomplish the above activities, the resources management division would require approximately 14.7 FTE, which could include the chief of resources management, a wildlife biologist, additional seasonal or full-time biological technicians, a GIS specialist, and seasonal administrative assist support. These positions would equal approximately \$785,700 in labor costs. In order to support these positions, overhead costs, computers, uniforms, vehicles and other equipment (e.g., signs, field gear, ATVs/UTVs) would be needed, resulting in approximately \$65,000 in support costs. The total approximate cost of implementing alternative F to the resources management division would be \$850,700. Alternative F would require more FTE to implement than alternatives A, B, C or D (but less than E) due to the increased monitoring and the number of fencing changes required to provide increased flexibility in visitor access.

The additional demand on Seashore resources management staff under alternative F would be readily apparent. The Seashore would use currently available funding and expected revenues from ORV permits fees, which would be based on cost recovery, to provide the 14.7 FTE needed to address these ORV management responsibilities, but this alternative would also require re-prioritizing work and re-allocating staff time away from other activities. With this level of funding and staffing, most field resources management staff would spend the majority of their time focused on ORV-management related activities and would have little time to address other field resources management needs, resulting in long-term moderate adverse impacts to resources management operations at the Seashore.

Facility Management. The Facility Management division at the Seashore would be responsible for all maintenance activities under alternative F. Related to ORV management, facility management personnel would provide routine maintenance and emergency repairs of beach ramps and parking lots and would also be responsible for maintaining the vehicles used by law enforcement, resources management, and other staff associated with ORV management activities. As with alternative C, staff would also be responsible for the establishment and maintenance of parking lots in pedestrian areas, additional toilet facilities, and trash receptacles in high-use areas, the expansion of and establishment of interdunal roads, and the implementation of a system to improve the interdunal roads. The addition of soundside access under alternative F would also create additional maintenance responsibilities.

Approximately 3.9 FTE of facility management time would be needed to carry out ORV management activities, equaling approximately \$181,400 of labor. In addition to the labor, approximately \$30,000 of

supplies would be required that could include ramp fill material, vehicle parts, and vehicle maintenance supplies. Total annual costs for facility management staff related to ORV management would be approximately \$211,400. Under alternative F, the increase in maintenance responsibilities, when compared to the no-action alternatives, would be primarily related to the expanded maintenance requirements for ramps and interdunal roads, parking areas, and other new access points.

Under alternative F, the Seashore would generally be able to conduct facility management activities related to ORV management within existing and expected funding sources, but would require re-prioritizing work and re-allocating staff time from other maintenance activities. No other divisions of the Seashore would be significantly impacted by these operations. Although there would be some noticeable changes to the divisions activities, impacts to facility management operations at the Seashore would be long-term minor adverse.

Interpretation. Under alternative F, Interpretation division staff responsibilities would be the same as those detailed under alternative B. In order to carry out these functions, alternative F would require approximately 3.0 FTE of staff time, equaling approximately \$181,500. Printing and other supporting costs would be approximately \$12,000, resulting in total approximate annual costs of \$193,500 to the interpretive division. Compared to alternative A, specific activities that would require additional staff under alternative F would include assisting in preparing the educational materials that are related to restrictions on nighttime driving and providing additional educational materials on species management and any associated user restrictions.

Under alternative F, the Seashore would generally be able to conduct interpretive activities related to ORV use and species protection within existing and expected funding sources and no other divisions of the Seashore would be impacted by these operations. Although there would be some changes to division activities, impacts to interpretive operations at the Seashore would be long-term negligible adverse.

Overall Impacts to Seashore Operations. Overall, there would be an increase in duties related to ORV management for staff in the facility management and Seashore management/administration divisions that could result in some re-prioritization of work, but would not be expected to impact overall duties, resulting in long-term minor adverse impacts. In the visitor protection and resources management divisions, staff could accomplish their duties with existing budgets, but it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the interpretation division would not see a large change in operations and would be able to accomplish ORV related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts.

Cumulative Impacts. Past, present, and reasonably foreseeable future actions that have the potential for cumulative impacts under alternative F would be the same as those under alternative A and would include the implementation of various plans and policies that would require varying levels of staff time for plan production and implementation.

The combination of these past, present, and reasonably foreseeable future actions, when combined with the long-term negligible to moderate impacts of alternative E, are expected to have long-term minor to moderate adverse cumulative impacts to Seashore operations and management.

Conclusion. Implementation of alternative F would require approximately 52.10 FTE across the Seashore management, administrative, visitor protection, resources management, facilities management, and interpretation divisions. Staff costs would equal approximately \$3,365,100, with an additional \$351,900 in support costs (e.g., signs, vehicles, materials). Total approximate cost to implement alternative F would

be \$3,717,000. Not all staffing and equipment requirements needed to implement alternative F would be accommodated by existing and expected funding sources, and could require re-prioritization in some divisions, with funding needs being partially off-set by ORV permit fee revenues. Overall impacts to Seashore operations would be long-term minor to moderate adverse.

Cumulative impacts to Seashore operations and management under alternative F would be long-term minor to moderate adverse.

TABLE 88. SUMMARY OF IMPACTS TO SEASHORE OPERATIONS AND MANAGEMENT UNDER THE ALTERNATIVES

Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F
Overall, each division could accomplish within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts to all areas of Seashore operations.	Overall, there would be an increase in duties related to ORV management for staff in the Seashore management / administration, visitor protection, and resources management divisions. Although these staff could accomplish these duties within existing budgets, it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in facility management and interpretation would not see a large change in operations and would be able to accomplish ORV related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts to these two divisions. Overall, impacts to Seashore operations would be long-term moderate adverse.	Overall, there would be an increase in duties related to ORV management for staff in the Seashore management / administration, resources management, facility management divisions that could result in some re-prioritization of work, but would not be expected to impact overall duties resulting in long-term minor adverse impacts. In the visitor protection division, staff could accomplish their duties with existing budgets, but it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the interpretation division would not see a large change in operations and would be able to accomplish ORV related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts Overall, impacts to Seashore operations would be long-term minor to moderate (but mostly minor) adverse.	Overall, there would long-term negligible adverse impacts to all divisions as each division would be expected to execute their duties from existing, or expected, funding sources, without having to re-prioritize staff. These impacts are due, in part, to the expected cost recovery under the proposed permit program. Overall, impacts to Seashore operations would be long-term negligible adverse.	Overall, there would be an increase in duties related to ORV management for staff in the facility management division that could result in some re-prioritization of work, but would not be expected to impact overall duties resulting in long-term minor adverse impacts. In the Seashore management / administration division, the increase in ORV related responsibilities would be similar, but slightly greater with long-term minor to moderate adverse impacts. In the visitor protection and resources management divisions, staff could accomplish their duties with existing budgets, but it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the interpretation division would not see a large change in operations and would be able to accomplish ORV related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts. Overall impacts to Seashore operations would be long-term moderate adverse.	Overall, there would be an increase in duties related to ORV management for staff in the facility management and Seashore management / administration divisions that could result in some re-prioritization of work, but would not be expected to impact overall duties resulting in long-term minor adverse impacts. In the visitor protection and resources management divisions, staff could accomplish their duties with existing budgets, but it would require them to re-prioritize and re-allocate staff, and would not leave staff with adequate time to address other needs at the Seashore outside of ORV management, resulting in long-term moderate adverse impacts. Staff in the interpretation division would not see a large change in operations and would be able to accomplish ORV related tasks within current funding, without shifting priorities or having a noticeable change in operations, resulting in long-term negligible adverse impacts. Overall impacts to Seashore operations would be long-term minor to moderate adverse.

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Chapter 5:

Consultation and Coordination

CHAPTER 5: CONSULTATION AND COORDINATION

Seashore staff place a high priority on meeting the intent of public involvement in the NEPA process and giving the public an opportunity to comment on proposed actions. As part of the NPS NEPA process, issues associated with the action were identified during scoping meetings with NPS staff, coordination with other affected agencies, public meetings, and public comment. This chapter describes the consultation that occurred during development of this plan/EIS, including consultation with stakeholders and other agencies. This chapter also includes a description of the public involvement process and a list of the recipients of the draft document.

THE SCOPING PROCESS

The NPS divides the scoping process into two parts: internal scoping and external public scoping. Internal scoping involved discussions among NPS personnel regarding the purpose of and need for management actions, issues, management alternative, mitigation measures, the analysis boundary, appropriate level of documentation, available references and guidance, and other related topics. Public scoping is the early involvement of the interested and affected public in the environmental analysis process. The public scoping process helps ensure that people have been given an opportunity to comment and contribute early in the decision-making process. For this plan/EIS, project information was distributed to individuals, agencies, and organizations early in the scoping process, and people were given opportunities to express concerns or views and identify important issues or even other alternatives or alternative elements. Taken together, internal and public scoping are essential elements of the NEPA planning process. The following sections describe the various ways scoping was conducted for this project.

INTERNAL SCOPING

Internal scoping for this project began on November 15, 2004, with staff members from the Seashore, NPS Environmental Quality Division, NPS Southeastern Region, and contractor personnel in attendance. During the three-day meeting, the NPS identified the purpose of and need for action, management objectives, issues, and impact topics. The planning team also discussed possible alternative elements, cumulative impacts, and strategies for public involvement throughout the process. Another set of internal scoping meetings was held November 7, 2006, after the completion of the Interim Protected Species Management Strategy/EA to revisit the discussions of the 2004 meeting and to update information. During the three-day meeting, NPS employees discussed the development of an ORV management plan for the Seashore, including a review of the purpose and need for action, management objectives, issues, impact topics, and preliminary alternative concepts. The 2006 internal scoping meetings also included a discussion of the procedures and schedule of the negotiated rulemaking process, strategies for public involvement, the no-action alternative, and data management.

PUBLIC SCOPING

Public scoping began with the December 11, 2006, Federal Register publication of the NOI to prepare an environmental impact statement (71 FR 71552–71553). The NOI summarized the history of ORV management at the Seashore, discussed preliminary issues and impact topics, listed the project website, and announced the upcoming public scoping meetings. The Seashore posted a public scoping newsletter on the NPS PEPC website at <http://parkplanning.nps.gov/caha>, sent informational e-mails to individuals, businesses, agencies, and organizations on the Seashore's email distribution list, and issued a news release inviting the public to comment at the scoping meetings. All four meetings were open-house style sessions with short presentations, which allowed the public to ask Seashore staff questions and provide input to the Seashore in a more informal atmosphere. These sessions occurred in 2007 on February 26

from 2:00 p.m. to 6:00 p.m. at the Fessenden Center in Buxton, North Carolina; February 27 from 6:00 p.m. to 9:00 p.m. at the Wright Brothers National Memorial First Flight Centennial Pavilion in Kill Devil Hills, North Carolina; February 28, 2007, from 6:00 p.m. to 9:00 p.m. at McKimmon Center (North Carolina State Campus), Raleigh, North Carolina; and March 1 from 6:00 p.m. to 9:00 p.m. at the American Geophysical Union Building in Washington, D.C.

The meetings offered a variety of methods for the public to provide comments. NPS personnel and contractor staff were present at each display to answer questions from attendees and record attendees' comments. Comment sheets were provided to meeting attendees as an additional method for accepting public comment. Following the open house and presentation, attendees were also offered an opportunity to comment in a public hearing format. These comments were transcribed by a court reporter and were posted on the NPS PEPC website. Those attending the meetings were also given a newsletter that provided additional opportunities for comment, including directing comments to the PEPC website. To keep the public involved and informed throughout the planning process, individuals were given the option to receive notification of the availability of draft ORV management documents by either e-mail or regular mail and the option to either download a digital copy or receive a hardcopy through the mail. The public scoping period was open until March 16, 2007.

During the public comment period, 3,511 pieces of correspondence were received, containing a total of 3,532 signatures and 14,397 individual comments. Generally, these comments focused on how the alternatives presented could be improved or suggested new alternative elements that should be considered. Many comments expressed concern about potential impacts to the local economy associated with limiting ORV use at the Seashore. Comments provided suggestions for reconfiguring the existing ORV access system, including opening or closing ramps and interdunal roads. Comments were also received that indicated the need to protect sensitive species and habitat along the beaches, provided that the protection measures implemented would be based on scientific studies. Public comments also recommended strengthening public education initiatives, increasing law enforcement presence, and implementing a fee or permit system for ORV use. Comments also indicated how ORVs either contributed to or detracted from the visitor experience at the Seashore.

PUBLIC ALTERNATIVE DEVELOPMENT WORKSHOPS

After the internal and public scoping meetings, suggestions and ideas for alternatives for ORV management were gathered and compiled into an extensive list of preliminary alternative elements. These alternative elements were organized by topic areas and formatted into a workbook for presentation to the public to obtain further comments and suggestions. Although not required by the NEPA process, the development of these workbooks and the public workshops that followed was intended to generate more detailed public input during the alternatives development process. Members of the public were asked if they thought that the preliminary alternatives met the objectives of the plan/EIS and were also encouraged to identify possible new alternative options for ORV management at the Seashore. Each workbook contained the following sections for public comment: ORV management, education and outreach, law enforcement, ORV permits, other ORV management issues, species protection, site specific management at Bodie Island District, site specific management at Hatteras Island District, and site specific management at Ocracoke Island District. The Alternatives Option Workbook was distributed to the public as follows:

- Copies were provided to participants at the January 3–4, 2008, meeting of the Negotiated Rulemaking Advisory Committee for ORV Management at Cape Hatteras National Seashore.
- A press release, with the workbook as an attachment, was sent electronically to all recipients on the Cape Hatteras National Seashore ORV e-mail list.

- Both Microsoft Word and PDF versions of the workbooks were made available online on the NPS PEPC website.
- Hard copies of the workbook were distributed at public alternatives development meetings held on January 14, 15, 16, and 17, 2008, in Buxton, Kill Devil Hills, and Raleigh, North Carolina and in Richmond, Virginia, respectively, and provided to members of the public by the Seashore when requested.

The public was asked to provide completed workbooks by February 15, 2008 (extended from the original January 30, 2008, date). A total of 386 workbooks were received during the public comment period in both electronic and hard copy formats. All workbooks were reviewed and considered during the alternatives development process. Extensive comments were received on the preliminary alternatives, many of which provided suggestions on how preliminary management options could be improved. Most comments offered options for protected species management, law enforcement, ORV permitting, closures, and ORV ramp and route configuration.

NEGOTIATED RULEMAKING PROCESS

The *Negotiated Rulemaking Act of 1990* (5 USC 561–570) establishes a statutory framework for agency use of negotiated rulemaking to reach a consensus with stakeholders on a proposed regulation. Concurrent with the NEPA process, the NPS used a negotiated rulemaking process in an effort to develop a proposed rule for long-term ORV management at the Seashore. Because negotiated rulemaking allows interested, affected parties more direct input into the development of the proposed regulation, the NPS had hoped that the negotiated rulemaking process would result in a rule that is sensitive to the needs and limitations of both the parties and the agency.

The Negotiated Rulemaking Advisory Committee for Off-Road Vehicle Management at Cape Hatteras National Seashore (Committee) was established through a feasibility assessment and convening process. A draft Negotiated Rulemaking Feasibility Report, based on 55 interviews, was released on June 17, 2005. The revised Feasibility Report was released for public comment on December 16, 2005. The final Feasibility Report, released April 4, 2006, concluded, “...a consensus-based negotiation to develop a management plan and proposed implementing regulations can be convened, can yield important benefits even if agreement is not reached, and has a modest chance of success...” The negotiated rulemaking process began informally in February 2007 when the Seashore held a workshop titled “Participating in the Negotiated Rulemaking Process.” The workshop was followed by two more pre-convening meetings.

On June 29, 2007, the NPS published in the Federal Register a Notice of Intent to Establish a Negotiated Rulemaking Advisory Committee at Cape Hatteras National Seashore (72 FR 124). The Secretary of the Interior signed the Charter establishing the Committee on November 26, 2007, and the NPS issued the Federal Register Notice of Establishment of the Committee, including Committee member names, on December 20, 2007.

The Committee convened its first meeting on January 3 and 4, 2008, which included adopting its Final Groundrules on the second day of the meeting. Subsequently, the Committee held 10 additional meetings on the following dates: February 26–27, 2008, March 18–19, 2008, May 8–9, 2008, June 17–18, 2008, September 8–9, 2008, November 14–15, 2008, December 11–12, 2008, January 6–7, 2009, February 3, 2009, and February 26, 2009. The Committee established seven subcommittees that undertook aspects of the Committee’s work. These subcommittees included: Agenda Planning; Natural Resources; Permits, Passes, and Fees; Routes and Areas; Socio-Economic Analysis; Vehicle Characteristics and Operations; and Village Closures. There also were a number of informal workgroups.

As required by Section 556 (g) of the *Negotiated Rulemaking Act* and the *Federal Advisory Committee Act*, 5 USC Appendix 2, documents, which were made available to or prepared for or by the Committee, and meeting summaries containing the required information were maintained by the Cape Hatteras National Seashore Superintendent, as the Designated Federal Official, and made available for public inspection.

At the February 3, 2009, meeting, the Committee charged an Integration Group to develop a single proposal recommendation to the Committee for discussion at the final meeting. The Integration Group met in person February 11–13 and 16–17, as well as via conference call on February 23 and 24. The Committee considered the work of the Integration Group in its final meeting and concluded its work on February 26, 2009. The Committee's work product can be found on the internet at: <http://parkplanning.nps.gov/parkHome.cfm?parkId=358>.

The Committee did not reach consensus on the concepts and language to be used as the basis for a proposed special regulation governing ORV use at the Seashore as contemplated by the Committee's Charter. The Committee in its Final Groundrules had defined consensus as unanimous concurrence of the principals, or in the absence of the principal, his or her alternate. As requested by the NPS and Committee members, the Committee discussed in detail, such issues as (1) access to beach areas for commercial fishing and recreational activities; (2) providing for a variety of visitor experiences on the seashore, including both ORV and non-ORV experiences; (3) public safety; and (4) protection of the beach environment and the associated plant and wildlife resources. The Committee gathered extensive information and data on key issues, deliberated about key subjects related to a proposed regulation, reviewed and discussed the NPS draft proposed NEPA ORV Management Alternatives (November 5, 2008) and developed numerous ideas and options for addressing the key issues.

After the final meeting, the facilitators submitted a report to the NPS pursuant to Section VI (F) of the Committee's final ground rules. The report outlined the Committee's process and the outcome of the Committee's work, and provided information, recommendations, and materials submitted by one or more Committee members as an addendum. As provided in Section 556(f) of the *Negotiated Rulemaking Act*, all Committee members were given the opportunity to submit information, recommendations, and materials along with the report. The final report, dated March 30, 2009, included six addenda and was 1,654 pages long.

OTHER CONSULTATION

Coordination and consultation efforts for this planning process focused on the means or processes to be used to include the public, major interest groups, and local public entities. Coordination with local and federal agencies and various interest groups was conducted during the NEPA process to identify issues and/or concerns related to protected species management within the Cape Hatteras National Seashore. The USFWS prepared a Biological Opinion on August 14, 2006, in response to the Interim Protected Species Management Strategy and amended the biological opinion on April 24, 2007. Additional USFWS consultation on the Interim Strategy has occurred annually in 2007 through 2009 during the course of the ORV management plan/EIS process. Notice of the availability of this document will be posted on the PEPC website and provided to a variety of federal, state, and local agencies and interest groups, including those listed below.

LIST OF RECIPIENTS

This plan/EIS was sent to the agencies, organizations, and businesses listed below. This document was also mailed to other entities and individuals who requested a copy.

CONGRESSIONAL DELEGATES

- Kay R. Hagan, Senator
- Richard Burr, Senator
- Walter B. Jones, 3rd District Representative

FEDERAL DEPARTMENTS AND AGENCIES

- Advisory Council on Historic Preservation
- NOAA National Marine Fisheries Service
- U.S. Army Corps of Engineers, Wilmington District
- U.S. Coast Guard
- U.S. Fish and Wildlife Service, Ecological Services, Raleigh Field Office
- U.S. Fish and Wildlife Service, Pea Island National Wildlife Refuge
- U.S. Geological Survey, Biological Resources Division
- U.S. Department of Transportation – Federal Highways Administration
- U.S. Environmental Protection Agency
- Federal Emergency Management Agency – Natural Hazards Branch

STATE OF NORTH CAROLINA GOVERNMENT

- Bev Perdue, Governor of North Carolina
- Marc Basnight, 1st District Senator, President Pro Tempore
- Timothy Spear, 2st District Representative
- North Carolina Department of Environment and Natural Resources
 - Division of Coastal Management
 - Coastal Resources Commission
 - Division of Marine Fisheries
 - North Carolina Natural Heritage Program
- North Carolina Department of Transportation
- North Carolina State Highway Patrol
- North Carolina State Historic Preservation Officer
- North Carolina Wildlife Resources Commission

LOCAL GOVERNMENTS

- Dare County Board of Commissioners
 - Warren Judge, Chairman

- Allen Burrus, Vice Chair
 - Max Dutton
 - Mike Johnson
 - Richard Johnson
 - Jack Shea
 - Virginia Tillett
- Hyde County Board of Commissioners
 - Geo. Thomas Davis Jr., Chairman
 - Sharon P. Spencer
 - Eugene Ballance
 - H. Anson Byrd
 - Barry Swindell

OTHER ORGANIZATIONS AND BUSINESSES

- 4 Plus Four Wheel Drive Club
- American Sport Fishing Association
- Avon Property Owners Association
- Cape Hatteras Anglers Club
- Cape Hatteras Bird Club
- Cape Hatteras Business Allies
- Cape Hatteras Recreational Alliance
- Capital City Four Wheelers
- Coalition of National Park Service Retirees
- Defenders of Wildlife
- Eastern Surfing Association
- Environmental Defense
- Friends of the Earth
- Greater Kinnakeet Shores Homeowners, Inc.
- Graveyard of the Atlantic Museum
- Hatteras Island Homeowners Coalition
- Hatteras Landing Homeowners Association
- Hatteras Village Civic Association
- Hyde County Chamber of Commerce
- League of Conservation Voters

- Nags Head Fishing Club
- Nags Head Woods Preserve
- National Parks Conservation Association
- Natural Resources Defense Council
- Network for Endangered Sea Turtles
- North Carolina Audubon
- North Carolina Coastal Federation
- North Carolina Beach Buggy Association
- North Carolina Fisheries Association
- Ocracoke Civic and Business Association
- Outer Banks Preservation Association
- Outer Banks Association of Realtors
- Outer Banks Chamber of Commerce
- Outer Banks Surf Fishing School
- Outer Banks Visitor Bureau
- Recreational Fishing Alliance
- Rodanthe/Waves/Salvo Civic Association
- Sierra Club, North Carolina Chapter
- Southern Environmental Law Center
- Surf Riders Association
- The Nature Conservancy
- Watersports Industry Association
- The Wilderness Society
- United Mobile Sportfishermen
- United Four Wheel Drive Association

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Glossary, References, Index

GLOSSARY

Abundance—An ecological concept referring to the relative representation of a species in a particular ecosystem. It is usually measured as the large number of individuals found per sample. How species abundances are distributed within an ecosystem is referred to as relative species abundances.

Accretion—The process where coastal sediments return to the visible portion of the beach following storm erosion.

Action—Any federal activity including, but not limited to, acquiring, managing, and disposing of federal lands and facilities; facilitating human occupation or visitation; providing federally undertaken, financed, or assisted construction and improvements; and conducting federal activities and programs affecting land use, including, but not limited to, water and related land resources planning, and regulating and licensing activities.

Adaptive management—A system of management practices based on clearly identified outcomes, monitoring to determine if management actions are meeting outcomes, and, if not, facilitating management changes that will best ensure that outcomes are met or to re-evaluate the outcomes. Adaptive management recognizes that knowledge about natural resource systems is sometimes uncertain and is the preferred method of management in these cases (source: Departmental Manual 516 DM 4.16).

Adult—An organism that is fully grown or developed and capable of sexual reproduction.

Affected Environment—Existing natural, cultural, and social conditions of an area that are subject to change, both directly and indirectly, as a result of a proposed human action.

Alternate (ORV) route—A route that uses another ramp or an existing interdunal route or NC-12 to provide ORV access to an area by serving as a detour around a closed area.

Alternative, No-Action—An alternative that maintains established trends or management direction.

Anecdotal—Based on or consisting of reports or observations of usually unscientific observers.

Appropriate use—A use that is suitable, proper, or fitting for a particular park, or to a particular location within a park.

Archeological resource—Any material remains or physical evidence of past human life or activities which are of archeological interest, including the record of the effects of human activities on the environment. An archeological resource is capable of revealing scientific or humanistic information through archeological research.

Arthropod—An invertebrate that has an exoskeleton (external skeleton), a segmented body, and jointed attachments called appendages.

Anthropogenic—Resulting from the influence or actions of human beings.

Artificial lighting—Light sources produced by humans.

Backshore—The part of an ocean beach between the spring high water level and the primary dune line.

Benthic—The bottom, or relating to the bottom of the ocean or other body of water.

Berm—As used in this document refers to remnants of the man-made dune or dune ridge originally constructed in the 1930s by the Civilian Conservation Corps and the Works Progress Administration. NPS actively maintained this dune ridge until the early 1970s when NPS ended the dune stabilization policy after scientists concluded that the man-made berms constructed since the 1930s had actually served to foreshorten the seashore's beaches and dramatically altered both the ecological and the topographical characteristics of the Outer Banks (NPS 2007f). "Berm" includes the man-made dune or dune ridge constructed to protect state highway NC-12 and interior sections of the island from ocean flooding and overwash during storms.

Best management practices—Practices that apply the most current means and technologies available to not only comply with mandatory environmental regulations, but also maintain a superior level of environmental performance. See also, "sustainable practices/principles."

Biosphere Reserves—Found in different countries across all the regions of the world. Biosphere reserves are protected areas that are meant to demonstrate a balanced relationship between man and nature.

Bird nesting—The act of building a structure by a bird for laying eggs and sheltering its young.

Bivalves—A shell consisting of two rounded plates called *valves* joined at one edge by a flexible ligament called the *hinge*. The shell is typically bilaterally symmetrical, with the hinge lying in the sagittal plane.

Breeding areas—Those areas that support the full suite of avian breeding activities including, courtship, territorial defense, copulation, scraping and nest building, egg laying and incubation, chick rearing and associated foraging.

Breeding behavior—Shorebird behavior that includes, but is not limited to, courtship, mating, scraping, confirmed scrapes, and other breeding or nest-building activities.

Breeding habitat—Habitat(s) that host the birds during territorial displaying, courtship and mating, scraping, nesting, incubation, brooding and chick foraging.

Breeding Shorebird and Seabeach Amaranth SMA—Area of suitable breeding habitat that has had multiple nests of individuals and/or multiple species of protected shorebirds, or concentrations of seabeach amaranth specimens, in more than 1 (i.e., 2 or more) of the past 5 years and is managed to minimize human disturbance during the breeding season. Focal species for Breeding Shorebird SMAs include piping plover, Wilson's plover, American oystercatcher, least tern, common tern, gull-billed tern, and black skimmer; however, there will be ongoing evaluation of the breeding shorebird species addressed by this plan, as part of the periodic review process described at the end of this table.

Brood—The offspring, as of an animal or a bird, that are the result of one breeding season.

Buffer—A protective area or distance surrounding a sensitive resource that limits visitor access.

Bypass—A temporary route established by the park in accordance with the bypass criteria to provide ORV access during short periods of time.

Camouflaged—A method of cryptic or concealing coloration that allows an otherwise visible organism or object to remain indiscernible from the surrounding environment through deception.

Canid—The biological family of carnivorous and omnivorous mammals that includes the wolves, foxes, jackals, coyotes, and the domestic dog.

Carrying capacity—The maximum population of a particular species that a particular region can support without hindering future generations' ability to maintain the same population. A visitor, or user, carrying capacity is the type and level of use that can be accommodated while sustaining the desired resource and visitor experience conditions.

Civic engagement—Continuous, dynamic conversation with the public on many levels that reinforces the commitment of both the National Park Service and the public to the preservation of heritage resources, both cultural and natural, and strengthens public understanding of the full meaning and contemporary relevance of these resources. The foundation of civic engagement is a commitment to building and sustaining relationships with neighbors and communities of interest.

Closure—An area delineated by posts with string between them (symbolic fencing), prohibiting vehicle and/or pedestrian access.

Coastal High Hazard Area (V Zone)—The Special Flood Hazard Area that extends from offshore to the inland limit of a primary frontal dune along an open coast and any other area subject to high velocity wave action. The area is designated on the FIRM as Zone VE.

Cobble substrates—A substrate where the majority of the material is between 2.5 and 10 inches in diameter.

Compaction—The process by which a sediment progressively loses its porosity due to the effects of loading. This forms part of the process of lithification. When a layer of sediment is originally deposited, it contains an open framework of particles with the pore space being usually filled with water. As more sediment is deposited above the layer, the effect of the increased loading is to increase the particle-to-particle stresses resulting in porosity reduction primarily through a more efficient packing of the particles and to a lesser extent through elastic compression and pressure solution.

Compendium—A concise, yet comprehensive compilation of a body of knowledge. A compendium may summarize a larger work. In most cases the body of knowledge will concern some delimited field of human interest or endeavor.

Consensus—Unanimous or general agreement; and secondly group solidarity of belief or sentiment. Within the context of the Cape Hatteras National Seashore Negotiated Rulemaking Advisory Committee, the Committee defined “consensus” as unanimous concurrence of the principals (members), or in the absence of the principal, his or her alternate. Members may also “abstain” or “stand aside” and not offer their consent, but refrain from blocking agreement and will thus also refrain from future negative comment or action on the consensus. Abstaining/standing aside members shall not be counted in determining if consensus has been reached.

Consent Decree—A judicial decree that sanctions a voluntary agreement between parties in dispute.

Conserve—To protect from loss or harm; preserve. Historically, the terms conserve, protect, and preserve have come collectively to embody the fundamental purpose of the NPS—preserving, protecting and conserving the national park system.

Contemporaneous—The historical timeframe that are immediately relevant to the present and is a certain perspective of modern history.

Council on Environmental Quality (CEQ)—Established by Congress within the Executive Office of the President with passage of the *National Environmental Policy Act of 1969*. CEQ coordinates federal environmental efforts and works closely with agencies and other White House offices in the development of environmental policies and initiatives.

Crawl—Tracks and other signs left on a beach by a sea turtle (FWC 2002).

Cultural resource—An aspect of a cultural system that is valued by or significantly representative of a culture, or that contains significant information about a culture. A cultural resource may be a tangible entity or a cultural practice. Tangible cultural resources are categorized as districts, sites, buildings, structures, and objects for the National Register of Historic Places, and as archeological resources, cultural landscapes, structures, museum objects, and ethnographic resources for NPS management purposes.

Cumulative impacts—Under NEPA regulations, the incremental environmental impact or effect of an action together with the effects of past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions (40 CFR 1508.7).

Dearth—A lack, shortage or scarcity.

Decapods—Invertebrate animals of the order Crustacea which have five pairs of legs and includes the shrimps, lobsters, crabs, etc.

Decibel (dBA)—A unit of measure of sound intensity.

Denudation—A geologic term that indicates the process by which the removal of material, through means of erosion and weathering, leads to a reduction of elevation and relief in landforms and landscapes. Exogenic processes, including the action of water, ice, and wind, predominantly involve denudation. Denudation can involve the removal of both solid particles and dissolved material. Both mechanical and chemical weathering occurs in relation to geomorphological landforms. At present the most significant processes leading to denudation include deforestation (including slash-and-burn practices of local peoples), overgrazing and certain forms of intensive farming which lead to large scale erosion. This phenomenon takes place generally by regional uplift by tectonic movement.

Derogation—See “impairment.”

Desiccation—The state of extreme dryness, or the process of extreme drying.

Desired future conditions—A park’s natural and cultural resource conditions that the NPS aspires to achieve and maintain over time, and the conditions necessary for visitors to understand, enjoy, and appreciate those resources. These conditions are identified through a park’s planning process.

Detritus—A *non*-living particulate organic material (as opposed to dissolved organic material). It typically includes the bodies or fragments of dead organisms as well as fecal material. Detritus is typically colonized by communities of microorganisms which act to decompose (or remineralize) the material.

Dredging—An excavation activity or operation usually carried out at least partly underwater, in shallow seas or fresh water areas with the purpose of gathering up bottom sediments and disposing of them at a different location.

Dune—A mound or ridge of sand or other loose sediment formed by the wind along the sea coast. The majority of dunes at the Seshore are man-made.

Ecology—The interdisciplinary scientific study of the interactions between organisms and the interactions of these organisms with their environment.

Ecosystem—A natural unit consisting of all plants, animals and micro-organisms (biotic factors) in an area functioning together with all of the physical (abiotic) factors of the environment, considered as a unit. Ecosystems can be permanent or temporary. An ecosystem is a unit of interdependent organisms which share the same habitat. Ecosystems usually form a number of food webs.

Emergence—The way complex systems and patterns arise out of a multiplicity of relatively simple interactions.

Enabling Legislation—National Park Service legislation that established a particular unit of the national Park System and set forth the legal parameters by which the respective park may operate.

Endangered species—“...any species (including subspecies or qualifying distinct population segment) that is in danger of extinction throughout all or a significant portion of its range (ESA Section 3(6)).” The lead federal agency, U.S. Fish and Wildlife Service, for the listing of a species as endangered is responsible for reviewing the status of the species on a five-year basis.

Endangered Species Act (ESA) (16 USC 1531 et seq.)—An Act to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved and to provide a program for the conservation of such endangered species and threatened species.

Environmental assessment (EA)—An environmental analysis prepared pursuant to the *National Environmental Policy Act* to determine whether a Federal action would significantly affect the environment and thus require a more detailed environmental impact statement (EIS).

Environmental impact statement (EIS)—A detailed NEPA analysis document that is prepared, with extensive public involvement, when a proposed action or alternatives have the potential for significant impact on the human environment. An EIS must meet the requirements of NEPA, CEQ, and the directives of the agency responsible for the proposed project or action.

Ephemeral pools—Temporary pools of water. They are usually devoid of fish, and thus allow the safe development of natal amphibian and insect species.

Erosion—Removal of surface material from the earth’s crust, primarily soil and rock debris, and the transportation of the eroded materials by natural agencies from the point of removal.

Escarpment—A transition zone between different physiogeographic provinces that involves a sharp, steep elevation differential, characterized by a cliff or steep slope. Usually *escarpment* is used interchangeably with scarp. A transition from one series of sedimentary rocks to another series of a different age and composition. When sedimentary beds are tilted and exposed to the surface, erosion and weathering may occur differentially based on the composition. Less resistant rocks will erode faster, retreating until the point they are overlain by more resistant rock.

Essential vehicle—Vehicles used by the National Park Service, or its agents, to conduct authorized administrative activities, such as resources management, law enforcement or other park operations, related to implementation of this plan or other applicable management plan(s) or permit(s), or as needed

to respond to emergency operations involving threats to life, property, or park resources, within in areas that are otherwise closed to recreational ORV or visitor use.

Estuarine—Referring to the area where a water passage where the tide meets a river current; especially an arm of the sea at the lower end of a river.

Ethnographic—A methodological strategy used to provide descriptions of human societies, which as a methodology does not prescribe any particular method (e.g., observation, interview, questionnaire), but instead prescribes the nature of the study (i.e., to describe people through writing). In the biological sciences, this type of study might be called a “field study” or a “case report,” both of which are used as common synonyms for “ethnography.”

Ethnographic resources—Objects and places, including sites, structures, landscapes, and natural resources, with traditional cultural meaning and value to associated peoples. Research and consultation with associated people identifies and explains the places and things they find culturally meaningful. Ethnographic resources eligible for the National Register of Historic Places are called traditional cultural properties.

Exclosure—An enclosed area for protection or shelter from predatory animals.

Executive Order—Official proclamation issued by the President that may set forth policy or direction or establish specific duties for federal agencies in connection with the execution of federal laws and programs.

Extirpate—To destroy the whole of; exterminate.

False crawl—An aborted nesting attempt (emergence onto a beach by a sea turtle). A more correct term is “non-nesting emergence.”

Fauna—All of the animal life of any particular region or time.

Feral—An organism that has escaped from domestication and returned, partly or wholly, to a wild state.

Fledge—To bring up a young bird (chick) until it is able to fly. A *fledgling* is a young bird whose feathers and wing muscles are sufficiently developed for sustained flight.

Floodplain—Any land area susceptible to inundation by floodwaters from any source.

Flora—The first meaning, flora of an area or of time period, refers to all plant life occurring in an area or time period, especially the naturally occurring or indigenous plant life. The second meaning refers to a *book or other work* which describes the plant species occurring in an area or time period, with the aim of allowing identification.

Foreshore—The area that is exposed to the air at low tide and underwater at high tide (for example, the area between tide marks). This area can include many different types of habitats, including steep rocky cliffs, sandy beaches, or wetlands (e.g., vast mudflats). The area can be a narrow strip, as in Pacific islands that have only a narrow tidal range, or can include many meters of shoreline where shallow beach slope interacts with high tidal excursion.

Geohazards—This definition implies that geohazards are widespread phenomena that are related to geological and environmental conditions and involve long-term and/or short-term geological processes.

Geohazards can thus be relatively small features, but they can also attain huge dimensions (e.g., submarine or surface landslide) and affect local and regional socio-economy (e.g., tsunamis) to a large extent. In addition, human activities - for example drilling through geohazards like overpressured zones - could result in significant risk, and as such mitigation and prevention are paramount, through improved understanding of geohazards, their preconditions, causes and implications. In other cases, particularly in montane regions, natural processes can cause catalytic events of a complex nature, such as an avalanche hitting a lake causes a debris flow, with consequences potentially hundreds of miles away, or a lahar released by volcanism.

Germination—The process in which a seed or spore emerges from a period of dormancy. The most common example of germination is the sprouting of a seedling from a seed of an angiosperm or gymnosperm.

Hatchlings—A young bird or turtle that has recently emerged from its egg.

Historic breeding area—Areas used within the last 10 breeding seasons.

Hopper dredging—A self-propelled dredge having compartments in which the dredged material can be carried and dumped through hoppers.

Human disturbance—Any human activity that changes the contemporaneous behavior of one or more individuals of breeding, nesting, foraging, or roosting colonial waterbirds, piping plover, Wilson's plover, or American oystercatcher. Behaviors indicating disturbance include defensive displays; alarm calls; flushing or leaving a nest or feeding area; and diving or mobbing pedestrians, dogs, or vehicles.

Hydrology—The study of the movement, distribution, and quality of water throughout earth, and thus addresses both the hydrologic cycle and water resources.

Impairment—An impact that, in the professional judgment of a responsible NPS manager, would harm the integrity of park resources or values and violate the 1916 NPS Organic Act mandate that park resources and values remain unimpaired.

IMPLAN—An economic impact assessment modeling system that allows the user to build economic models to estimate the impacts of economic changes.

Incidental take—Take of listed fish or wildlife species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by a federal agency or applicant (50 CFR 402.02).

Inlet—A narrow body of water between islands or leading inland from a larger body of water, often leading to an enclosed body of water, such as a sound, bay, lagoon or marsh. In sea coasts an inlet usually refers to the actual connection between a bay and the ocean and is often called an “entrance” or a recession in the shore of a sea, lake or river. A certain kind of inlet created by glaciation is a fjord, typically but not always in mountainous coastlines and also in montane lakes.

Interdune blowout—Refers to the wind-swept, flat areas that lie between primary and secondary coastal dune systems.

Intertidal—The area that is exposed to the air at low tide and underwater at high tide (for example, the area between tide marks). This area can include many different types of habitats, including steep rocky cliffs, sandy beaches, or wetlands (e.g., vast mudflats).

Intertidal zone—(Also known as the foreshore and sometimes referred to as the littoral zone). The area that is exposed to the air at low tide and underwater at high tide (for example, the area between tide marks). This area can include many different types of habitats, including steep rocky cliffs, sandy beaches, or wetlands (e.g., vast mudflats). The area can be a narrow strip, as in Pacific islands that have only a narrow tidal range, or can include many meters of shoreline where shallow beach slope interacts with high tidal excursion.

Lightscape management (natural ambient)—The effective use of good design to appropriately light areas and minimize or eliminate light clutter, the spill over of light into areas where light is not wanted, and light pollution, all of which wastes energy and impacts park visitors, neighbors and resources.

Logarithmic Scale—A scale of measurement that uses the logarithm of a physical quantity instead of the quantity itself.

Misorientation—Orientation in the wrong direction. For hatchling sea turtles on the beach, travel in any direction other than the general vicinity of the ocean.

Mitigation—“Mitigation,” is defined in NPS Director’s Order 12 as a modification of the proposal or alternative that lessens the intensity of its impact on a particular resource. The definition references 40 CFR 1508.20, which states:

1. Avoiding the impact altogether by not taking a certain action or parts of an action.
2. Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the impact of repairing, rehabilitating, or restoring the affected environment.
4. Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
5. Compensating for the impact by replacing or providing substitute resources or environments.

The term “mitigation” is used interchangeably in this plan/EIS with other terms, including “mitigation measure,” “mitigation techniques,” and “mitigation strategies.”

Mobile (precocial)—A young bird or turtle hatched or born in an advanced state of development and mobility and able to feed itself almost immediately.

Morphology—The form, structure and configuration of an organism.¹ This includes aspects of the outward appearance (shape, structure, colour, pattern) as well as the form and structure of the internal parts like bones and organs.

Mudflats—Coastal wetlands that form when mud is deposited by tides or rivers. They are found in sheltered areas such as bays, bayous, lagoons, and estuaries. Mudflats may be viewed geologically as exposed layers of bay mud, resulting from deposition of estuarine silts, clays and marine animal detritus. Most of the sediment within a mudflat is within the intertidal zone, and thus the flat is submerged and exposed approximately twice daily.

Mudflats are typically important regions for wildlife, supporting a large population, although levels of biodiversity are not particularly high. They are often of particular importance to migratory birds. The

maintenance of mudflats is important in preventing coastal erosion. However, mudflats worldwide are under threat from predicted sea level rises, land claims for development, dredging due to shipping purposes, and chemical pollution.

NEPA process—The objective analysis of a proposed action to determine the degree of its impact on the natural, physical, and human environment; alternatives and mitigation that reduce that impact; and the full and candid presentation of the analysis to, and involvement of, the interested and affected public—as required of federal agencies by the National Environmental Policy Act of 1969.

Nesting crawl—A crawl resulting from a nesting attempt in which eggs were deposited (FWC 2002).

Nesting habitat—Habitat(s) that host the birds during nesting including incubation, brooding and chick foraging.

Nestling—A bird that is too young to leave its nest.

Niche—A habitat supplying all of the necessary factors for a species existence.

Nocturnal—An animal behavior characterized by being active during the night and sleeping during the day.

Off-road vehicle (ORV)—Any motorized vehicle designed for or capable of cross-country travel on or immediately over land, water, sand, snow, ice, marsh, swampland, or other natural terrain; except that such term excludes (a) any registered motorboat, (b) any fire, military, emergency or law enforcement vehicle when used for emergency purposes, and any combat or combat support vehicle when used for national defense purposes, and (c) any vehicle whose use contrary to restrictions proposed in this plan is expressly authorized by the Superintendent or the Refuge Manager under a permit, lease, license, or contract.

Organic Act (NPS)—The 1916 law (and subsequent amendments) that created the National Park Service and assigned it responsibility to manage the national parks.

ORV corridor—An *ORV corridor* is the actual physical demarcation of the ORV route in the field. The ORV corridor on the ocean beach would be marked by posts seaward of the toe of dune or vegetation line to the high tide line.

ORV pass-through zone—An area where an ORV route would be defined to provide access to a specific area. ORV may drive through this zone to reach their destination, but may not stop or disembark passengers within this zone.

ORV route—A designated location, typically linear in nature (e.g., from point A to point B), where ORV travel may be authorized by the Superintendent, but which may be temporarily closed to ORV use to protect park resources, provide for visitor safety, or prevent user conflicts.

Overwash—Areas where water has run over or crested a berm or other structure that does not flow directly back to the ocean or lake.

Overwash fan—A fan-shaped deposit of sand, gravel or cobbles that is deposited from water that has run over or crested a berm or structure that does not flow directly back to the ocean or lake.

Park—Any one of the hundreds of areas of land and water administered as part of the national park system. The term is used interchangeably in this document with “unit,” “park unit,” and “park area.” In the context of this plan, “park” is synonymous with “National Seashore” or “Seashore.”

Pedestrian corridor—An established/marked area for pedestrian access.

Periodic review—A systematic review of data, habitat conditions, and other information to be conducted by NPS every 5 years, after a major hurricane, or after a significant change in protected species status (e.g., listing or de-listing), in order to evaluate the effectiveness of management actions in making progress toward the accomplishment of stated objectives. Periodic review could result in changes to the management actions in order to improve effectiveness. When desired future conditions for resources are met or exceeded, periodic review and adaptive management may allow for more flexible management of recreational use, provided adverse impacts of such use are effectively managed and wildlife populations remained stable. Where progress is not being made toward the attainment of desired future conditions, periodic review and adaptive management may provide for additional management including appropriate restrictions on recreational use.

Physiographic—(also known as geosystems or physiography) is one of the three major subfields of geography, as opposed to the cultural or built environment, the domain of human geography. Within the body of physical geography, the Earth is often split either into several spheres or environments, the main spheres being the atmosphere, biosphere, cryosphere, geosphere, hydrosphere, lithosphere and pedosphere. Research in physical geography is often interdisciplinary and uses the systems approach.

Plumage—The layer of feathers that cover a bird and the pattern, color, and arrangement of those feathers. The pattern and colors of plumage vary between species and subspecies and can also vary between different age classes, sexes, and season. Within species there can also be a number of different colour morphs. Differences in plumage are used by ornithologists and birdwatchers in order to distinguish between species and collect other species specific information.

Poaching—The illegal hunting, fishing, trapping, or eating of wild plants or animals contrary to local and international conservation and wildlife management laws.

Pollutants—The introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the ecosystem (i.e., physical systems or living organisms). Pollution can take the form of chemical substances, or energy, such as noise, heat, or light. Pollutants, the elements of pollution, can be foreign substances or energies, or naturally occurring; when naturally occurring, they are considered contaminants when they exceed natural levels.

Potential new habitat—Habitat recently created, usually by storms (e.g., overwash passes, blowouts, etc.).

Predation—Describes a biological interaction where a predator (an organism that is hunting) feeds on its prey, (the organism that is attacked). Predators may or may not kill their prey prior to feeding on them, but the act of predation always results in the death of the prey. The other main category of consumption is detritivory, the consumption of dead organic material. It can at times be difficult to separate the two feeding behaviors, for example where parasitic species prey on a host organism and then lay their eggs on it for their offspring to feed on its decaying corpse. The key characteristic of predation however is the predator's direct impact on the prey population. On the other hand, detritivores simply eat what is available and have no direct impact on the “donor” organism(s).

Predator—An organism that hunts and feeds on its prey (the organism that is attacked). Predators may or may not kill their prey prior to feeding on them, but the act of predation always results in the death of the prey.

Prenesting closure—A kind of resource closure in which an area of suitable habitat is proactively closed to ORVs and pedestrians at the start of the shorebird breeding season to provide undisturbed habitat for bird breeding activities to occur.

Preserve—To protect from loss or harm; conserve. Historically, the terms preserve, protect and conserve have come collectively to embody the fundamental purpose of the NPS—preserving, protecting and conserving the national park system.

Recent breeding areas—Areas used in the last three breeding seasons.

Research area—Area of suitable habitat set aside on a temporary or long-term basis (such as a study site or control plot) as part of a research project authorized by NPS under a research permit.

Resource closure—Any area posted as closed to all public entry in order to protect wildlife, such as breeding and foraging shorebirds and bird and turtle nests, or vegetation from human disturbance.

Riparian—Relating to or living or located on the bank of a natural watercourse (as a river) or sometimes of a lake or a tidewater.

Roosting—A resting state or period of relative inactivity employed by birds to save energy and compensate for the high metabolic rates that occur during the active part of the day. Sleeping birds often use a type of sleep known as vigilant sleep, where periods of rest are interspersed with quick eye-opening ‘peeks,’ allowing them to be sensitive to disturbances and enable rapid escape from threats.

Salinity—The saltiness or dissolved salt content of a body of water. It is a general term used to describe the levels of different salts such as sodium chloride, magnesium and calcium sulfates, and bicarbonates.

Scarified—To break a seed coat through nicking or abrasion.

Scrapes—A place where soil has been scraped away, esp. a shallow hollow formed in the ground by a bird during a courtship display or for nesting.

Sediment—Any particulate matter that can be transported by fluid flow, and which eventually is deposited. Sediments are most often transported by water transported by wind) and glaciers. Beach sands and river channel deposits are examples of fluvial transport and deposition, though sediment also often settles out of slow-moving or standing water in lakes and oceans.

Sheetflow—Flowing water that is not confined to a channel.

Socioeconomic—The study of the relationship between economic activity and social life.

Soundscape (natural)— the aggregate of all the natural, nonhuman-caused sounds that occur in parks, together with the physical capacity for transmitting natural sounds.

Species Management Area (SMA)—Area of suitable habitat that has had concentrated and recurring use by multiple individuals and/or multiple species of protected shorebirds during the breeding season or nonbreeding season, or concentrations of seabeach amaranth specimens, in more than one (i.e., two or

more) of the past 5 years and is managed to reduce or minimize human disturbance. SMAs are reevaluated and redesignated every 5 years, or after major hurricanes, as part of the periodic review process.

Subarctic—A region in the Northern Hemisphere immediately south of the true Arctic and covering much of Alaska, Canada, southern Greenland, the north of Scandinavia, Siberia, northern Mongolia and the Chinese province of Heilongjiang. Generally, subarctic regions fall between 50°N and 70°N latitude, depending on local climates.

Substrate—The earthy material that exists in the bottom of a marine habitat, like dirt, rocks, sand, or gravel.

Subtropical—The geographical zone of the Earth immediately north and south of the tropical zone, which is bounded by the Tropic of Cancer and the Tropic of Capricorn, at latitudes 23.5°N and 23.5°S.

Superintendent—The senior on-site NPS official in a park. Used interchangeably with “park superintendent,” “park manager,” or “unit manager.”

Symbolic fencing—Posts with string tied between them.

Synonym—Different words (or sometimes phrases) with identical or very similar meanings. Words that are synonyms are said to be synonymous, and the state of being a synonym is called synonymy.

Take—An act that potentially harasses, injures, or kills a protected species (FWC 2002). Take is defined differently depending on the governing legislation (i.e., Title 36 Code of Federal Regulations (CFR), *Endangered Species Act*, *Migratory Bird Treaty Act*).

“Take” as it applies to Title 36 CFR and as stated in 36 CFR 1.4 means to pursue, hunt, harass, harm, shoot, trap, net, capture, collect, kill, wound, or attempt to do any of the above.

“Take” as it applies to the Endangered Species Act and as stated in the Act Section 3.19 means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harass is defined by Fish and Wildlife Service as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding feeding or sheltering. Harm is further defined by the Fish and Wildlife Service to include significant habitat modification or degradation that results in death to listed species by significantly impairing behavioral patterns such as breeding, feed or sheltering (50 CFR 17.3).

“Take” as it applies to the Migratory Bird Treaty Act and as stated in 50 CFR 10.12, includes pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect. Executive Order 13186 which calls for an MOU that has not been completed by NPS or other land management agencies defines intentional and unintentional take.

Taxon—A group of (one or more) organisms, which a taxonomist adjudges to be a unit.

Telemetry—A technology that allows remote measurement and reporting of information.

Thermal—A column of rising air in the lower altitudes of the earth's atmosphere. Thermals are created by the uneven heating of the Earth's surface from solar radiation, and an example of convection. The sun warms the ground, which in turn warms the air directly above it.

Traditional—Pertains to recognizable, but not necessarily identical, cultural patterns transmitted by a group across at least two generations. Also applies to sites, structures, objects, landscapes, and natural resources associated with those patterns. Popular synonyms include “ancestral” and “customary.”

Traditionally associated peoples—Social/cultural entities such as tribes, communities, and kinship units, as well as park neighbors, traditional residents, and former residents who remain attached to a park area despite having relocated, are “traditionally associated” with a particular park when (1) the entity regards park resources as essential to its development and continued identity as a culturally distinct people; (2) the association has endured for at least two generations (40 years); and (3) the association began prior to establishment of the park.

Traditional cultural property—A property associated with cultural practices, beliefs, the sense of purpose, or existence of a living community that is rooted in that community's history or is important in maintaining its cultural identity and development as an ethnically distinctive people. Traditional cultural properties are ethnographic resources eligible for listing in the National Register of Historic Places.

Unacceptable impacts—Impacts that, individually or cumulatively, would

- be inconsistent with a park's purposes or values, or impede the attainment of a park's desired future conditions for natural and cultural resources as identified through the park's planning process, or
- create an unsafe or unhealthful environment for visitors or employees, or
- diminish opportunities for current or future generations to enjoy, learn about, or be inspired by park resources or values, or
- unreasonably interfere with
 - park programs or activities, or
 - an appropriate use, or
 - the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park.
 - NPS concessioner or contractor operations or services.

Viewsheds—An area of land, water, or other environmental element that is visible to the human eye from a fixed vantage point. The term is used widely in such areas as urban planning, archaeology, and military science. In urban planning, for example, viewsheds tend to be areas of particular scenic or historic value that are deemed worthy of preservation against development or other change. Viewsheds are often spaces that are readily visible from public areas such as from public roadways or public parks. The preservation of viewsheds is frequently a goal in the designation of open space areas, green belts, and community separators.

Visitor—Anyone who physically visits a park for recreational, educational or scientific purposes, or who otherwise uses a park's interpretive and educational services, regardless of where such use occurs (e.g., via Internet access, library, etc.).

Visitor experience—The perceptions, feelings, and reactions a park visitor has in relationship with the surrounding environment.

Vulnerable—A species which is likely to become endangered unless the circumstances threatening its survival and reproduction improve.

Wetlands—Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominantly hydrophytes; 2) the substrate is predominantly undrained hydric soil; and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (Classification of Wetlands and Deepwater Habitats of the United States [Cowardin et al. 1979]).

Wrack line—Also known as a drift line, it is a line of stranded debris along a beach face marking the point of maximum run-up during a previous high tide.

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Appendix A:
Literature Review: Impacts and
Management of Off-Road
Vehicles



LITERATURE REVIEW: IMPACTS AND MANAGEMENT OF OFF-ROAD VEHICLES

December 2009

Prepared in support of the Cape Hatteras National Seashore Off-Road Vehicle Management
Plan/Environmental Impact Statement

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INTRODUCTION

Officially authorized in 1937 along the Outer Banks of North Carolina, Cape Hatteras National Seashore (the Seashore) is the nation's first national seashore. Consisting of more than 30,000 acres distributed along approximately 68 miles of shoreline, the Seashore is part of a dynamic barrier island system.

The Seashore serves as a popular recreation destination with more than 2.1 million visitors in 2008 (NPS 2008e), showing an 8-fold increase in visitation since 1955 (NPS 2007f). Seashore visitors participate in a variety of recreational activities, including beach recreation (sunbathing, swimming, shell collecting, etc.), fishing (surf and boat), hiking, hunting, motorized boating, non-motorized boating (sailing, kayaking, canoeing), nature study, photography, off-road vehicle use (beach driving), shellfishing, sightseeing, watersports (surfing, windsurfing, kiteboarding, etc.), and wildlife viewing. Seashore visitors use ORVs for traveling to and from swimming, fishing, and surfing areas, and for pleasure driving.

Current management practices at the Seashore allow ORV users to drive on the beach seaward of the primary dune line, with a 10 meter backshore areas seaward of the primary dune line protected seasonally. Drivers must use designated ramps to cross between the beach and NC-12 which runs behind the primary dune line. In addition to a multitude of visitor opportunities, the Seashore provides a variety of important habitats created by its dynamic environmental processes, including habitats for the federally-listed piping plover; sea turtles, and one listed plant species, the seabeach amaranth. The Seashore contains ecologically important habitats such as marshes, tidal flats, and riparian areas, and hosts various species of concern such as colonial waterbirds (least terns, common terns, and black skimmers), American oystercatcher, and Wilson's plover, all of which are listed by the North Carolina Wildlife Resources Commission (NCRWC) as species of special concern. In addition, the gull-billed tern, also found at the Seashore, is listed by the NCRWC as threatened.

Historically, beach driving at the Seashore was for the purpose of transportation, and not recreation. The paving of NC-12, the completion of the Bonner Bridge connecting Bodie and Hatteras islands in 1963, and the introduction of the State of North Carolina ferry system to Ocracoke Island facilitated visitor access to the sound and ocean beaches. Improved access, increased population, and the popularity of the SUV have resulted in a dramatic increase in vehicle use on Seashore beaches. There has also been a decline in most beach nesting bird populations on the Seashore since the 1990's.

ORV use has increased substantially on public lands nationwide over the last half-century (The Wilderness Society 2006), including at the Seashore. In response to the widespread and rapidly increasing use of ORVs on public lands "often for legitimate purposes but also in frequent conflict with wise land and resource management practices, environmental values, and other types of recreational activity," Executive Order 11644, *Use of Off-Road Vehicles on the Public Lands*, was issued in 1972 and amended by Executive Order 11989, *Use of Off-Road Vehicles on The Public Lands* in 1977. These executive orders require federal agencies allowing ORVs to designate specific areas and trails on public lands where the use of ORVs is or is not permitted.

In units of the national park system, including the Seashore, the NPS is required to manage according to the NPS *Organic Act*, through which Congress requires the NPS to preserve park resources "unimpaired for the enjoyment of future generations" (16 USC 1). While the Secretary of the Interior has the authority to allow certain activities in park units, those activities must comply with the *General Authorities Act*, which specifies that activities that lead to the "derogation of the values and purposes" of a park unit should not be allowed (16 USC 1a – 2(h))—language that is mirrored in the *Redwoods Act of 1978* (16 USC 1a-1). This congressional emphasis on uses compliant with park values and purposes is further described in NPS management policies and is vital to policy-based decision-making about land use in national park units.

NPS *Management Policies 2006* includes several guidelines that pertain to monitoring certain uses in park units. Consistent with the Congressional acts, the management policies state that the NPS “must ensure that park uses that are allowed would not cause impairment of, or unacceptable impacts to, park resources and values” (NPS 2006: 1.5). Unacceptable impacts are those that, among other things, “unreasonably interfere with park programs or activities, or an appropriate use, or the atmosphere of peace and tranquility, or the natural soundscape maintained in wilderness and natural, historic, or commemorative locations within the park” (NPS 2006: 1.4.7.1). If unacceptable impacts result from any activity, superintendents are required to “engage in a thoughtful, deliberate process to further manage or constrain the use, or discontinue it” (NPS 2006: 1.5).

While access to public lands improves the experience of ORV users, motorized access to sensitive environments, such as coastal ecosystems, can pose a threat to sensitive species that rely on the beach habitat. Other impacts from motorized access to public lands include adverse effects on water quality, adverse effects on vegetation, impacts to cultural resources, detracting from other visitors’ enjoyment of public lands, and creation of law enforcement issues. ORVs can churn up and damage delicate soils (Proescholdt 2007; Ouren et al. 2007; Webb 1982). Air quality can be negatively affected by exhaust fumes, oil, and dust resulting from ORV use (Taylor n.d.; Proescholdt 2007; Ouren et al. 2007). Loud engines in quiet environments can disturb wildlife and affect visitor enjoyment for those who use parks as places of peace and solace (Proescholdt 2007). Park rangers surveyed during a 1999 study reported incidents where ORV use has destroyed or disturbed cultural resources that parks are bound by law to protect (Bluewater Network 1999). While it is unknown how many coastal park units were included in the study, it can be assumed that such issues also occur in coastal units where ORV traffic is allowed.

This literature review has been prepared to support the development of an ORV management plan at the Seashore. The following sections summarize available information related to the potential effects of ORV use on natural resources, such as wildlife habitat, aesthetics/sound, and vegetation, found in national park units with coastal sand dune ecosystems. Relevant water quality findings are also reported here. In addition, information on the effects of ORV use on socioeconomics and management issues are examined. Because the majority of the area administered as Cape Hatteras National Seashore is best described as a coastal beach environment, with the major issues for resource protection being the protection of threatened and endangered species and the maintenance of coastal wildlife habitat, this literature review focuses on impacts from ORV use in similar coastal environments.

Wildlife and Wildlife Habitat

Numerous studies have detailed the impacts to wildlife of ORV use on public lands. Impacts generally described in these studies include direct mortality, harassment, noise effects, and habitat destruction. Specific risks to wildlife include injury during escape responses and, in severe cases, habitat avoidance and abandonment of young. Radle (2007) found that wildlife generally experience an increase in heart rate, as well as altered metabolism and hormone balance, when introduced to human-made noise. Noise from ORVs can affect the senses of animals that depend on hearing and vibration detection to survive (resulting in inability of wildlife to hear sounds important for mating, avoiding predators, and finding prey) (Berry 1980; Bury 1980; Bluewater Network 1999). ORVs also impact wildlife by destroying or fragmenting habitat. Much of the existing research has dealt specifically with the effects of vegetation damage by visitors and the associated impacts to wildlife habitat values (Monz et al. 2003). This has led some to conclude that the most effective strategies for avoiding habitat disturbance are outright road removal and the avoidance of new road construction in roadless or sparsely roaded areas (Trombulak and Frissell 2001; Walder n.d.).

Park managers generally agree that intensive ORV use harms wildlife, including endangered species. From July to November of 1999, Bluewater Network conducted a survey of 108 national park units

regarding the use of all-terrain vehicles and other ORVs. While the number of surveys conducted at seashore units is not reported, among the issues cited by respondents was the use of ORVs resulting in collisions with and crushing of animals, destruction of habitat, and animals being frightened away from shelter or important habitat (Bluewater Network 1999).

Various studies have examined the effects of ORVs on intertidal invertebrates. Work done on high-energy beaches has suggested that life in the intertidal and supratidal areas may be far more abundant and varied than previously thought (Zaremba et al. 1973), and this life could be affected by ORV use. One study conducted at the Seashore (Landry 2004) documented recovery rates of ghost crab (*Ocypode quadrata*) populations following ORV impacts and high-energy weather events. Beach closures were initiated to study short-term effects and recovery rates. Sediment analysis and beach soil compaction differences in the ghost crab habitat were measured in both untraveled and travelled zones. The study found differences in crab burrow densities between closed and open beaches. Alternative time spans for beach closings varied in their effectiveness for promoting recovery at various beach areas.

Findings from a 1984 study conducted at nearby Cape Lookout (Wolcott and Wolcott 1984) examined impacts of ORV use on mole crabs (*Emerita talpoida*), coquina clams (*Donax variabilis*) and ghost crabs. Results indicated that ghost crabs were completely protected if borrows were at least 5 centimeters (2 inches) deep. The ghost crab creates burrows for shelter from heat and desiccation stress during summer daytime periods. Juveniles produce shallow J-shaped burrows with a mean depth of 160 millimeters (6.3 inches), while adults dig Y-shaped and spiral burrows with mean depths of 361 millimeters (14.2 inches) (Chan et al. 2006). The Wolcott study also found no damage to mole crabs or coquinas; however, crushing of ghost crabs by ORVs occurred during their nighttime feeding on the foreshore¹. The study recommended establishing a ban on ORV traffic on the foreshore between dusk and dawn to protect this species (Wolcott and Wolcott 1984).

Moss and McPhee (2006) compared ghost crab burrow counts on exposed sandy beaches off the coast of southeast Queensland in areas designated as “open” and “closed” to recreational ORV use and found that beaches where recreational ORV activity was present had significantly lower ghost crab abundance than beaches where ORV use was absent. Similarly, a study on North Stradbroke Island in Australia found crab densities to be significantly lower in areas subject to heavy beach traffic. While crab mortality declined with depth of burrows, burrowing only partially protected crabs. Crabs in shallow burrows of 5 centimeters (1.9 inches) were killed by 10 vehicle passes. While deep-living crabs (which burrowed to depths of least 30 centimeters [11.8 inches]) were not killed by ORVs, this subpopulation represented only half of the total population surveyed (Schlacher et al. 2007).

Schlacher and others (2008) used surf clams (*Donax deltoides*) to investigate damages caused by vehicles to sandy shore invertebrates, and found that in situations where cars traversed soft sand and turned across the beach face, clams had some tolerance against vehicles at low traffic volumes (5 vehicle passes), but more than half of them were killed at higher traffic volumes (75 passes). Van Der Merwe (1991) studied the effects of ORVs on four intertidal invertebrate species in South Africa: the gastropod *Bullia rhodostoma*, the bivalves *Donax serra* and *Donax sordidus*, the benthic mysid *Gastrosaccus psammodytes*, and the supralittoral isopod, *Tylos capensis*. All the above-named species except for the benthic mysid showed a high tolerance for vehicular disturbances. The supralittoral isopod demonstrated increasing damage as with more vehicle passes in the less compact sand above the drift line.

¹ Also known as the intertidal zone, the foreshore is defined as that part of the beach between the spring low water mark and the spring high water mark. The upper limits of the intertidal zone are defined by the uppermost wrack line. A wrack line is a line of stranded debris along a beach face marking the point of maximum run-up during a previous high tide, and there may be several on a beach.

In a study of four beaches at Cape Cod and Fire Island National Seashores, Kluft and Ginsberg (2004), used analysis of variance as a statistical metric and found that invertebrates such as the talitrid amphipod (*Talorchestia longicornis*) and the lycosid spider (*Arcotosa littoralis*) were significantly more abundant in the wrackline in vehicle-free areas than in high-traffic zones. On sandy beaches, invertebrates such as gastropods and bivalves could be safe if buried beneath compact sand (which is common when the tide is out). Stephenson (1999), while not specifying particular invertebrate species, cited research that indicated a reduction in both the abundance and number of species of surface and subsurface invertebrates as a result of vehicles on coastal dunes. Crushing by vehicle wheels, destruction of the surface litter layer (where present), and the changes in soil properties and microclimate that accompany track creation, or the overall reduction in plant cover, all contribute to the negative response of these elements of the fauna. Invertebrates associated with the above-ground portions of plants also exhibited reductions in abundance and number of species as a consequence of vehicle impacts to the vegetation and microclimate of dunes (Stephenson 1999).

Bird species are also affected by ORV use on shoreline ecosystems. Historically, many beach-nesting waterbirds have shown population declines along the beaches of the Seashore in response to increased human disturbance, retreating to small soundside islands created from dredge material excavated from navigational channels. By the late 1970s, erosional forces and changes to dredging techniques had whittled away much of these refuges, leaving no choice for the birds but to return to ocean beaches. One such species of special concern is the piping plover (*Charadrius melodus*), which lays speckled eggs that are perfectly camouflaged in the beach sand. A two-year study of piping plovers along the New Jersey shore (Burger 1994) found that plovers forage along the tidal oceanfront, in the dunes, and in backbays, and their relative use of these habitats partially depends upon human presence. While on beaches with few people, plovers can spend 90 percent of time foraging, whereas on beaches with many people they may spend less than 50 percent of their foraging time in direct feeding behaviors (Burger 1994). Results of a logistic regression analysis of the spatial distribution and productivity of piping plover nests in relation to proxy indicators of human disturbance on the barrier islands of Long Island, New York, indicated that for each additional kilometer of road within a 500-meter (1640-foot) radius, the likelihood of the presence of a plover nest decreased by up to 53%. Higher productivity appeared to be only slightly correlated with increasing distance from parking lots, roads, and residential areas. Moreover, no difference in mean productivity was observed among the levels of ORV access (Thomsen 2006).

Among bird species, adverse reactions to human recreational activities have included nest desertion, temporary nest abandonment, and changes in foraging habits (Douglass et al. 1999). Comparing two beach plots open and closed to human traffic along North Carolina's Outer Banks, Collazo and others (1995) found that resting time of shorebirds was reduced by nearly 50 % in areas open to human activity. Although some research indicates predators are the main cause of nest failure of shore-nesting birds, Stephenson (1999) identifies vehicle use as a major cause for reductions in reproductive potential of birds on both coastal dunes and shorelines. Similarly, Melvin and others (1994) described 14 incidents of direct piping plover mortality caused by ORVs in Massachusetts and New York from 1989 through 1993. They estimated the number of one-way vehicle passes per day during the period when mortality occurred, demonstrating that ORV use, even at levels of less than 10 vehicle passes per day, is a threat to unfledged piping plover chicks and adults during brood-rearing periods.

An in-depth study of colonial waterbird reproductive success and population trends along the Atlantic coast, which involved field research at Cape Lookout National Seashore, revealed that American oystercatchers are also at risk in rapidly changing coastal ecosystems. The nest survival rate was calculated to be 0.928 per nest day (213 nests lost during 2,961 nest-days of incubation), with the probability of a clutch surviving to hatching of 0.133 (Davis et al. 2001). A comparison of reproductive success of the American oystercatcher on three river islands in the lower Cape Fear of North Carolina with that of birds nesting on barrier island beach habitat of Cape Lookout National Seashore (McGowan

et al. n.d.) revealed that there were 17.6 times more oystercatcher breeding pairs per kilometer on the river island habitat than on the barrier beach habitat. ORV use was directly investigated in this study. The primary cause of nest failure on river islands was flooding, while the primary cause on barrier islands was mammalian predation. In their study of reproductive success of American oystercatchers along the Atlantic coast from Cape Fear to Cape Hatteras National Seashore, Simons and McGowan (2003) also identified predation as the major factor accounting for population decline. Patterson and others (1991) studied piping plovers on Assateague Island, Maryland, in 1986–87 to estimate population size and to identify factors affecting productivity. The study found that predators accounted for most of the known causes of nest losses (91%), with only one nest lost due to direct human destruction and no evidence that suggested recreational disturbance was a factor affecting productivity.

Detailed results of an analysis of eight seasons of reproductive success data at the Seashore found that mammalian predation accounted for 29 % of nest failures (McGowan 2004). The study also found that human disturbance, 24 % of which attributable to ORVs, increased the frequency of trips from the nest during incubation and could contribute to reduced oystercatcher hatching success (McGowan 2004). A recent study by Sabine (2005) involved video monitoring of 32 American oystercatcher nests to document causes of nest failure at Cumberland Island National Seashore, Georgia. Predation was determined to be the primary cause of nest failure. Vehicle disturbances were also simulated by driving immediately below the high water line at approximately 50 meters (164 feet) seaward of nests in order to observe oystercatcher behavioral responses. Although the study found that vehicular activity reduced foraging behavior during brood rearing, results from the disturbance experiment indicated that oystercatchers were more sensitive to pedestrian disturbance than vehicle disturbance during incubation. McGowan and Simons (2006) also suggest that changes in incubation behavior might be one mechanism by which human recreation affects the reproductive success of American oystercatchers. While ATV traffic was positively associated with the rate of trips to and away from the nest, and negatively correlated with percent of time spent incubating, truck and pedestrian traffic had little measured effect on incubation. Stolen (2003) studied the effects of passing vehicles on the foraging behavior of wading birds at the Merritt Island National Wildlife Refuge near Titusville, Florida, and found that foraging wading birds were more likely to be disturbed when vehicles slowed or stopped adjacent to them than when vehicles continued driving by. Experimental disturbance by a vehicle caused a significant depression in the foraging rates of the snowy egret (*Egretta thula*) and the great egret (*Ardea alba*) and non-significant reductions in foraging rates in the tricolored heron (*E. tricolor*). Nineteen percent of the birds flushed after being disturbed. Species reacted differently to disturbance as vehicles approached closer to nests. Tri-colored heron were the most sensitive to flushing; the great egret was intermediately sensitive; and the snowy egret was the least sensitive.

In a study of shorebirds at South Core Banks, South Carolina, Tarr (2008) determined that vehicle disturbance influences shorebird use of ocean beach habitat for roosting during the nonbreeding season. This conclusion was based on the finding that shorebirds were abundant in areas where vehicle abundance was also relatively high, but their distribution among microhabitats was opposite that of vehicles. Vehicles were primarily located on dry sand, while shorebirds were typically found in the swash zone and wet sand microhabitats. When disturbance was introduced, microhabitat use shifted towards the swash zone. This study concluded that vehicle disturbance influences shorebird use of ocean beach habitat for roosting during the nonbreeding season. A study of the results of a ban on beach driving in 2001 on the South African coastline (Williams et al. 2004) found that in the first breeding season after the ban, there was an increase in breeding pairs for all five species in the study (two waders, two terns and a cormorant). Available data indicated that a 50-meter buffer distance around nests is adequate to prevent harassment of the majority of incubating piping plovers, as stated in the Piping Plover Revised Recovery Plan (USFWS 1996). However, fencing around nests should be expanded in cases where the standard 50-meter (164-foot) radius is inadequate to protect incubating adults or unfledged chicks from harm or disturbance.

Impacts may result from species' inability to adapt to the pace of human development. Loggerhead sea turtles, for instance, face many anthropogenic nesting threats, including beach armoring, beach nourishment, artificial lighting, commercial fishing, beach vehicular driving, and pollution (Nester 2006). Vehicles on the beach could negatively impact sea turtles by running over nests or nesting females, hatchlings, or stranded turtles that have washed ashore. In addition, ruts left by vehicles in the sand may prevent or impede hatchlings from reaching the ocean after they emerge from the nest. Hatchlings impeded by vehicle ruts are at greater risk of death from predation, fatigue, desiccation, and being crushed by vehicles. Sand compaction due to vehicles on the beach may hinder nest construction and hatchling emergence from nests. Driving directly over incubating egg clutches can cause sand compaction, which may decrease hatching success and directly kill pre-emergent hatchlings. Additionally, vehicle traffic on nesting beaches may contribute to erosion, especially during high tides or on narrow beaches where driving is concentrated on the high beach and foredune (USFWS 2008).

Witherington (2003) cites challenges to loggerhead sea turtle (*Caretta caretta*) conservation: uncertainty over the historical abundance of loggerheads so that assessment of status can be made, and the incremental deterioration of suitable loggerhead nesting beaches through development (including coastal armoring and sources of beach lighting) and sea level rise. A 1996 report by the Florida Department of Environmental Protection explains that artificial lighting from a variety of sources on beaches tends to deter sea turtles from emerging from the sea to nest (Witherington and Martin 1996). If sea turtles do nest on lighted beaches, hatchlings can be jeopardized as artificial lighting disrupts a critical nocturnal behavior of hatchlings, which will move toward artificial light sources instead of crawling from their nest to the sea. Artificial lighting has also been found to deter sea turtles from emerging from the water to nest. The increase of false crawls on ORV beaches may cause nesting turtles to expend additional energy. This energy could be put into egg production or growth. To evaluate the effect of driving ORVs on nesting activity, Nester (2006) compared driven and non-driven beaches, data on beach slope, sand compaction, beach width, sand color, sand grain size, moisture content, incubation temperature, and pedestrian activity collected during the 2005 nesting season at Cape Lookout National Seashore, Cape Hatteras National Seashore, and Pea Island Wildlife Refuge, North Carolina. The study found that light intensities presented a significant factor in determining nesting or false crawls. False crawls were more likely on ORV beaches where light intensities from vehicles were found to be greater than those on non-ORV beaches. A resulting decline of 20% in production of female loggerhead turtles was estimated at these locations. Recommendations for mitigating the impacts of artificial lighting on sea turtles included installing timers and monitoring devices to minimize unnecessary lighting (Witherington and Martin 1996).

ORV tracks interfere with the ability of hatchling loggerhead turtles to reach the ocean. By observing newly-hatched loggerhead turtles which were released to the intertidal beaches at Fort Fisher Beach in southeastern North Carolina and Cape Lookout Beach in coastal North Carolina, Hosier and others (1981) determined the effect of ORV tracks on the behavior and rate of sea-approach of these turtles. The extended period of travel required to negotiate suitable paths to the surf, together with the tendency to invert, may increase the susceptibility of loggerhead turtles to stress and predation during transit to the ocean when hatching on ORV-impacted beaches. Tracks in the sand may change the micro-topography as much as 10–15 centimeters (3.9–5.9 inches), which may serve as a significant impediment to the movement of hatchling turtles to the sea. Moreover, vehicle tracks generally run parallel to the beach, and can result in distances of 10–20 meters (33–66 feet) where hatchlings cannot successfully negotiate such barriers, especially in coarse sands. At Cape San Blas, Florida, near Eglin Air Force Base, Cox and others (1994) examined hatchling tracks and observed four instances of sea turtle hatchlings being disorientated. Vehicle tracks were thought to be a contributing factor at two sites, causing some hatchlings to make a perpendicular diversion of more than 91 meters (300 feet) en route to the sea. Some hatchling tracks ended within vehicle tracks, which suggests that vehicle tracks may lengthen the time of critical exposure to beach predators, particularly ghost crabs.

Water Quality

Many studies have addressed the effects of ORV use on water quality. Most studies have focused primarily on non-coastal desert or forest environments including soil erosion and sedimentation. In these environments, ORVs which travel along, across, or through creeks, rivers, streams and other waterways create turbidity, harm vegetation, destroy habitat for aquatic species and species that use water resources, and cause increased sedimentation and soil erosion that result in impairments to water quality (Bluewater Network 1999). The Texas Chapter of the American Fisheries Society (2002) cites that ORV use could result in erosion, siltation, bank destabilization, and an increased potential for other water quality impacts. The damage to stream bottoms and increased siltation can change stream temperatures, resulting in increased extremes and temperature variability that can be detrimental to fish populations (TCAFS 2002). No studies were found relating to water quality impacts of ORV use on beaches.

Soils/Dune Ecosystems

Several studies of ORV impacts to coastal soils have focused on comparisons of soil characteristics between high-traffic areas versus non-traffic areas. One such study (Hosier and Eaton 1980) compared two barrier beaches in southeastern North Carolina. Less vegetation cover and fewer species were present on both dunes and grassland areas with vehicular traffic. To illustrate this, when quadrants containing vehicle tracks were removed from the analysis, the average vegetative cover of the dunes on the impacted beaches increased to that of the non-impacted beaches. The soil was also more compact where vehicular traffic had been most intense and where, it was suggested, this compaction may have been contributing to increasing salt flats in the area. Similarly, results of experimental testing of ORV impacts to coastal ecosystems of Cape Cod National Seashore between 1974 and 1977 (Leatherman and Godfrey 1979) showed that the ecosystem most resistant to long-term vehicle impact was the intertidal ocean beach, while the most easily damaged were areas protected from the direct ocean waves by barrier dunes or other upland features (such as salt marshes and sand flats). ORV effects are longest lasting farthest from the source of new sand; the areas farthest away from new sand promote optimal growth of grasses. More specifically, the effects of vehicles on dunes depended on the portion of the dune that was impacted. At dune edges, fewer than 100 vehicle passes stopped seaward growth of grass. In the foredune region, a relatively low number of passes (50–200) reduced plant biomass to very low levels. Recovery of the grasses on the dunes varied with the exact location of the vehicle tracks. On the foredunes, where grass growth is lush and rapid due to fresh sand input, the impacted sites were almost completely recovered after three growing seasons. Findings demonstrated that environments that undergo the greatest physical changes, such as the intertidal ocean beach, appear to have the greatest tolerance to vehicle traffic.

Studies on barrier islands have shown that although infrequent travel over dune vegetation had noticeable immediate impacts, permanent damage was ultimately caused by repeated travel over the same tracks (Judd et al. 1989). Impacts of historic ORV use at Gulf Islands National Seashore included denudation of coastal dunes and resulting blowouts and interior flooding, which have flattened the interior island topography; and the creation of trails that contribute to erosion, further narrowing the island (Shabica 1979). In a similar study at Fire Island National Seashore in New York, Anders and Leatherman (1987) found that vehicular passage over the open beach displaces sand seaward and that ORV use levels could be contributing to the overall erosion rate by delivering large quantities of sand to the swash zone and affecting dune topography. Vehicle traffic resulted in a maximum of 0.75 meters (2.5 feet) of deposition in the zone of actual impact and a slight reduction in the elevation of the foredune. The results of 89 field experiments to examine the effects of ORVs on the beach showed that slope, sand compaction, and the number of vehicle passes in the same track were the principal factors controlling the measured net seaward displacement of sand.

Investigations made between 1973 and 1974 found beach and foredune areas of North Padre Island along the mid-Texas coast to be greatly modified by vehicular traffic (McAtee and Drawe 1981). The primary effects were reduced ground cover and reduced species diversity of vegetation in the foredune areas. As the intensity of human activity increased, dune elevation decreased. Increasing human activity also correlated to higher observed evaporation, soil pH, soil temperature, average wind velocity, atmospheric and soil salinity, and wind-carried sand particles near the ground surface.

Liddle and Grieg-Smith (1975) demonstrated that below 18-centimeter (7-inch) depths, soils became less compacted as a result of vehicle use. But a study of vehicle impacts to sandy beaches on the east coast of Australia (Schlacher and Thompson 2006) found that ORVs corrugated sand as deep as 28 centimeters (11 inches), with the deepest rutting occurring between the foredunes and the drift line. Off-road vehicles in this study were capable of disrupting from 5.8% to 9.4% of the available faunal habitat matrix (the top 30 centimeters [11.8 inches] of the sand which contain the necessary conditions to support the study fauna) in a single day and routinely disturbed the drift line and the base of the foredunes. Belnap (1995) cited several causes of desertification from off-road vehicle use, including soil compaction resulting in decreased water availability to vascular plants through decreased water infiltration. Soil loss can be further accelerated by wind and water erosion and decreased diversity and abundance of soil biota.

Vegetation and Invasive Species

Numerous studies describe the impacts of ORVs on vegetative communities, including both direct and indirect damage to vegetation by vehicle use. Research conducted in the late 1970s at Cape Cod National Seashore on the ecologic and geomorphic effects of ORVs on coastal ecosystems concluded that there is no “carrying capacity” for vehicular impact on coastal ecosystems, and even low-level impacts can result in severe environmental degradation. The most naturally unstable areas, such as the intertidal ocean beach, tend to be the least susceptible to damage due to the rapid pace of natural environmental change and recovery in these areas. Dunes can be quickly devegetated by vehicular passage, resulting in blowouts and sand migration. Of all the ecosystems evaluated, salt marshes and intertidal sand flats are the least tolerant of ORV impacts and should be closed to all vehicle traffic (Leatherman and Godfrey 1979). Similarly results were demonstrated in an experimental testing of ORV traffic on coastal ecosystems of Cape Cod National Seashore between 1974 and 1977 (Godfrey et al. 1978). As detailed in the Soils/Dune Ecosystems section, this study found that even a relatively low number of vehicle passes can reduce plant biomass to very low levels in the foredune area.

At Cape Hatteras National Seashore, potential habitat for the seabeach amaranth includes coastal overwash flats at the accreting ends of the islands and lower foredunes and on ocean beaches above mean high tide (occasionally on sound-side beaches). In its known range, it often grows in the same areas selected for nesting by shorebirds such as plovers, terns, and skimmers. Intensive recreational use, both vehicular and pedestrian, is one factor that threatens the plant’s survival. Its stems are easily broken or crushed by foot traffic and tires, thus, even minor traffic can be detrimental during the growing season (USSWS 1996).

Hosier (1980) cites several cases at the Seashore where vehicle impacts to vegetation have occurred, such as at Oregon and Ocracoke inlets where vehicle traffic has compacted sediments along the unvegetated portions of the beach and near Ocracoke Inlet. In these areas, sand flat vegetation has been altered by ORV tracks and chronic operation of ORVs has kept natural stabilizing vegetation from invading the flats.

A study of vehicle impacts to coastal dunes at Fire Island National Seashore, in which vegetation was monitored in both an experimental field test and a control before and after experimental vehicle impacts, revealed that low-level ORV use (one pass per week) is severely damaging to natural dune vegetation,

and that a steepening of the dune profile occurred in the impacted zones due to higher rates of ORV-related erosion (Anders and Leatherman 1987). Another study of the response of grassy vegetation and soils of coastal sand dunes to varying degrees of vehicle use in Australia found that some species of grassy vegetation demonstrated decline, while others increased under moderate use (Liddle and Grieg-Smith 1975). The researchers also noted that while damage to plant shoots by vehicles was detrimental to plants, soil compaction alone could be beneficial in the sand dune habitat due to roots gaining greater access to higher moisture retaining soils beneath trampled areas. Similarly, results of a study at Cape Cod National Seashore, in which unstabilized and moderately stabilized dune sites were driven at varying levels of intensity, suggested that a single summer season of driving (300–700 passes) on a confined track through grass vegetation can completely destroy the above-ground portions but leave adequate underground roots and rhizomes for a small amount of vegetative regrowth after driving season ends in the late summer and fall (Brodhead and Godfrey 1977).

Three studies reviewed involved direct examination of vehicles to determine if they were potential distributors of exotic plant seeds. Osborn and others (2002) discuss a study that investigated the potential for seed transport into Kakadu National Park in Australia by means of tourist vehicles. The study concluded that vehicles were partially responsible for weed seed dispersal, but the low density of seeds found on the vehicles did not warrant the park taking preventative action. Another study (Rooney 2005) compared soil samples taken from the undercarriage of ORVs to field surveys for seven invasive species in forested areas of Wisconsin. No evidence of actual invasive plant dispersal was noted; however, because invasive plants have seed traits that predispose them to dispersal, the study found that ORVs may occasionally contribute to long-distance dispersal events. This is further supported by a study conducted by the Montana Weed Control Association (Trunkle and Fay 1991), which involved driving a vehicle 40 feet into a vegetated plot and then to various distances from the plot. Afterwards, plant material (including spotted knapweed (*Centaurea stoebe*) seeds) was collected from the undercarriage. At Cape Lookout National Seashore, Hosier (1980) found that deep ORV tracks trapped seeds of sea oats as they were blown across the beach. The captured seeds were then buried and began germination, but the vehicles subsequently churned up the sand and exposed the roots, thus destroying the plants.

Lathrop (1983) found that in arid regions direct vehicle impacts constituted the primary means of vegetative destruction. The study showed that areas beyond the vehicle track width were also affected, although the degree of impact varied with conditions and intensity of vehicle use. The study demonstrated that concentrated current or recent use in localized areas (such as heavy weekend use) created the greatest reduction in vegetative cover. Also in a study of desert environments, Wilshire (1983) found that even a single pass of an ORV could destroy many types of annual and some perennial plants, although hundreds of passes may be required to destroy tough, deep-rooted shrubs.

Aesthetics/Sound

ORV use influences the character of the wild landscape and can result in conflicts between ORV users and other recreational users. With regard to ORV noise-related impacts to park resources, attempts have been made to qualify how visitor experiences in national parks are affected by the addition of mechanical versus natural sound that may come from ORV or other motorized vehicle use such as personal watercraft (PWC). A limited amount of study has been undertaken regarding ORV use and its impacts to soundscapes in NPS units. Studies related to air tours and PWC are available but not directly relevant to ORV use at Cape Hatteras National Seashore.

Gramann (1999) used many approaches to garner information from visitors about sound in NPS units to formulate a more precise picture of human reactions to sound. Overall, results showed that park users identify natural sounds as more enjoyable than mechanical sounds, but mechanical sounds do not always interfere with the user's experience. Visitor experience and sensitivity to mechanical sound are dependent

on visitor expectations, group size, front or backcountry experience, and activity type. For example, a visitor in a group of three or more visiting a park for the first time in the front country and taking pictures may not be as sensitive to mechanical sounds as a lone hiker in the backcountry. People are generally tolerant of certain noise disturbances if they perceive them as necessary (e.g., helicopters conducting fire suppression activities). In this sense, the Gramann study indicated that it is important for sounds to be consistent with the visual setting within which they are heard. Variable noise disturbances may be more readily tolerated depending on the observer's perception of the setting. As a result, from a management perspective, some scenic overlooks and short front country trails may not require as much protection as backcountry locales where preserving the experience of natural sound is paramount to overall visitor experience (Gramann 1999).

Archeological Resources

Whether it is intentional or inadvertent, ORV use has the potential to affect archeological resources on public lands (BLM 2000; Lyneis et al. 1980; Schiffman 2005; Sowl and Poetter 2004; SUWA 2002). Direct impacts result from the damage or destruction that occurs when ORVs drive over and/or near archeological sites. Site integrity, a necessary element for listing a cultural resource on the National Register of Historic Places, is also affected by the visible changes caused by vehicle tracks and erosion (Sowl and Poetter 2004). Studies conducted in the California desert note that ORVs provide access to previously inaccessible, remote areas as ORV users explore new terrain (Lyneis et al. 1980). According to the BLM, this leads to increased visitation to lands previously used only by small numbers of hikers, and increases the intentional and inadvertent damage of archeological resources through surface disturbances (BLM 2000). ORVs have also enabled collectors and pothunters to reach these remote areas, which facilitates greater archeological resource damage from intentional collection and vandalism (BLM 2000; Schiffman 2005; Lyneis et al. 1980; SUWA 2002).

Socioeconomics

ORV-related economic impacts vary by state and region. The large proportion of revenue generated by ORV-related activities was documented in a 2005 report that provides economic impact estimates for a ban on nighttime vehicular access to Fort Fisher State Recreation Area in North Carolina during the spring/summer season. The study, which incorporated electronic vehicle counts and visitor surveys, found that while the baseline number of annual beach vehicle trips (28,884) supported an estimated \$21.6 million in annual regional sales (as well as 382 regional jobs, and 3.7 million in tax revenues), the proposed policy would result in an estimated loss of \$859,590 per year in regional sales, 15 regional jobs (mostly from restaurants, automotive services, lodging and related visitor services), and \$149,334 per year in tax revenues (NCDENR 2005).

A recent report on the economic benefits of hunting, fishing, and wildlife watching in North Carolina found that in 2006, 3.4 million residents and non-residents participated in some form of fish and wildlife-related recreation in North Carolina and spent \$2.62 billion in retail sales, created \$1.26 billion in salaries and wages, and supported 45,224 jobs. The total economic benefit from fish and wildlife-related recreation was estimated at \$4.3 billion (Southwick 2008). For fishing-related activities alone, a national survey in 2006 found that in North Carolina, there were nearly 1.3 million fishing participants who spent almost 1.2 billion dollars on the sport (USFWS 2006).

Management Issues

Nationwide, 15 NPS units allow ORV use by the general public. Within these areas, various user groups and ORV manufacturers contend that NPS limits on ORV use unfairly restrict access, establish a

precedent for other federal land managers to impose or extend restrictions, and may be economically harmful to gateway communities and industries serving users (Calvert et al. 2007). Conversely, opponents of motorized recreation in NPS units cite damage to the environment and cultural artifacts from ORV use. Conflicts also arise on U.S. Forest Service lands, where uses such as timber harvesting and ORV recreation may affect birdwatching and sightseeing, and can degrade water quality in certain settings (Calvert et al. 2007).

In 1997 the NPS and the National Parks and Conservation Association (NPCA) identified damage from recreational uses as a major concern in coastal units of the NPS (Recksiek 1997). To deal with these issues, Godfrey (1978) explains that while not all shorelines have the same geology or patterns of erosion, some general management recommendations related to ORV use can be applied. These include preventing indiscriminant traffic on dunes and routing traffic around sites of significant dune formation; restricting traffic to intertidal ocean beaches where surveys have shown relatively few marine animal populations are present; not reopening areas that have been closed or have been inaccessible previously; closing off bird and marine turtle nesting sites and important feeding areas; and closing beaches to vehicles during periods of exceptionally high tides (because during high tides vehicles must be driven up the face of dunes, often through nest sites and incipient dune areas).

Operating vehicles on beaches presents special management constraints where loggerhead sea turtles are present. Beach cleaning vehicles, for instance, are common on beaches in southern Florida, and management measures have been established for the use of such vehicles. In order to obtain beach cleaning permits, certain requirements must be met pursuant to Rule 62B-33.005 (11) of the Florida Administrative Code that restricts the timing and nature of beach cleaning. The following permit conditions are included:

- limiting beach cleaning activities to daylight hours only
- limiting cleaning activities to the average high tide mark or debris line and seaward in some areas
- ensuring a daily sea turtle nesting survey has been completed before cleaning activities are conducted
- marking nests for avoidance
- using vehicles with a maximum tire pressure of 10 pounds per square inch and a rake or cleaning apparatus that limits penetration into the surface of the beach to a maximum of 2 inches
- removing accumulated debris from the beach immediately after cleaning has been performed
- avoiding all native, salt tolerant dune vegetation by a minimum of 10 feet (USFWS 2008)

Similarly, the Volusia County, Florida Habitat Conservation Plan (HCP) limits the potential for sea turtle-vehicle interactions through four basic mechanisms: (1) public access is limited to daylight hours and public safety vehicles that operate at night must follow specific guidelines; (2) public driving is limited primarily to those areas where nest densities are lowest; (3) in those areas where public driving is permitted, all driving and parking must occur outside a marked Conservation Zone near the dune, where the majority of nests are typically deposited; and (4) all nests are conspicuously marked so they can be avoided (USFWS 2008).

Appropriate travel management planning has increased among public agencies and various stakeholder groups in response to continuing ORV use on public lands, particularly BLM lands. Other federal regulatory requirements concerning the protection of resources also provide guidance for travel management plans that may be relevant to management options at the Seashore. However, challenges to

crafting and implementing park travel management plans often arise that carry significant implications to the functional management of park resources.

Meyer (2002) prescribes regular maintenance and monitoring of ORV routes, including periodic inspections and condition assessments at 5-year intervals. In addition, Meyer offers several management approaches that can be implemented to curtail trail degradation, some of which may be relevant to seashore environments, including trail rerouting in cases where numerous segments have been degraded by recreational use; seasonal or type-of-use restrictions in instances when specific seasonal uses may be contributing to greater impacts; and outright trail closure as a last resort to protect threatened resources. Traffic volume restrictions or “controlled use” are also suggested as a means to prevent significant resource degradation, although enforcement is needed to implement this management strategy (Meyer 2002).

Christensen and Watson (2006) described challenges resulting from the implementation of the 2006 Bitterroot National Forest ORV management plan, which included maintaining an up-to-date inventory of routes; working with ORV users to reduce impacts and conflicts; and working with all stakeholders to identify appropriate and acceptable ORV opportunities. They also cite lessons learned from the U.S. Forest Service policy and experiences of planners nationwide, which suggest that a collaborative process with a “system-wide, forest-level perspective” is likely to be the most appropriate and successful strategy for developing a widely-supported ORV travel management plan. Moreover, they stress on-going involvement of the public in ORV planning as being crucial for public acceptance of the resulting plans. In an assessment of the efficacy of such a cooperative effort in four counties in North Central Michigan, Nelson and Lynch (2001) conducted stakeholder interviews, surveys of ORV drivers, and investigations of route signage survival. They found that after plan implementation compliance with ORV rules increased as most riders supported the program. By contrast, a study in Utah aimed at creating an inventory of ORV use occurring in 12 high-use or “hotspot” regions of U.S. Forest Service land found that ORV users had taken excessive measures to access closed routes by moving large boulders, removing posts, chain-sawing trees or logs, or purposefully negotiating terrain to create a new trail around management-placed and natural barriers to ORV traffic (Divine and Foti 2004).

Some monitoring efforts have benefitted from the simultaneous observation and data collection of traffic and wildlife made possible by pneumatic road counters and GPS units (USGS 2005). However, Calvert and others (2007) note that monitoring and enforcement may be impeded in some locations (and especially on BLM lands) due to their remoteness, insufficient signs, and inadequate staff and resources, challenges which would also be relevant to the NPS. Adaptive management strategies targeted toward the specific needs of individual parks could provide the most efficacy in resource management. James (2000) argues that a focus on both the component systems of beach environments and interactions among those systems is necessary for improvements in the management, conservation, and overall environmental quality of beaches.

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**Appendix B:
Draft Statement of Findings
for Floodplains
for the Proposed Off-Road
Vehicle Management Plan**

**Draft Statement of Findings for Floodplains
for the Proposed
Off-Road Vehicle Management Plan**

**Cape Hatteras National Seashore
North Carolina**

Recommended:

Superintendent, Cape Hatteras National Seashore

Date

Concurred:

Chief, Water Resources Division

Date

Approved:

Southeast Regional Director

Date

INTRODUCTION

Executive Order 11988 (Floodplain Management) requires the National Park Service (NPS) and other federal agencies to evaluate the likely impacts of their actions in floodplains. The objectives of the Executive Order are to avoid, as much as possible, the short- and long-term adverse impacts associated with occupancy, modification, or destruction of floodplains and to avoid indirect support of development and new construction in such areas where there is a practicable alternative. NPS Director's Order #77-2: *Floodplain Management* provides NPS procedures for complying with Executive Order 11988. This Statement of Findings (SOF) for the Cape Hatteras National Seashore draft Off-Road Vehicle Management Plan/EIS (draft Plan/EIS) has been prepared in accordance with the guidelines in NPS Director's Order #77-2. The draft Plan/EIS states that the purpose of taking action is to develop regulations and procedures that carefully manage ORV use/access to protect and preserve natural and cultural resources and natural processes, provide a variety of visitor use experiences while minimizing conflicts among various users, and promote the safety of all visitors.

DESCRIPTION OF THE PROPOSED ACTION

Alternative F – Management Based on Advisory Committee Input is identified as the NPS preferred alternative in the draft Plan/EIS. Alternative F would provide a variety of ORV and non-ORV access, but often with controls or restrictions in place to limit impacts on sensitive resources. Interdunal road and ramp access for ORVs would be improved, and more pedestrian access would be provided through substantial additions to parking capacity at various key locations that lend themselves to walking on the beach. Implementation of alternative F would involve the construction of 1 relocated and 8 new ORV access ramps; construction of 9 new and 3 expanded parking areas; establishment of 1 extended, 1 relocated and 2 new interdunal roads; and establishment of two pedestrian trails. These actions are listed in Table 1 below and are considered in this SOF.

Table 1. Alternative F Proposed New or Relocated Ramps; New or Expanded Parking Areas; New, Expanded or Relocated Interdunal Roads; and New Pedestrian Trails

BODIE ISLAND
Ramp 2 relocated approx. 0.5 mile south of Coquina Beach.
Pedestrian trail to inlet from new parking near campground established.
HATTERAS ISLAND
Parking at ramp 23 expanded.
New ramps with parking established at 24 and 26.
New ramp with parking established at 32.5.
Parking at ramp 38 expanded.
New ramp 39 across from Haulover and new soundside parking at Kite Point established.
NPS or Dare County to establish new parking at old Coast Guard Station site.
Interdunal road extended and new ramp 47 established.
Interdunal road extended west of new ramp 47 to ramp 49 and new ramp 48 established.
West of the overwash fan, Pole Road re-routed toward the sound to provide natural barrier to bird nesting area south of road.
New interdunal road extending southwest and northeast of the south end of Pole Road established to provide access to False Point and inlet.

OCRACOKE ISLAND
New interdunal road established parallel to the beach extending from ramp 59 for 0.3 mile northeast toward the inlet, with parking at the terminus.
New ramps 62 and 64 established. Parking established at ramp 64.
Parking at Pony Pen expanded.
New ORV route from .65 miles south of ramp 72 ending in a small, unpaved parking area with a pedestrian trail leading to the sound.

Source: Routes and Areas Table and Summary of Alternative Elements of the draft Plan/EIS.

The interdunal roads would be constructed at grade. They would not alter topography, require a finished or impervious surface, or involve any above-grade structures. The pedestrian trails would be primitive sand trails and would not be paved or surfaced. The new or relocated ORV ramps would be surfaced with semi-permeable clay/shell base or some other porous material. The average ORV ramp is 40 feet wide and 500 feet long, occupying 20,000 square feet.

The alternative F parking areas accessible by 4-wheel drive vehicles at the terminus of the new interdunal routes for Hatteras Inlet and North Ocracoke would not need a hardened surface because vehicles would travel over sand to reach them. The other new or expanded parking areas directly accessible by 2-wheel drive vehicles from NC Highway 12 (NC 12) would be designed and constructed with a semi-permeable clay/shell base, turf block or some other porous material, using environmentally sensitive standards to minimize stormwater runoff. The only area where a paved surface would be considered is a short section from handicapped spaces to an adjacent boardwalk. New and expanded parking would comprise an estimated 25 – 50 spaces per parking area. A 25 space, 200 foot by 80 foot parking area, would occupy about 16,000 square feet.

Before constructing the proposed new parking areas, the Seashore would conduct a separate process of environmental analysis to evaluate the potential surface materials that could provide an environmentally sustainable, porous treatment and could avoid the need for stormwater control structures (curbs, drains, culverts, holding ponds, etc.). This on-site analysis would also evaluate specific locations to avoid sensitive species in the Seashore's Significant Natural Heritage Areas that have been identified by the North Carolina Natural Heritage Program. Exact location and number of added spaces for each area would be determined during the site-specific planning and environmental analysis subsequent to approval of the Plan/EIS.

Signs informing visitors of flooding and suggested actions in the event of flooding would be located at the parking areas.

SITE DESCRIPTION

The project site is on three North Carolina barrier islands, which are part of the Outer Banks. These islands have historically been and continue to be affected by coastal forces and flooding events. The barrier islands comprising the Seashore are flat and narrow and lie between the Atlantic Ocean and the shallow and wide Pamlico Sound. The widest part of the Seashore islands is near Cape Point, between Buxton and Frisco. According to FEMA Flood Insurance Rate Maps, nearly the entire Seashore is within the 100-year floodplain. Generally, lands along the ocean beaches and adjacent to the sound (at wide points) are in flood zone "VE," which is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. Zone "VE" is also referred to as the "Coastal High Hazard Area." The rest of the Seashore not directly adjacent to the ocean or sound lies in the "AE" zone, which is in the 100-year floodplain and subject to waves less than 3 feet high (NCDCCPS 2008).

Because the Seashore is almost entirely in the 100-year floodplain and is subject to high-water-table conditions, many areas are conducive to drainage and flooding that often result from storm events. Areas near Buxton Woods and Cape Point Campground have been documented as historically flood-prone and are examples of popular Seashore destinations that experience flooding during times of above-average precipitation events (NPS 2003).

Elevations in the vicinity of the proposed ramps, interdunal roads, pedestrian trails and parking areas range from sea level to about 25 feet above sea level. Due to the low topography, the entire project area is located within the 100-year flood zone and is subject to inundation during extreme storm events. Some parking areas would be within the “VE” flood zone, and others would be located in the “AE” flood zone. Those in the “VE” or coastal high hazard area are classified as a Class III Action, according to Director’s Order #77-2.

GENERAL CHARACTERIZATION OF FLOODPLAIN VALUES AND OF THE NATURE OF FLOODING AND ASSOCIATED FLOODPLAIN PROCESSES IN THE AREA

The Seashore’s barrier island floodplains help reduce the impact of hurricanes and other storms on the shorelines that they shelter. These floodplains provide storm water holding capacity, reducing runoff that could otherwise flood NC12 and other developed areas. They also provide habitat for species adapted to the coastal barrier island environment.

Storm events such as hurricanes and nor’easters (winter storms along the mid-Atlantic coast) and associated wave action and high precipitation are the prime sources of flooding in the Seashore. Additionally some areas are known to be susceptible to minor flooding without wave involvement when large amounts of rainfall occur.

JUSTIFICATION FOR LOCATION OF THE ACTION IN THE FLOODPLAIN

The purpose of constructing or relocating ORV ramps, establishing interdunal roads, creating pedestrian trails, and constructing or expanding parking areas is to improve visitor access to the shoreline, both in areas where ORV routes would be designated and in areas where ORV routes would not be designated. To provide access the ORV ramps, interdunal roads, pedestrian trails and parking areas must be located in the vicinity of the shoreline. Avoidance of impacts to floodplains is not possible because the all areas between access points along NC-12 or interdunal roads and the shoreline is within the 100-year floodplain.

INVESTIGATION OF ALTERNATE SITES

Alternatives A and B (the no-action alternatives) do not provide for any new ORV ramps, interdunal roads, pedestrian trails, or new or expanded parking areas. Alternative F and the other action alternatives provide for differing numbers of ramps, interdunal roads, and new or expanded parking areas, as displayed in Table 2 below. As explained above, because all areas between access points along NC-12 (or interdunal roads) and the shoreline is in the floodplain and access to the beach is needed, no sites outside the floodplain were considered.

Table 2. Number of New or Relocated Ramps; New or Expanded Parking Areas; New, Relocated or Extended Interdunal Roads; and New Pedestrian Trails Proposed in the draft Plan/EIS Alternatives

	Alternative A/B	Alternative C	Alternative D	Alternative E	Alternative F
Number of new or relocated ramps	0	6	4	7	9
Number of new or expanded parking areas	0	7	0	14	12
Number of new, extended or relocated interdunal roads	0	1	0	1	4
Number of new pedestrian trails	0	0	0	1	2

Source: Routes and Areas Table and Summary of Alternative Elements of the draft plan/EIS

The impact analysis in the draft Plan/EIS indicates that Alternatives A and B would have no impacts on floodplains, and the preferred alternative and the other 3 action alternatives would have minor impacts on floodplains. A minor floodplain impact is defined in the draft Plan/EIS as an impact that “would result in a detectable change to floodplain functions and values, but the change would be expected to be small, of little consequence, and localized. There would be no appreciable increased risk to life or property. Mitigation measures, if needed to offset adverse effects, would be simple and successful.”

IMPACTS TO FLOODPLAIN FUNCTIONS AND VALUES

The use of vehicles for NPS administrative use and by visitors for beach access would result in no or negligible impacts to floodplain functions or values because the amounts of oil and grease deposited on the sand by these vehicles would not have any measurable or perceptible consequence on floodplain functions or values. Under alternative F, the establishment of interdunal roads would not result in floodplain impacts because impervious surfaces or above-grade structures would not be constructed. The interdunal roads would be constructed at grade and would not alter topography or require a finished surface. Therefore floodplain functions would not be altered.

The pedestrian trails would also not result in floodplain impacts because the trails would be primitive sand trails and would not be paved or surfaced. Minor impacts would result from the construction or relocation of ramps, which would be surfaced with semi-permeable clay/shell base, reducing storm water runoff and limiting the potential for impacts to the floodplain’s water storage function. Similarly, minor impacts would result from the construction or expansion of parking areas because they also would be surfaced with semi-permeable or porous materials, with the possible exception of a short access path from handicapped spaces to an adjacent handicapped accessible boardwalk. Because there are no more than minor impacts to the floodplain, there would not be significant impacts to floodplain function and values from establishment or relocation of interdunal roads and ramps, establishment of pedestrian trails, or construction of new or expanded parking areas.

MINIMIZATION OF HARM OR RISKS TO LIFE AND PROPERTY

Mitigation would be provided by incorporating methods for protecting human safety and protection of investment. Minimization of harm or risk to life and property would be accomplished by siting new parking areas and adding new spaces to existing parking areas in locations known to be less susceptible to flooding from rainfall alone. Parking areas directly accessible from NC 12 are landward of the primary dune line. Overnight camping would not be allowed in the new or expanded parking areas, nor on the

beach. Hurricanes and large nor'easters that may result in storm surge are predicted far enough in advance to allow ample time for evacuation.

In addition to Cape Hatteras National Seashore, the Fort Raleigh National Historic Site and the Wright Brothers National Memorial are collectively managed by NPS as the Outer Banks Group. The NPS – Outer Banks Group annually updates its *Hurricane Plan* (NPS 2009), which describes the Incident Command System (ICS) priorities, procedures, and timelines for the protection of human safety, property, and park resources and values in the event of a hurricane or other emergency. The *2009 Hurricane Plan* details actions to be taken at the beginning of hurricane season (June 1), at critical intervals from 96 hours before storm force winds through landfall of a hurricane, recovery, and re-entry. As early as 96 hours before storm force winds, the Superintendent activates the ICS and the following occurs on the Seashore:

- Visitors are informed of weather conditions, park status, and recommended actions.
- Hurricane watch notices are posted at all visitor centers, campground kiosks, and on the Park's website.
- Visitors are advised to leave the island or be prepared for short notice evacuation. Ocracoke must be evacuated before termination of ferry services or before onset of gale-force winds, and preparatory actions for Ocracoke Island occur a day in advance of the other Seashore islands.
- Normal park operations and visitor facilities (e.g., visitor centers, campgrounds, swim beaches) close.
- Concessionaires and local businesses are notified of the park status.
- All non-assigned personnel are released by noon to permit daylight evacuation.
- All non-essential vehicles and equipment are secured.

Since the ramps, interdunal roads, pedestrian trails, and parking areas cannot be assured of protection from all future damage related to flood/storm events, the NPS would tolerate risk to these investments and would repair or reconstruct them when damage occurs.

CONCLUSION

Alternative F (the preferred alternative) includes construction or relocation of 9 ORV ramps; establishment, relocation or extension of 4 interdunal roads; establishment of 2 pedestrian trails; and construction or expansion of 12 public parking areas. The NPS concludes that there is no practicable alternative for locating these outside the floodplain because their purpose is to provide access for visitors on foot and by ORV to the shoreline. To accomplish this purpose the ramps, interdunal roads, pedestrian trail, and parking areas must be located close to the shoreline.

The establishment of ramps and interdunal roads would not result in floodplain impacts because impervious surfaces or above-grade structures would not be constructed. The pedestrian trails would also not result in floodplain impacts because the trails would be sand trails that would not be paved or surfaced. On the ocean side of NC 12, the parking area construction or expansion would be located behind the primary dunes. Because hurricanes and big nor'easters are predicted far enough in advance to allow ample time for visitors to evacuate the area, overnight camping would not be allowed in the parking areas, and the park has prepared and regularly implements and updates a *Hurricane Plan* for the protection of human safety, property, and park resources and values in the event of a hurricane or other emergency, there would be no effect on human safety from the alternative F actions. Construction or expansion of the parking areas would result in long-term, minor adverse effects to floodplain functions

and values because, although the change to floodplain functions and values would be detectable, it is expected to be small, of little consequence, and localized in the immediate area of the parking areas, ramps and interdunal roads. Mitigation measures, such as signage and avoiding the use of impermeable surface materials, would be simple and successful and these measures have been incorporated into alternative F.

Establishment of the ramps, interdunal roads, pedestrian trails, and parking areas would not affect flood storage capacity of the Seashore as a whole. The existing floodplain would continue to function as a floodplain after the construction or expansion of these areas.

The NPS finds the proposal to be consistent with Executive Order 11988. The NPS finds that this proposed action is consistent with the policies and procedures of NPS Special Directive 93-4 (Floodplain Management Guidelines).

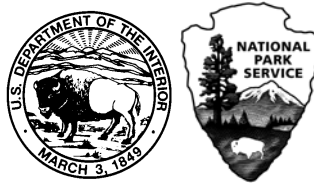
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As the nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering wise use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historic places, and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people. The department also promotes the goals of the Take Pride in America campaign by encouraging stewardship and citizen responsibility for the public lands and promoting citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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