CHAPTER 4: ENVIRONMENTAL CONSEQUENCES

Photograph courtesy of the Alaska State Library - Historical Collection.

Huna women wearing sashes depicting the seagull.

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CHAPTER FOUR: ENVIRONMENTAL CONSEQUENCES

4.1. INTRODUCTION

This chapter evaluates the environmental consequences of three alternatives presented in Chapter 2. The potential effects associated with each alternative are analyzed and compared to the existing conditions of each environmental resource topic identified in Chapter 1. The effects analysis is organized by resource topic and includes subsections on methodology, impact analysis by alternative, and conclusions.

The methodology section, included for each impact topic, describes the methods used to predict the impacts resulting from each alternative, defines impact threshold criteria, and analysis assumptions.

Threshold criteria help to establish the sideboards for understanding the severity and magnitude of an impact. Thresholds consider both the geographic area of effect, the severity of the effect, and the duration of the effect. Each resource topic discussion includes a set of threshold criteria defined using four categories of impact: negligible, minor, moderate, and major impact levels. In general:

- Negligible effects may or may not cause observable changes to natural conditions; regardless, they do not reduce the integrity of a resource.
- Minor effects cause observable and short-term changes to natural conditions, but they do not reduce the integrity of a resource.
- Moderate effects cause observable and short-term changes to natural conditions, and/or they reduce the integrity of a resource.
- Major effects cause observable and long-term changes to natural conditions, and they reduce the integrity of a resource.

Resource assumptions that are used to frame the impact analysis are provided for each impact topic (i.e., reproductive rates remain constant or predation levels remain constant). In accordance with the NEPA and its implementing regulations, this LEIS considers direct, indirect, and cumulative effects for each alternative.

- Direct and Indirect Effects: Direct effects are those that result from the action and occur at the same time and place. Indirect effects are those reasonably foreseeable effects that are caused by the action but that may occur later and not at the location of the direct effect.
- Cumulative Effects: Cumulative effects are the incremental effect of an action when added to the effects of past, other present, or reasonably foreseeable future actions (see Cumulative Impact Analysis Assumptions). Cumulative effects can result from individually minor, but collectively significant, actions taking place over time.

A conclusion follows the discussion of impacts (direct, indirect and cumulative) by impact topic for each alternative. Each conclusion summarizes the major findings and includes an overall summary indicating whether the effects would be negligible, minor, moderate, or major. The conclusion also indicates whether the anticipated impacts would cause an impairment of resources.

4.2 CUMULATIVE ANALYSIS ASSUMPTIONS

The cumulative effects analysis considers any actions or natural phenomena which may occur within Glacier Bay. The effects of any actions which have – or may – occur from the mid 1960s, when the NPS began actively enforcing the federal prohibition on egg harvest, until 20 years into the future (approximately one human generation) will be analyzed. Projects and actions assumed to contribute to cumulative effects are listed below. These projects and actions are likely to affect several or all resources evaluated in this LEIS.

4.2.1 Natural Phenomena

Many forces acting on the marine and/or terrestrial environment (e.g., global climate change, sea otter recolonization of portions of Glacier Bay, disease or parasite epidemics, vegetational succession) may be responsible for increases or decreases in the population and distribution of species living within the park.

4.2.2 Migratory Bird Treaty Act Amendment and Annual Regulations

The Migratory Bird Treaty Act (MBTA) currently authorizes the permanent residents of Hoonah to harvest gull eggs in Icy Strait and Cross Sound. However, because regulations state that harvest is closed unless otherwise authorized, implementing regulations must be promulgated annually by the U.S. Fish and Wildlife Service (USFWS) to authorize this harvest (see section 1.4.2 Related Legal Mandates, Regulations, and Policies). This analysis assumes that USFWS would continue to promulgate such regulations annually and that harvest would continue to be authorized outside the park.

4.2.3 Commercial Fishing Life Time Permit Holders

Approximately ten Hoonah Indian Association (HIA) tribal members currently hold lifetime access permits to commercial fish in Glacier Bay. These permit holders and their crews have the opportunity to fish in their traditional homeland for their lifetime. This analysis assumes that few, if any, of these permit holders would still be commercial fishing in Glacier Bay within 20 years.

4.2.4 Other Park Cultural Programs

Glacier Bay National Park currently sponsors a number of cultural activities and visits designed to maintain and enhance traditional cultural knowledge and practices including berry picking trips, school trips, anthropological and archeological studies, workshops, and classes. These activities are expected to continue.

4.2.5 Other Restrictions on Traditional Cultural Practices

Numerous other traditional cultural practices including seal hunting, mountain goat hunting and sea otter harvest, as well as several traditional fisheries, are prohibited within Glacier Bay National Park. Important traditional fisheries outside of park waters, including the historic Inian Islands commercial seine fishery, are prohibited by State regulation. These activities are not expected to be authorized in the foreseeable future.

4.2.6 Other Traditional Harvest Practices

The Huna Tlingit continue to legally harvest a variety of resources within their traditional territory outside the park including harbor seal, deer, various fish and shellfish, and seaweed. These practices are expected to continue. Current use of Glacier Bay for authorized traditional activities (personal use fisheries, gathering seaweed, harvesting berries) is currently very limited, largely due to the expense of travel between Hoonah and Glacier Bay, misunderstandings about what activities are authorized, and an ongoing sense of displacement from the park. Participation in these activities is expected to increase only gradually over time.

4.3 BIOLOGICAL ENVIRONMENT

4.3.1 Glaucous-winged Gull Population

The analysis of effects of alternatives on the glaucous-winged gull population includes discussions of the effects of harvest activities on reproductive success due to egg removal , physiological consequences to adult birds subject to disturbance and higher energetic costs associated with relaying, and loss of eggs or chicks due to flushing adults from nests.

Methodology

The methodology for evaluating the effects on the glaucous-winged gull population consists of:

- Identifying proposed activities that could affect the gull population.
- Determining how those activities would affect the gull population (e.g. behavioral changes, changes in mortality, changes in reproduction, changes in habitat use).
- Determining the level of effect of those activities and whether the effects are adverse or beneficial.
- Determining the significance of those effects in terms of the resource.

Impact Threshold Criteria

To determine the significance of effects on the glaucous-winged gull population the impacts were compared against the threshold criteria in Table 4-1.

Table 4-1. Threshold Criteria for Effects Analysis on Glaucous-winged Gulls

Negligible	Individuals may be disturbed, but disturbance would be infrequent (less than once per day), lasting less than a few minutes, and limited to the point of disturbance. No measurable reductions in the survival, reproduction, and/or habitat use of the gull population in the park would occur.
Minor	Local abundance may be reduced, but at levels that are within the range of normal population flux. Reductions and/or other effects would be localized to portions of the breeding colony.
Moderate	Disturbance would be sufficiently high to reduce the numbers present in a breeding colony. Disturbance and resulting declines would occur over a relatively large area, such as an entire breeding colony.
Major	Local abundance would decline to the point that Glacier Bay breeding colonies are essentially abandoned.

Assumptions

The following analysis relies on a mathematical model developed by Dr. Stephani Zador following two years of data collection on gull egg reproduction following simulated harvest she conducted on South Marble Island. Calculations of the number of nesting pairs (expressed as the number of nests), number of eggs harvested, total numbers of eggs laid (including first and second clutches) and hatching success are based on rates documented by Zador (2001) and Zador et al. (2006) from data collected at South Marble Island in Glacier Bay in 1999 and 2000. This analysis assumes that similar rates of nesting, egg laying, relaying after harvest, and hatching would be exhibited in other nesting colonies and that these rates would remain constant over time. Reproductive rates (i.e., number of nesting pairs and number of eggs laid) depend on various parameters including food availability. For the purposes of this analysis, food availability is assumed to remain constant over time.

Zador (2001) noted high levels of egg predation at South Marble Island which can affect gull reproductive success directly through loss of eggs and indirectly through increased stress to adult birds forced to relay. This analysis assumes that predation levels would remain constant. The majority of predation Zador noted was attributed to bald eagles; the number of bald eagles in Glacier Bay is expected to remain constant or increase only gradually.

The analysis also assumes a constant rate of vegetational succession which will slowly reduce the suitability of existing nesting habitat. However, new colonies are expected to become established elsewhere as glacial recession creates suitable habitat in other areas. For the purposes of this analysis, the amount of suitable nesting habitat is assumed to remain fairly constant over time.

The analysis also assumes that the existing vessel approach distances mandated by NPS regulation (36 CFR Part 13) would remain in place, precluding other human disturbance from vessels or foot traffic to nesting gulls and other cliff and ground nesting species.

Alternative 1 (No-Action) – Effects on the Glaucous-winged Gull Population

Direct and Indirect Effects: Because Alternative 1 (No-Action) would not authorize gull egg harvest in Glacier Bay National Park, glaucous-winged gull populations in the park would not be affected by human harvest. Gulls in nesting colonies on South Marble Island and elsewhere would continue to lay and hatch eggs and fledge young with no human predation.

Cumulative Effects: In the absence of gull egg harvest, the glaucous-winged gull population would most likely be affected by predation, other natural processes, and very limited disturbance from inappropriate vessel and foot traffic. Zador and Piatt (1999:4, 13-14) noted significant bald eagle predation on gull eggs on South Marble Island; many one and two egg clutches (73% and 50% respectively) were depredated within five days of when the last egg was laid. Gulls did not relay eggs in 49 percent and 32 percent of the cases in 1999 and 2000, respectively. The variables that were important for predicting whether gulls would renest following predation included lay date and the age of the clutch at predation. Existing levels of predation do not appear to be resulting in decreased gull populations.

Predation would continue to affect gull populations and may increase as vegetation cover suitable for perching increases. Bald eagle and raven populations are expected to remain relatively constant in Glacier Bay, so predation should remain similar to that which currently occurs.

Vegetational succession is expected to continue to reduce suitable habitat in some currently suitable nesting areas. Conversely, glacial retreat is expected to reveal additional suitable habitat. No net loss of suitable gull nesting habitat would be expected.

Because most nesting areas are closed to foot traffic and vessel approaches are limited in the Vessel Quota and Operating Requirements, human disturbance is expected to be minimal.

Alternative 1 (No Action) would not involve any action that would contribute to existing potential impacts to the glaucous-winged gull population; hence no additional cumulative effects would be expected.

Conclusion: Alternative 1 (No Action) would have no affect on glaucous-winged gulls and would not contribute to cumulative effects on the species. The level of impact on glaucous-winged gulls under Alternative 1 (No Action) would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

Alternative 2 (One Harvest Visit to Two Locations) - Effects on the Glaucous-winged Gull Population

Direct and Indirect Effects: This alternative would authorize gull egg harvest at two locations within Glacier Bay National Park. Harvest would occur early in the nesting season, on or before June 9, the date Zador (2001) found to be the median lay date on South Marble Island (the date by which 50% of nests in the colony had eggs). All eggs would be removed from harvested nests because this practice stimulates gulls to relay. If harvesters left one or two eggs in a nest, adult females would incubate the remaining egg(s) but would not relay lost eggs.

Removal of Eggs: Glaucous-winged gulls respond to the loss of eggs by laying more if the loss occurs early in the season, food is available, and the adults are in good physical condition (Parsons 1976, Pierotti and Bellrose 1986, Ehrlich et al. 1988:165, Kennedy 1991, Wendeln et al. 2000, Zador 2001:2). In harvest simulation experiments on South Marble Island, Zador (2001) found that most (93%) gulls parenting nests from which all eggs had been removed laid replacement clutches of one to three eggs and the total number of eggs hatched did not differ statistically between manipulated and unmanipulated nests.

A model developed by Zador et al. (2006) was used to simulate the effects of this alternative on the total number of eggs laid, number of eggs harvested, and number of eggs hatched at South Marble Island in Glacier Bay (Table 4-2). The model predicts a range of outcomes due to random predation and random laying dates generated by the model; data presented here represent the average value for that outcome. Outputs from this model were extrapolated to other selected glaucous-winged gull nesting areas to calculate eggs laid, eggs harvested, and eggs hatched for each site. The model assumes a harvest date between June 3 and June 4 and allows for random predation in addition to the single harvest event.

For example, if harvest were to occur at the two currently most productive sites, South Marble and Lone islands, the model predicts that approximately 278 eggs could be harvested on a given day assuming harvesters located and harvested from all nests with eggs (i.e., all nests including one, two, three or four eggs). Gulls would relay most of the harvested eggs, laying a total of 1,647 eggs compared to 1,542 eggs in Alternative 1 (No Action). Thus, gulls are predicted to lay 105 more eggs than in Alternative 1 (No Action) at these two sites including eggs laid as first clutches and those laid to replace harvested eggs. Of the 1,647 eggs laid, 714 are estimated to hatch (44%) compared to 755 of 1,542 eggs (49%) in Alternative 1 (No Action) producing approximately 41 fewer chicks (5% fewer) at these two sites and 4 percent fewer across all of Glacier Bay than in Alternative 1 (No Action). An additional 566 eggs in other gull nesting areas not subject to harvest would yield approximately 276 chicks.

In summary, the model predicts that – if all located nests were harvested from regardless of the number of eggs in each nest - this alternative would yield approximately 278 eggs to harvesters; 990 eggs would hatch throughout Glacier Bay (714 of these on South Marble and Lone Island); female gulls would lay approximately 105 more eggs than in Alternative 1 (No Action); and approximately 41 fewer chicks would be hatched than in Alternative 1 (No Action).

Table 4-2. Comparison of eggs harvested, eggs relaid, and eggs available to hatch for selected glaucous-winged gull colonies subjected to harvest strategies outlined for each alternative.

		Alt 1: No Harvest		**Alt. 2: Single Harvest Visit (Modeled for June 3 or 4)**			**Alt. 3: Two Harvest Visits (Modeled for June 5 & 14)**		
Location	**# nests[1]**	**# eggs laid[2]**	**# eggs hatched[3]**	**# eggs laid[2]**	**# eggs harvested[4]**	**# eggs hatched[3]**	**# eggs laid[2]**	**# eggs harvested[4]**	**# eggs hatched[3]**
South Marble Is.	285	1,099	538	1,173	198	509	1194	243	500
Lone Island	115	443	217	474	80	205	482	98	202
Geikie Rock	48	185	90	198	33	86	201	41	84
Boulder Island	41	158	77	169	28	73	172	35	72
Muir Inlet, north shore	32	123	60	132	22	57	134	27	56
Flapjack Island	26	100	49	107	18	46	109	22	46

[1] From Arimitsu et al. 2007 except data for South Marble Island which is from Zador et al. 2006.
[2] # eggs laid = average number eggs laid per nest in model (Zador et al. 2006) * # nests at location. Includes eggs from first and second clutches for those alternatives that authorize harvest.
[3] # eggs hatched = total nests in colony * average # eggs laid/nest (2.48) * predicted hatching success from model (Zador et al. 2006)
[4] # eggs harvested =average # eggs harvested per nest from model (Zador et al. 2006) * # nests

The model predicts that this alternative would yield 5 percent fewer chicks on South Marble and Lone islands and 4 percent fewer chicks across all nesting areas in Glacier Bay. Because the model assumes that all nests in a colony would be subject to harvest - an unlikely scenario as many nests are inaccessible and/or are difficult to locate (between 10-50% depending on the weather and sea lion distribution at South Marble Island) and because many harvesters traditionally do not harvest from nests with three or four eggs - these numbers overstate impacts by some unknown degree. This alternative is expected to have minor effects on the reproduction of glaucous-winged gulls in Glacier Bay.

Survivability of Replacement Clutches: Chicks hatching from replacement clutches may be somewhat less likely to survive until fledging and/or less likely to survive to reproduce. Hatching late led to lower survival rates for glaucous-winged gull chicks in a year of poor food availability, although the relationship was not strong when food supply was high (Hunt and Hunt 1976). Herring gulls hatched from replacement clutches suffered higher post-fledging mortality (Nisbet and Drury 1972) but post-fledging survival was not affected by later hatching in common terns (Nisbet 1996, Becker 1999). Black-headed gull chicks that hatched late began breeding at an older age (Prevot-Julliard et al. 2000) and daily egg collection associated with a commercial harvest from black-headed gulls resulted in generally lower hatching success and reduced chick survival (Wood et al. 2009), and depleted physiological condition of females (Heaney and Monaghan 1995, Monaghan et al. 1998). Wood et al (2009) conclude that non-commercial harvest for local consumption may have much lower impacts. While there might be some future demographic impact due to these late-hatching chicks, we expect impacts to be small compared to other demographic impacts caused by succession and natural predation. The annual harvest plan is precautionary in this matter by keeping the option of reducing or closing harvest if the gull population declines.

Physiological Stress to Adults: Egg production is energetically costly for both male and female birds. Laying replacement eggs has energetic costs to both female and male gulls, resulting in some level of physiological stress and potentially causing reduced adult fitness. Physiologically stressed adults may produce poorer quality eggs or chicks (Monaghan et al. 1998, Nager et al. 2000), may produce fewer eggs (Risch and Rohwer 2000), and/or may produce chicks less able to survive (Nager et al. 2000).

Zador (2001) found that gull pairs with their entire clutches removed laid on average 2.71 (in 1999) and 2.01 (in 2000) more eggs than those in the unmanipulated group. Although she found no measurable changes in body condition of male or female gulls following replacement laying, Zador (2001:30) did note that females that replaced a clutch secreted lower maximum levels of corticosterone than those that incubated their original clutch (Zador 2001:34). For these females, the additional energetic demands resulting from laying a replacement clutch could have increased the likelihood of abandonment when faced with potential stressors. Suppression of the normal physiological stress response, as indicated by lower maximum levels of corticosterone, may have allowed the females to continue incubating, thereby not reducing their hatching success.

If harvesters removed eggs from the two largest colonies, South Marble and Lone islands, this alternative would result in approximately 105 more eggs being laid than in Alternative 1 (No

Action). Females parenting nests from which eggs are harvested might exhibit slightly decreased maximum corticosterone levels. The specific long-term effects of this physiological change are not known; however, adult fitness would not be expected to diminish.

Loss of Eggs or Chicks Due to Human Disturbance: Human disturbance within a breeding colony of gulls typically results in adults flushing from nests. Eggs and/or chicks left unattended are subject to chilling and predation. Humans moving through a breeding colony may also inadvertently crush eggs and/or chicks.

Adult gulls would likely flush from nests as harvesters approach and walk through the colony, leaving eggs and/or chicks temporarily subject to chilling or predation. However, because harvesters would be instructed to move quickly but cautiously through the colony and would make only one pass through each colony section, disturbance would be limited. This level of disturbance would not be expected to cause measurable reductions in survival or reproduction.

Cumulative Effects: In addition to the effects of harvest described above, glaucous-winged gull populations in the park would most likely be affected by other natural processes and limited disturbance from inappropriate vessel and foot traffic. The predictive model used to assess impacts of harvest takes random predation into account, but does not incorporate the potential beneficial effect harvest may have on reducing predation by facilitating synchronized egg laying. Consequently, egg loss associated with harvest may be partially offset by reduced egg loss from predation. Vegetational succession may reduce the suitability of some current nesting areas thereby decreasing the number of eggs hatched in a given area; however, new nesting areas are expected to be colonized over time resulting in no net loss of suitable gull nesting habitat and no net loss in number of eggs laid and hatched. Consequently, habitat succession is not expected to add cumulative effects to this alternative. Inappropriate foot traffic and/or close vessel approaches are very uncommon and are not expected to add to the effects of this alternative. The minor effects associated with this alternative, when added to the negligible effects of natural processes and existing human disturbance are expected to result in minor cumulative effects.

Conclusion: Under this alternative the number of gull eggs hatched would be slightly reduced from that which would occur in Alternative 1 (No Action). Some portion of adult gulls would expend energy in protracted laying due to harvesting; however, physiological effects are expected to be negligible or minor. Disturbance to adults and chicks due to human presence in the colony during the harvest would be minimal. This alternative would have minor direct, indirect, and cumulative effects on the gull population. The level of impact on glaucous-winged gulls under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

Alternative 3 (Two Harvest Visits at Up to Five Locations) - Effects on the Glaucous-winged Gull Population

Direct and Indirect Effects: This alternative would authorize two harvest visits to each of five gull colonies in Glacier Bay. The first harvest visit would occur on or before the 5th day following onset of laying as determined by NPS staff monitoring a reference site at South Marble

Island. A second harvest at the same sites would be authorized to occur within nine days of the first harvest. Because glaucous-winged gulls require 10-12 days to begin relaying after loss of an entire clutch of eggs, this would ensure that eggs harvested on the second visit were laid as first clutches rather than replacement clutches laid in nests harvested during the first visit.

Removal of Eggs: A model developed by Zador et al. (2006) was used to simulate the effects of this alternative on the total number of eggs laid, number of eggs harvested, and number of eggs hatched at South Marble Island (Table 4-2). The model assumes that the first harvest occurs on the 5th day following the onset of laying with a second harvest on the 14th day following the onset of laying (9 days following the first harvest). The model allows for random predation in addition to the two harvest events. The model predicts a range of outcomes due to random predation and random laying dates generated by the model; data presented here represent the average value for that outcome. Outputs from this model were extrapolated to other glaucous-winged gull nesting areas to calculate eggs laid, eggs harvested, and eggs hatched for each site to estimate the effects of this alternative on hatching success.

For example, if harvest were to occur at the five currently most productive sites, South Marble Island, Lone Island, Geikie Rock, Boulder Island, and the north shore of Muir Inlet approximately 444 eggs could be harvested on the two harvest days combined if all nests were located and harvested from (an unlikely scenario). The model predicts that gulls would lay a total of 2,183 eggs compared to 2,008 eggs in Alternative 1 (No Action) (175 more eggs) at these five sites including eggs laid as first clutches and those laid to replace harvested eggs. Of the 2,183 eggs laid; 914 are predicted to hatch (42%) compared to 982 of 2,008 (49%) in Alternative 1 (No Action) (68 fewer eggs hatched). An additional 100 eggs in other gull nesting areas not subject to harvest would yield approximately 49 chicks.

In summary, the model predicts that this alternative would yield approximately 444 eggs to harvesters, 963 eggs would hatch throughout Glacier Bay, female gulls would lay approximately 175 more eggs than in Action 1 (No Action), and approximately 68 fewer chicks (7% fewer across five sites; 6% fewer across Glacier Bay) would be hatched than in Action 1 (No Action). However, as the model assumes that all nests in colonies would be harvested from, an unlikely scenario as some nests are inaccessible or difficult to locate (between 10 and 50% depending on weather and distribution of seal lions at South Marble Island) and because some traditional harvesters would leave nests with three or four eggs undisturbed, this number slightly overstates the impact to gull reproduction. This alternative is expected to have a minor effect on the reproduction of glaucous-winged gulls as 6 percent fewer chicks would be hatched throughout a broader area in Glacier Bay.

Physiological Stress to Adults: The model predicts that female gulls would relay approximately 175 more eggs in this alternative than in Alternative 1 (No Action). Females parenting nests from which eggs are harvested would likely exhibit decreased corticosterone levels, an adaptation to the stress caused by disturbance and/or relaying. The specific effects of this physiological change are not known; however, adult fitness would not be expected to diminish as a result.

Loss of Eggs or Chicks Due to Human Disturbance: This alternative would result in a small amount of human disturbance within the breeding colony. However, because harvesters would remain in the colonies for a short period of time during each visit, effects are expected to be minimal.

Cumulative Effects: In addition to the effects described above, gull populations could be affected by natural processes and inappropriate foot and/or vessel disturbance. The predictive model used to assess impacts of harvest takes random predation into account, but does not incorporate the potential beneficial effect harvest may have on reducing predation by facilitating synchronized egg laying. Consequently, egg loss associated with harvest may be partially offset by reduced egg loss from predation. Habitat succession is not expected to add cumulative effects to this alternative as new habitat is expected to develop at a rate equal to habitat lost due to advanced vegetative growth. Inappropriate foot traffic and/or close vessel approaches are very uncommon and are not expected to add to the effects of this alternative. The minor to moderate effects of this alternative would be partially offset by reduced predation and, combined with the effects of other natural processes and existing human disturbance, would result in minor cumulative effects.

Conclusion: Zador's (2006) model predicts that this alternative would result in a hatching success rate that could be reduced by 6% across Glacier Bay from an unharvested situation. Adult gulls would expend energy in protracted laying but individuals are not expected to be physiologically affected. Disturbance to adults and chicks due to human presence in the colony during the harvest visits would be minimal. This alternative would have minor effects on the gull population and minor cumulative effects. The level of impact on glaucous-winged gulls under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park's enabling legislation or that are essential to the integrity of the park.

4.3.2 Other Cliff and Ground Nesting Bird Populations

The analysis of effects of alternatives on other cliff and ground nesting birds includes discussions of the effects of harvest-related vessel and foot traffic on birds nesting near the gull population.

Methodology

The methodology for evaluating the effects on cliff/ground nesting bird populations consists of:

- Identifying proposed activities that could affect cliff/ground nesting bird populations.
- Determining how those activities would affect the cliff/ground nesting bird populations (e.g. behavioral changes, changes in mortality, changes in reproduction, changes in habitat use).
- Determining the level of effect of those activities and whether the effects are adverse or beneficial.
- Determining the significance of those effects in terms of the resource.

To determine the significance of effects on cliff and ground nesting birds the impacts were compared against the threshold criteria in Table 4-3.

Table 4-3. Threshold Criteria for Effects Analysis on Cliff/Ground Nesting Birds.

Negligible	Individuals may be disturbed, but disturbance would be infrequent (less than once per day), lasting less than a few minutes, and limited to the point of disturbance. No measurable reductions in the survival, reproduction, and/or habitat use of the cliff/ground nesting bird populations in the park would occur.
Minor	Local abundance may be reduced, but at levels that are within the range of normal population flux. Reductions and/or other effects would be localized.
Moderate	Disturbance would be sufficiently high to reduce the numbers present in a breeding colony. Disturbance and resulting declines would occur over a relatively large area, such as an entire breeding colony.
Major	Local abundance would decline to the point that breeding colonies are essentially abandoned.

Assumptions

Most areas currently used as nesting grounds by glaucous-winged gulls are closed to foot traffic. The analysis also assumes that the existing foot traffic closures and vessel approach distances mandated by NPS regulation (36 CFR 13.65 (b)(3)(vi)(A) through (C)) would remain in place, precluding other human disturbance to nesting gulls and other cliff and ground nesting species.

Alternative 1 (No-Action) – Effects on Cliff/Ground Nesting Bird Populations

Direct and Indirect Effects: Because Alternative 1 (No Action) would not authorize gull egg harvest in Glacier Bay National Park, cliff/ground nesting bird populations would not be affected by harvest activities. Cliff/ground nesting birds in nesting colonies on South Marble Island and elsewhere would continue to lay and hatch eggs and fledge young with no human disturbance from harvest activities.

Cumulative Effects: In the absence of glaucous-winged gull egg harvest, other cliff and ground nesting birds would most likely be impacted by occasional vessel or foot traffic, natural successional processes, and natural predation from eagles, ravens, conspecifics or land mammals. Because most nesting areas are closed to foot traffic and vessels are precluded from closely approaching nesting areas, human disturbance would have very little effect on cliff and ground nesting birds. As vegetational succession proceeds through time, some current nesting areas would likely become unsuitable for nesting but other recently deglaciated sites may become more suitable resulting in no net loss or gain of nesting habitat. Because predator populations are not expected to increase substantially, predation is expected to have some

ongoing, small effect on cliff and ground nesters. Alternative 1 (No Action) would not contribute to the cumulative effects on cliff and ground nesting birds.

Conclusion: This alternative would have no effect on cliff and ground nesting birds and would not contribute to cumulative effects on bird populations. The level of impact on cliff and ground nesting bird populations under Alternative 1 (No Action) would not result in any impairment of park resources that fulfill specific purposes identified in the park's enabling legislation or that are essential to the integrity of the park.

Alternative 2 (One Harvest Visit to Two Locations) - Effects on Cliff/Ground Nesting Bird Populations

Direct and Indirect Effects: Ground nesting marine birds are vulnerable to human disturbance where human visitors can access nest site during the breeding season. Repeated disturbance can result in reduced productivity or total abandonment of nests (Leseberg et al. 2000). Even temporary nest desertion by breeding birds in disturbed areas has been shown to increase predation on eggs and hatchlings by conspecifics or other predators (Bolduc and Guillemette 2003). Human disturbance of ground-nesting birds may also affect incubation schedules and adult foraging success, which in turn can reduce breeding success (Verhulst et al. 2001). Human activity can even result in colony failure when disturbance is so great as to prevent the initiation of nesting (Hatch 2002). Beale and Monaghan (2004) found that the number of people disturbing breeding colonies of black-legged kittiwakes and pigeon guillemots was significantly related to breeding success as was the distance between human intruders and nesting birds. Birds exposed to more people for longer periods of time produced and hatched fewer eggs.

This alternative would authorize close vessel approaches and foot traffic in two locations on a single day. Several of the potential harvest locations support other cliff and ground nesting species (Figure 2-1, Table 3-2) which could be disturbed by harvest activities. In most cases, gull nesting areas are spatially separate from the nesting areas of other cliff and/or ground nesting species so harvesters would not be moving through the breeding sites of other species (Figure 3-3, 3-4). For example, black-legged kittiwakes colonize South Marble Island and Lone Island, but nest on steep cliffs which would not be traversed by harvesters. Black oystercatchers are frequent, albeit sporadic, nesters on many islands where harvest may occur. Their nests are dispersed on gentle slopes above mean high tide but are not typically located on the grassy slopes where glaucous-winged gulls prefer to nest. However, harvesters moving from the vessel to gull nesting areas may disturb breeding oystercatchers. Arctic terns do not currently nest at sites where glaucous-winged gulls nest; however, changes in nesting habitat and expansion of nesting colonies may increase nesting overlap in the future. These birds are susceptible to human disturbance.

Disturbance as vessels approach and/or as harvesters move through or adjacent to breeding sites of other cliff and ground nesting birds would be short in duration (less than ten minutes) and would be limited to a single day so eggs and chicks would not be exposed for long periods to inclement weather or predation. Disturbance of cliff and ground nesting birds would be minimal.

Cumulative Effect: In addition to the limited, short-term human disturbance associated with one harvest visit, ground nesting birds would be subject to very minimal disturbance from inappropriate foot and vessel traffic. Although vegetational succession is likely to reduce the suitability of some nesting habitat, other habitat will become suitable over time due to glacial retreat resulting in no net loss of nesting habitat. Natural predation will continue to result in some egg and/or chick loss. The effects of this alternative combined with the effects from natural processes and existing human disturbance would result in negligible cumulative impacts on cliff and ground nesting birds.

Conclusion: Because gull nesting habitat is typically spatially separated from the nesting areas of other cliff and ground nesting birds and human presence in any one area would be limited, this alternative would have negligible direct, indirect, or cumulative effects on cliff and ground nesting bird populations. The level of impact on cliff and ground nesting bird populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

Alternative 3 (Two Harvest Visits at Up to Five Locations) - Effects on Cliff/Ground Nesting Bird Populations

Direct and Indirect Effects: This alternative would authorize close vessel approaches and foot traffic in several locations on two separate days but disturbance would be limited in duration so eggs and chicks would not be exposed for long periods to inclement weather or predation. Disturbance of cliff and ground nesting birds would be minimal.

Cumulative Effects: In addition to the limited, short-term human disturbance associated with two harvest visits, ground nesting birds would be subject to very minimal disturbance from inappropriate foot and vessel traffic. Although vegetational succession is likely to reduce the suitability of some nesting habitat, other habitat will become suitable over time resulting in no net loss of nesting habitat. Natural predation would continue to result in some egg and/or chick loss. The effects of this alternative combined with the effects from natural processes and existing human disturbance would result in negligible cumulative impacts on cliff and ground nesting birds.

Conclusion: Because gull nesting habitat is typically spatially separate from the nesting areas of other cliff and ground nesting birds and human presence in any one area would be limited on each of two visits, this alternative would have negligible direct, indirect, or cumulative effects on cliff and ground nesting bird populations. The level of impact on cliff and ground nesting bird populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

4.3.3 Steller Sea Lion Population

The eastern and western stock of Steller sea lions are protected under the Endangered Species Act of 1973 (ESA); the eastern stock is listed as threatened and the western is listed as endangered. The ESA prohibits the “taking” of any listed species unless National

Oceanographic and Atmospheric Agency (NOAA) Fisheries issues an incidental take statement. The definition of "taking" includes harassment and harm. The ESA also requires federal agencies to exercise their authority, through consultation with the NOAA Fisheries, not to take any action that may jeopardize the species' continued existence. The analysis of effects of alternatives on Steller sea lions includes discussions of the effects of harvest-related vessel and foot traffic on sea lions hauled out near harvest locations.

Methodology

The methodology for evaluating the effects on the Steller sea lion population consists of:

- Identifying proposed activities that could affect the Steller sea lion population.
- Determining how those activities would affect sea lions (e.g. behavioral changes, changes in mortality, changes in reproduction, changes in habitat use).
- Determining the level of effect of those activities and whether the effects are adverse or beneficial.
- Determining the significance of those effects in terms of the resource.

To determine the significance of effects on Steller sea lions the impacts were compared against the threshold criteria in Table 4-4.

Table 4-4. Threshold Criteria for the Effects Analysis on Endangered and Threatened Steller Sea Lion Population.

Negligible	Little or no change in the behavior, abundance, or distribution of Steller sea lions. Any changes would not reduce individual survival or reproduction.
Minor	Small, temporary change in the behavior, abundance, or distribution of Steller sea lions. These temporary changes would have little or no effect on individual survival or reproduction.
Moderate	The behavior, abundance, or distribution of Steller sea lions would change for a period longer than the summer season, but less than one year. Individuals could experience sublethal effects that lead to reductions in long-term survival or reproduction. Population-level distribution, abundance, survival, or reproduction would remain unchanged.
Major	The behavior, abundance, distribution, or mortality of Steller sea lions would permanently change, resulting in reduced individual survival or reproduction sufficient to change population-level distribution and abundance, jeopardizing the continued existence of these species in Glacier Bay.

Assumptions

The analysis assumes that the number of Steller sea lions and harbor seals hauling out at South Marble Island and elsewhere would remain constant over time. The analysis also assumes that the existing vessel approach distances mandated by the Glacier Bay National Park Vessel Quota and Operating Restrictions of 100 yards would remain in place, precluding human disturbance to hauled-out marine mammals.

Alternative 1 (No-Action) – Effects on the Steller Sea Lion Population

Direct and Indirect Effects: Because Alternative 1 (No Action) would not authorize gull egg harvest in Glacier Bay National Park, Steller sea lions would not be affected by activities associated with harvest practices. Sea lions hauling out on South Marble Island and elsewhere would continue to be protected by the ESA, the Marine Mammal Protection Act, and NPS regulations which prohibit vessel or human approaches within 100 yards (90 meters) of hauled out sea lions.

Cumulative Effects: In the absence of egg harvest, Steller sea lion populations would be affected most by natural phenomena and limited human disturbance associated with inappropriate close vessel approaches. Although the Steller sea lion is a listed species, natural phenomena appear to be favoring the eastern stock of sea lions as population numbers have been increasing in Southeast Alaska, and in particular, in Glacier Bay.

Numerous vessels including tour boats, charter boats and private vessels approach South Marble Island daily during the visitor use season to view colonial nesting birds and Steller sea lions. Although vessels are required to remain at least 100 yards from hauled out sea lions, research indicates that not all vessels do so (Mathews 2000) and some animals are likely disturbed throughout the season. This occasional disturbance does not appear to affect the Steller sea lion population at South Marble Island as the haul out continues to be heavily used and surveys indicate that sea lion numbers are increasing at that site.

Conclusion: Because Alternative 1 (No Action) would not authorize gull egg harvest in Glacier Bay National Park, Steller sea lions would not be affected and the alternative would not contribute to cumulative effects on the species. The level of impact on Steller sea lion populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park's enabling legislation or that are essential to the integrity of the park.

Alternative 2 (One Harvest Visit to Two Locations) - Effects on the Steller Sea Lion Population

Direct and Indirect Effects: Steller sea lions are susceptible to human disturbance associated with foot and vessel traffic. Sea lions react to direct human approach by increasing vocalizations and agitated head movements, shifting positions on the haul out, and fleeing into the water. In the short-term, human disturbance can disrupt daily activities and redistribute animals within and among haul out sites. Severe, consistent disturbance could result in reduced reproductive

success and increased stress and vigilance levels (Engelhard et al. 2002). The type, intensity and duration of the disturbance as well as the frequency of disturbance events all affect how animals respond (Born et al. 1999, Suryan and Harvey 1999, Henry and Hammill 2001).

In a study of various types of human disturbance, Kucey (2005) noted that sea lions reacted strongly to direct boat approaches, particularly if the vessel did not slow down as it approached the haul out. However, when vessels made slow, parallel passes they were able to approach quite closely to haul outs without animals entering the water. Kucey (2005) also noted that sea lions at haul outs that are frequently visited by tourists on vessels may become habituated to vessel approach and presence. However, these animals may still experience physiological stress not apparent to the observer (Fowler 1999).

Mathews (2000) studied the effects of vessel approaches on sea lions hauled out at South Marble Island. Mathews noted increased disturbance (as measured by changes from resting to non-resting behavior and abandoning the haul out for water) as vessels approached between 42 and 345 yards with a mean distance of 152 yards. Kayaks as well as powered vessels were noted to cause disturbance at these distances.

Sea lions haul out at several sites throughout Glacier Bay National Park (Figure 3-1); two sites, Graves Rocks and South Marble Island, also support nesting glaucous-winged gulls. In this alternative, harvest is likely to occur at South Marble Island for the foreseeable future. If South Marble Island is selected as a harvest location, a vessel would approach and off-load passengers at one or more of five beaches on a single day between late May and mid- June. Sea lions use haul outs near several of these landing sites (Figure 2-1). The vessel would land at a site only if the landing could be made while remaining 100 yards or farther from hauled out animals. Harvest locations and access pathways would be delineated such that harvesters moving through a colony would not disturb sea lions hauled out. Such practices would cause little or no change in sea lion behavior or survival.

Sea lions may temporarily become more alert as the vessel approaches the haul out but are not expected to leave the haul out and enter the water. Limited disturbance may result as harvesters move into colonies. The effects of this alternative on Steller sea lions are expected to be negligible.

Cumulative Effects: In addition to the effects described above**,** Steller sea lion populations would be affected most by natural phenomena and limited human disturbance associated with inappropriate close vessel approaches. Natural phenomena appear to favor Southeast Alaskan populations of Steller sea lions and inappropriate vessel approaches are thought to be uncommon in Glacier Bay. This alternative is not expected to contribute towards cumulative effects on Steller sea lion populations.

Conclusion: Behavioral disturbance to Steller sea lions would be limited because vessels associated with harvest activities would not be permitted to approach hauled out marine mammals closer than 100 yards. In addition, disturbance by harvester contact with sea lions would be minimized by requiring that harvesters remain out of view of hauled out animals while on the islands. The direct, indirect and cumulative effects of this alternative on Steller sea lions

would be negligible. The level of impact on Steller sea lion populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

Alternative 3 (Two Harvest Visits at Up to Five Locations) - Effects on the Steller Sea Lion Population

Direct and Indirect Effects: In this alternative, harvest is likely to occur at South Marble Island for the foreseeable future. If South Marble Island is selected as a harvest location, a vessel would approach and off load passengers at one or more of five beaches on two days in late May to mid June. Sea lions use haul outs near several of these landing sites (Figure 2-1). The vessel would land at a site only if the landing could be made while remaining 100 yards or farther from hauled out animals. Harvest locations and access pathways would be delineated such that harvesters moving through a colony would not disturb sea lions hauled out. Such practices would cause little or no change in sea lion behavior or survival.

Sea lions may temporarily become more alert as the vessel approaches the haul out but are not expected to leave the haul out and enter the water as vessels would remain more than 100 yards away from haul outs. The effects of this alternative on Steller sea lions would be negligible.

Cumulative Effects: In addition to effects associated with harvest activities described above, Steller sea lion populations would be affected most by natural phenomena and limited human disturbance associated with inappropriate close vessel approaches. Natural phenomena appear to favor Southeast Alaskan populations of Steller sea lions and inappropriate vessel approaches are thought to be uncommon in Glacier Bay. This alternative is not expected to contribute towards cumulative effects on Steller sea lion populations.

Conclusion: Behavioral disturbance to Steller sea lions would be limited because vessels associated with harvest activities would not be permitted to approach hauled out marine mammals closer than 100 yards. In addition, disturbance by harvester contact with sea lions would be minimized by delineating pathways that reduce disturbance to hauled out animals while on the islands. The direct, indirect, and cumulative effects of this alternative on Steller sea lions would be negligible and would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

4.3.4 Harbor Seal Population

The analysis of effects of alternatives on harbor seals includes discussions of the effects of harvest-related vessel and foot traffic on seals hauled out near harvest locations.

Methodology

The methodology for evaluating the effects on the harbor seal population consists of:

- Identifying proposed activities that could affect the harbor seal population.

- Determining how those activities would affect the harbor seal population (e.g. behavioral changes, changes in mortality, changes in reproduction, changes in habitat use).
- Determining the level of effect of those activities and whether the effects are adverse or beneficial.
- Determining the significance of those effects in terms of the resource.

To determine the significance of effects on harbor seals the impacts were compared against the threshold criteria in Table 4-5.

Table 4-5. Threshold Criteria for the Effects Analysis on Harbor Seal Population

Negligible	Little or no change in the behavior, abundance, or distribution of harbor seals. The changes would not reduce individual survival or reproduction.
Minor	Small, temporary change in the behavior, abundance, or distribution of harbor seals. Any change would have little or no effect on individual survival or reproduction.
Moderate	The behavior, abundance, or distribution of harbor seals would change for a period longer than the summer season, but less than one year. Individuals could experience sublethal effects that lead to reductions in long-term survival or reproduction. Population-level distribution, abundance, survival, or reproduction would remain unchanged.
Major	The behavior, abundance, distribution, or mortality of harbor seals would permanently change, resulting in reduced individual survival or reproduction sufficient to change population-level distribution and abundance.

Assumptions

The analysis assumes that the number of harbor seals hauling out near gull colonies would remain constant over time. The analysis also assumes that the existing vessel approach distances mandated by the Vessel Quota and Operating Restrictions which prohibit vessels from approaching within 100 yards of hauled out seals would remain in place, precluding human disturbance to hauled out marine mammals.

Alternative 1 (No-Action) – Effects on Harbor Seal Population

Direct and Indirect Effects: Because Alternative 1 (No Action) would not authorize gull egg harvest in Glacier Bay National Park, harbor seals would not be affected by activities associated with harvest practices. Seals hauling out near gull colonies and elsewhere would continue to be protected by the Marine Mammal Protection Act, and NPS regulations which prohibit vessel or human approaches within 100 yards (90 meters) of hauled out seals.

Cumulative Effects: In the absence of harvest activities, harbor seals would continue to be affected by unknown phenomena as well as occasional vessel disturbance. Harbor seal populations have declined dramatically in Glacier Bay and researchers are unable to determine the cause for this decline. Although human disturbance cannot be ruled out, researchers suspect natural phenomena including increased predation or shifts in prey abundance. The harbor seal population decline is expected to continue.

Despite prohibitions on approaching hauled out seals closer than 100 yards, vessels occasionally disturb seals in Glacier Bay at larger haul outs (Mathews 1999). Few motorized vessels approach harbor seals hauled out on small islands or reefs as these areas are typically shallow and rocky. While kayaks may approach such locations, they are required to remain 100 yards from hauled out marine mammals (1/4 mile at Spider Island haul outs). Disturbance appears to be relatively insignificant, particularly in the face of larger declines caused by a yet unknown cause.

Because Alternative 1 (No Action) would not authorize gull egg harvest, close approaches or landings on South Marble Island or elsewhere would not occur so this alternative would not contribute toward cumulative effects on harbor seal populations.

Conclusion: Because Alternative 1 (No Action) would not authorize gull egg harvest in Glacier Bay National Park, harbor seals would not be subject to additional disturbance and the alternative would not contribute to cumulative effects on the population. The level of impact on harbor seal populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park.

Alternative 2 (One Harvest Visit to Two Locations) - Effects on Harbor Seal Population

Direct and Indirect Effects: Studies in Glacier Bay have shown that harbor seals can be disturbed off haul outs by commercial and private vessels and their wakes (Calambokidis et al. 1985, Mathews 1999). Calambokidis and others (1985) found the average distance at which disturbance occurred for 50 percent of seals monitored in a glacial fjord was 183 yards (167 m). In Mathews' study (1999), seals abandoned a haul out for more than 52 hours following disturbance. Harbor seals deprived of access to haul outs may increase the time that they subsequently spend ashore, indicating that time out of the water is needed for normal maintenance (Brasseur et al. 1996). Repeated disturbance at seal haul outs could result in reduced survival of pups, disruption of social interactions, increased energy expenditures, protraction of molt processes, increased susceptibility to predation, and/or abandonment of a haul out.

In this alternative, harvest could occur at a number of locations used as haul out sites by harbor seals (Figure 3-1). Vessels associated with harvest activities would only approach and land at these sites if the landing could be made while remaining 100 yards or farther from hauled out animals.

Harbor seals may temporarily become more alert as the vessel approaches the haul out, but are not expected to leave the haul out and enter the water. Because harvesters would be instructed to remain a distance from hauled out animals, human presence near hauled out animals would result in only minimal disturbance. The disturbance period would be limited to less than an hour in a single day. The effects of this alternative on harbor seals would be negligible.

Cumulative Effects: Harbor seals would continue to be primarily affected by unknown phenomena as well as occasional inappropriate vessel disturbance by charter or private vessels. The effects of unknown natural phenomena would have far greater effects than actions associated with this alternative; this alternative would not contribute to the cumulative effects on harbor seals.

Conclusion: Behavioral disturbance to harbor seals would be limited because vessels associated with harvest activities would not be permitted to approach hauled out seals closer than 100 yards. In addition, disturbance by harvesters contact with harbor seals would be minimized by the requirements that they remain out of view of hauled out animals while on the islands. The direct, indirect, and cumulative effects of this alternative on harbor seals would be negligible. The level of impact on harbor seal populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park and preserve.

Alternative 3 (Two Harvest Visits at Up to Five Locations) - Effects on Harbor Seal Population

Direct and Indirect Effects: In this alternative, harvest could occur at a number of locations used as haul out sites by harbor seals on two days in late May to mid June (Figure 3-1). Vessels associated with harvest activities would only approach and land at these sites if the landing could be made while remaining 100 yards or farther from hauled out animals.

Harbor seals may temporarily become more alert as the vessel approaches the haul out, but are not expected to leave the haul out and enter the water. Because harvesters would be instructed to remain a distance from hauled out animals, human presence near hauled out animals would result in only minimal disturbance. The disturbance period would be limited to less than an hour in a single day. The effects of this alternative on harbor seals would be negligible.

Cumulative Effects: Harbor seals would continue to be primarily affected by unknown phenomena as well as occasional vessel disturbance. Because vessels associated with this alternative would not be permitted to approach hauled out marine mammals closer than 100 yards and harvesters on land would be required to remain out of view of hauled out animals, this alternative is not expected to add cumulative effects to existing factors affecting harbor seal populations in Glacier Bay.

Conclusion: Behavioral disturbance to harbor seals would be limited because vessels associated with harvest activities would not be permitted to approach hauled out seals closer than 100 yards. In addition, disturbance by harvester contact with harbor seals would be minimized as harvesters would be required to remain out of view of hauled out animals while on the islands. The direct,

indirect, and cumulative effects of this alternative on harbor seals would be negligible. The level of impact on harbor seal populations under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park and preserve.

4.4 HUMAN ENVIRONMENT

4.4.1 Wilderness

The analysis of effects of alternatives on wilderness resources includes discussion of the effects of egg harvest practices on the pristine, undeveloped, untrammeled character of wilderness areas as well as the opportunities for solitude or unconfined recreation provided by wilderness areas. The NPS completed the Wilderness Minimum Requirements Decision Guide for this project (Appendix 3).

Methodology

The methodology for evaluating the effects on wilderness consists of:

- Identifying proposed activities that could affect wilderness.
- Determining how those activities would affect wilderness.
- Determining the level of effect of those activities and whether the effects are adverse or beneficial.
- Determining the significance of those effects in terms of the resource.

To determine the significance of effects on wilderness the impacts were compared against the threshold criteria in Table 4-6.

Table 4-6. Threshold Criteria for Wilderness Effects Analysis

Negligible	Little or no change in wilderness character (undeveloped, untrammeled environment) and opportunities for solitude and unconfined recreation.
Minor	Little or no change in wilderness character (undeveloped, untrammeled environment). Small, temporary change in opportunities for solitude and unconfined recreation in a limited area.
Moderate	Some change in wilderness character (evidence of development or human use of environment occurs). Small, temporary change in opportunities for solitude and unconfined recreation across large areas of wilderness.
Major	Some change in wilderness character (evidence of development or human use of environment occurs). Changes in opportunities for solitude and unconfined recreation are long term and occur across large areas of wilderness.

Assumptions

The wilderness character of Glacier Bay is currently protected by carefully managing both vessel use (through the Vessel Quota and Operating Restrictions), the Wilderness Visitor Use Management Plan, park-specific regulations [e.g., 36CFR13.65(b)(8)] and the annual park compendium focused on reducing human impacts to the pristine, untrammeled character of the park. This analysis assumes that the NPS would continue to manage vessel and backcountry use in a manner that protects the wilderness character of Glacier Bay.

Alternative 1 (No-Action) – Effects on Wilderness

Direct and Indirect Effects: This alternative would not authorize egg harvest in Glacier Bay National Park and would thus not affect natural processes, evidence of human presence, or opportunities for solitude and unconfined recreation.

Cumulative Effects: In the absence of harvest activities, wilderness character in Glacier Bay would most likely be affected by other visitor uses including cruise ship and other vessel use as well as backcountry uses. The NPS currently regulates vessel and backcountry use in part to maintain wilderness characteristics. This alternative is not expected to result in cumulative effects to wilderness.

Conclusion: Because this alternative would not result in additional human use of Glacier Bay and would not affect natural processes, the direct, indirect or cumulative effects would be negligible. The level of impact on wilderness under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park and preserve.

Alternative 2 (One Harvest Visit to Two Locations) – Effects on Wilderness

Direct and Indirect Effects: Almost all (97.7%) of Glacier Bay land is designated wilderness including all current glaucous-winged gull nesting sites where harvest may occur. Wilderness areas in Glacier Bay, as elsewhere, are managed to maintain natural processes, minimize evidence of human impacts, and provide opportunities for solitude and unconfined recreation.

A 1999 survey documented that “experiencing wilderness” was important to 93 percent of visitors to Glacier Bay National Park and 93 percent indicated that “enjoying solitude/quiet” was important (Littlejohn 2000). This study also noted that, of the 56 backcountry users surveyed, 50 percent saw trails, 30 percent saw litter, 25 percent saw campfire rings, 23 percent saw hardened tent sites, 11percent saw trampled vegetation, 2 percent saw food scraps and 14 percent noted other evidence of human use of the backcountry (all of which comprises designated wilderness). Of 110 backcountry users surveyed, 85 percent saw other humans (kayakers and/or campers) during their backcountry experience. The majority of backcountry visitors also saw cruise ships (78%), other boats (85%), and airplanes (63%). Only 7 percent of backcountry visitors surveyed noted that seeing other people in kayaks or camping detracted from their experience; these visitors were more likely to feel that cruise ships (44%), other boats (31%) and airplanes (40%)

detracted from their experience. These results suggest that wilderness is valued by park visitors and can be negatively effected by evidence of human use both motorized and non-motorized.

This alternative would authorize one or more vessels to travel to, and stand off at, one or two sites to facilitate harvest practices. Because these administrative vessel entries are considered in the Vessel Quota and Operating Restrictions Environmental Impact Statement, their effects have already been analyzed. The alternative would limit the group size to twelve individuals and one observer who would remain on shore or on the vessel. Harvest activities would not involve placement of structures, would not trammel the character of wilderness areas, and would be limited in duration (i.e., one day) so few park visitors would witness and potentially be affected by such activities. Opportunities for solitude and unconfined forms of recreation would not be affected. This alternative would not directly or indirectly affect wilderness.

Cumulative Effects: In addition to the negligible effects of harvest activities described above, Glacier Bay's wilderness character would most likely be affected by other visitor uses, both motorized and non-motorized. The NPS currently regulates vessel and backcountry use in part to maintain wilderness characteristics. This alternative is not expected to result in cumulative effects to wilderness.

Conclusion: Because this alternative would not involve development, would not result in long-term evidence of human use, and harvest activities would be short in duration, the direct, indirect and cumulative effects would be negligible. The level of impact on wilderness under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park and preserve.

Alternative 3 (Two Harvest Visits at Up to Five Locations) – Effects on Wilderness

Direct and Indirect Effects: This alternative would involve one or more vessels traveling in Glacier Bay on two or more days to several locations throughout the park. Because these administrative vessel entries are considered in the Vessel Quota and Operating Restrictions Environmental Impact Statement, their effects have already been analyzed.

In addition, up to twelve tribal members would spend some portion of two or more days harvesting gull eggs at a given location in designated wilderness. Harvest activities would not involve placement of structures, would not trammel the character of wilderness areas, and would be limited in duration (i.e., one day) so few park visitors would witness and potentially be affected by such activities. Opportunities for solitude and unconfined forms of recreation would not be affected. This alternative would not directly or indirectly affect wilderness. Opportunities for solitude and unconfined forms of recreation would not be affected. This alternative would not directly or indirectly affect wilderness.

Cumulative Effects: In addition to the negligible effects of harvest activities described above, Glacier Bay's wilderness character would most likely be affected by other visitor uses, both motorized and non-motorized. The NPS currently regulates vessel and backcountry use in part

to maintain wilderness characteristics. This alternative is not expected to result in cumulative effects to wilderness.

Conclusion: Because this alternative would not involve development, would not result in long-term evidence of human use, and harvest activities would be short in duration, the direct, indirect and cumulative effects would be negligible. The level of impact on wilderness under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park and preserve.

4.4.2 Ethnographic Resources: Huna Tlingit Gull Egg Harvest Practices

The analysis of effects of alternatives on ethnographic resources includes discussions of the effects of egg harvest on the cultural integrity and tribal identity of the Huna Tlingit, their connection to homeland, transmission of traditional life ways to young people, and the perpetuation of traditional Tlingit laws and life ways. The NPS conducted an ANILCA section 810 analysis for subsistence (Appendix 4).

Methodology

The methodology for evaluating the effects on ethnographic resources consists of:

- Identifying proposed activities that could affect the ethnographic resource.
- Determining how those activities would affect the ethnographic resource.
- Determining the level of effect of those activities and whether the effects are adverse or beneficial.
- Determining the significance of those effects in terms of the resource.

To determine the significance of effects on ethnographic resources the impacts were compared against the threshold criteria in Table 4-7.

Table 4-7. Threshold Criteria for Ethnographic Resources Effects Analysis

Negligible	Perceptible and/or measurable effect would not occur; any effect would last less than one year.
Minor	Perceptible and/or measurable effect would occur; effect would last less than one year and would be limited to a few individuals.
Moderate	Perceptible and/or measurable effect would occur; the effect would last longer than one year and would affect numerous individuals.
Major	Perceptible and/or measurable effect would occur; effect would be permanent and would effect the Huna Tlingit population as a whole.

Assumptions

Huna Tlingit tribal members' use of Glacier Bay is currently quite limited due to the expense of travel and changes in the Huna Tlingit annual round of food harvesting, misperceptions about currently authorized activities, and a sense of alienation from the Tlingit homeland. Restrictions on seal and goat hunting and commercial fishing closures in Glacier Bay have also reduced Tlingit use of the Bay. This analysis assumes that Huna Tlingit use of Glacier Bay would remain similar to that experience today.

Huna Tlingit participation in traditional activities of all kinds has diminished among young tribal members for various reasons. Although the tribal government, tribal corporation, Hoonah City Schools, and numerous federal agencies have and continue to sponsor programs aimed at increasing young peoples awareness of, and participation, in cultural activities, this analysis assumes only a small increase in participation on the part of Huna Tlingit youth.

Alternative 1 (No-Action) – Effects on Ethnographic Resources

Direct and Indirect Effects: This alternative would not authorize egg harvest in Glacier Bay National Park. Tribal members would not have the opportunity to gather gull eggs within the park and eggs from Glacier Bay would not be distributed in the community.

Gathering gull eggs is the first spring phase in the annual seasonal round of food harvest for the Huna Tlingit. This seasonal round defines the Tlingit, tying them to their homeland and their ancestors through *Haa Shagoon* – a process that links past, current and future generations through ritualized activity. Failure to participate in any phase of the seasonal round essentially unbalances the ritual. This alternative would have major negative effects on the cultural link between past, current and future generations by precluding an activity essential to the ritualized seasonal food gathering rounds.

Tlingit tribes (or kwaans) were not originally conceived of as political or even social bodies, but achieved their identity as units through their connection to, and relationship with, a particular

territory. Any action which alienates a tribe from its traditional territory impacts the identity of the tribe. Appropriate caretaking of the resource within their territory is a primary means by which the Tlingit maintain their sense of tribal unity. This alternative would deny the Huna Tlingit one means of participating in a meaningful relationship with their homeland, and would have major negative effects on the identity of the Huna Tlingit as a tribal unit.

Gull egg harvest visits were typically a family or group event which provided ideal opportunities for elders to transmit clan-held stories, morals, ethics, and Tlingit values to the younger generation. Because this alternative would not authorize harvest visits, young people would have few chances to learn traditional egg harvesting techniques from elders and few chances to learn traditional stories and receive life guidance from the elder generation. While much traditional knowledge associated with gull egg harvest has been documented in an ethnographic study (Hunn et al. 2002) and would be available for review by future HIA tribal members, members would have no opportunity for participatory learning. The alternative would have moderate negative effects on the transmission of cultural practices to younger generations in the short-term and ultimately would have major negative effects on this transmission as the next generation would have no familiarity with harvest practices and associated stories, morals and ethics.

Few young tribal members have developed a taste for gull eggs as the sites outside of Glacier Bay which can be legally harvested from produce only enough eggs for elders. It is likely that the majority of young people would lose interest in a tradition – and food source – with which they have no experience. Within one generation (20 years), it is likely that there would be few living tribal members with experience in harvesting and eating gull eggs. The alternative would have moderate negative effects on the current younger generations' interest in gull egg harvest and ultimately would have major negative effects as the next generation would have no familiarity with harvest practices and associated stories, morals, and ethics.

The alternative would continue to preclude the Huna Tlingit from participating in an activity that they define as responsible and ecologically and spiritually essential. De Laguna (1990:209) notes that food gathering is a "moral and religious occupation." Tlingit law and ethics require that resources be harvested appropriately. Failure to harvest a particular resource is viewed as refusing a gift thereby offending the spirits associated with the resource being offered. This alternative would force the Huna Tlingit to violate their tribal law as well as their values, morals and ethics and would have a major negative effect on their self concept. Additionally, the Huna Tlingit would be largely precluded from relying on a natural, healthy food source.

In summary, this alternative does not allow the Huna Tlingit access to, or use of, an ethnographic resource important to the survival of the communities' cultural system and would have major negative effects on the practice as well as the ethnographic resource itself.

Cumulative Effects: In addition to the effects described above, the ethnographic resource is likely to be affected by Huna Tlingit participation in other traditional activities and life ways**.** Numerous other traditional activities are prohibited and/or heavily regulated in Glacier Bay National Park and other parts of the Huna Tlingit territory. As a result, the Huna Tlingit's connection with their homeland is tenuous, they have few meaningful ways in which to interact

with the landscape, and are essentially "removed" from the ecosystem processes they were once an integral part of. For example, seal and mountain goat hunting which once drew tribal member to Glacier Bay is now illegal. Commercial fishing historically served as one means by which a subset of Huna Tlingit were able to continue interacting in a meaningful way with their homeland; current regulations phasing out commercial fishing will eventually result in complete fishery closures in Glacier Bay. Summer fish camps once considered seasonal homes for entire families are no longer inhabited and cannot legally be reinhabited except on a few small native inholdings. Cumulatively, these existing regulations and the continued prohibition of gull egg harvest have had major negative effects on Huna Tlingit cultural practices and the associated ethnographic resources. Although permanent residents of Hoonah are authorized to harvest glaucous-winged gull eggs on islands outside of Glacier Bay National Park in Icy Strait and Cross Sound, these nesting sites are virtually inaccessible on most days due to ocean swells and tidal currents. In recent years, Middle Pass Rock, the site outside the park most typically harvested from has supported an increasing number of Steller sea lions making landing even more difficult. Moreover, such sites were never favored by the Huna Tlingit and do not fulfill the traditional practice of harvesting eggs within the homeland of Glacier Bay. The effects of this alternative would be expected to add to the cumulative negative effects on the ethnographic resource.

Conclusion: This alternative would not allow the Huna Tlingit access to, or use of, an ethnographic resource important to the survival of the communities' cultural system. When combined with the effects of other prohibitions on traditional activities in Glacier Bay, this alternative would have major direct, indirect, and cumulative negative effects on the ethnographic resource associated with traditional egg harvesting practices.

Alternative 2 (One Harvest Visit to Two Locations) - Effects on Ethnographic Resources

Direct and Indirect Effects: This alternative would provide as many as twenty four tribal members (two groups of twelve each; one group visiting one site and the other group visiting a second site), including adults (as many as twelve) and youth (as many as twelve) the opportunity to travel into Glacier Bay and gather gull eggs using traditional harvest methods. Harvest would yield approximately 278 eggs which would be distributed in the community.

Authorization of gull egg harvest would restore an essential phase in the traditional seasonal rounds, facilitating the connection between the past, current, and future generations. Although the number of eggs available to community members would be limited, the symbolic importance of "eating from the landscape" would have minor to moderate positive effects on the Tlingit community. A few tribal members would have the opportunity to interact in a meaningful way with their traditional homeland on a single day. Traditional Tlingit laws associated with honoring resources through appropriate harvest would be partially restored. Because the harvest would still be regulated and more formally structured than in traditional times, some sense of artificiality would prevail. Through the annual harvest plan prepared by the HIA, the tribe would be involved in cooperatively managing one aspect of their traditional homeland which would have major positive effects on the communities' sense of self-determination and tribal identity. However, over time the positive effects of the alternative would likely diminish as only a few young people would have the opportunity to participate in egg harvest and consumption. This

alternative would allow only a few young people to gather and eat eggs. Of the few young people participating each year, perhaps half would remain in the area long term and/or continue to participate in the activity. In the short term, this alternative is expected to have moderate positive effects on the ethnographic resource. However, the positive effects would diminish over time as young people who have participated in the activity no longer participate; long term positive effects on the culture are expected to be minor to moderate.

Cumulative Effects: In addition to the effects described above, Huna Tlingit participation in other cultural activities could affect the ethnographic resource. The continued prohibition of other traditional practices in Glacier Bay and elsewhere would result in minor to moderate cumulative effects. Although permanent residents of Hoonah are authorized to harvest glaucous-winged gull eggs on islands outside of Glacier Bay National Park in Icy Strait and Cross Sound, these nesting sites are largely inaccessible on most days due to ocean swells, tidal currents, and increasingly high concentrations of Steller sea lions. Moreover, such sites do not fulfill the traditional practice of harvesting eggs within the homeland of Glacier Bay. The alternative is expected to diminish the cumulative effects of loss of traditions on the ethnographic resource.

Conclusion: This alternative would restore and protect an ethnographic resource in the short term, having a moderate positive effect on the resource. However, over a 20-year time period, the positive effects of the alternative would diminish and ultimately have a minor effect when combined with the negative effects of other prohibitions on cultural activities. The level of impact on the ethnographic resource under this alternative would not result in any impairment of park resources that fulfill specific purposes identified in the park enabling legislation or that are essential to the integrity of the park and preserve.

Alternative 3 (Two Harvest Visits at Up to Five Locations) - Effects on Ethnographic Resources

Direct and Indirect Effects: This alternative would authorize two harvest visits at up to five locations within Glacier Bay to harvest gull eggs. Many tribal members, including adults and youth would have the opportunity to travel into Glacier Bay and gather gull eggs using traditional harvest methods. For example, five separate groups of twelve individual could be authorized to harvest at each of the five authorized sites. Five additional groups of twelve could be authorized to harvest at those same sites for a second visit (a total of 120 tribal members). Harvest would yield approximately 444 eggs which would be distributed in the community.

The effects of this alternative on ethnographic resource are similar to those described for Alternative 2, except that many more tribal members would harvest eggs and many more young people would have the opportunity to taste harvested eggs. Although some of the young people participating may leave the area and/or cease to participate in the activity, many more would remain than in Alternative 2. Because this alternative more closely simulates traditional egg harvest practices (in that the Huna Tlingit typically made several harvest visits to a given colony), it would result in a stronger connection to ancestors and traditional life ways. This alternative is expected to have moderate to major positive impacts on the cultural practices of the Huna Tlingit in both the short and long term.

Cumulative Effects: The positive effects of authorizing egg harvest would be somewhat offset by the continued prohibition of other traditional practices in Glacier Bay and elsewhere. However, because a large number of young people would be able to participate in egg harvest and eat gull eggs each year, knowledge of and participation in the practice would be maintained over time. Although permanent residents of Hoonah are authorized to harvest glaucous-winged gull eggs on islands outside of Glacier Bay National Park in Icy Strait and Cross Sound, these nesting sites are inaccessible on most days due to ocean swells and tidal currents. Moreover, such sites were never favored by the Huna Tlingit and do not fulfill the traditional practice of harvesting eggs within the homeland of Glacier Bay.

Conclusion: This alternative would restore and protect an ethnographic resource in both the short and long term, having a moderate to major positive effect on the ethnographic resource.

4.5 UNAVOIDABLE ADVERSE EFFECTS

4.5.1 Alternative 1 (No-Action)

This alternative would have unavoidable adverse effects to the ethnographic resource as the Huna Tlingit would not have access to, or use of, an ethnographic resource important to the survival of the communities' cultural system. While mitigation measures including documentation of the traditional egg harvest practice and facilitation of visits to Glacier Bay would partially address the loss of a cultural tradition and Huna Tlingit contact with their homeland, the traditional practice of egg harvesting in Glacier Bay would be lost.

4.5.2 Alternative 2

This alternative would have unavoidable adverse effects to individual chicks by harvesting eggs prior to hatching. Harvested eggs, and the chicks they likely contain, would be adversely affected.

4.5.3 Alternative 3

This alternative would have unavoidable adverse effects to individual chicks by harvesting eggs prior to hatching. Harvested eggs, and the chicks they likely contain, would be adversely affected.

4.6 THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

This required consideration addresses the question of whether any proposed actions would be providing short-term benefits at the cost of future generations.

4.6.1 Alternative 1 (No-Action)

This alternative does not authorize harvest and therefore would not trade short-term uses at the expense of long-term productivity of any resource.

4.6.2 Alternative 2

Alternative 2 provides short-term benefits to the ethnographic resource but would not benefit the Huna Tlingit over the long-term and would not affect the long-term productivity of any Glacier Bay resource. A model predicts that 4 percent fewer glaucous-winged gull chicks would be hatched throughout Glacier Bay, but long-term reproduction of gulls would not be affected.

4.6.3 Alternative 3

Alternative 3 provides long-term benefits to the ethnographic resource and would not affect the long-term productivity of any Glacier Bay resource. A model predicts that 6 percent fewer glaucous-winged gull chicks would be hatched throughout Glacier Bay, but long-term reproduction of gulls would not be affected.

4.7 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

4.7.1 Alternative 1 (No-Action)

In the long-term, this alternative would result in the irreversible, irretrievable loss of the ethnographic resource associated with Huna Tlingit traditional gull egg harvest as individuals with first person experience of harvest in Glacier Bay would pass away. Once elders with knowledge of, and experience in, harvesting gull eggs have passed away, the vital living link between past, current, and future generations' knowledge would be broken. While young people could read about the practice and attempt to learn egg harvest practices from ethnographic documents, the living connection – vital to Tlingit learning – would not be available. However, should NPS re-consider authorizing gull egg harvest prior to the death of all individuals with firsthand experience harvesting eggs in Glacier Bay, the ethnographic resource could be maintained.

4.7.2 Alternative 2

This alternative would also result in the irreversible, irretrievable loss of the ethnographic resource associated with Huna Tlingit traditional gull egg harvest as individuals with first person experience of harvest in Glacier Bay passed away. This irreversible, irretrievable loss would occur over a much greater time span than under Alternative 1 (No Action) as some young people would have the opportunity to harvest eggs in Glacier Bay. Of the few young people participating each year, perhaps half would remain in the area long term and/or continue to participate in the activity. Ultimately, the tradition would be lost as fewer young people would be available to pass it on.

No irreversible or irretrievable commitment of biological resources would occur as the NPS would monitor gull, other cliff and ground nesting birds, harbor seal, and Steller sea lion populations annually and could alter harvest practices each year to ensure sustainability of all wildlife populations.

4.7.3 Alternative 3

This alternative would not result in the irreversible, irretrievable loss of the ethnographic resource associated with Huna Tlingit traditional gull egg harvest as a greater number of individuals would be provided with first person experience in harvesting gull eggs in Glacier Bay. These individuals would pass the tradition and practice on, allowing it to thrive over time.

No irreversible or irretrievable commitment of biological resources would occur as the NPS would monitor gull, other cliff and ground nesting birds, harbor seal, and Steller sea lion populations annually and could halt or alter harvest practices each year to ensure sustainability of all wildlife populations.