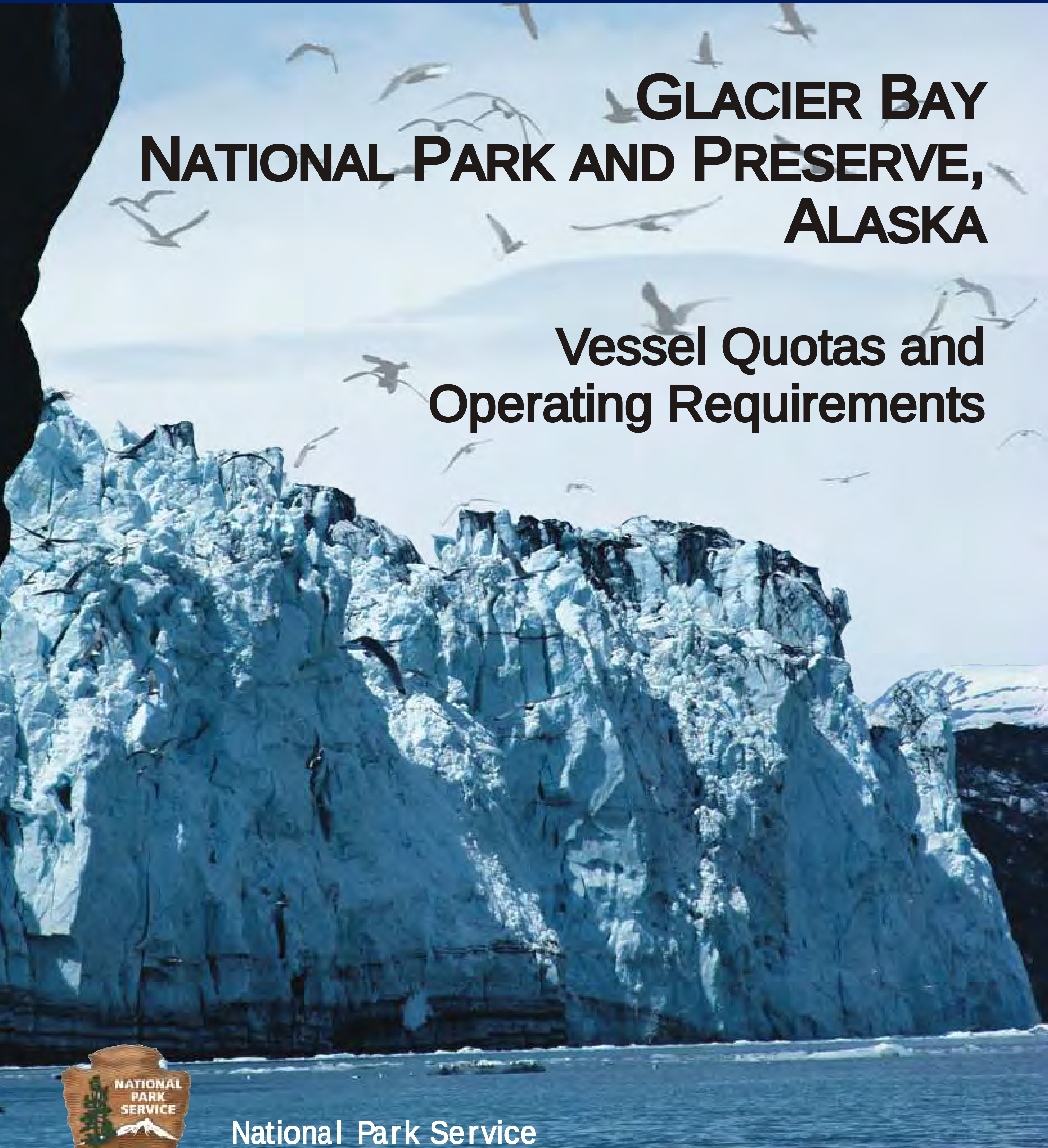
FINAL ENVIRONMENTAL IMPACT STATEMENT VOLUME II OF II



GLACIER BAY NATIONAL PARK AND PRESERVE, ALASKA

Vessel Quotas and Operating Requirements

National Park Service

Glacier Bay National Park and Preserve, Alaska
United States Department of the Interior

Front Cover Photograph by Mark Kelley • *www.markkelley.com*
Back Cover, Tufted Puffin Photograph by Shiway Wang

GLACIER BAY
NATIONAL PARK AND PRESERVE, ALASKA

VESSEL QUOTAS AND OPERATING REQUIREMENTS • FINAL ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

36 Code of Federal Regulations 13.65
Vessel Operating Requirements for Glacier Bay National Park and Preserve

§ 13.65 Glacier Bay National Park and Preserve.

(a) *Commercial fishing: authorizations, closures and restrictions*—(1) *What terms do I need to know?* (i) *Commercial fishing* means conducting fishing activities under the appropriate commercial fishing permits and licenses as required and defined by the State of Alaska.

(ii) *Glacier Bay* means all marine waters within Glacier Bay National Park, including coves and inlets, north of an imaginary line drawn from Point Gustavus to Point Carolus.

(iii) *Outer waters* means all of the non-wilderness marine waters of the park located outside of Glacier Bay.

(2) *Is commercial fishing authorized in the marine waters of Glacier Bay National Park?* Yes—Commercial fishing is authorized within the outer waters of the park and within the non-wilderness waters of Glacier Bay, subject to the provisions of this chapter.

(i) Commercial fishing shall be administered pursuant to A cooperatively developed State/federal park fisheries management plan, international conservation and management treaties, and existing federal and Non-conflicting State law. The management plan shall provide for the protection of park values and purposes, the prohibition on any new or expanded fisheries, and the opportunity to study marine resources.

(ii) Commercial fishing or conducting an associated buying or processing operation in wilderness waters is prohibited.

(iii) A new or expanded fishery is prohibited. The Superintendent shall compile a list of the existing fisheries and gear types used in the outer waters and follow the procedures in §§ 1.5 and 1.7 of this chapter to inform the public.

(iv) Maps and charts showing which marine areas of Glacier Bay are closed to commercial fishing are available from the Superintendent.

(3) *What types of commercial fishing are authorized in Glacier Bay?* Three types of commercial fishing are authorized in Glacier Bay non-wilderness waters: longline fishing for halibut; pot and ring fishing for Tanner crab; and trolling for salmon.

(i) All other commercial fishing, or a buying or a processing operation not related to an authorized fishery is prohibited in Glacier Bay.

(ii) On October 1, 2000, each fishery will be limited to fishermen who qualify for a non-transferable commercial fishing lifetime access permit (see paragraph (a)(4) of this section). Commercial fishing without a permit issued by the superintendent, or other than in accordance with the terms and conditions of the permit, is prohibited.

(iii) The Superintendent shall include in a permit the terms and conditions that the superintendent deems necessary to protect park resources. Violating a term or condition of the permit is prohibited.

(4) Who is *eligible for a Glacier Bay commercial fishing lifetime access permit?* A Glacier Bay commercial fishing lifetime access permit will be issued by the superintendent to fishermen who have submitted documentation to the superintendent, on or before October 1, 2000, which demonstrates to the satisfaction of the superintendent that:

(i) They possess valid State limited entry commercial fishing permits for the district or statistical area encompassing Glacier Bay for each fishery for which a lifetime access permit is being sought; and,

(ii) They have participated as limited entry permit holders for the district or statistical area encompassing Glacier Bay for each fishery for which a lifetime access permit is being sought.

(A) For the Glacier Bay commercial halibut fishery, the Applicant must have participated as a permit holder for at least two years during the period 1992–1998.

(B) For the Glacier Bay salmon or Tanner crab commercial fisheries, the applicant must have participated as a permit holder for at least three years during the period 1989–1998.

(5) *What documentation is required to apply for a commercial fishing lifetime access permit?* The required documentation includes:

(i) The applicants full name, date of birth, mailing address and phone number;

(ii) A notarized affidavit, sworn by the applicant, attesting to his or her history of participation as a limited permit holder in Glacier Bay, during the qualifying period, for each fishery for which a lifetime access permit is being sought;

(iii) A copy of the applicant's current State of Alaska limited entry permit and in the case of halibut an International Pacific Halibut Commission quota share, that is valid for the area that includes Glacier Bay, for each fishery for which a lifetime access permit is sought;

(iv) Proof of the applicant's permit and quota share history for the Glacier Bay fishery during the qualifying period;

(v) Documentation of commercial landings for the Glacier Bay fishery during the qualifying periods, i.e., within the statistical unit or area that includes Glacier Bay: for halibut, regulatory sub-area 184; for Tanner crab, statistical areas 114–70 through 114–77. For salmon, the superintendent will consider landing reports from District 114; however, the superintendent may require additional documentation that supports the applicant's declaration of Glacier Bay salmon landings. For halibut and Tanner crab, the superintendent may consider documented commercial landings from the unit or area immediately adjacent to Glacier Bay (in Icy Strait) if additional documentation supports the applicant's declaration that landings occurred in Glacier Bay.

(vi) Any additional corroborating documentation that might assist the superintendent in a timely determination of eligibility for the access permits.

(6) *Where should the documentation for a lifetime access permit be sent?* Before October 1, 2000, all required information (as listed in paragraph (a)(5) of this section) should be sent to: Superintendent, Attn: Access Permit Program, Glacier Bay National Park and Preserve, P.O. Box 140, Gustavus, Alaska 99826.

(7) *Who determines eligibility?* The superintendent will make a written determination of an applicant's eligibility for the lifetime access permit based on information provided. A copy of the determination will be mailed to the applicant. If additional information is required to make an eligibility determination, the applicant will be notified in writing of that need and be given an opportunity to provide it.

(8) *Is there an appeals process if a commercial fishing lifetime access permit application is denied?* Yes—If an applicant's request for an a commercial fishing lifetime access permit is denied, the superintendent will provide the applicant with the reasons for the denial in writing within 15 days of the decision. The applicant may appeal to the Regional Director, Alaska Region, within 180 days. The appeal must substantiate the basis of the applicant's disagreement with the Superintendent's determination. The Regional Director (or his representative) will meet with the applicant to discuss the appeal within 30 days of receiving the appeal. Within 15 days of receipt of written materials and the meeting, if requested, the Regional Director will affirm, reverse, or modify the Superintendent's determination and explain the reasons for the decision in writing. A copy of the decision will be forwarded promptly to the applicant and will be the final agency action.

(9) *How often will commercial fishing lifetime access permit be renewed?* The superintendent will renew lifetime access permit at 5-year intervals for the lifetime of a permittee who continues to hold a valid State limited entry commercial fishing permit, and for halibut an International Pacific Halibut Commission quota share, and is otherwise eligible to participate in the fishery under federal and State law.

(10) *What other closures and restrictions apply to commercial fishermen and commercial fishing vessels?*—The following are prohibited:

(i) Commercial fishing in the waters of Geikie, Tarr, Johns Hopkins and Reid Inlets.

(ii) Commercial fishing in the waters of the west arm of Glacier Bay north of 58°50′N latitude, except commercial fishermen who have been authorized by the superintendent to troll for salmon may troll for king salmon during the period October 1 through April 30, in compliance with state commercial fishing regulations.

(iii) Commercial fishing in the east arm of Glacier Bay, north of an imaginary line running from Point Caroline through the southern point of Garforth

Island and extending to the east side of Muir Inlet, except commercial fishermen who have been authorized by the superintendent to troll for salmon may troll for king salmon south of 58°50′N latitude during the period October 1 through April 30, in compliance with state commercial fishing regulations.

(b) *Resource protection and vessel management*—(1) *Definitions*. As used in this section:

Charter vessel means any motor vessel under 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that is rated to carry up to 49 passengers, and is available for hire on an unscheduled basis; except a charter vessel used to provide a scheduled camper or kayak drop off service.

Commercial fishing vessel means any motor vessel conducting fishing activities under the appropriate commercial fishing licenses as required and defined by the State of Alaska.

Cruise ship means any motor vessel at or over 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) carrying passengers for hire.

Entry means each time a motor vessel passes the mouth of Glacier Bay into the bay; each time a private vessel activates or extends a permit; each time a motor vessel based at or launched from Bartlett Cove leaves the dock area on the way into Glacier Bay, except a private vessel based at Bartlett Cove that is gaining access or egress to or from outside Glacier Bay; the first time a local private vessel uses a day of the seven use-day permit; or each time a motor vessel is launched from another vessel within Glacier Bay, except a motor vessel singularly launched from a permitted motor vessel and operated only while the permitted vessel remains at anchor, or a motor vessel launched and operated from a permitted motor vessel while that vessel is not under way and in accordance with a concession agreement.

Glacier Bay means all marine waters contiguous with Glacier Bay, lying north of an imaginary line between Point Gustavus and Point Carolus.

Motor vessel means any vessel, other than a seaplane, propelled or capable of being propelled by machinery (including steam), whether or not such machinery is the principal source of power, except a skiff or tender under tow or carried on board another vessel.

Operate or *Operating* includes the actual or constructive possession of a vessel or motor vessel.

Private vessel means any motor vessel used for recreation that is not engaged in commercial transport of passengers, commercial fishing or official government business.

Pursue means to alter the course or speed of a vessel or a seaplane in a manner that results in retaining a vessel, or a seaplane operating on the water, at a distance less than one-half nautical mile from a whale.

Speed through the water means the speed that a vessel moves through the water (which itself may be moving); as distinguished from ''speed over the ground.''

Tour vessel means any motor vessel under 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that is rated to carry more than 49 passengers, or any smaller vessel that conducts tours or provides transportation at regularly scheduled times along a regularly scheduled route.

Transit means to operate a motor vessel under power and continuously so as to accomplish one-half nautical mile of littoral (*i.e.*, along the shore) travel.

Vessel includes every type or description of craft used as a means of transportation on the water, including a buoyant device permitting or capable of free flotation and a seaplane while operating on the water.

Vessel use-day means any continuous period of time that a motor vessel is in Glacier Bay between the hours of 12 midnight on one day to 12 midnight the next day.

Whale means any humpback whale (*Megaptera novaeangliae*).

Whale waters means any portion of Glacier Bay, designated by the superintendent, having a high probability of whale occupancy, based upon recent sighting and/or past patterns of occurrence.

(2) *Permits*. The superintendent will issue permits for private motor vessels in accordance with this part and for cruise ships, tour vessels, and charter vessels in accordance with National

Park Service concession authorizations and this part.

(i) *Private vessel permits and conditions.* Each private motor vessel must have a permit to enter Glacier Bay June 1 through August 31.

(A) The superintendent may establish conditions regulating how permits can be obtained, whom a vessel operator must contact when entering or leaving Glacier Bay, designated anchorages, the maximum length of stay in Glacier Bay, and other appropriate conditions.

(B) June 1 through August 31, upon entering Glacier Bay through the mouth, the operator of a private motor vessel must report directly to the Bartlett Cove Ranger Station for orientation.

(*1*) Failing to report as required is prohibited.

(*2*) The superintendent may waive this requirement before or upon entry.

(ii) *Commercial vessel permits and conditions.* Each commercially operated motor vessel must have the required permit(s) to enter Glacier Bay.

(A) To obtain or renew an entry permit, a cruise ship company must submit and, after approval, implement a pollution minimization plan. The plan must ensure, to the fullest extent possible, that any ship permitted to travel within Glacier Bay will apply the industry's best approaches toward vessel oil-spill response planning and prevention and minimization of air and underwater noise pollution while operating in Glacier Bay. The superintendent will approve or disapprove the plan.

(B) Each cruise ship company must assess the impacts of its activities on Glacier Bay resources pursuant to the NPS research, inventory and monitoring plan as specified in the applicable concession permit.

(C) The superintendent at any time may impose operating conditions to prevent or mitigate air pollution, water pollution, underwater noise pollution or other effects of cruise ship operation.

(D) The superintendent will immediately suspend the entry permit(s) of any cruise ship that fails to submit, implement or comply with a pollution minimization plan or additional operating condition.

(E) A commercial vessel, except a commercial fishing vessel, is prohibited from entering Glacier Bay unless the operator notifies the Bartlett Cove Ranger Station of the vessel's entry immediately upon entry or within the 48 hours before entry.

(F) Off-boat activity from a commercial vessel is prohibited, unless the superintendent allows it under conditions that the superintendent establishes.

(iii) *Exceptions from entry permit requirement.* A permit is not required to enter Glacier Bay when:

(A) A motor vessel is engaged in official business of the state or federal government.

(B) A private motor vessel based at Bartlett Cove is transiting between Bartlett Cove and waters outside Glacier Bay, or is operated in Bartlett Cove in waters bounded by the public and administrative docks.

(C) A motor vessel is singularly launched from a permitted motor vessel and operated only while the permitted motor vessel remains at anchor, or a motor vessel is launched and operated in accordance with a concession agreement from a permitted motor vessel while that vessel is not underway.

(D) A commercial fishing vessel otherwise permitted under all applicable authorities is actually engaged in commercial fishing within Glacier Bay.

(E) The superintendent grants a vessel safe harbor at Bartlett Cove.

(iv) *Prohibitions.* (A) Operating a motor vessel in Glacier Bay without a required permit is prohibited.

(B) Violating a term or condition of a permit or an operating condition or restriction issued or imposed pursuant to this chapter is prohibited.

(C) The superintendent may immediately suspend or revoke a permit or deny a future permit request as a result of a violation of a provision of this chapter.

(v) *Restrictions on vessel entry.* The superintendent will allow vessel entry in accordance with the following table:

Type of vessel	Allowable vessel use days per day	Total entries allowed	Total vessel use days allowed	Period covered by limitation
Cruise ship	2	([1])	([1])	Year round.
Tour vessel	3	....	....	Year round.
Charter vessel	6	312	552	June 1–Aug. 31.
Private vessel	25	468	1,971	June 1–Aug. 31.

[1] See paragraphs (b)(2)(v) (A) through (C) of this section.

(A) By October 1, 1996, the superintendent will reinitiate consultation with the National Marine Fisheries Service (NMFS) and request a biological opinion under section 7 of the Endangered Species Act. The superintendent will request that NMFS assess and analyze any effects of vessel traffic authorized by this section, on the endangered and threatened species that occur in or use Glacier Bay National Park and Preserve.

(*1*) Based on this biological opinion, applicable authority, and any other relevant information, the director shall reduce the vessel entry and use levels for any or all categories of vessels in this section effective for the 1998 season or any year thereafter, if required to assure protection of the values and purposes of Glacier Bay National Park and Preserve.

(*2*) The director will publish a document in the FEDERAL REGISTER on any revision in the number of seasonal entries and use days under this paragraph (b)(2)(v), with an opportunity for public comment.

(B) By October 1, 1997, the superintendent will determine, with the director's approval, whether studies have been completed and sufficient scientific and other information has been developed to support an increase in cruise ship entries for the 1998 summer season (June 1 through August 31) while assuring protection of the values and purposes of Glacier Bay National Park and Preserve. Any increase will be subject to the maximum daily limit of two vessel use-days. If the superintendent recommends an increase, the superintendent will publish a document of the increase in the FEDERAL REGISTER with an opportunity for public comments.

(C) By October 1 of each year (beginning in 1998), the superintendent will determine, with the director's approval, the number of cruise ship entries for the following summer season (June 1 through August 31). This determination will be based upon available scientific and other information and applicable authorities. The number will be subject to the maximum daily limit of two vessel use-days. The superintendent will publish a document of any revision in seasonal entries in the FEDERAL REGISTER with an opportunity for public comment.

(D) Nothing in this paragraph will be construed to prevent the superintendent from taking any action at any time to assure protection of the values and purposes of Glacier Bay National Park and Preserve.

(3) *Operating restrictions.* (i) Operating a vessel within one-quarter nautical mile of a whale is prohibited, except for a commercial fishing vessel actually trolling or setting or pulling long lines or crab pots as otherwise authorized by the superintendent.

(ii) The operator of a vessel accidentally positioned within one-quarter nautical mile of a whale shall immediately slow the vessel to ten knots or less, without shifting into reverse unless impact is likely. The operator shall then direct or maintain the vessel on as steady a course as possible away from the whale until at least one-quarter nautical mile of separation is established. Failure to take such action is prohibited.

(iii) Pursuing or attempting to pursue a whale is prohibited.

(iv) *Whale water restrictions.* (A) May 15 through August 31, the following Glacier Bay waters are designated as whale waters.

(*1*) Lower bay waters, defined as waters north of an imaginary line drawn from Point Carolus to Point Gustavus; and south of an imaginary line drawn from the northernmost point of Lars Island across the northernmost point of Strawberry Island to the point where it intersects the line that defines the Beardslee Island group, as described in paragraph (b)(3)(vii)(A)(*4*) of this section, and following that line south and west to the Bartlett Cove shore.

(*2*) [Reserved]

(B) June 1 through August 31, the following Glacier Bay waters are designated as whale waters.

(*1*) Whidbey Passage waters, defined as waters north of an imaginary line drawn from the northernmost point of Lars Island to the northernmost point of Strawberry Island; west of imaginary lines drawn from the northernmost point of Strawberry Island to the southernmost point of Willoughby Island, the northernmost point of Willoughby Island (proper) to the southernmost point of Francis Island, the northernmost point of Francis Island to the southernmost point of Drake Island; and south of the northernmost point of Drake Island to the northernmost point of the Marble Mountain peninsula.

(*2*) East Arm Entrance waters, defined as waters north of an imaginary line drawn from the southernmost point of Sebree Island to the northernmost point of Sturgess Island, and from there to the westernmost point of the unnamed island south of Puffin Island (that comprises the south shore of North Sandy Cove); and south of an imaginary line drawn from Caroline Point across the northernmost point of Garforth Island to shore.

(*3*) Russell Island Passage waters, defined as waters enclosed by imaginary lines drawn from: the easternmost point of Russell Island due east to shore, and from the westernmost point of Russell Island due north to shore.

(C) The superintendent may designate temporary whale waters and impose motor vessel speed restrictions in whale waters. Maps of temporary whale waters and notice of vessel speed restrictions imposed pursuant to this paragraph (b)(3)(iv)(C) shall be made available to the public at park offices at Bartlett Cove and Juneau, Alaska, and shall be submitted to the U.S. Coast Guard for publication as a ''Notice to Mariners.''

(D) Violation of a whale water restriction is prohibited. The following restrictions apply in designated whale waters:

(*1*) Except on vessels actually fishing as otherwise authorized the superintendent or vessels operating solely under sail, while in transit, operators of motor vessels over 18 feet in length will in all cases where the width of the water permits, maintain a distance of at least one nautical mile from shore, and, in narrower areas will navigate in mid-channel: *Provided, however,* that unless other restrictions apply, operators may perpendicularly approach or land on shore (*i.e.,* by the most direct line to shore) through designated whale waters.

(*2*) Motor vessel speed limits established by the superintendent pursuant to paragraph (b)(3)(iv)(C) of this section.

(v) *Speed restrictions.* (A) May 15 through August 31, in the waters of the lower bay as defined in paragraph (b)(3)(iv)(A)(*1*) of this section, the following are prohibited:

(*1*) Operating a motor vessel at more than 20 knots speed through the water; or

(*2*) Operating a motor vessel at more than 10 knots speed through the water, when the superintendent has designated a maximum speed of 10 knots (due to the presence of whales).

(B) July 1 through August 31, operating a motor vessel on Johns Hopkins Inlet south of 58°54.2′N. latitude (an imaginary line running approximately due west from Jaw Point) at more than 10 knots speed through the water is prohibited.

(vi) *Closed waters, islands and other areas.* The following are prohibited:

(A) Operating a vessel or otherwise approaching within 100 yards of South Marble Island; or Flapjack Island; or any of the three small unnamed islets approximately one nautical mile southeast of Flapjack Island; or Eider Island; or Boulder Island; or Geikie Rock; or Lone Island; or the northern three-fourths of Leland Island (north of 58°39.1′N. latitude; or any of the four small unnamed islands located approximately one nautical mile north (one island), and 1.5 nautical miles east (three islands) of the easternmost point of

Russell Island; or Graves Rocks (on the outer coast); or Cormorant Rock, or any adjacent rock, including all of the near-shore rocks located along the outer coast, for a distance of 1½ nautical miles, southeast from the mouth of Lituya Bay; or the surf line along the outer coast, for a distance of 1½ nautical miles northwest of the mouth of the glacial river at Cape Fairweather.

(B) Operating a vessel or otherwise approaching within 100 yards of a Steller (northern) sea lion (*Eumetopias jubatus*) hauled-out on land or a rock or a nesting seabird colony: *Provided, however,* that vessels may approach within 50 yards of that part of South Marble Island lying south of 58°38.6′N. latitude (approximately the southern one-half of South Marble Island) to view seabirds.

(C) May 1 through August 31, operating a vessel, or otherwise approaching within ¼ nautical mile of, Spider Island or any of the four small islets lying immediately west of Spider Island.

(D) May 1 through August 31, operating a cruise ship on Johns Hopkins Inlet waters south of 58°54.2′N. latitude (an imaginary line running approximately due west from Jaw Point).

(E) May 1 through June 30, operating a vessel or a seaplane on Johns Hopkins Inlet waters south of 58°54.2′N. latitude (an imaginary line running approximately due west from Jaw Point).

(F) July 1 through August 31, operating a vessel or a seaplane on Johns Hopkins Inlet waters south of 58°54.2′N. latitude (an imaginary line running approximately due west from Jaw Point), within ¼ nautical mile of a seal hauled out on ice; except when safe navigation requires, and then with due care to maintain the ¼ nautical mile distance from concentrations of seals.

(G) Restrictions imposed in this paragraph (b)(3)(vi) are minimum distances. Park visitors are advised that protection of park wildlife may require that visitors maintain greater distances from wildlife. *See,* 36 CFR 2.2 (Wildlife protection).

(vii) *Closed waters, motor vessels and seaplanes.* (A) May 1 through September 15, operating a motor vessel or a seaplane on the following water is prohibited:

(*1*) Adams Inlet, east of 135°59.2′W. longitude (an imaginary line running approximately due north and south through the charted (*5*) obstruction located approximately 2¼ nautical miles east of Pt. George).

(*2*) Rendu Inlet, north of the wilderness boundary at the mouth of the inlet.

(*3*) Hugh Miller complex, including Scidmore Bay and Charpentier Inlet, west of the wilderness boundary at the mouth of the Hugh Miller Inlet.

(*4*) Waters within the Beardslee Island group (except the Beardslee Entrance), that is defined by an imaginary line running due west from shore to the easternmost point of Lester Island, then along the south shore of Lester Island to its western end, then to the southernmost point of Young Island, then north along the west shore and east along the north shore of Young Island to its northernmost point, then at a bearing of 15° true to an imaginary point located one nautical mile due east of the easternmost point of Strawberry Island, then at a bearing of 345° true to the northernmost point of Flapjack Island, then at a bearing of 81° true to the northernmost point of the unnamed island immediately to the east of Flapjack Island, then southeasterly to the northernmost point of the next unnamed island, then southeasterly along the (Beartrack Cove) shore of that island to its easternmost point, then due east to shore.

(B) June 1 through July 15, operating a motor vessel or a seaplane on the waters of Muir Inlet north of 59°02.7′N. latitude (an imaginary line running approximately due west from the point of land on the east shore approximately 1 nautical mile north of the McBride Glacier) is prohibited.

(C) July 16 through August 31, operating a motor vessel or a seaplane on the waters of Wachusett Inlet west of 136°12.0′W longitude (an imaginary line running approximately due north from the point of land on the south shore of Wachusett Inlet approximately 2¼ nautical miles west of Rowlee Point) is prohibited.

(viii) *Noise restrictions*. June 1 through August 31, except on vessels in transit or as otherwise permitted by the superintendent, the use of generators or other non-propulsive motors (except a windless) is prohibited from 10:00 p.m. until 6:00 a.m. in Reid Inlet, Blue Mouse Cove and North Sandy Cove.

(ix) *Other restrictions*. Notwithstanding any other provision of this part, due to the rapidly emerging and changing ecosystems of, and for the protection of wildlife in Glacier Bay National Park and Preserve, including but not limited to whales, seals, sea lions, nesting birds and molting waterfowl:

(A) Pursuant to §§1.5 and 1.6 of this chapter, the superintendent may establish, designate, implement and enforce restrictions and public use limits and terminate such restrictions and public use limits.

(B) The public shall be notified of restrictions or public use limits imposed under this paragraph (b)(3)(ix) and the termination or relaxation of such, in accordance with §1.7 of this chapter, and by submission to the U.S. Coast Guard for publication as a ''Notice to Mariners,'' where appropriate.

(C) The superintendent shall make rules for the safe and equitable use of Bartlett Cove waters and for park docks. The public shall be notified of these rules by the posting of a sign or a copy of the rules at the dock. Failure to obey a sign or posted rule is prohibited.

(x) Closed waters and islands within Glacier Bay as described in paragraphs (b)(3) (iv) through (vii) of this section are described as depicted on NOAA Chart #17318 GLACIER BAY (4th Ed., Mar. 6/93) available to the public at park offices at Bartlett Cove and Juneau, Alaska.

(xi) Paragraphs (b)(3) (i) through (iii) of this section do not apply to a vessel being used in connection with federally permitted whale research or monitoring; other closures and restrictions in this paragraph (b)(3) do not apply to authorized persons conducting emergency or law enforcement operations, research or resource management, park administration/supply, or other necessary patrols.

(4) *Marine vessel visible emission standards*. Visible emissions from a marine vessel, excluding condensed water vapor, may not result in a reduction of visibility through the exhaust effluent of greater than 20 percent for a period or periods aggregating more than:

(i) Three minutes in any one hour while underway, at berth, or at anchor; or

(ii) Six minutes in any one hour during initial startup of diesel-driven vessels; or

(iii) 12 minutes in one hour while anchoring, berthing, getting underway or maneuvering in Bartlett Cove.

(5)–(6) [Reserved]

(7) The information collection requirements contained in paragraph (b)(3) of this section have been approved by the Office of Management and Budget under 44 U.S.C. 3507 and assigned Clearance Number 1024–0016. The information is being collected to allow the superintendent to issue permits to allow vessels into Glacier Bay during the whale season. This information will be used to grant administrative benefits.

[50 FR 19886, May 10, 1985, as amended at 61 FR 27016, May 30, 1996; 64 FR 56463, Oct. 20, 1999]

§ 13.66 Katmai National Park and Preserve.

(a) [Reserved]

(b) *Fishing*. Fishing is allowed in accordance with §13.21 of this chapter, but only with artificial lures and with the following additional exceptions:

(1) Bait, as defined by State law, may be used only on the Naknek River during times and dates established by the Alaska Department of Fish and Game, and only from markers located just above Trefon's cabin downstream to the park boundary.

(2) Flyfishing only is allowed on the Brooks River between Brooks Lake and the posted signs near Brooks Camp.

(3) No person may retain more than one fish per day caught on Brooks River, on the waters between the posted signs 200 yards from the outlet of Brooks lake, or on the water between the posted signs 200 yards from the mouth of the Brooks River on Naknek Lake.

[54 FR 18493, May 1, 1989]

APPENDIX B

Glacier Bay National Park and Preserve 2003 Compendium

GLACIER BAY NATIONAL PARK AND PRESERVE
2003 COMPENDIUM

National Park Service (NPS) regulations applicable to the protection and equitable public use of units of the National Park System grant specified authorities to a park superintendent to allow or restrict certain activities. NPS regulations are found in Titles 36 and 43 of the Code of Federal Regulations (CFR) and created under authority and responsibility granted the Secretary of Interior in Titles 16 and 18 of the United States Code. The following compendium comprises a listing of all NPS regulations that provide the Superintendent with discretionary authority to make designations or impose public use restrictions or conditions. The larger body of NPS regulations that do not provide discretionary authority to the Superintendent is not cited in this compendium. A complete and accurate picture of regulations governing use and protection of the park can only be gained by viewing this compendium in context with the full body of applicable regulations found in Titles 36 and 43 CFR. *Please contact Glacier Bay National Park and Preserve, Gustavus, Alaska at (907) 697-2230 for questions relating to information provided in this compendium.*

TITLE 36 CODE OF FEDERAL REGULATIONS

PART 1. GENERAL PROVISIONS

1.5 Closures and public use limits

(a)(1) Visiting hours, public use limits, closures

See specific sections in this document for additional information regarding closures, visiting hours, and public use limits.

(a)(2) Designated areas for specific use or activity or conditions

Sledding is permitted on park roads if persons or other traffic control devices are posted to warn approaching motorists.
This restriction is intended to provide maximum safety to sledders and motorists using the park road.

See specific sections in this document for additional information regarding designated areas and conditions for engaging in certain activities.

1.6(f) Compilation of activities requiring a permit

- Scientific research, (1.5)
- Collecting research specimens, (2.5)
- Backcountry camping, (2.10(a))
- Operating a power saw in developed areas, (2.12(a)(2))
- Operating a portable motor or engine in undeveloped areas, (2.12(a)(3))
- Operating a public address system, (2.12)(a)(4))
- Air delivery, (2.17(a)(3))
- Noncommercial soliciting, (2.37)

- Using, possessing, storing, or transporting explosives, blasting agents, or explosive materials, (2.38(a))
- Special events, (2.50(a))
- Public assemblies and meetings, (2.51(a))
- Sale and distribution of printed matter, (2.52(a))
- Residing on federal lands, (2.61(a))
- Installing a monument, (2.62(a))
- Grazing, (2.60(a)-(b))
- Commercial notices or advertisements, (5.1)
- Commercial operations, (5.3)
- Commercial photography or filming, (5.5)
- Repair or construction of any structure or facility, road, trail, or airstrip on federal lands, (5.7)
- Mining operations (9.9(a)) or an approved Plan of Operations (in lieu of permit))
- Abandoned property, leaving property unattended for over 12 months, (13.22(b))
- Cabins on federal lands-
    - ◊ General use and occupancy, (13.17(e)(1), (2))
    - ◊ Commercial fishing, (13.17(e)(3))
    - ◊ Subsistence-exclusive use, (13.17(e)(4)(i))
    - ◊ Temporary (over 14 days) facilities in Preserve for taking of fish and wildlife, (13.17(e)(7))
    - ◊ Cabins otherwise authorized by law, (13.17(e)(8))
- Cutting of live standing timber greater than 3 inches in diameter for non-commercial subsistence uses, (13.49(a)(1))
- Commercial fishing in the marine waters of Glacier Bay National Park, (13.65(a)(3)(ii))
- Private vessels in Glacier Bay marine waters unless exempted under 13.65(b)(2)(iii), (13.65(b)(2)(i))
- Cruise ships, tour vessels, and charter vessel in Glacier Bay marine waters unless exempted under 13.65(b)(2)(iii), (13.65(b)(2)(ii))
- Access to inholding where access is not made by aircraft, snowmachine, motorboat or nonmotorized surface transportation, (43 CFR 36.10(b))
- Nonmotorized watercraft on the Alsek River, (43 CFR 36.11(d), (h))
- Salvaging, removing, possessing aircraft, (43 CFR 36.11 (f)(3)(ii))
- Helicopter landings, (43 CFR 36.11(f)(4))
- Off-road vehicle (ORV) use, (43 CFR 36.11(g)(2))
- Temporary access across federal land for survey, geophysical or exploratory work, (43 CFR 36.12(c))

PART 2. RESOURCE PROTECTION, PUBLIC USE AND RECREATION

2.1(a)(4) Designated areas for collection of dead and downed timber for firewood

Dead and down wood, other than interstadial wood (aged wood preserved in glacial deposits) may be collected for use as fuel within the former Glacier Bay National Monument.

Superseded by 13.20(b)(4) in the Park additions and Preserve, which allows the collection of dead or downed timber by hand for personal use for firewood. Subsistence use in the Preserve comes under 13.49(b) and allows federally qualified subsistence users to collect dead or downed timber for firewood.

2.1(a)(5) Designated areas and conditions for walking, climbing on archeological cultural resource sites

There are no designated areas. Walking and climbing on archeological cultural resource sites is prohibited.

2.1(b) Designated trails

No restrictions on walking or hiking.

2.1(c)(1-3) Designated fruits and berries, to harvest by hand

In the former Glacier Bay National Monument, all edible fruits, berries, nuts and unoccupied seashells may be gathered by hand for personal use or consumption.

Superseded by 13.20(b)(4) in the Park additions and Preserve, which allows the collection of fruits, berries, mushrooms, and other natural plant food items by hand for personal use. Subsistence use in the Preserve comes under 13.49(b) and allows federally qualified subsistence users to collect fruits, berries, mushrooms, and other natural plant food items.

2.2(d) Established conditions and procedures for transporting lawfully taken wildlife through the Park area

While transitting the park road between Gustavus and Bartlett Cove:
Wildlife legally taken outside the Park may be transported by motor vehicle or vessel to private residences within the Park for personal consumption.
Wildlife legally taken outside the Park may be transported through the Park provided the transporter contacts the superintendent verbally or in writing prior to entering the Park and provides the following information:

* Where the hunting took place
* Names and addresses of hunters
* Means of access (aircraft/vessel descriptions and registration numbers)
* Species hunted and taken
* Agreement to show or locate kill location on map if contacted

In all other areas of the park, hunters are required to identify themselves and the location where the wildlife that is being transported across park/preserve land was taken when requested by a park ranger. Identification of the site may consist of specific directions, maps, or upon request the hunter may be required to accompany the ranger to the location to verify the kill site.

This designation is intended to allow transport of legally taken game across Park lands. Specific conditions exist for hunts taking place in Gustavus, which is surrounded on three sides by park land. During Gustavus hunts in which commonly involve transit via the *park road prior notification of transport precludes lengthy inspections and investigations which may occur to ensure wildlife was not taken from park lands .*

2.2(e) Designated areas for wildlife viewing with artificial light

No areas designated for closure. For sport hunting in the Preserve, state law prohibits the use of artificial light. Federal subsistence hunting regulations provide for the use of artificial light in some circumstances (50 CFR Section 100).

2.3(d)(2) Fresh waters designated as open to bait fishing with live or dead minnows or other bait fish, amphibians, nonpreserved fish eggs or fish roe

No waters are designated as open to fishing with the types of bait identified above. Other types of bait may be used in accordance with state law. Subsistence fishing is allowed in accordance with 36 CFR part 13 and 50 CFR part 100.

2.3(d)(8) Designated areas open for fishing from motor road bridges and public boat docks

All areas are designated as open for fishing from motor road bridges and boat docks except the Barlett Cove fuel dock.

By Coast Guard regulation, a public fuel dock may only be occupied by individuals engaged in the act of fueling. The Bartlett Cove fuel dock may only be used while fueling a vessel.

2.4(a)(2)(i) Carrying of weapons at designated locations and times

Weapons and traps may not be carried within areas designated as in the former Glacier Bay National Monument. (Note: see 2.4(a)(3), which authorizes possession of unloaded, inoperable, and inaccessible weapons in vehicles and vessels). Superseded by 13.19(b) in the Park additions and Preserve.

The intent of this requirement is to provide maximum wildlife protection by not allowing the carrying of weapons or traps within the Park unless the weapon is broken down and made inaccessible during transport. Weapons or traps may be carried within the Preserve during times the taking of fish or wildlife is authorized by State law.

2.10(a) Camping-conditions and permits

Superseded in part by 13.18(a).

Bartlett Cove Campground

- Overnight registration for use of the Bartlett Cove Campground is required May 1 - September 30.
  The above restriction serves to prevent resource damage associated with long term use.

Outside the Bartlett Cove Campground-May 1 through September 30

- A non-fee permit is required for all persons camping overnight in the backcountry of Glacier Bay proper between May 1 through September 30.
  This requirement will allow NPS to better track overall backcountry use and distribution within Glacier Bay proper. This requirement does not apply to other areas of the park. Backcountry permits may be obtained from the park's Visitor Information Station on a first-come, first-serve basis.

2.10(d) Food storage - designated areas and methods

Throughout the park, all food, food containers, garbage, harvested fish and equipment used to cook or store food must be stored in one of the following ways when not in use:

- secured within a hard sided building, _or_
- secured within lockable and hard sided section of a vehicle, vessel, or aircraft, _or_
- in a bear resistant food container at least 100 yds from the campsite, _or_
- suspended at least 10 feet above the ground and 4 feet horizontally from a post, tree trunk, wire cable, or other object, and at least 4 ft. down from the object.

Note: This does not apply to:

- Clean dishes and cooking equipment that are free of food odors. We strongly recommend that these items be securely stored; but clean and odor free items are not required to be stored in secure containers.
- Food that is being transported, consumed or prepared for consumption.
- The use of bait for trapping and hunting under the provisions of state and federal law.

A bear resistant section or container is securable and constructed in such a manner and of material capable of preventing access by a brown or black bear. Acceptable Bear Resistant Food Containers include:

- PVC plastic or aluminum backpacker canisters (such as those manufactured by Garcia Machine, Wild Ideas, or Purple Mountain Engineering)
- steel drums with locking rings
- modified military ammo cans or bear resistant metal panniers
- metal raft dry boxes

Unacceptable Bear Resistant Food Containers include:

- ice chests
- coolers
- tents
- dry bags or stuff sacks
- plastic packing boxes (Totes, Action Packers, etc.)
- hard or soft shelled kayaks with standard hatch covers

Bartlett Cove Campground Food Preparation

The cooking, consumption or preparation of food within the limits of the Bartlett Cove campground is prohibited. Food will be cooked, prepared and consumed in the intertidal zone adjacent to the campground.

Storage/Security Requirements

All food, fish, garbage, and equipment used to cook or store food (not being transported, consumed, or prepared for consumption) must be cached:

- _Bartlett Cove_- In a sealed motor vehicle, vessel (excluding kayaks), building, approved bear resistant food container, bear resistant trash receptacle or designated food cache.

The intent of these requirements is to prevent bears and other wildlife from obtaining and habituating to food and garbage, thus protecting wildlife and park visitors alike. Specific guidance on what constitutes secure storage is needed to help prevent any wildlife-human food or garbage incidents from occurring.

2.11 Picnicking - designated areas

Superseded by 13.18(b).

2.13(a)(1) Fires - Designated areas and conditions

Campfires may be lighted and maintained in the following areas:

Within 1 mile of Bartlett Cove – Unless otherwise authorized by the superintendent, fires are only allowed in the designated campground beach fire ring(s).

Within 1/2 mile of the Alsek River - Fires must be contained inside a fire pan, except at Dry Bay.

All Other Areas - Fires are allowed in backcountry areas below the high tide line, or more than one-quarter mile from marine shorelines. For the purposes of this section, *high tide* is defined as the line delineated in the intertidal area by the last high water mark of the preceding highest tide.

All trash (tin foil, burnt food, glass, and cans) must be removed from the fire site after use.

The intent of this requirement is to allow for fires in the backcountry while ensuring that resource impacts associated with fires are minimized. The geography of the areas suitable for camping have caused repetitive use of the same campsites. The use of fire pans and constructing fires below the high tide line helps ensure that hardened campfire sites and buildup of ash piles will not occur.

2.14(a)(2) Sanitation and refuse - using government receptacles

Dumping of refuse brought into the Park or Preserve in the NPS landfill or trash receptacles is prohibited unless otherwise authorized by the superintendent. This does not preclude PRIVATE boaters from using trash receptacles at the Public Use Dock.

This requirement is intended to ensure the refuse handled by the park is generated by activities occurring within the park.

2.14(a)(5) Sanitation - designated areas for bathing and washing

No designated areas; therefore, unless allowed by the Superintendent, bathing and washing of cooking utensils, food and other property at all public water outlets or fixtures is prohibited.

2.14(a)(7) Sanitation - designated areas for disposal of fish remains

No designated areas at present. Fish remains may not be disposed of on either land or water within 200 feet of public boat docks or designated swimming beaches.

Modified by 13.65(b)(3)(ix)(C) for Bartlett Cove.

2.14(a)(8) Sanitation - human waste in developed areas

Human waste must be disposed of in public restrooms and outhouses where available. Use of existing fixtures and facilities at Bartlett Cove required.

2.14(a)(9) Sanitation - designated areas for disposal of human waste in undeveloped areas

Within 1/4 mile of shoreline, human body waste will either be removed as trash or deposited in cat-holes dug at least 100 feet from any surface freshwater source and at least 6 inches deep.
This requirement is intended to ensure that proper disposal of human waste occurs in the backcountry to protect water quality and visitor safety.

2.14(b) Sanitation- conditions concerning disposal, carrying out of human waste

Toilet paper will be burned or removed as trash.

Alsek River – Disposal of human body waste within one-half mile of the Alsek River is prohibited. Solid waste must be carried to the NPS dump station provided at Dry Bay.
The intent of this requirement to ensure adequate disposal methods of human waste are complied with within the intensively-used Alsek River corridor, especially where popular campsites are used repeatedly throughout the summer and human waste disposal has been an issue and problem.

2.15(a)(1), (a)(3), (a)(5), (b), (e) Pets

Within Area Designated as Park - Pets on leash, crated, or otherwise under physical restraint are permitted in the developed area of Bartlett Cove from the Public Use Dock area to the Park Service administration area. Outside of the developed area, pets must be within 100 feet of established roads or parking areas. Pets are prohibited in backcountry areas, except in a vessel on the water.

Within the Preserve - Pets must be kept on a leash or under control and attended at all times.

This restriction limits the free-range of pets within the park to protect wildlife and park visitors from harassment. .

2.16(a)-(c) Horses and pack animals

Superseded by 43 CFR 36.11(e).
Access for subsistence purposes under 36 CFR 13.46(a) supersedes this section.

2.17(a)(1) Aircraft operation

Superseded by 43 CFR 36.11(f)(1).
Access for subsistence purposes under 36 CFR 13.45 supersedes this section.

2.17(a)(2) Aircraft operation near docks, piers, swimming beaches and other designated areas

No areas prohibited at present. Aircraft access to the Public Use Dock in Bartlett Cove is permitted. See also 13.65(b)(3)(ix)(C) regarding dock use restrictions.

2.17(c)(1) Removal of downed aircraft

Superseded by 43 CFR 36.11(f)(3)(ii).

2.18(c) Snowmobiles-designated areas for use

No areas designated for snowmachine use.

Superceded in part by 43 CFR 36.11 Special access.
Superceded by 36 CFR 13.46 for subsistence use.

2.19(a) Winter activities-designated areas

Roads and parking areas open to vehicle traffic in the winter are designated as open to winter activities in 2.19(a).

2.20 Skating and skateboards

Superseded by 43 CFR 36.11(e).

2.21 Smoking

All public buildings are closed to smoking unless specifically permitted and signed as a designated smoking area. Smoking is prohibited on the Fuel Dock and within 100 feet of the underground fuel storage facility.
These restrictions are intended to protect public safety from fire or explosion around fuel storage and dispensing facilities on and adjacent to the dock.

2.22 Property - leaving property unattended for 24 hours

Superseded by 13.22.

2.35(a)(3)(i) Alcoholic beverages - areas closed to consumption

No closures or restrictions at present.

2.38(b) Explosives - areas designated for using fireworks

No areas designated for use of fireworks. Fireworks are prohibited.

2.51(e) Public assemblies/meetings - designated areas

All areas are open to public assemblies with a permit from the superintendent.

2.52(e) Sale and distribution of printed matter-areas designated for such use

All areas are open to distribution with a permit from the superintendent.

2.60(a)(3) Designated areas for grazing

No areas are designated for agricultural grazing of livestock in Glacier Bay National Park.

2.62(b) Memorialization-designation of areas for scattering ashes

All areas of the park are open to scattering of ashes without a permit.

PART 3. BOATING AND WATER USE ACTIVITIES

3.3 Permits

- Commercial fishing vessels in the marine waters of Glacier Bay National Park must have a permit pursuant to (13.65(a)(3)(ii))
- Private vessels in Glacier Bay marine waters must have a permit unless exempted under 13.65(b)(2)(iii) pursuant to 13.65(b)(2)(i)
- Cruise ships, tour vessels, and charter vessel in Glacier Bay marine waters must have a permit unless exempted under 13.65(b)(2)(iii) pursuant to 13.65(b)(2)(ii))
- Users of nonmotorized watercraft on the Alsek River must have a permit pursuant to 43 CFR 36.11(d), (h)

3.6(i) Boating, prohibited operations - designated launching areas

All areas are open to launching of boats.

3.6(j) Operating a vessel not directly accessible by road

Superseded by 43 CFR 36.11(d).
Access for subsistence purposes under 36 CFR 13.46(a) supersedes this section.

3.6(k) Launching or operating airboats

Superseded by 43 CFR 36.11(d)
Access for subsistence purposes under 36 CFR 13.46(a) supersedes this section.

3.6(l) Operating a vessel in excess of designated size

No maximum size designations at present.

3.20(a) Water skiing-designated waters

All waters are designated as open.

3.21(a)(1) Swimming and bathing-areas designated as closed

All park areas are open to swimming and bathing.

3.23(a) SCUBA and snorkeling - designated conditions in swimming areas, docks, etc.

SCUBA diving is authorized at the Public Use Dock and in the mooring area at Bartlett Cove to inspect and repair vessels, or retrieve equipment.

PART 4. VEHICLES AND TRAFFIC SAFETY

4.10 Travel on park roads and designated routes-areas designated for off-road use in Preserves

See ANILCA §205; 43 CFR 36.10, 36.11(c), (g).
Access for subsistence purposes under 36 CFR 13.46(a) supersedes this section.

4.11(a) Load weight and size limits - permit requirements and restrictive conditions

A 30,000 lbs. load limit is established for the Bartlett Cove Public Use Dock. Exceeding this limit is prohibited.

4.21(b)-(c) Speed limits-designation of a different speed limit

The speed limit in the Bartlett Cove developed area, and on the park road between Bartlett Cove and Gustavus, is 15 mph, except as otherwise posted.
The reduced speed limit in Bartlett Cove is for public safety. Pedestrians and bicyclists often use the roadway and visibility is limited due to road design and vegetation.

4.30(a) Bicycles-closed areas

Superseded by 43 CFR 36.11(e).

4.30(d)(1) Wilderness closed to bicycle use

Superseded by 43 CFR 36.11(e).

4.31 Hitchhiking-designated areas

All areas of the park are open to hitchhiking.

PART 5. COMMERCIAL AND PRIVATE OPERATIONS

5.7 Construction of buildings, roads, trails, airstrips, or other facilities

Maintenance of established landing strips utilizing non-motorized hand tools is not considered construction or repair and no permit is required. Any other construction requires a permit.

PART 13. ALASKA REGULATIONS

SUBPART A – PUBLIC USE AND RECREATION

13.17(d)(8)(ii), (iv) Established conditions for removal of cabin for which a cabin permit has been denied, expired, or revoked

No conditions established at present (may require access permit).

13.17(e)(4)(i) Designated existing cabins, shelters or temporary facilities that may be shared for subsistence purposes without a permit

All uses of existing cabins, shelters, or temporary facilities for subsistence purposes require a permit from the superintendent. During the Federal subsistence moose hunt, the East River Public Use Cabin at Dry Bay may be reserved by local rural residents at no charge via the NPS Office in Yakutat.
This provision allows subsistence users to share and use the East River Public Use Cabin during the federal subsistence moose hunt.

13.17(e)(4)(vi) Established conditions and standards governing the use and construction of temporary structures and facilities for subsistence purposes, published annually

No conditions or standards established.

13.17(e)(5)(i) Designated cabins or other structures for general public use

The East River cabin in the Preserve is designated as a public use cabin. All other cabins, not otherwise under NPS permit, are open for short-term public use (less than 14 days/year).
The East River cabin is a short-term, public use cabin.

13.17(e)(5)(ii) Established conditions and allocation system to manage the use of designated public use cabins

A reservation and permit, available through the NPS Ranger Station in Yakutat, are required for use of the East River Public Use Cabin. An overnight public use fee will be charged for the cabin, with exception noted under § 13.17(e)(4)(i) of this compendium.

13.17(e)(7)(iv)(B) Established conditions for removal of temporary facility (more than 14 days)

Individuals must remove facility, all personal property, and return the site to its natural condition.
These conditions are intended to protect the park from impacts to vegetation and soil and to ensure that personal items are not left in the park.

13.18(a) Restricted areas for camping

Areas temporarily restricted or closed to camping are listed under 13.30(d)(2).

13.18(b) Picnicking-areas where prohibited by posted signs

No restrictions at present.

13.19(b) Carrying firearms

Temporary restrictions are listed under 13.30(d)(2).
See 2.4(a)(2)(i) for the former Glacier Bay National Monument.

13.21(c) Commercial Fishing-ATV use

Use of ATVs to support commercial fishing activities is permitted in the Temporary Fish Camp Zone identified on a map in Appendix C.

13.20(d) Collection of Natural Features

There are no additional restrictions.

13.22(c) Designate areas where personal property may not be left unattended for any time period, limits on amounts and types, manner in which property is stored

- All caches must be labeled with the name of the owner, home address, telephone number, and date that the cache was established. If the cache contains fuel, the type of fuel must be noted. Unlabeled caches may be removed or impounded.
- Caches left for more than 30 days will be considered abandoned and may be removed or impounded by Park Rangers.
- All caches must be secured in such a manner that wildlife is unable to access the cache contents.
- Fuel caches will be limited to one location, and may contain no more than 10 gallons of fuel or any combination of fuel types.

- Fuel caches will be stored at least 100 feet from any water source, gravel bar, or flood plain. Fuel must be contained in a UL approved steel fuel container and placed on impervious material in such a manner that any spillage would be contained and prevented from coming into contact with water, soil or vegetation.
- From May 1 to September 30, personal kayaks and small boats may be stored within 150 yards of the administrative dock or above the intertidal area between the Public Use Dock and the Barge Ramp in Bartlett Cove.
- A Special Use Permit may be requested from the Superintendent for unique or special circumstances that require a cache to be left in place for more than 30 days. All such requests must be made in writing to the Superintendent at Glacier Bay National Park & Preserve, Gustavus, AK 99664.

Unlabeled or undated caches are an indication that the owner has no intention of returning or retrieving the property. Experience indicates that caches older than 30 days are usually abandoned. Unlabeled fuel is of questionable use since fuel deteriorates with age. Fuel caches require special containers and handling because fuel spills can contaminate soil and water. Fluctuating river levels and unstable stream banks make streamside, gravel bar, and flood plain cache locations unsuitable. This restriction is intended to limit abandonment of personal property in the park and impacts to resources and other park users. Provisions are provided for longer-term storage of gear where warranted with permission of the Superintendent. A written determination of need per 36 CFR § 1.5(c) is on file at park headquarters.

13.30(d)(1) Temporary closures and restrictions relating to the use of aircraft, motorboats, and non-motorized surface transportation or to the taking of fish and wildlife

See 13.65 (b)(3)(ix)(C), Public Use Dock and Bartlett Cove use restrictions.

13.30(d)(2) Temporary closures and restrictions (other)

Camping

<u>Bartlett Cove– between May 1 through September 30, except as otherwise noted</u>

- Camping in the Bartlett Cove Campground for more than 14 days is prohibited unless otherwise authorized by the superintendent.
  This limitation is intended to prevent residential use of the campground.
- Overnight registration for use of the Bartlett Cove Campground is required May 1 - September 30 under 36 CFR 2.10(a).
  The above restriction serves to prevent resource damage associated with long term use.
- Camping is prohibited within 1 mile of Bartlett Cove, except inside the boundary of the Bartlett Cove Campground.
  This is intended to minimize camper impacts on the numerous other visitors to the Bartlett Cove area.

<u>Outside Bartlett Cove Campground– between May 1 through September 30, except as otherwise noted</u>

- A non-fee permit is required for all persons camping overnight in the backcountry of Glacier Bay proper under 36 CFR 2.10(a).

This requirement will allow NPS to better track overall backcountry use and distribution within Glacier Bay proper. This requirement does not apply to other areas of the park. Backcountry permits may be obtained from the park's Visitor Information Station on a first-come, first-serve basis.

- Camping for more than 3 consecutive nights in one location is prohibited unless otherwise authorized by the superintendent.
  This limitation is derived from the park's Wilderness Visitor Use Management Plan, July 1989, and is intended to "prevent long term occupancy of campsites other groups may wish to use, minimize campsite deterioration and disruption of wildlife use patterns."
- Group size is limited to a maximum of 12 persons. The superintendent may authorize an exception for educational groups.
  This restriction is also derived from the Wilderness Visitor Use Management Plan and is intended to minimize impacts on resources and other park visitors.
- The number of overnight, non-commercial backcountry visitors in Glacier Bay proper is limited to no more than 1870.
  This limitation on backcountry use in Glacier Bay proper is necessary to protect park resources and the quality of the backcountry visitor's experience. The cap precludes continuing growth in backcountry use until an updated backcountry management plan and implementing regulations are in place. Commercial, guided backcountry groups are already limited in number through concession permits and are not included in the visitor use limit described. This limitation only applies to backcountry use associated with Glacier Bay proper and does not affect backcountry use in other, less visited areas of the park.

<u>Alsek River– between May 1 through September 30</u>

- Group size is limited to a maximum of 15 persons, except specific commercial groups limited to 25 persons under concession permit.
  The limitation on group sizes is derived from the 1989 Alsek River Visitor Use Management Plan and is intended to minimize impacts on resources and other visitors.
- Campers may camp only one night at each of the following areas: Walker Glacier, Alsek Spit and Gateway Knob. However, campers may choose to layover one additional night at one of these areas. (4 camping nights allowed among these 3 locations.)
  This restriction is intended to provide equitable public use of these very popular Alsek River campsites.

<u>Areas Closed to Overnight Camping– between May 1 through August 15</u>

- The landmass from Wolf Creek to a point directly east of the southern tip of Garforth Island including Puffin Island and the two unnamed islands in North Sandy Cove, and the one unnamed island in South Sandy Cove, from sea level to any elevation is closed to overnight camping due to a high concentration of bears. (See Appendix B)
  This restriction is intended to minimize conflicts between backcountry campers and bears in an area habitually used and important to bear. The restriction on overnight camping does not preclude day use of this area for hiking and other activities.

- The landmass between Margerie Glacier and Toyatte Glacier from sea level to any elevation is closed to overnight camping to all campers other than an organized group of 10-12 with an experienced wilderness leader with experience camping in bear country unless otherwise authorized by the superintendent due to a history of bear/human incidents. (See Appendix B)
  This restriction is intended to minimize conflicts between backcountry campers and bears in an area habitually used and important to bear. The restriction on overnight camping does not preclude day use of this area for hiking and other activities. The allowance for a organized group with an experienced wilderness leader is intended to verify if the closure in the past has had an impact on the bear behavior. Large groups have experienced less bear encounters than smaller groups camping in bear frequented areas.

SUBPART B – SUBSISTENCE

13.49(a)(1) May permit cutting in accordance with specifications of permit for subsistence timber harvest (house logs & firewood)

Cutting of live standing trees greater than 3” in the Park is prohibited. The superintendent may allow subsistence harvest of live standing trees greater than 3” in the Preserve subject to the terms and conditions of a permit issued by the superintendent.

13.49(a)(2) Restrictions on cutting of live timber less than 3" in diameter for subsistence purposes

Cutting of live timber is not authorized within the Park. Verbal or written permission from a park ranger is required to cut live timber less than 3" in diameter in the Preserve, except as necessary to clear designated vehicle routes and airstrips.

SUBPART C – SPECIAL REGULATIONS, SPECIFIC PARK AREAS

13.65 Glacier Bay National Park and Preserve Special Regulations

(a)(2)(iii) New or expanded fisheries prohibited. List of existing fisheries and gear types for the park’s outer waters:

- King Crab, Pot
- Tanner Crab, Pot and Ring
- Dungeness Crab, Pot
- Weathervane Scallop, Dredge
- Shrimp, Pot
- Pacific Salmon, Troll
- Chum Salmon, Purse Seine
- Pacific Halibut, Longline
- Groundfish, Dinglebar and Longline

The commercial fisheries listed above are those fisheries which have, at the time of the 1998 legislation regarding commercial fishing in the park (P.L. 105-277), been established legally in outside waters. All fisheries are subject to current state and

Federal regulations and emergency closures, which should be referred to prior to engaging in any fishery in Glacier Bay National Park & Preserve.

(a)(2)(iv) Maps and charts showing marine waters of Glacier Bay that are closed to commercial fishing

See Appendix D.

(b)(2)(i)(A) Private vessel permits and conditions

<u>Obtaining Private Vessel Permits</u>

Private motor vessel permits are only required for Glacier Bay proper, and only for the months of June, July, August. The following procedures and conditions apply to the issuance and use of private motor vessel entry permits:

- Permits may be obtained via telephone (907-697-2627), marine band radio (KWM20Bartlett Cove), by mail or in person at Glacier Bay headquarters at Bartlett Cove.
- Permits may be reserved up to 60 days in advance of an entry and are issued on a first received priority basis.
- Permits must be confirmed within 48 hours of the scheduled entry. Permits not confirmed by 10:00 a.m. on the date of entry, will be canceled and made available for reissue.
- Three of the daily 25 maximum permitted vessels, are reserved for local private vessels; these are restricted to residents of the Icy Straits/Cross Sound area, including the communities of Elfin Cove, Excursion Inlet, Gustavus, Hoonah, Pelican. These permits will be valid for any 7 use days, not necessarily consecutive ones, and may be issued up to 48 hours in advance.

<u>Administration of Private Permits</u>

- June 1 - August 31, the following schedule will generally be used to allocate daily vessel entries within Glacier Bay proper:

  June 1 - 10: 3 entries per day
  June 11 – August 2: 6 entries per day
  August 3 - 15: 5 entries per day
  August 16 - 31: 3 entries per day

  The above allocations are necessary to ensure entry permits (limited in total number by NPS regulation) are available for visitor use throughout the June – August permit season. Park staff may vary the daily entry numbers to maximize opportunities for public access, consistent with allowable use day and season entry limits.
  Unused daily entries will be carried forward and issued.
- All private vessel entries will be allocated in a manner that will prevent the maximum daily presence of more than 36 motorized vessels of all types in Glacier Bay on any given day.
- The total number of private vessel entries will not exceed 468 for the period June 1 – August 31.

  No more than 25 private motor vessels will be permitted on any day.
- The total number of vessel use days will be limited to 1,971 for the period June 1 to August 31.

- A private boater may apply for and hold up to 2 permits at one time. However, a second private vessel permit will not be issued during the peak boater use period, June 11–August 2.
  The intent of this limitation is to ensure first time visitors are provided a priority opportunity for a Glacier Bay entry permit over returning visitors during the period of highest demand.

<u>Length of Stay</u>

- Private motor vessels that entered Glacier Bay prior to June 1 may remain in the Bay until June 6 without an entry permit, however the vessel use days will be counted toward the allowable vessel use day total.
- Permits are valid for up to 7 consecutive days. An extension permit may be requested and issued for an additional 7 days, provided days are available. Request for an extension permit must be made between 8:00 AM and 7:00 PM on the last day of the initial permit.
- If an extension permit is unavailable, a vessel may remain anchored for up to seven additional days without motorized operation at Blue Mouse Cove, Sandy Cove, or Bartlett Cove. If the vessel leaves an anchorage without obtaining an extension permit it must proceed directly out of the Bay. After using an extension, a vessel must leave the bay for at least 7 days prior to applying for another vessel permit.

<u>Notification Requirements Upon Entry/Departure</u>

- Motor vessel operators are required to notify park headquarters by telephone (907-697-2627) or marine band radio (KWM20 Bartlett Cove on Channels 12 or 16) prior to entering or departing Glacier Bay.
  This requirement allows NPS to track the number of vessel permits in Glacier Bay each day and reallocate available permits when boaters fail to arrive or depart early.

(b)(3)(ix)(A) Other restrictions for the protection of wildlife.

No restrictions at present.
(See 13.30(d)(2) Temporary closures and restrictions (other) re: areas closed to camping)

(b)(3)(ix)(C) Rules for the safe and equitable use of Bartlett Cove waters and docks.

The following use restrictions are for the safe and equitable use of park facilities and are in effect during the primary visitor use season, <u>May 1 - September 15</u>, unless otherwise noted.

<u>Bartlett Cove Public Use Dock</u> (See Appendix A)

- Vessels may dock for a maximum of three hours in any 24-hour period, unless otherwise authorized by a park ranger.
  This provides flexibility to allow longer docking periods on a space available basis to complete boat repairs, etc.
- Dinghies may dock in the designated area (see Appendix A) for up to 24 hrs.
  This allows overnight docking of small vessels (<10') commonly used as tenders for larger vessels.

- Aircraft are restricted to use of the designated aircraft float and are limited to three hours in any 24-hour period. Pilots must remain with aircraft or provide notice of their location to a park ranger.
  Space exists for only one floatplane on the aircraft float at a time.
- Trailers specifically designed for transport of kayaks and canoes are allowed on the dock when authorized by a park ranger. However, when backing, the trailers must be detached from the tow vehicle and backed by hand. All other trailers and commercial passenger-carrying vehicles (such as B&B vans, taxis and buses) are prohibited from driving onto the dock unless authorized by a park ranger.

<u>(January 1 - December 31)</u>

- From September 16 to April 30, vessels may tie up to the Public Use Dock for up to ten consecutive days. Vessels must leave the dock for at least one 24 hr. period for each period of 10 consecutive days. All vessels tying up to the dock must register with a park ranger on the initial day of each docking period.
  This relaxation of summer docking limits allows for more flexible use of the dock during the winter season when weather is inclement and vessel movement is more difficult, yet still prevents long term storage of vessels on the public dock.
- Dock space is assigned for use by private vessels, NPS vessels, Glacier Bay Lodge, Inc. vessels, and aircraft as depicted in Appendix A. Parking in a space otherwise reserved is prohibited.
- Motor vehicles may not be left unattended on the Public Use Dock or parked overnight in the parking lot adjacent to the dock.
  Vehicles parked on the dock block access and limit use of the facility; the parking lot at the head of the dock is not large enough to accommodate overnight use during the visitor use season.
- The load limit on the Public Use Dock is 30,000 pounds GVW. No vehicle exceeding this limit is permitted on the dock, unless authorized by the Superintendent.
  This is necessary for public safety and to prevent structural damage to the dock facility.
- Unattended personal property may not be left on or attached to the floats or pier without prior permission from a park ranger.
  Prevents clutter from accumulating on the dock/floats.
- Processing of commercially-caught fish on the surface of the Public Use Dock is prohibited.
- Commercial fish buying or selling is prohibited on or over the Public Use Dock unless otherwise authorized in writing by the superintendent.
- Public access not directly related to fueling or pumpout is not permitted on the fuel dock. Unattended vessels are prohibited on the fuel dock.
  This dock is only to be used for fueling and waste pumpout.
- Vessels may not use electrical shore power unless otherwise authorized by a park ranger.
- Residing on a vessel within Bartlett Cove for more than fourteen days is prohibited unless otherwise authorized by the superintendent.

<u>Bartlett Cove Waters</u>

- The discharge of “blackwater” (water contaminated with human waste) is prohibited in Bartlett Cove waters.
  This requirement is to limit the discharge of human waste that might complicate the water quality monitoring by the park.
- The placement of temporary moorings is authorized to the north or east of the Public Use Dock, provided they are at least one-quarter mile from the dock. These moorings must meet applicable marking requirements, may not be installed prior to April 1, and must be removed by November 1 in a given calendar year. Contact must be made with the Protection Ranger prior to placement of a mooring and Mooring Buoy Agreement signed.
  These limitations are necessary to ensure that fixed moorings not preempt the most convenient anchorage locations or impede access to the dock, are properly tended, and are temporary rather than permanent fixtures.
- Anchoring vessels within 300 ft. of the Public Use Dock is prohibited. The No Anchor Zone is depicted in Appendix A of this compendium. The placement of buoys, markers, or lines (including fishing gear) is authorized to the north or east of the Public Use Dock, provided they are at least one-quarter mile from the dock.
  This limitation is necessary to ensure adequate room for safe maneuvering of vessels and aircraft accessing and departing from the Public Use Dock.

<u>Bartlett Cove Inner Lagoon and Administrative Dock</u>
The Administrative Dock is reserved for NPS vessels. The superintendent may authorize employee use of the dock on a space available and fee basis consistent with applicable Federal law.

- A park ranger may authorize temporary public use of the Administrative Dock on a space available basis. Use will be limited to 3 consecutive days during the peak use season, May 1 - September 30, and 7 consecutive days the remainder of the calendar year.
  This accommodates visitor and local resident use of the administrative dock for repairs, etc., on a space available basis.
- Anchoring in the inner lagoon area is limited to 7 consecutive days unless otherwise authorized by a park ranger, January 1 – December 31.
  The inner lagoon is known and used by local residents as a storm anchorage. These limitations are intended to accommodate short-term use of the lagoon, which is limited in size, but preclude long-term use that limits opportunity for use by other visitors or local residents.
- No buoys or lines may be placed inside the inner lagoon unless otherwise authorized by a park ranger.
  This limitation is intended to ensure clear and safe passage for all vessels transiting the inner lagoon, and availability of the lagoon for temporary storm anchorage use.

43 CFR, PART 36 TRANSPORTATION AND UTILITY SYSTEMS (Access Regulations)

36.11(c) Temporary closures or restrictions on the use of snowmachines for traditional activities

No closures or restrictions at present.

36.11(d) Temporary closures or restrictions on use of motorboats

The use of motorized boats is prohibited on the Alsek River at Alsek Lake above Gateway Knob between April 1 through October 31 in accordance with the approved Alsek River Visitor Use Management Plan (1989).

See also 13.65 and 13.30(d)(1).

This restriction is to ensure the wilderness experience of visitors rafting the Alsek River is minimally disrupted by powerboats. Congress directed that the Alsek River corridor be managed to preserve its outstanding wilderness characteristics.

36.11(e) Temporary closures or restrictions on use of non-motorized surface transportation

<u>Vessels-</u> A permit is required for non-commercial use within the Alsek River corridor above Gateway Knob between May 1 through September 30.

This requirement is necessary to manage public use of the Alsek River corridor in accordance with the Alsek River Visitor Use Management Plan (1989). The Plan seeks to manage use for no more than one party initiating travel within the river corridor each day. This use level would be exceeded without the current permit and management system. Permits for the Alsek River can be obtained by contacting the NPS office in Yakutat, Alaska, phone (907) 784-3370.

<u>Bicycles-</u> Bicycles are prohibited on the Forest Loop, Bartlett River and Bartlett Lake Trail between April 1 through October 31.

This limitation is necessary to minimize resource damage to what are generally wet and muddy trails.

36.11(f)(1) Temporary closures or restrictions on landing areas for fixed-wing aircraft

No closures or restrictions at present.

36.11(f)(3)(ii) Established procedure for salvaging and removing downed aircraft.

A permit is required from the superintendent before downed aircraft may be salvaged and removed from the park; violation of the terms and conditions of the permit is prohibited.

This requirement allows the superintendent to establish terms and conditions for salvage operations as necessary to protect resources, provide for public safety, and minimize impacts on visitors.

36.11(g)(1) Use of off-road vehicles (ORV) on established trails

In Glacier Bay National Preserve, off-road vehicles are allowed with a permit only on the existing trails shown on the map in Appendix C and on existing trails to and from gill net sites.

List of Attachments

Appendix A: Restrictions on the Use of Bartlett Cove Docks, 13.65 (b)(3)(ix)(C)
Appendix B: Areas Closed to Overnight Camping, 13.30(d)(2)
Appendix C: Areas Open to ATVs, 13.21(c), 43 CFR 36.11(g)(1)
Appendix D: Maps and Charts of Glacier Bay Marine Waters Closed to Commercial Fishing

This compendium is approved and rescinds all previous compendiums issued for Glacier Bay National Park and Preserve.

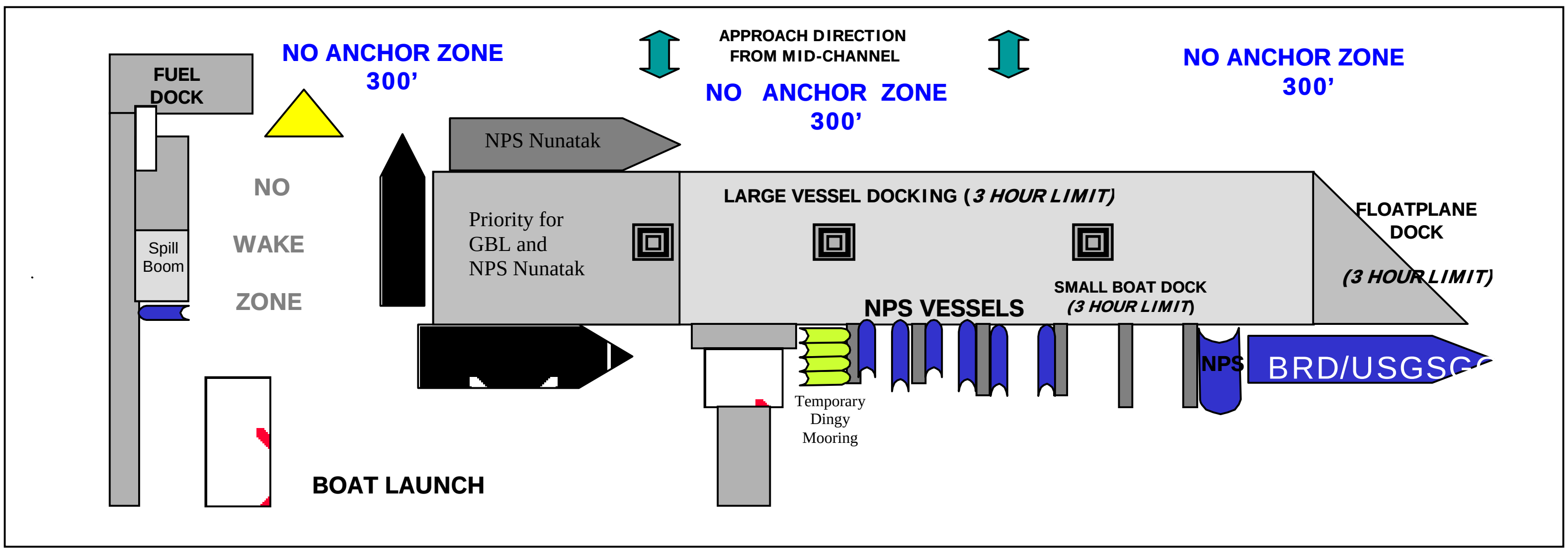
Superintendent **Date**

Appendix A: Restrictions on the Use of Bartlett Cove Docks, 13.65 (b)(3)(ix)(C)

Rules for the safe and equitable use of Bartlett Cove waters and docks: Bartlett Cove Public Use Dock.

GUIDE TO DOCKING

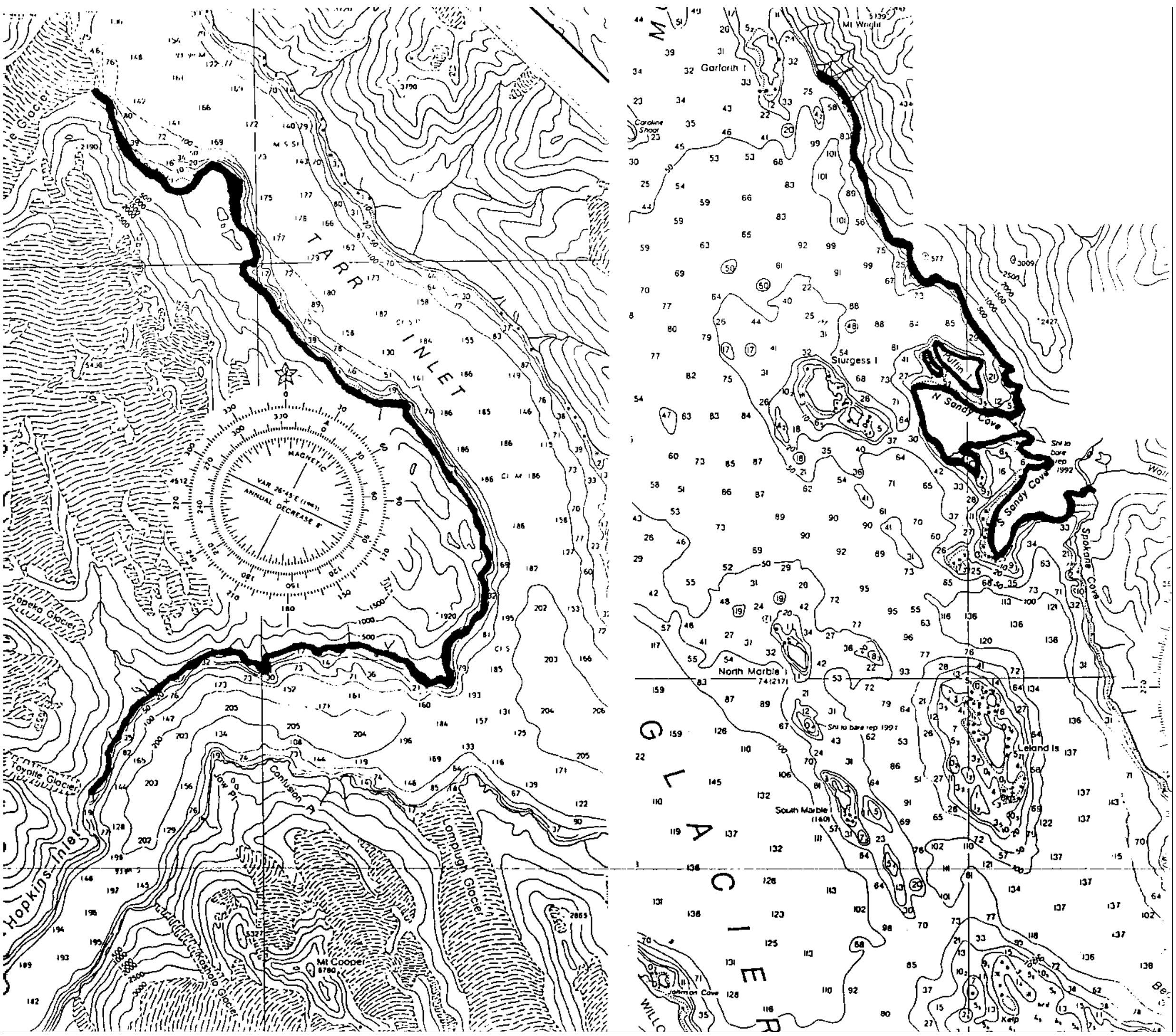
Bartlett Cove Public Use Dock



Appendix B, Areas Closed to Overnight Camping, 13.30(d)(2)

- The landmass between Margerie Glacier and Toyatte Glacier from sea level to any elevation is closed to overnight camping unless otherwise authorized by the superintendent due to a history of bear/human incidents, May 1 - August 15. (See Appendix B)

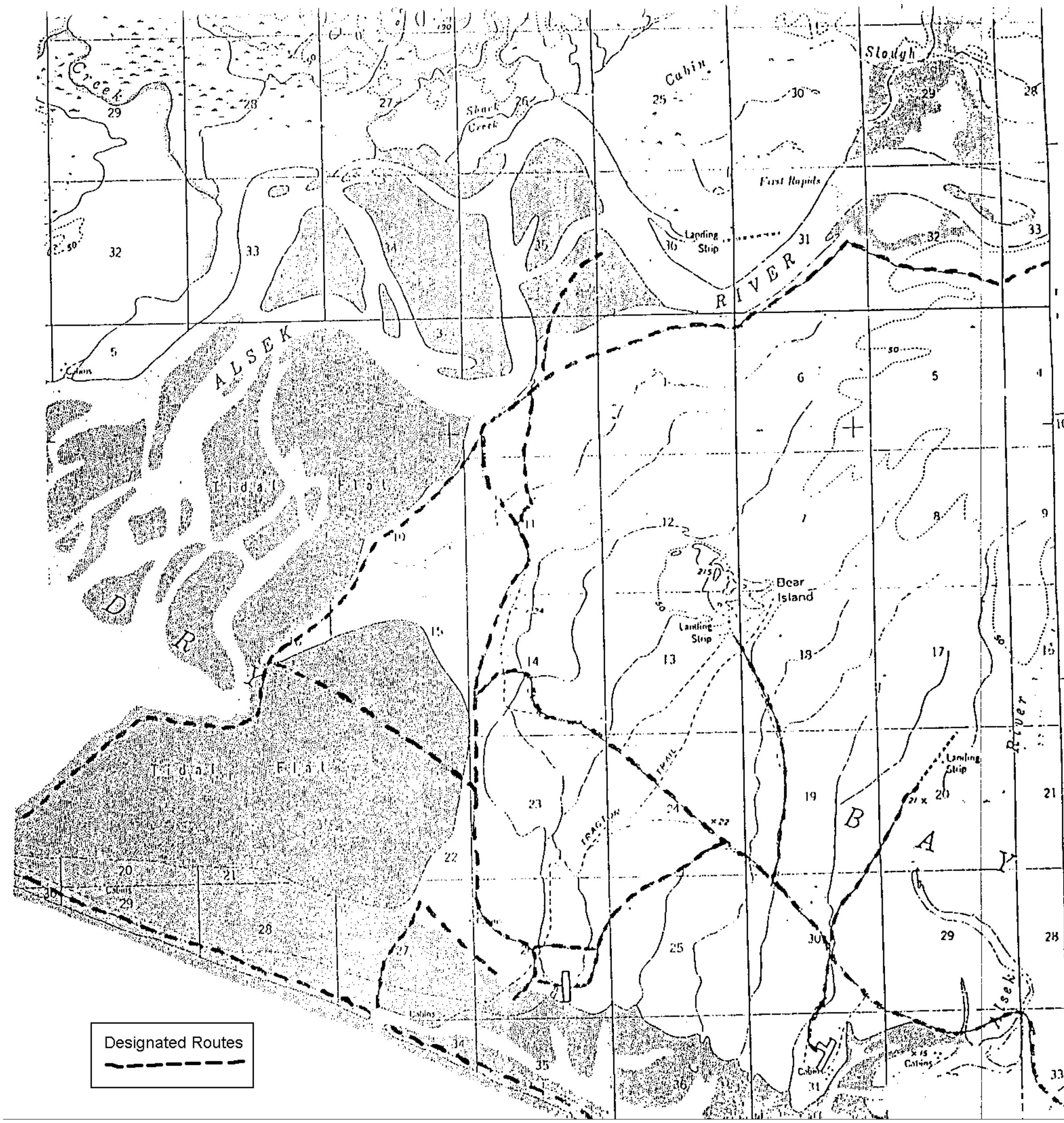
- The landmass from Wolf Creek to a point directly east of the southern tip of Garforth Island including Puffin Island and the two unnamed islands in North Sandy Cove, and the one unnamed island in South Sandy Cove, from sea level to any elevation is closed to overnight camping due to a high concentration of bears, May 1 - August 15.



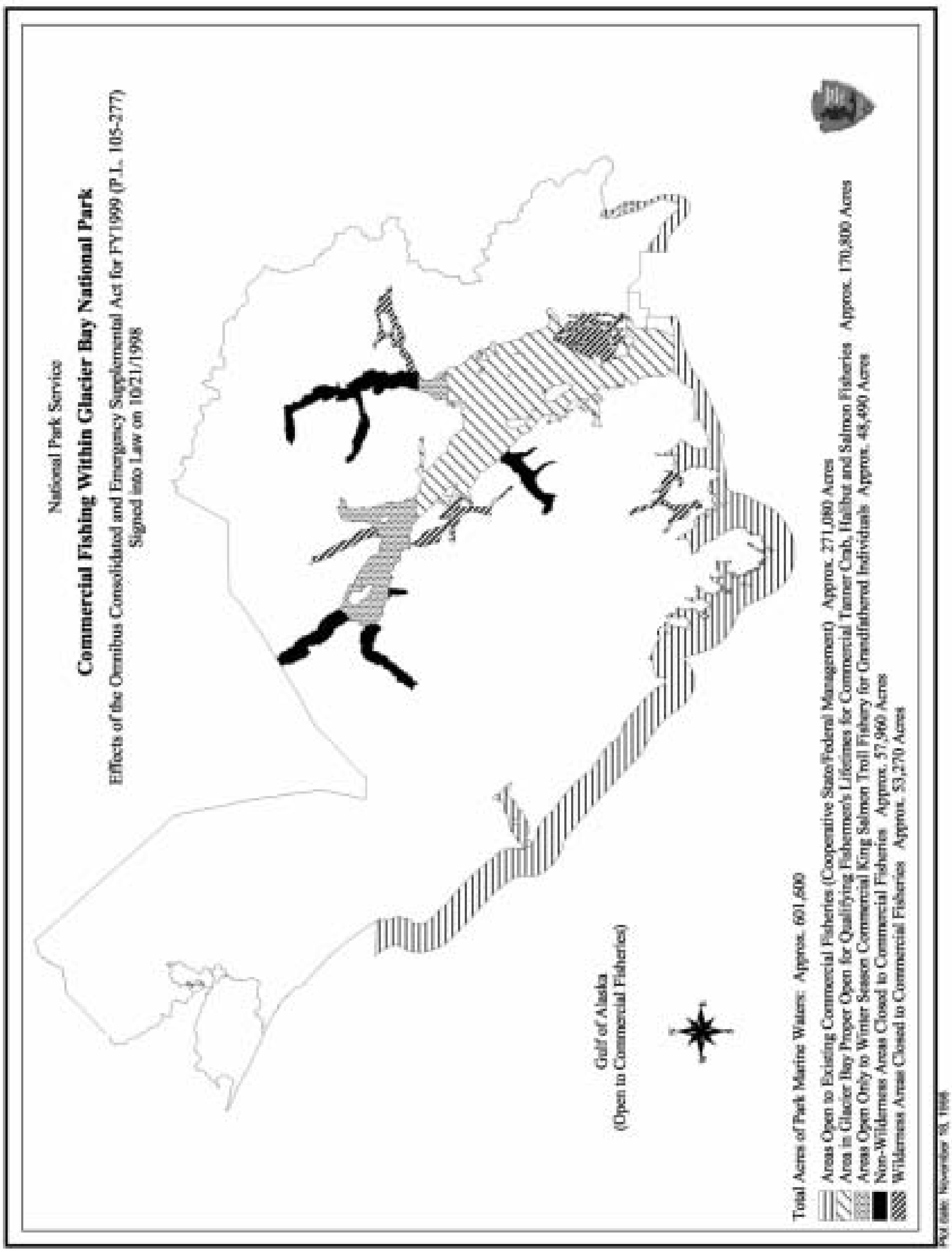
Appendix C, Areas open to ATVs, 43 CFR 36.11(g)(1), 36 CFR 13.21(c)

36.11(g)(1) Use of off-road vehicles (ORV) on established trails (recreational use)
In Glacier Bay National Preserve, off-road vehicles are allowed with a permit only on the existing trails shown on the map in Appendix C and on existing trails to and from gill net sites.

ANILCA § 205 Use of ATVs associated with commercial fishing
ATV use for commercial fishing purposes are allowed inside the boundary of the designated Temporary Fish Camp Zone identified on the map below.



Appendix D: Maps and Charts of Glacier Bay Marine Waters Closed to Commercial Fishing, 13.65 (a)(10)



APPENDIX C

Acoustics Memorandum

LGL Alaska Research Associates, Inc.
1101 E. 76th Avenue, Suite B
Anchorage, Alaska 99518 USA
Tel: (907) 562-3339 Fax: (907) 562-7223
e-mail: alaska@lgl.com web: www.lgl.com

Memorandum

To: Louise Flynn, Assistant Project Manager

From: Michael T. Williams

Date: 31 October 2002

Re: Acoustic Appendix

Ms. Flynn, attached is an appendix that includes (1) Acoustic Concepts and Terminology, (2) Underwater Noise Propagation, (3) Zones of Influence, (4) Marine Mammal Hearing, and (5) Underwater Noise and Acoustics Environment. Please consider this text as supplemental to the other sections of the EIS to provide an in depth discussion of acoustics in order for the reader to gain a better understanding of the concepts discussed in the Soundscape, Threatened and Endangered Animals, and Marine Mammals sections.

1.0 ACOUSTIC CONCEPTS AND TERMINOLOGY

1.1 INTRODUCTION AND SCOPE

This section contains an introduction to acoustic concepts and terminology to aid non-acousticians in understanding the terms and techniques used in this report. It is based on a longer presentation given by Charles R. Greene, Jr. in Chapter 2 of *Marine Mammals and Noise* (Richardson et al. 1995). The scope of the material presented here is focused on acoustic principles and terminology used in this report. For a broader coverage of general acoustic concepts the reader should refer to *Marine Mammals and Noise* and to *Principles of Underwater Sound* (Urick 1983). Technical terms are identified by an underline when first described.

1.2 SOUND MEASUREMENT UNITS

1.2.1 Basic Units

Sound is produced when waves of vibrational energy travel through air or water as oscillations of the fluid particles to exert tiny push-pull pressures on our eardrums or transducers. Transducers (hydrophones or microphones) act as electronic ears, converting pressure waves to electronic signals. The frequency of the oscillation or vibration is measured in cycles per second or hertz.(Hz) The pitch of a sound as perceived by a human is directly related to frequency. Humans are often said to hear sounds ranging from 20 to 20,000 Hz. However, for most individuals the actual range of useful sensitivity is narrower. A tone, sometimes called a pure tone, involves a sinusoidal oscillation at a specific frequency. Frequency is the reciprocal of the oscillation period, which is the time required for one oscillation. The wavelength (•) of a periodic sound is the length of the fundamental oscillation in the propagation medium. To a physical acoustician, sound is a mechanical wave motion propagating in an elastic medium at a sound velocity (c) that depends on the relative compressibility of the medium. The wavelength of a single tone is related to its frequency by the equation:

• = c/f (1.1)

Some fluctuations in fluid pressure are commonly called sounds even though they cannot be heard by humans. Ultrasonic frequencies are too high to be heard by humans (>20,000 Hz); infrasonic sounds are too low to be heard (<20 Hz). Many animals (e.g., dolphins, bats, and dogs) can detect certain ultrasounds. Some animals, including elephants, pigeons, and probably some baleen whales, can detect certain infrasounds.

A useful model of the acoustic process is the 'source-path-receiver' model. This model includes
a source of sound with specific frequency and temporal characteristics,
the sound transmission path(s) that changes sound characteristics as the sound propagates
and
a receiver with specific detection capabilities.

For example, consider a whale swimming near a ship: the ship is a source of underwater sound, the water (including surface and bottom) is the path from source to whale, and the whale is the receiver.

Source characteristics include variability over time (transient versus continuous), and sound intensity distribution in frequency (source level spectrum). Transmission refers to the propagation of sound through the air, water, or bottom from a source to a receiver. The transmission path is the route from source to receiver, The path may include various combinations of air, water, or bottom materials. The path often is not a straight line. Multiple transmission paths (multipaths) occur when sound reflects from surfaces along the path, such as the surface and (in underwater sound transmission) the bottom. Rough surface or bottom features cause sound to be scattered, and some underwater sound impacting the bottom is absorbed. Refraction (ray bending) can be important in either under-water or airborne sound transmission. In this report the receivers of interest are marine mammals. Important receiver characteristics include an animal's hearing sensitivity to sounds at different frequencies and its responsiveness to different types and levels of sounds.

The energy or acoustic intensity transmitted by sound waves is rarely measured directly but is often discussed. It is important because it is a fundamental measure of propagating sound. It is defined as the acoustical power per unit area in the direction of propagation; the units are watts/m^2. The intensity, power, and energy of an acoustic wave are proportional to the average of the pressure squared (mean square pressure). Acoustics researchers often refer to intensities or powers, but they derive these from pressures squared. Measurement instruments (and ears) normally sense pressure, from which intensity or power is computed. This practice is legitimate for measurements in the same medium (i.e., in water or in air), where constants of proportionality between intensity or power and pressure are the same. For most sound receivers sound pressure is measured in micropascals (• Pa). A pascal is a standard unit of pressure in the SI system of units. One pascal is the pressure resulting from a force of one Newton exerted over an area of one square meter.

In presenting sound measurements, acousticians use ratios of pressures, or pressures squared, requiring adoption of a standard reference pressure for use in the denominator of the ratio. The reference pressure for underwater sounds is 1 • Pa (Table 1.1). For airborne sound it is conventional to use 20 • Pa as the reference pressure—the approximate threshold of human hearing at 1 kHz (Table 1.1).

The human ear is capable of responding to a very wide range of sound intensity levels – a factor of 10^{13}. It spans this range by means of a logarithmic response, therefore acousticians have adopted a logartithmic scale for sound intensity denoted in decibels. In decibels, the intensity level of a sound of intensity I is given by equation (1.2):

Intensity Level (dB) = $10 \log (I/I_0)$ (1.2)

where I_0 is the reference intensity, 10^{-12} W/m^2 . Because intensity is proportional to pressure squared, the sound pressure level (SPL) of a sound of pressure P is given by

Sound Pressure Level (dB) = $20 \log (P/P_0)$ (1.3)

where P is the reference pressure, e.g., 1 • Pa. The phrase "sound pressure level" implies a decibel measure and that a reference pressure has been used as the denominator of the ratio.

In summary, when studying underwater sound, we usually measure pressure, not intensity. The reference pressure for underwater sounds is one micropascal (• Pa).

Pulsed sounds usually should be measured in terms of their energy, not just their pressure or power. Energy is proportional to the time integral of the pressure squared. Thus, sound energy is proportional to and may be described in terms of • Pa^2–s (micropascal, squared, for one second). Airborne impulsive sounds are usually measured on an energy basis, integrating the squared instantaneous sound pressure over the pulse duration and adjusting the resulting level to a reference one sec duration to obtain the Sound Exposure Level (SEL). A frequency-dependent filter approximating the human hearing curve (A-weighting) is used unless otherwise stated (ANSI 1994). The energy measurement technique, without A-weights, is sometimes applied in underwater acoustics, but rarely in studies of underwater noise versus marine mammals. Better standardization and reporting of measurement methods for pulsed underwater sounds are urgently needed to permit meaningful comparisons among studies.

1.2.2 Sound Spectra

Sound spectra are important because we use them to describe the distribution of sound power as a function of frequency. An animal's sensitivity to sounds varies with frequency, and its response to a sound is expected to depend strongly on the presence and levels of sound in the frequency band (range of frequencies) to which it is sensitive.

A sound waveform represents the amplitude variations of the sound with time. Sound from some sources has power distributed over a wide range of frequencies. Some sound components may be periodic, consisting of a repeated waveform whose power is concentrated at specific frequencies. The waveform of a pure tone is a simple sinusoid. However, other components of sounds are continuously distributed across frequency. Such sound may have a hissing quality at high frequencies or a rumbling quality at low frequencies. The waveforms of these more complex sounds are erratic.

To describe continuously distributed sounds, acousticians use the concept of power density spectrum. This is a graph plotting power per unit frequency versus frequency. Because measurements are usually in terms of pressure rather than power, a more common graph is the sound pressure density spectrum—the mean square pressure per unit frequency, in • Pa^2/Hz (e.g., Fig. 1.1).

1.2.3 Levels of Tones

A tone is a sinusoidal waveform for which all power is at a particular frequency. Tones originate from rotating or oscillating objects. For example, something that rotates at 3000 rpm (50 times/s) likely will create a tone at 50 Hz. There may be additional tones (harmonics) at integer multiples of this fundamental frequency (100, 150 .Hz). For a multibladed propeller or turbine, the blade rate (rotation rate per second times number of blades) is often the fundamental frequency of a harmonic family of tones.. The pure tone has all its power at one frequency. As filter bandwidth decreases, the output from the filter containing the tone remains constant.

1.2.4 Octave and 1/3-Octave Levels

Sound pressure density spectrum levels, representing mean square sound pressure per unit of frequency, can be integrated over a range of frequencies (band) to obtain the mean square pressure expected in the band.

To facilitate comparison of sources with different ouput power and frequency content, two types of proportional bandwidth filters have been adopted as standards: octave band for noise-control engineering applications, and one-third octave band for hearing response related applications. In each case, filter bandwidth is proportional to filter center frequency. An octave is a factor of two in frequency. For example, middle C on the music scale is at 262 Hz; the next higher C on the scale, an octave higher, is at 524 Hz. The bandwidth of a 1-octave band is 70.7% of its center frequency and the bandwidth of a 1/3-octave band is 23% of its center frequency. Standard center frequencies (in Hz) for adjacent ½-octave bands include the following:

50 63 80 100 125 160 200 250 315 400 500 Hz

plus other frequencies lower or higher by factors of 10. Sound levels are often presented for 1/3 -octave bands because, in humans and some animals, the effective filter bandwidth of the hearing system is roughly 1/3 octave.

1.3 TERMS DESCRIBING SOUND SOURCES

1.3.1 Temporal Properties

A sound may be transient, of relatively short duration having an obvious start and end, or it may be continuous, seeming to go on and on. Transient underwater sounds include impulsive transient sounds from explosions, airguns, pile drivers, and sonars. An explosion produces a single transient sound, but airguns, pile drivers, and many sonars produce repeated transients. Sound from a fixed, ongoing source like an operating drillship is continuous. However, the distinction between transient and continuous sounds is not absolute. Sound emitted from an aircraft or a ship underway is continuous, but it is transient insofar as a stationary receiver is concerned. Also, many sounds are not purely transient or purely continuous even at the source. For example, on a drillship, generators and pumps operate essentially continuously, but there are occasional transient bangs and clanks from various impacts during operations.

In describing a transient sound it is useful to present the peak level as well as some description of how the sound varies with time— its waveform. The peak level may be described as being a particular pressure, or as a mean square pressure averaged over a relatively short interval. The latter approach allows more reasonable comparisons with mean square pressures of continuous sounds. When transient sounds are so short as to be impulsive, they are best described in terms of their energy levels (Section 1.2.1) and energy density spectra. Some transient sounds, like airgun impulses, occur periodically. For such sources it is also helpful to describe the duty cycle, or the fraction of time during which the transients are significant.

A continuous sound or slow transient may be described by its mean square pressure and its mean square pressure density spectrum, for some defined averaging time. The latter shows the distribution of sound power versus frequency (e.g., Fig. 1.1). It may also be useful to show the corresponding levels in various 1/3-octave and 1-octave bands (e.g., Fig. 1.2).

1.3.2 Amplitude Properties

Source level is defined as the pressure level that would be measured at a standard reference distance (e.g., 1 m) from an ideal point source radiating the same amount of sound as the actual source being measured. This concept is necessary because sound measurements near large, distributed sources, like ships, depend strongly on source size and measurement location, and are difficult to relate to levels measured far away. Such near-field measurements are generally lower than would be obtained at the same distance from a point source radiating the same amount of energy. The concept of source level introduces the dimension of distance into the description of sound. In general, sound level decreases with increasing distance from the source. To compare different sound sources, it is necessary to adopt a standardized reference distance at which source levels will be determined. Normally, field measurements are made at distances larger than the standard reference distance, beyond the near field. Source level is determined by taking into account the known or expected change in level (propagation loss) between the reference and actual distances. For underwater sounds, a reference distance of 1 m (or 1 yard in older reports) is usually cited (and is used in this report). However, in some reports on ship noise the reference distance may be 100 m or 100 yards. In any case, source level is estimated by adjusting the measured level to allow for transmission loss between a standard reference range and the range where the sound was measured. Only in this way can source levels of various sounds be compared.

1.4 TERMS DESCRIBING SOUND PROPAGATION

Discussions of sound propagation include two equivalent terms: transmission loss (TL*)* and propagation loss. Chapter 1 discusses this topic in greater detail, but some introductory material is necessary to understand parts of that and other chapters. Conceptually, a sound wave traveling from point A to point B diminishes in amplitude, or intensity, as it spreads out in space, is reflected, and is absorbed. If the source level (at 1 m) is 160 dB re 1 • Pa-m, the received level at range 1 km may be only 100 dB re 1 • Pa; in this case TL is 60 dB. TL is generally expressed in dB, representing a ratio of powers, intensities, or energies of a sound wave at two distances from the source. The distance at which the denominator measurement was taken is the reference distance for TL. Because dB scales are logarithmic, and log (ratio) equals log (numerator) minus log (denominator), TL can be expressed as the difference, in dB, between the levels at the two distances. Strictly speaking, TL is a positive quantity, but it is plotted downward, as in Fig. 1.3. A person viewing a TL graph can visualize the way in which a sound diminishes with increasing distance.

A major component of transmission loss is spreading loss. From a point source in a uniform medium (water or air), sound spreads outward as spherical waves. Spherical spreading implies that intensity, or the mean square pressure, varies inversely with the square of the distance from the source. Thus, TL due to spherical spreading is given in dB by 20 log (R/R_0) where R_0 is the reference range, normally 1 m. With spherical spreading, sound levels diminish by 6 dB when the distance is doubled, and by 20 dB when distance increases by a factor of 10 (Fig. 1.3).

Cylindrical spreading sometimes occurs when the medium is non homogeneous. In shallow water, sound reflects from the surface and bottom. At some distance from the source that is long compared to water depth, various reflected waves combine to form a cylindrical wave. Such a wave may be imagined by picturing a short tuna fish can. The top and bottom of the can correspond to the water surface and ocean bottom, and the curved outer surface is the cylindrical wavefront. In some situations (Chapter 1), a near-cylindrical wave can also form as a result of refraction or ray-bending. With cylindrical spreading, the sound intensity varies inversely with distance from the source. With cylindrical spreading, sound levels diminish by 3 dB when distance doubles, and by 10 dB when distance increases 10-fold. Thus, levels diminish much more slowly with increasing distance with cylindrical than with spherical spreading (Fig. 1.3).

Sound rays are refracted (bent) when sound speed changes along the ray path. *Refraction* is common in the atmosphere and the ocean when temperature varies with height above ground or depth in the ocean; temperature has a major influence on sound speed. Refraction of sound rays can result in convergence zones, which are regions of focused rays and higher sound levels; and shadow zones, which are regions of very low sound level.

As sound travels, some power is absorbed by the medium, giving rise to absorption losses. Such losses vary linearly with distance traveled, and absorption loss can be described as x dB/km. Absorption losses depend strongly on frequency, becoming greater with increasing frequencies. Scattering losses also vary linearly with distance, but result from different physical mechanisms. These losses are in addition to the spherical, cylindrical, or other spreading losses previously mentioned (e.g., Fig. 1.3B).

The terms phase, phase difference, relative phase, and phase angle can be used in comparing two periodic waveforms with the same period. For example, sound components from one source that arrive at a given point via two different propagation paths may differ in phase. Phase refers to the difference in time, or the offset, between two waveforms. If the difference equals the period, or any integer multiple of the period, the two waveforms look the same and the phase difference is zero. Thus, it is possible to describe phase as an angle in the range ± 180°. For example, if phase difference is 1/4 of the period, phase angle is ±90°. The sign depends on whether the waveform of interest is "ahead of" (leads +) or "behind" (lags -) the reference waveform. For continuous waveforms that are random or nonperiodic, the phase concept generalizes to one of time delay, describing the time offset of a waveform and its replica.

1.5 TERMS DESCRIBING AMBIENT NOISE

Ambient noise is the background noise. There is no single source, point or otherwise. In the ocean, ambient noise arises from wind, waves, surf, ice, organisms, earthquakes, distant shipping, volcanoes, fishing boats, and more. At any one place and time, several of these sources are likely to contribute significantly to ambient noise. In the source-path-receiver model, ambient noise is present in the medium (water or air) along the path, and it is present at any receiver location. Ambient noise varies with season, location, time of day, and frequency. It has the same attributes as other sounds, including transient and continuous components, tones, hisses, and rumbles. It is measured in the same units as other sounds. However, in measuring ambient noise, it makes no sense to use a reference distance from the "source", as there is no one source.

1.6 TERMS DESCRIBING SOUND RECEPTION

Sounds can be received by animals' ears and instruments such as hydrophones and microphones. Hydrophones and microphones are transducers that transform received acoustic pressures into electrical voltages or currents, which may be amplified and conditioned for application to meters, tape recorders, speakers, or earphones. These transducers are characterized by their sensitivities, which vary with frequency, by the electrical noise they add to received sound, and by their distortion properties. Hydrophone sensitivities generally are described in volts per micropascal or in dB re 1 V/• Pa.

Animals, including people, have complicated sound reception capabilities. We introduce a few key terms here. More terminology related to hearing is given in Chapter 8 of *Marine Mammals and Noise* (Richardson *et al*. 1995) and Section 4 of this memorandum. The absolute auditory threshold of an animal is the minimum received sound level at which a sound with particular frequency and other properties can be perceived in the absence of significant background noise. Threshold and auditory sensitivity are inversely related. In other words, an animal can hear a fainter sound if the threshold is low than if it is high, and vice versa.

Auditory thresholds vary with frequency. A graph of thresholds versus frequency, called an audiogram, typically is U-shaped. Thresholds generally are high (poor sensitivity) at low frequencies. From there, thresholds generally diminish (improved sensitivity) with increasing frequency, up to some frequency range of optimal sensitivity (best frequency). Above that range, thresholds increase (deteriorating sensitivity) with a further increase in frequency. The "best frequency" varies from one species to another. Section 8.2 in Richardson *et al*. (1995) includes underwater and in-air audiograms of all marine mammal species for which audiograms have been measured; the human in-air audiogram is also shown (Fig. 8.3).

The terms critical ratio and critical band deal with the audibility of a pure tone in the presence of background noise. People and animals have varying abilities in this regard. The critical ratio is the ratio of the level of a barely audible tone to the spectrum level of background noise at similar frequencies. Because of the logarithmic nature of dB scales, a critical ratio can be derived by subtracting the spectrum level of the background noise from the tone level. For example, if a tone must be 100 dB re 1 • Pa to be detected with background noise of 80 dB re 1 • Pa at similar frequencies, the critical ratio is 20 dB (i.e., 100 minus 80). Critical ratios tend to increase with increasing frequency.

Critical bands can be defined in different ways, but in general the critical band around a given frequency is the band within which background noise affects detection of a sound signal at that frequency. Background noise at frequencies outside the critical band has little effect on detection of a sound within that band unless the noise level is very high. Critical bands are often roughly 1/3 octave wide. Hence, it is often useful to summarize man-made noise and ambient noise on a 1/3 octave basis. The process by which background noise may prevent detection of sound signals at nearby frequencies is called masking.

2.0 Underwater Noise Propogation

2.1 Introduction

This section is included to provide an introduction to sound propagation for non-acousticians. It is based on a longer summary of sound propagation principles contained in Chapter 4 of *Marine Mammals and Noise* (Richardson et al. 1995). The scope of the material presented here is concerned primarily with the acoustics of the Glacier Bay environment and focuses on underwater sound propagation in shallow water with a brief discussion of airborne sound propagation and transmission of airborne sound into water. For a more complete discussion, including deep water sound transmission and theoretical aspects of sound propagation, the reader is referred to *Marine Mammals and Noise*, and to *Principles of Underwater Sound* (Urick 1983).

The audibility or apparent loudness of a noise source is determined by the radiated acoustic power (source level), the propagation efficiency, the ambient noise, and the hearing sensitivity of the subject species. Noise levels produced by human activities in underwater and terrestrial environments are determined not only by their acoustic power output but, equally important, by the local sound transmission conditions. A moderate-level source transmitting over an efficient path may produce the same received level at a given range as a higher-level source transmitting through an area where sound is attenuated rapidly, that is, over a "lossy" path. Likewise, a given noise source operating in different areas, or in the same area at different times, may be detectable for greatly varying distances, depending on regional and temporal changes in sound propagation conditions among other factors. In deep water, depth variations in water properties strongly affect sound propagation. In shallow water, interactions with the surface and bottom have strong effects.

As a result, the zone of acoustic influence for a given source of man-made noise can vary in radius 10-fold or more, depending on operating site and depth, and on seasonal changes in water properties. Hence, sound transmission measurements, analyses, and model predictions are necessary to estimate the potential radius of acoustic influence of noisy human activities.

Site-specific sound propagation data are often lacking when a potentially noisy activity is planned. It is often not feasible to obtain in situ sound transmission measurements to estimate how intrusive the new noise will be. However, predictions can often be made even without site-specific propagation data. Predictions are based on propagation models developed for both airborne and underwater sound. These models provide procedures for estimating the received noise level as a function of distance, assuming that the source level and characteristics are known. These propagation models may be purely theoretical, based on physical principles; or semi-empirical, using both physical principles plus field measurements.

Model predictions can be useful for planning and for preparing environmental impact statements, but it is advisable to obtain relevant empirical data as well. This is important because of the highly variable and site-specific nature of underwater sound transmission, especially in shallow water, and of airborne sound transmission near the ground.

This section describes some sound propagation concepts relevant to noise impact prediction. We provide a brief review of theoretical aspects; shallow water, and airborne sound transmission; and air-to-water transmission. Equations are included where useful for clarity, but the reader should refer to the references described previously for a more detailed theoretical treatment of the topics presented here.

2.2 Theoretical Aspects

In a uniform medium with no nearby boundaries and no absorption loss, sound from an omnidirectional source spreads uniformly outward with a spherical wavefront. Intensity decreases as the area of the wavefront expands. At distances that are large compared with the source dimensions (far field), sound intensity varies inversely as the square of range from the acoustic center of the source. Since sound intensity is proportional to sound pressure squared, sound pressure is inversely proportional to range. In logarithmic terms, this is called a 20 log R spreading loss or spherical spreading:

$Lr = L_s - 20 \log R$

where Lr is the received level in dB re 1 • Pa (underwater) or dB re 20 • Pa (in-air),

L_s is the source level at 1 m in the same units, and R is the range in m.

When sound becomes trapped in a sound duct between horizontal refracting or reflecting layers, it is constrained to spread outward cylindrically rather than spherically. Cylindrical spreading also occurs when sound is trapped between the surface and bottom in shallow water. In these cases, sound intensity decreases in proportion to the increase in area of the expanding cylindrical wavefront. As a result, sound intensity varies inversely as the range from the source (i.e., as 1/R), in contrast to the $1/R^2$ that applies with spherical spreading. Sound pressure varies inversely as the square root of range (i.e., as $1/R^{0.5}$), in contrast to the 1/R that applies with spherical spreading. This is the 10 log R spreading loss of cylindrical sound transmission:

$L_r = L_s - 10 \log H - 10 \log R$

where H is the effective channel depth. The "- 10 log H" term is related to the fact that cylindrical spreading does not begin at the source; spreading is usually more or less spherical from the source out to some distance (approximately equal to the water depth), and then may transition to cylindrical. Sound attenuates much more rapidly with increasing distance with spherical (20 log R) than with cylindrical (10 log R) spreading (Fig. 1.3). A given source can be heard farther away when there is cylindrical spreading along much of the path from source to receiver.

Simple spherical or cylindrical spreading are important theoretical concepts and apply at least approximately to many real-world situations. However, the ocean is not a uniform medium. Variations in temperature and salinity with water depth affect the rate of propagation loss. The speed of sound increases with increasing temperature, salinity, and pressure. This results in distortion of the wavefront as it propagates. This distortion is equivalent to bending (refraction) of the sound rays that trace the paths of points on the wavefront. Refraction causes rays to be bent toward the direction of slower sound speed, since the portion of the wavefront traveling in the region of higher sound speed advances faster than the remaining portion. Refraction is a dominant feature of sound transmission in both deep and shallow water. Variation of sound speed with depth controls the ray paths. As a result, the decrease of sound intensity with range is influenced not only by spreading loss but also by concentration or reduction in the ray density due to refraction. In the current application the gradients are those of the summer season in Glacier Bay so the effects of seasonal changes on transmission loss will not be discussed in detail.

In shallow water with an absorptive bottom the 10 Log R spreading loss of cylindrical reflection is not appropriate because energy is lost by bottom absorption and scattering. In regions where the bottom reflection loss for sound rays is proportional to the angle of incidence with the bottom a 15 Log R spreading loss is developed, but often there are variations in the transmission path properties that result in a multistage range-dependent spreading loss characteristic. This is discussed in more detail in the next subsection.

2.3 Shallow Water Sound Propagation

Sound transmission in shallow water is highly variable and site-specific because it is strongly influenced by the acoustic properties of the bottom and surface as well as by variations in sound speed within the water column. As in deep water, variations in temperature and salinity with depth cause sound rays to be refracted downward or upward. Refraction of sound in shallow water can result in either reduced or enhanced sound transmission. With upward refraction, bottom reflections and the resulting bottom losses are reduced; with downward refraction the opposite occurs. Thus, sound transmission conditions in continental shelf waters and bays can vary widely.

The many environmental factors that influence shallow water sound transmission make it difficult to develop adequate theoretical models. One must combine theory with site-specific empirical data to obtain reliable propagation predictions. Low frequency sounds do not propagate well in shallow waters due to the long wave lengths, whereas high frequency sounds propagate relatively well. In many cases, however, the bottom consists of water-saturated sediment and does not reflect all the sound energy. In these conditions, propagation of low-frequency energy extends downward into the bottom material. If the composition and layer structure of the bottom are known, or can be estimated, this information, when incorporated into the modal analysis procedure, permits calculation of shallow water sound transmission losses with good accuracy.

To accommodate the variability of real-world data, semi-empirical propagation models have been designed for application to shallow water. It is possible to make reasonable propagation predictions from simple formulas of these types if sound speed is nearly independent of water depth and if the bottom either is flat or slopes uniformly and gradually (Weston 1976). Weston's formulas divide the shallow water transmission path into four regions: a spherical spreading region near the source (20 Log R); a transitional, cylindrical-spreading region where bottom- and surface-reflected rays contribute more energy than the directly transmitted rays (10 log R); a grazing angle dependent, "mode-stripping", region (15 Log R); and a "lowest-mode" cylindrical spreading region (10 Log R). Weston's formulas have been modified by P.W. Smith, Jr. (Malme et al. 1986), and incorporated into a short computer program (Weston/Smith Model) that calculates transmission loss when given parameters of frequency, water depth at the source, bottom slope, and two parameters describing the bottom reflection loss.

2.4 Absorption and Factors Affecting Spreading Loss

Several additional factors can have important influences on sound propagation in both deep and shallow water. These include molecular absorption and interference effects associated with shallow sources or receivers. A sloping bottom or special types of subbottom layers can also affect propagation, especially in shallow water.

2.4.1 Absorption

When sound energy is transmitted through water, a small portion is absorbed by water molecules. Absorption of sound by seawater increases with increasing frequency; energy loss is approximately proportional to the square of frequency. Absorption is also weakly influenced by water temperature. Furthermore, there is a relatively strong pressure dependence, with absorption coefficients being reduced with increasing depth. At frequencies >5 kHz, absorption causes significant (>2 dB) transmission loss if range is >10 km. At frequencies <1 kHz, absorption is not significant at ranges <40 km.

2.4.2 Shallow Source and Receiver Effects

When the source or receiver are very close to the surface, the surface reflection of the sound interacts strongly with direct sound radiation. The reflected sound is out of phase with the direct sound. If the source has strong tonal or narrow-bandwidth components, this phenomenon produces an interference pattern. It may be observed as range-dependent fluctuations in sound level at receiving locations along a horizontal radial line from the source. This phenomenon, the Lloyd mirror effect, is strongest with low-frequency tones and in calm sea conditions.

This effect occurs when range from source to receiver is long enough such that the direct and reflected path lengths are comparable. An interference field develops with alternating maxima and minima in received level. Beyond the interference zone, propagation loss is higher than normal when either the source or the receiver is close to the surface, that is, when their depths are less than• /4 for the dominant frequencies. With a shallow source, the source and its reflected image become effectively a dipole source with a vertical directionality (Urick 1983). In deep water, with both a shallow source and a shallow receiver, spreading loss may be as much as 40 log R, versus the 20 log R expected from spherical spreading. In shallow water, the shallow source dipole effect introduces an additional 10 log R spreading loss, increasing the loss from - 15 log R to - 25 log R. A similar interference effect occurs when the receiving location is within 1/4 wavelength of the surface. Thus, propagation from a shallow source to a shallow receiver in shallow water will show - 35 log R spreading loss. These types of effects occur for low frequency ship noise. Low frequency propeller noise is typically several decibels weaker when received near the surface than when received at depth.

2.4.3 Bottom Slope Effects

The slope of the bottom has a strong influence on sound transmission in shallow water. For transmission from a shallow region into deeper water, the increasing depth permits sound energy to spread out into a

larger volume than would have been available if depth had remained constant. This tends to result in a reduced sound level. On the other hand, a downward-sloping bottom causes decreasing angles of incidence of sound rays with the bottom and surface. This results in fewer reflections per kilometer, and thus less energy loss. For most bottom types, the reduction in reflection loss with increasing depth has a stronger influence than the increased water volume.
Hence, the net effect of a downward slope along the propagation path often is lower transmission loss.

An upward slope causes more surface and bottom reflections, and a steeper incidence angle for each reflection. Consequently, there is a net increase in loss rate as sound enters shallower water unless bottom loss is very low. As propagation continues upslope, there is a transition from multimode to single-mode propagation and a shift from 15 log R to 10 log R spreading loss. Although spreading loss is reduced, attenuation from bottom loss may be high because of the many reflections in shallow water. Eventually, depth is reduced to the point where modal transmission is not supported and the remaining sound energy is attenuated very rapidly.

2.5 Airborne Sound Transmission

Airborne sound transmission needs to be considered for two reasons. First, sound from some sources, especially aircraft, travels through air before entering water, and is attenuated along the airborne portion of the propagation path. Second, some marine mammals—pinnipeds and sea otters—commonly occur on land or ice, where they hear airborne sounds and emit aerial calls.

Sound from an omnidirectional source in an unbounded uniform atmosphere is attenuated only by spherical spreading (20 log R) and by absorption of sound energy by air molecules. However, sound from a source near the ground is affected by additional factors. The ground is usually nonrigid and permeable, and propagation near this surface is influenced by reflections and wave transmission along the surface. Interference between the direct, reflected, and ground wave paths causes fluctuations in received level and in frequency composition for near-ground transmission. Also, refraction caused by wind and temperature gradients produces shadow zones with poor sound transmission in the upwind direction, and often produces enhanced transmission downwind. When sound is transmitted from an elevated source such as an aircraft, the influence of gradient refraction and ground effects are greatly reduced, so for most airborne noise sources of concern in Glacier Bay the received level may be estimated by a simplified transmission loss relationship.

$L_r = L_s - 20 \text{ Log } R - \bullet\, R/1000$

Where • is the atmospheric absorption loss in dB/km.

2.5.1 Atmospheric Absorption

Atmospheric absorption of sound at frequencies below 30 kHz is produced by oxygen and nitrogen molecules. The dominant mechanism is similar to the process acting underwater. The amount of absorption depends on frequency, temperature, relative humidity, and to a small degree atmospheric pressure. The physical relationships between these parameters and absorption are not easily expressed mathematically, but an empirical algorithm has been developed to compute absorption coefficients from these four parameters. At middle frequencies, sound absorption has more influence on sound transmission in the atmosphere than in the ocean. For example, at 1 kHz the underwater sound absorption coefficient is - 0.06 dB/km, whereas a typical value for in-air attenuation is - 4 dB/km. The absorption coefficient increases rapidly with frequency to - 130 dB/km at 10 kHz, depending on temperature and humidity. Hence, only low-frequency sound is transmitted well in air

2.6 Air-to-Water Transmission

Sound traveling from a source in air to a receiver underwater propagates in four ways: (1) via a direct refracted path; (2) via direct refracted paths that are reflected by the bottom; (3) via a lateral (surface-traveling) wave; and (4) via scattering from a rough sea surface. The types of propagation vary in importance depending on local conditions, depth of receiver, and bottom depth. The direct refracted path is important when the receiver is nearly under the aircraft. Snell's law predicts a critical angle of 13° from the vertical for the transmission of sound from air to water. Under calm sea conditions, sound is totally reflected at larger angles and does not enter the water. However, some airborne sound may penetrate water at angles >13° from the vertical when rough seas provide water surfaces at suitable angles.

Sound traveling from air to water along the direct refracted path passes through three phases: through air; across the air-water surface; and from the surface to the underwater receiver. To a first approximation, propagation loss in air can be described by simple spherical spreading—a 6 dB decrease per distance doubled. At the surface, the great difference in acoustic properties of air and water results in most acoustic energy being reflected. However, the sound pressure transmitted to the water is actually enhanced because of a pressure-doubling effect at the interface. Hence, sound pressure at the surface directly beneath the source is twice that expected in air at the same distance if there were no water surface. From the surface to the underwater receiver, sound propagation includes both geometrical spreading and the effects of the divergence of sound energy as it passes through the surface. This results in a complicated distribution of underwater sound pressure that depends on height of source, location of receiver, water depth, and temperature-salinity profile of the water column. Air-to-water sound propagation has been documented using wave theory. To estimate underwater sound levels produced by an airborne source over shallow water, an air-to-water sound transmission model has been developed (Richardson et al. 1995).

Model results are consistent with empirical data. In deep water, there are high transmission losses between a source in air and an underwater receiver distant from the subsource point. Underwater received levels away from the subsource point are higher in shallow than in deep water. This difference occurs because, in shallow water, sound is transmitted horizontally away from the subsource point by multiple reflections from the bottom and surface. This process is more efficient for hard bottom conditions. Even with a hard bottom, however, underwater noise diminishes more rapidly with increasing horizontal distance than does airborne noise. Consistent with this, under typical ambient noise conditions, an approaching aircraft can be heard in the air well before it is audible underwater.

2.7 Summary

Sound propagation in the sea has been the subject of intensive research. The open literature is voluminous, and there is additional unpublished and classified information. For specific applications, the information provided in this chapter should be augmented by a detailed review of relevant references.

Sound propagation research has made considerable progress in recent years. Field measurements of sound levels in relation to distance, frequency, and environmental parameters have been obtained in many areas and situations. Based on these data and on theoretical considerations, efficient computer models have been developed. Some models provide sufficient detail to account for many of the propagation processes occurring in the real world. However, most models are designed for specialized applications (often classified) and are not easily generalized for use in predicting potential noise impact ranges for anthropogenic sources. Fortunately, simple and general relationships can be used to make estimates of transmission loss for many sources and locations, both underwater and in air (Richardson et al.1995).

3.0 Zones of Influence

One method to assess the effects of man-made noise on marine mammals is to estimate the radii within which effects are expected. This "Zone of Influence" model was described in detail in Richardson *et al.* (1995) and is summarized here. Readers are directed to the original source for a more detailed description of the factors affecting zones of influence, and the variability therein.

There are at least four zones identified in which man-made noise can affect marine mammals. Those zones are:

1. *zone of audibility* – the area within which a sound is barely audible above background noise,
2. *zone of responsiveness* – the region within which an animal reacts to the sound either behaviorally of physiologically. This zone may or may not be smaller than the zone of audibility,
3. *zone of masking* – the region within which a man-made sound is strong enough to interfere with the detection of other sounds, such as communication or echolocation sounds,
4. *zone of hearing loss, discomfort, or injury* – the area within which the level of sound is high enough to cause discomfort or tissue damage to auditory or other systems.

Many assumptions must be made to predict radii of acoustic influence on marine mammals, and in many cases the data are not adequate to allow precise predictions. Local variables, including time, season, and location, will also affect radii of influence. While many factors prevent zones of influence from being exact predictors of the effects of noise to marine mammals, the model may be the best way to predict and mitigate the effects of man-made noise to marine mammals.

3.1 Zone of Audibility

The zone of audibility is the maximum possible radius of influence of a man-made noise on marine mammals. The radius of the zone of audibility is affected by many variables, including the source level and frequency, propagation loss, ambient noise, hearing sensitivity of the animal and individual variation.

Ambient noise greatly affects the zone of audibility. If the Signal to Noise Ratio (SNR, the difference between the received signal level and background noise level) is • 0 dB, the man-made noise may not be detected, and may not affect the animal.

Many man-made sounds are dominated by low frequency components. For a single source, dominated by low frequency components, the zone of audibility will vary greatly depending on the animals' abilities to hear low frequency sounds. Pinnipeds and odontocetes (toothed whales and dolphins) generally are not highly sensitive to low frequency sounds, while baleen whales are believed to be highly sensitive to low frequency sounds. Therefore, for a single source, the zone of audibility will vary greatly from species to species. If the ambient level is lower than the absolute threshold (the lowest sound level that can be detected) for the frequency in question, the zone of audibility will be determined not by the man-made sound, but by the sensitivity of the animal. The radius of influence will also vary depending on the sensitivity of the individual.

3.2 Zone of Responsiveness

The zone of responsiveness is the area around of source of man-made noise within which marine mammals of a given species show observable behavioral responses (Richardson *et al.* 1995). Many studies (e.g. Baker and Herman 1989, Frankel and Clark 1998, 2000, Bogaard *et al.* 1999, Todd *et al.* 1996) have documented behavioral changes in response to sound from human activities. However, types of behavioral responses and the distance at which reactions became evident varied widely, even for a particular species with the same human activity. Furthermore, behavioral differences are generally only detectible with sophisticated statistical techniques. Therefore, while the zone of responsiveness is a real phenomenon for many species and human activities, the radius is a statistical phenomenon: a few animals may respond at great distances, the majority may react when the source is closer, and a few may not respond until the source is very close or may not respond at all. To define the zone of responsiveness, it is necessary to define the proportion of animals expected to react, and the type of reaction that is expected.

The most obvious behavioral response to noise is an avoidance reaction. However, avoidance responses can be strong or weak. Animals may swim rapidly, directly away from a noise source, or may vary speed and direction from the source. Animals may even swim *toward* a source, for instance pinnipeds may move toward the water, or cetaceans in shallow water may move toward deeper water, even if the sound source is offshore. Other behavioral responses also may indicate disturbance. Pinnipeds on a beach may lift their heads or otherwise become alert, and cetaceans may change general activity state, resting or socializing whales may begin to travel. Other indications may not be easily detected by observation, the mean duration of surfacings and dives, blow rate, and blow intervals may change in response to sound. However, these responses are often only detectible with statistical tests. Those changes may, nevertheless, be useful as indicators of stress without any obvious avoidance response.

Biological factors can influence the responsiveness of animals to sound disturbance. Resting whales may be more apt to respond than animals that are socializing, feeding or mating (Richardson *et al.* 1985). Age and sex classes can also vary in their responsiveness. Immature or pregnant Steller sea lions at a haul-out site were more likely to enter the water when an airplane flew over than were territorial males or females with pups (Calkins 1979). Habitat differences may also influence responsiveness: walruses were more responsive to approaching boats when they were hauled out on ice than in the water (Fay 1984), and whales in shallow water or surrounded by ice may react more strongly to noise.

It is often difficult to determine appropriate criteria to measure the zone of responsiveness. Several methods of estimating the radii of influence have been suggested. One method is based on received sound levels: animals may react when the received sound level reaches or exceeds a specific level, in a specific bandwidth. One complicating factor of this method is determining which frequency band is appropriate. Response thresholds for broad bands are likely to be higher than for narrower bands which contain the most intense noise. For example, Richardson *et al*. (1990) determined that the response threshold for bowhead whales in the Beaufort Sea exposed to drilling and dredging sounds was approximately 115 dB re 1 • Pa on a broadband (20-1000 Hz) basis and approximately 110 dB re 1 • Pain the 1/3 octave band where industrial noise was most prominent. Another possible criterion is the Signal-to-Noise Ratio. A sound of given level may be more disturbing when the ambient level is low than when the ambient level is high. A third criterion possibility is that of distance from a sound source. Distance criteria are easy to define, implement and monitor for compliance. However, received sound level and distance are not perfectly correlated, and received sound level a given distance from a source will vary with time and location. Sound sources also vary, so received levels at a given distance will vary depending on the sound source (e.g. cruise ship v. private skiff). A further complication is the sensitivity of species in question. Distance criteria will be larger for species more sensitive to the dominant frequencies from a man-made sound source than for species less sensitive.

3.3 Zone of Masking

If noise is strong enough relative to a target signal, the signal will be "masked" and undetectable. In theory, each man-made sound source is surrounded by a Zone of Masking within which useful sounds are undetectable to marine mammals of a given species. The area where masking will occur is highly variable, and dependent upon all factors that affect the received levels of background noise and the sound signal.

Any man-made noise introduced into the marine environment will add to the background noise. This increase will interfere with an animal's ability to detect very weak signals. Therefore, the Zone of Audibility is also the largest potential Zone of Masking. For an animal close to a source of man-made noise, the noise level will be high and the animal would only be able to hear sounds from nearby animals, calls from animals further away would be weaker and may be undetectable. Thus, for animals that use low level sounds for communication such as baleen whales that may use weak, low-frequency sounds for communication (Payne and Webb 1971) the Zone of Masking will be larger than for animals that do not regularly use weak, low-frequency sounds. Short-distance communications are unlikely to be masked by distant sources of man-made noise. Therefore, the Zone of Masking is influenced not only by the level of the target sound, but also by its function. For a single species in a single situation, there may be multiple Zones of Masking, depending on the frequency, level, and function of the target sound.

There is some evidence that animals may have strategies to compensate for masking of useful sounds. This would be expected since natural background noise (wave noise, non-useful biological noise, etc.) can also mask useful sounds. Serrano and Terhune (2001) report that harp seals (*Pagophilus groenlandicus*) in the Gulf of St. Lawrence, Canada increased the number of elements per call as ambient calling rates (noise) within a breeding colony increased. The increase in the number of elements per call may be a strategy to avoid masking in a noisy environment and to maximize call detection over long distances.

3.4 Zone of Hearing Loss, Discomfort , and Injury

Prolonged or repeated exposures to high levels of airborne sound accelerates the normal process of gradual hearing loss in humans (Kryter 1985). This deterioration is a *permanent threshold shift* (PTS) in that sensitivity at some frequencies is permanently lowered; a higher level is required before it is detected. Besides PTS, temporary exposure to high noise levels can cause a *temporary threshold shift* (TTS) that can last anywhere from a few minutes to days. PTS can also develop from a brief exposure to an extremely high sound level, such as that from a nearby explosion.

There is little direct evidence that marine mammals suffer TTS or PTS, although it is assumed that the hearing sensitivity of marine mammals can be reduced at least temporarily by exposure to strong noises. Kastak *et al*. (1999) reported TTS in three species of pinnipeds after underwater exposure to noise. A harbor seal exposed to white noise with frequencies ranging from 100 Hz to 2,000 Hz at source levels between 60-75 dB for 20 – 22 min. experienced a threshold shift of approximately 4.8 dB, recovery to near baseline levels was reported within 24 hours of noise exposure (Kastak *et al*. 1999). Threshold shifts were similar for two California sea lions (*Zalophus californianus*)and a juvenile elephant seal (*Mirounga angustirostris*).

In humans, a chronic exposure of approximately 80 dB above threshold is required for PTS to develop. If the same follows for marine mammals hearing underwater, a chronic exposure to noise levels of ~120 db re 1• Pa, approximately 80 dB above absolute threshold, would be required for induce PTS in belugas (one of a few cetaceans for which absolute thresholds have been measured). For pinnipeds the exposure would probably be higher (~ 140 dB re 1 • Pa) given their higher absolute thresholds. While some marine mammals tolerate noise at ~120 dB re 1 • Pa, it is doubtful that marine mammals would remain in an area ensonified at 120 – 140 dB re 1 • Pa long enough to suffer TTS or PTS. Many of the loudest sources of man-made noise (e.g. supertankers or icebreakers) are themselves mobile, and are unlikely to ensonify a given area for long enough to induce TTS or PTS in marine mammals. However, while chronic exposure is unlikely, intermittent or explosive noise may be strong enough in some circumstances to induce TTS or PTS in marine mammals. In addition to inducing TTS or PTS, very strong explosive noise has the potential to cause tissue damage to auditory or other tissues. Todd *et al*. (1996) examined two dead humpback whales found near industrial explosive activities in Trinity Bay, Newfoundland. Both whales showed evidence of tissue damage consistent with extremely high noise levels, and it is likely that the noise contributed to the deaths of the whales. Besides damage to auditory tissues, extremely strong noise sources can cause damage to internal organs: respiratory cavities can be induced to resonate in response to strong underwater noise with the appropriate wavelengths.

3.5 Summary

Radii of influence of man-made noise to marine mammals are dependent upon numerous factors. The source level and spectral characteristics of the noise, the rate of attenuation of the noise, and ambient noise will all affect radii of influence. Attenuation and ambient noise are themselves dependent upon environmental characteristics, including water depth, water qualities, bottom characteristics, sea state, and many others. When considering masking, characteristics of the target signal also add to the variability in predicting radii. Predictions of radii are also variable due to the sensitivity, individual variation, and motivation of the marine mammals themselves. Much caution must be taken in developing and interpreting zones of influence. However, while many factors prevent zones of influence from being exact predictors of the effects of noise to marine mammals, the model may be the best way to predict and mitigate the effects from man-made noise.

4.0 Marine Mammal Hearing

Sound, unlike light and other stimuli, is transmitted very efficiently through water. Sounds from natural and man-made sources can often be heard for many kilometers, far beyond the range at which the stimuli would be detected visually either underwater or in air. Marine mammals probably use the characteristics of sound transmission to obtain information about their surroundings, including the presence of conspecifics and other marine mammals, and the presence of prey or predators. Concern has been raised that the multitude of man-made sounds introduced into the ocean may have deleterious effects to marine mammals.

Factors affecting marine mammal hearing

The hearing abilities of marine mammals (and other animals) are functions of the following (after Richardson et al. 1995):

1. Absolute hearing threshold – the level of sound that is barely audible in the absence of significant ambient noise.

2. Frequency and intensity discrimination – the ability to discriminate among sounds of different frequencies and intensities.

3. Localization – the ability to localize sound direction at the frequencies under consideration

4. Masking – the ability or inability to distinguish target sounds from ambient noise

5. Motivation – the psychological state of the animal may influence whether the sound is detected, and whether the animal reacts.

6. Individual variation – the variation between individuals in hearing sensitivity.

4.1 Absolute Threshold

Audiograms show the sensitivity of marine mammals to sounds of different frequencies. Audiograms are normally obtained using captive animals specially trained to respond when sounds become audible. In this way, the absolute threshold for various frequencies can be measured. Audiograms typically produce a U-shaped chart, with the best sensitivity (bottom of the U) in the middle frequencies, and decreasing sensitivity (higher intensity required for detection) at low and high frequencies. It is not known how well baleen whales follow this trend, their use of low frequency sound, and the anatomy of their auditory organs suggest that they may have good low frequency hearing. Audiograms have been obtained for seven species of toothed whales and seven species of pinnipeds. No audiograms have been collected for baleen whales. Of the marine mammals inhabiting Glacier Bay National Park and Preserve, audiograms have been obtained for only the killer whale and the harbor porpoise.

4.1.1 Odontocete Threshold

Odontocetes generally have very acute hearing at the middle frequencies, with lower sensitivity at low and high frequencies. The best frequencies for the seven species of odontocetes for which audiograms have been obtained ranged from ~8 to 90 kHz (Richardson et al. 1995). Hearing extends at least as low as 40 – 75 Hz in the beluga and the bottlenose dolphin, but their sensitivity at low frequencies appears to be low. By contrast, the sensitivity at high frequencies appears to be very good for most odontocetes, extending up to 80 – 150 kHz. The good high-frequency hearing is likely related to the use of high frequency sounds for echolocation.

4.1.2 Pinniped Threshold

Underwater audiograms have been obtained for four species of phocid (hair or true seals) including one for the harbor seal, which inhabits Glacier Bay National Park and Preserve waters, and for three species of otariid (sea lions and fur seals).

Phocids generally have flat audiograms from 1 kHz to 30 – 50 kHz with thresholds between 60 and 85 dB re 1 • Pa (Richardson et al. 1995). Little is known about pinniped hearing below 1 kHz, but for a single harbor seal sensitivity was 96 dB re 1 • Pa at 100 Hz (Kastak and Schusterman 1995). Sensitivity for most phocids remains good until about 60 kHz, after which sensitivity is poor (Richardson et al. 1995).

Underwater sensitivity at the high and low frequency ends of otariids is generally lower than for phocids, but there is little difference in the middle frequencies (Richardson et al. 1995). The high-frequency limit for most otariids appears to be about 36 – 40 kHz (Schusterman 1981), and sensitivity in the 100 – 1 kHz range appears to be lower than for phocids, based on the slopes of the audiograms that have been performed. Otariids that have been tested appear to have best sensitivity between 2 and 17 kHz (Moore and Schusterman 1987; Schusterman et al. 1972). Kastak and Schusterman (2002) recently reported that the auditory sensitivity of a free-diving California sea lion changed at depth. Hearing sensitivity generally worsened with depth, with significant interaction between depth and frequency. However, sensitivity at 50 m increased above 35 kHz compared to sensitivity at 10 m. Similar studies have not been conducted with phocids, but would help elucidate mechanisms of pinnipeds' underwater hearing.

Pinnipeds are amphibious and thus must also respond to airborne sounds. In-air audiograms have been obtained for two otariids and two phocids, including the harbor seal. Otariids apparently are more sensitive to airborne sounds and appear to detect higher frequency airborne sounds than phocids. The high frequency limit for otariids is similar to the underwater limit of 36 – 40 kHz, whereas for phocids, the upper limit appears to be around 20 kHz, considerably lower than the 60 kHz limit underwater. Sensitivity for both otariids and phocids deteriorates as the frequency goes below 2 kHz.

4.2.2 Frequency and Intensity Discrimination

The ability to differentiate between two signals of different frequency and intensity is important in detecting sound signals amidst background noise. This ability is also important for detecting calls from conspecifics, prey and predators.

Odontocetes apparently have very good frequency discrimination. Bottlenose dolphins can discriminate frequencies differing by 0.21 – 0.81% between 2 and 130 kHz (Thompson and Herman 1975). Pinnipeds have less precise frequency discrimination than odontocetes. Harbor seals were able to detect differences as small as 1.0 – 1.8% between 1 and 57 kHz (Møhl 1967, 1968).

Intensity discrimination may be important in detecting signals in the presence of noise. Odontocetes may be able to detect differences as small as 0.35 – 2.0 dB (Johnson 1971). Few data exist on the ability of pinnipeds to detect differences in intensity. Moore and Schusterman (1976) report that the California sea lion may be able to detect differences as small as 3 dB at 16 kHz.

4.2.3 Directional Hearing

The ability to localize sounds may be important for interactions among social marine mammals, and is undoubtedly important in prey detection by echolocation or by passive signal detection. Humans' ability to localize sounds depends on the interaural delay of sounds. Sound travels five times faster in water than in air, greatly reducing the ability to detect interaural delay. Bone conduction may also reduce the ability of terrestrial animals to localize sound underwater. In whales, the auditory organs are isolated from the skull, enhancing the ability to localize sound. Pinnipeds auditory structures are fused to the skull, which suggests a reduced ability to localize underwater sounds, but pinnipeds have other adaptations for hearing both in-air and underwater.

Odontocetes have very good ability to localize sound, as would be expected based on their echolocation abilities. Bottlenose dolphins are able to differentiate tones 2-3° off midline, and may have been able to detect clicks 0.7 – 0.9° off midline (Renaud and Popper 1975). Clicks are used for echolocation and should be more easily located than pure tones. These results were measured with the dolphin's head restrained. Head movement may increase the localization abilities of echolocating dolphins.

Pinnipeds have less precise abilities to localize sounds than odontocetes. A harbor seal was able to localize underwater tones ~ 6º apart (Møhl 1968b), and a California sea lion was able to localize underwater tones ~ 4º apart (Moore and Au 1975). The ability to localize tones is better in air than underwater. A harbor seal was able to localize clicks in air ~ 3º apart (Terhune 1974).

There is some indirect evidence that baleen whales have the ability to localize sounds at frequencies of a few hundreds, to tens of hertz (Richardson et al. 1995). Baleen whales sometimes orient and swim towards distant calling conspecifics (Watkins 1981; Tyack and Whitehead 1983), or swim directly away from predator calls (Malme et al. 1983) or industrial noise (Richardson et al. 1995).

4.3 Auditory Masking

Normal background noise (natural and man-made) may interfere with the ability of an animal to detect a sound signal. The amount by which a pure tone must exceed the background level in order to be audible is called the Critical Ratio (CR). CRs are generally measured for specific frequencies, since ability to detect sounds is dependent upon frequency. In general, CRs increase with increasing frequency.

4.3.1 Adaptations to Reduce Masking

Since natural noise can interfere with the ability to detect sounds, it would be expected that animals have developed strategies to reduce masking. Marine mammals that localize sounds reduce the effect of masking as a result of directional noises, that is masking is not as severe for important sounds that come from directions different than those of the noise. Masking of high frequency sounds in the bottlenose dolphin is strongly dependent upon the directionality of the sound and noise signals (Au and Moore 1984). In general, the masking effect of background noise is reduced if the noise either comes from a direction other than that of the target, or is omnidirectional (Richardson et al. 1995).

In order to reduce masking marine mammals may also shift the frequency of their calls from a "noisy" frequency band to one with less ambient noise (Lesage et al. 1999), increase the length of calls (Miller et al. 2000), change the duration of elements in calls (Norris 1999), increase the number of specific calls (Lesage et al. 1999) or elements within calls (Serrano and Terhune 2001).

4.4 Individual Variation and Motivation

In addition to the physical factors that influence marine mammal hearing, individual variation in hearing abilities and differences in motivation will influence the effects of sound to marine mammals. Ketten et al. (1995) compared hearing abilities of a long-term captive dolphin, one juvenile, and two young adult dolphins. The older dolphin showed hearing loss consistent with age related hearing loss in humans. The older dolphin showed a shift in high frequency sensitivity from normal threshold levels up to 165 kHz to no functional hearing above 60 kHz at his death at age 28. The conclusion was that the hearing loss was attributable only to age-related changes in the ear.

Reactions of marine mammals to sounds vary considerably. Some humpbacks show little or no reaction to vessels within distances that other humpbacks have shown obvious reactions. Krieger and Wing (1984, 1986) determined that humpbacks are less likely to react to vessels when they are actively feeding than when resting or engaged in other activities. Humpback pods with calves, or small pods, were more likely to react to vessels than were larger pods or pods without calves present (Bauer et al. 1993). Thus, the motivation (behavioral state, whether sound is perceived as a threat) will affect how or whether marine mammals will react to sound.

4.5 Baleen Whale Hearing

There are no audiograms for baleen whales, so all information about hearing in baleen whales is based on behavioral observations, anatomical evidence, and extrapolations from other marine mammal hearing characteristics. Field observations of the responsiveness of baleen whales to sounds can set an upper bound for detection thresholds. However, it is not possible to determine if sounds at lower levels than those that elicited a response were detected but did not elicit an overt response or were undetected by the animal. Humpback whales reacted to calls from other humpbacks at levels as low as 102 dB re 1 • Pa,and bowhead whales fled from an approaching boat when the noise level was 90 dB re 1 • Pa(Frankel et al. 1995; Richardson and Greene 1993).

Baleen whales are probably able to hear low frequency sounds, including infrasounds (< 20 Hz). Baleen whales react to sounds from conspecifics that range from 20 Hz (fin whales) to 550 Hz (humpback whales) (Watkins 1981; Frankel et al. 1995). Humpback, gray and bowhead whales all react to airgun pulses and underwater playbacks of low frequency (50 – 500 Hz) man-made sounds (Richardson et al. 1995). Anatomical evidence also suggests that baleen whales are adapted to hear low frequency sounds (Ketten 1998). The upper bounds of baleen whale hearing are not as high as odontocetes. Humpback whales reacted to sonar signals at 3.1 – 3.6 kHz and broadband clinkers centered around 4 kHz (Lien et al. 1990, 1992; Maybaum 1993). Watkins (1986) reported that baleen whales react to sonar sounds up to 28 kHz, but not to sounds 36 kHz and above.

4.6 Marine Mammal Sounds

The frequencies of sounds produced by marine mammals identify at least some of the frequencies important to these species. Marine mammals probably use sounds they create to obtain much information about their environment, including information about the presence of danger, food, a conspecific or other animal, and to transmit information about their own position, identity, and territorial or reproductive status (Richardson et al. 1995). While the sounds created by marine mammals are a good indication of frequencies important to those species, it is likely that higher and lower frequencies are also important.

4.6.1 Mysticete Sounds

Since baleen whales have rarely been held in captivity, sounds created by baleen whales have generally been recorded in the wild. Most baleen whale sounds are dominated by low frequencies, generally below 1 kHz, although a few recordings of clicks with dominant frequencies from 16 to 25 kHz have been recorded near minke, fin and blue whales (Beamish and Mitchell 1973; Thompson et al. 1979; Beamish 1979). It is thought these high frequency sounds may have been from odontocetes in the area, or recording artifacts (Richardson et al. 1995).

Humpback whales produce stereotyped songs associated with reproduction on low-latitude wintering grounds (Tyack 1981). Songs have occasionally been recorded on the high-latitude summer feeding grounds (Mattila et al. 1987; McSweeney et al. 1989; Gabriele et al. 2001), in late summer or early fall. Gabriele et al. (2001) suggest that the increase in song frequency in fall may correspond with the beginning of hormonal activity in male humpbacks associated with the migration to the wintering grounds. Humpback whale song elements range from • 20 Hz to 4 or 8 kHz, estimated source levels range from 144 to 174 dB re 1• Pa (Thompson et al. 1979).

On the summer feeding grounds humpbacks produce sounds associated with feeding behavior (Jurasz and Jurasz 1979; Cerchio and Dahlheim 2001). These calls ranged from 236 – 1219 Hz (Cerchio and Dahlheim 2001). It is suggested that these calls may serve to manipulate prey distribution (scaring fish into tighter groups) and as assembly calls, but not to coordinate feeding (Baker 1985).

Humpbacks also produce sounds on the wintering grounds associated with agonistic behavior in social groups. The sounds extend from 50 Hz to • 10 kHz. These sounds may elicit response from humpbacks up to 9 km away (Tyack and Whitehead 1983).

4.6.2 Odontocete Sounds

Odontocetes produce three broad types of sounds, tonal whistles, short duration pulsed sounds, and less distinct pulsed sounds such as cries, grunts and barks. Odontocetes that produce whistles tend to be social, gathering in large groups of up to thousands of individuals, while non-whistling odontocetes tend to be non-social or gather in small groups of a few individuals (Tyack 1986; Herman and Tavolga 1980).

Most odontocete's whistles are narrow-band sounds. Whistles typically have most of their energy below 20 kHz and can vary greatly in frequency structure. Some odontocetes may use special, unique whistles as "signature calls" that may carry some information about the sender. Whistles may also serve to coordinate activity such as feeding in large, dispersed groups (Norris and Dohl 1980; Würsig and Würsig 1980).

Clicks and pulsed sounds are typically short (50 – 200 • s) bursts of sound that can range from 0.1 – 200 kHz (Watkins 1980; Santoro et al. 1989). Source levels of sperm whale clicks can be near 180 dB re 1 • Pa-m (Watkins 1980). Clicks have been demonstrated to be used for echolocation in several species of odontocetes, and numerous other species produce echolocation type sounds although they have not been proved to echolocate. Echolocating odontocetes produce forward directional pulsed sounds of high frequency (12 – 150 kHz), short duration (50 – 200 • s), high intensity (up to 220 – 230 dB re 1 • Pa-m) sounds.

4.6.3 Phocid Sounds

Phocid seals are diverse in their behavior and habitat use, some spend almost all their time in water or hauled out on ice. Others haul out regularly on land. Most phocid seal calls seem to be associated with mating, mother-pup associations or territoriality. Underwater calls may be less important for species that perform those activities on land. Some phocids produce sounds that propagate for long distances, and others produce faint sounds that probably do not propagate far. Phocids probably hear sounds up to approx. 60 kHz underwater, and most calls are made between 90 Hz and 16 kHz (Richardson et al. 1995).

Harbor seals spend considerable time hauled out on land, although much social behavior occurs underwater as well. Males produce repeated call trains of low frequency (<4 kHz) underwater pulses including roars, grunts, and creaks (Hanggi and Schusterman 1994). Calls from pups are individually distinct and broadcast simultaneously in-air and underwater when the pups head is in the air. Females use calls from their pups both in-air and underwater to recognize and maintain contact with their pups. Pup calls in-air are centered around 350 Hz, (Ralls et al. 1985) while underwater calls are shifted to higher frequencies (Richardson et al. 1995).

4.6.4 Otariid Sounds

Sea lions and fur seals spend a great deal of time hauled out on land. They defend territories, mate, and give birth on traditional terrestrial rookeries. In-air vocalizations are used to defend territories, attract females, and establish and maintain mother-pup bonds.

No information exists on the frequency composition or source levels of Steller sea lion calls. Only California sea lion calls have been recorded and analyzed, and are thought to be generally consistent with those of Steller sea lions. California sea lion males bark incessantly while defending territories on rookeries. Barks have most energy <1 kHz. Females bark at intruders into their territory, squeal, belch and growl. Females exchange calls with new pups for several hours after birth. Mothers and pups are then able to recognize one another by their calls (Trillmich 1981). Female belches and growls have most energy between 0.25 – 4 kHz, female – pup attraction calls are 1 – 2 kHz and the pup's bleat is at 0.25 – 6 kHz (Peterson and Bartholomew 1969). Male Steller sea lions roar and hiss to defend territories on rookeries, and females defend birthing territories with barks and growls. Females and pups exchange vocal signals soon after birth, the calls may function in mother – pup recognition.

Underwater sounds of California sea lions are generally associated with social situations (Schusterman et al. 1966). Most underwater sounds are barks that are produced while the head is above the surface. Most of the energy is at frequencies below 2 kHz, and is similar in water and air (Schevill et al. 1963). When submerged, California sea lions produce barks, whinny and buzzing sounds, and click trains (Schusterman et al. 1966). Steller sea lions are said to produce clicks, growls, snorts and bleats underwater (Poulter 1968).

4.6.5 Sea Otter Sounds

Sea otters spend much of their time in water, but underwater sounds have not been studied. Airborne sounds of adult sea otters include: whines, whistles, growls, cooing, chuckles, snarls, and screams (Kenyon 1981). Otters may also produce sounds by vigorously kicking and splashing while at the surface (Calkins and Lent 1975). Calls between mothers and pups appear to be important for maintaining contact (Sandegren et al. 1973). Most of the energy in mother and pup calls is between 3 – 5 kHz.

5.0 UNDERWATER NOISE ACOUSTICS ENVIRONMENT

The ambient underwater noise in Glacier Bay results from both natural and man-made sources. The natural sources are primarily splash noise from wind-generated waves, and turbulence noise from high tidal currents in restricted channels. Other sources of natural noise that are unique to Glacier Bay are found in Sitakaday Narrows and in upper-bay waters that are near the glaciers. The noise in Sitakaday Narrows is produced by current interaction with the bottom - that results in turbulence noise and impact noise caused by the movement of small rocks and boulders as they are tumbled down bay by the strong tidal flow. In the upper bay, and in particular, Queen Inlet, glaciers advancing intermittently down mountain slopes produce strong low frequency underwater rumbles resembling thunder. These sounds can be heard as they propagate out into the bay as far as the Marble Islands, and occasionally, in quiet background conditions, in Bartlett Cove.

Man-made components of ambient noise are primarily caused by water transportation activities. Cruise ships are the loudest sources but tour boats, charter boats, private skiffs, and even airplanes contribute to the underwater noise levels in areas near Bartlett Cove and other areas where park visitors may be concentrated. Vessel noise is considered part of the ambient noise if no nearby source can be recognized. The following discussion presents details concerning the natural and man-made components of Glacier Bay underwater noise collected in the 1980s. Readers are encouraged to read the previous sections "Acoustic Concepts and Terminology", "Sound Propagation", "Zones of Influence", and "Marine Mammal Hearing" before reading this section. It must be noted that there are more current data for the underwater acoustics environment in Glacier Bay, however, those data are not widely available. Obtaining those data will allow a more complete description of the underwater environment in Glacier Bay and provide a better basis for comparisons of the effects of the alternatives presented within this EIS.

5.1 Ambient Noise Levels

Ambient noise has both long-term and transient properties. The long-term properties are described in terms of their average (mean rms) overall sound level, temporal statistics (transient level fluctuations in time) and frequency composition. Ambient noise data are generally measured at a single point for a long period (several hours or days). . The fluctuations in sound energy that normally occur over the sampling period are generally averaged to an <u>equivalent sound level</u> (L_{eq}), which is the constant rms sound level that would provide the same acoustic energy as the actual signal over the same period. The range in amplitude of the fluctuating sound level is described statistically by the percentage of time that the "instantaneous" rms level is above or below selected values, typically 5%, 50% and 95% of the total range observed during the measurement period. The frequency composition is usually measured as a 1/3 octave band using the same measurement period as used in determining the L_{eq}. When signals with strong tonal components are present, a narrow band analysis may be used to obtain better frequency definition since most of the energy is contained in a narrow band that includes the tonal frequency. The 1/3 octave band analysis is used for broadband signals because it provides a better correspondence to the hearing sensitivity of humans (and other mammals).

Acoustic measurements in Glacier Bay have provided data to compare the ambient sound levels in various parts of the bay with archival data obtained in open water areas to determine if Glacier Bay is more or less "noisy" than open water areas nearby. Data reported by Wenz (1982) and Urick (1983) are compared with data obtained by Miles and Malme (1983) in Bartlett Cove as shown in Fig. 1. The Bartlett Cove data were obtained for conditions with very light winds, so the variation in sound level over the two

8-hr measurement periods was due primarily to boat and ship traffic, rather than differing environmental conditions. The mean sound level from boat and ship traffic in Bartlett Cove corresponds to a Sea State 4 (wind speed of about 20 kts) in open water.

It is also necessary to consider the temporal characteristics of ambient noise. The long term averages discussed previously convey the impression that sound levels under water are nearly constant. This is not the case in Bartlett Cove as shown in Fig. 2, taken from a graphic level recording sequence obtained over two 10-minute periods in Bartlett Cove (Miles and Malme 1982). The record shows the fluctuations in overall sound levels due to humpback whale vocalizations, ship arrivals and departures, and fishing boat movements. The level of the whale vocalizations is much higher (at the measurement position) than the departure of the cruise ship Statendam as it begins to travel up bay.

There is a wide variation in ambient noise for other sites in the bay, as can be seen in Figs.3A and 3B. Station 17 near North Marble Island shows sound levels lower than Sea State 0 (calm winds, smooth seas) at frequencies above 250 Hz. The low frequency noise levels seen in Figs. 3A and 3B are from either distant ships or glacier motion. Intermediate levels of noise are seen in the spectrum obtained in Queen Inlet. The narrow band peaks in this spectrum are caused by glacier rumbles. The spectrum obtained near Muir Glacier is dominated by the noise of out-gassing from the glacial ice nearby. The high frequency sounds are higher than would be obtained by wind and wave noise at Sea State 6 (wind speed about 30 kts).

5.2 Description of Noise Range for Each Vessel Class

The man-made component of ambient noise is produced primarily by ship and boat movements. It is possible to categorize the classes of vessels using the bay by type or application. However, on analyzing the acoustic output of vessels of the same type, a wide variation is often found. As a result, only two general classifications, cruise ships, and other miscellaneous boats, have been used. This may be modified when acoustic data from additional vessels become available. Figure 4 shows the source level spectra for the range of sound levels produced by 6 representative cruise ships for which data are available. For comparison, the source levels of a range of smaller vessels, representative of the types that use the bay, are also shown. These spectra were obtained by estimating transmission loss (TL) for received levels reported by Malme et.al. (1982). The received energy levels for each 1/3 octave band were summed to obtain an overall source level (L_s) for each vessel. The average source level for the cruise ships is about 179 dB, with 9 dB variation between the maximum and minimum overall source levels. The average source level for the smaller vessels is 164 dB with variation of 10 dB. The difference in average source levels between the cruise ships and the smaller vessels is about 15 dB.

In order to estimate the assumed zone of responsiveness (Sec. 3.2.4.2), or the range at which the overall radiated sound level from these vessels approaches the 130 dB disturbance criterion, it is necessary to review the Glacier Bay TL data reported by Malme et al. (1982). The data are summarized for 200 Hz in Fig. 5. The TL measured for Station 41, at the bay entrance, was selected for a whale waters location. The estimated ranges are shown in Table 5-1.

TABLE 5-1: NOISE RANGES BY VESSEL

Vessel Class	L_s, dB re 1 µPa @ 1 m	Criterion, dB re 1 µPa	Required TL, dB	Minimum Range, m
Cruise Ships	179	130	49	600
Tour, fishing, sport, misc.	164	130	34	50

The TL data reported by Malme *et al*. (1982) at six sites in Glacier Bay included a range of 100 Hz - 16,000 Hz. In this case 200 Hz was selected as a representative frequency, as sounds from cruise ship are generally low frequency. Further TL analyses will be made to include TL values for all frequencies at selected sites reported by Malme *et al*. (1982) to provide a more optimum match with the spectra of the cruise ships. Additional analysis will also be made using an expanded ship database including all the vessels that visited the park during the 2001 season to provide a more detailed and relevant analysis for ships in Glacier Bay.

LITERATURE CITED

Au, W. W. L., and P. W. B. Moore. 1984. Receiving beam patterns and directivity indices of the Atlantic bottlenose dolphin *Tursiops truncatus. Journal of Acoustical Society of America* 75 (1): 255-262.

Baker, C. S. 1985. The population structure and social organization of humpback whales (*Megaptera novaeangliae*) in the central and eastern North Pacific. Ph.D. thesis, University of Hawaii, Honolulu, HI.

Bauer, G. B., J. R. Mobley, and L. M. Herman. 1993. Responses of wintering humpback whales to vessel traffic. *Journal of Acoustical Society of America* 94(3, Pt. 2): 1848.

Beamish, P. 1979. Behavior and significance of entrapped baleen whales. *In*: H. E. Winn and B. L. Olla (eds.), Behavior of marine animals, vol. 3: Cetaceans. Plenum, New York.

Beamish, P. and E. Mitchell. 1973. Short pulse length audio frequency sounds recorded in the presence of a minke whale (*Balaenoptera acutorostrata*). Deep-Sea Res. 20($): 375-386.

Calkins, D. and P. C. Lent. 1975. Territoriality and mating behavior in Prince William Sound sea otters. *Journal of Mammalogy* 56 (2): 528-529.

Cerchio, S. and M. Dahlheim. 2001. Variation in feeding vocalizations of humpback whales *Megaptera novaeangliae* from southeast Alaska. Bioacoustics 11: 277-295.

Frankel, A. S., J. R. Mobley, Jr., and L. M. Herman. 1995. Estimation of auditory response thresholds in humpback whales using biologically meaningful sounds. *In*: R. A. Kastelein, J. A. Thomas and P. E. Nachtigall (eds.). Sensory systems of aquatic mammals. De Spil Publ., Woerden, Netherlands.

Gabriele, C., A. Frankel, and T. Lewis. 2001. Frequent humpback whale songs recorded in Glacier Bay, Alaska in fall 2000. *Abstract* 14th Biennial Conference on the Biology of Marine Mammals, Vancouver, Canada, 2001.

Hanggi, E. B., and R. J. Schusterman. 1994. Underwater acoustic displays and individual variation I male harbour seals, *Phoca vitulina*. *Animal Behaviour* 48 (6): 1275-1283.

Herman, L. M., and W. N. Tavolga. 1980. The communication systems of cetaceans. *In*: L. M. Herman (ed.), Cetacean behavior: Mechanisms and functions. Wiley-Interscience, New York.

Jameson, R.J. and A.M. Johnson. 1993. Reproductive characteristics of female sea otters. *Marine Mammal Science* 9 (2): 156-167.

Johnson, C. S. 1971. Auditory masking of one pure tone by another in the bottlenosed porpoise. *Journal of the Acoustical Society of America* 49(4, Pt. 2): 1317-1318.

Jurasz, C. M., and V. P. Jurasz. 1979. Feeding modes of the humpback whale, *Megaptera novaeangliae*, in southeast Alaska. *Scientific Report of the Whales Research Institute* 31: 69-83.

Kastak, D. and R. J. Schusterman. 1995. Aerial and underwater hearing thresholds for 100 Hz pure tones in two pinnipeds species. *In*: R. A. Kastelein, J. A. Thomas and P. E. Nachtigall (eds.), Sensory systems of aquatic mammals. DeSpil Publ., Woerden, Netherlands.

Kastak, D., and R. J. Schusterman. 2002. Changes in auditory sensitivity with depth in a free-diving California sea lion (*Zalophus californianus*). *Journal of the Acoustical Society of America* 112 (1): 329-333.

Kenyon, K. W. 1981. Sea otter *Enhydra lutris* (Linnaeus, 1758). *In*: S. H. Ridgway, and R. J. Harrison (eds.), Handbook of marine mammals, vol. 1. Academic Press, London.

Ketten, D. R. 1998. Marine mammal auditory systems: a summary of audiometric and anatomical data and its implications for underwater acoustic impacts. NOAA-TM-NMFS-SWFSC-256.

Ketten, D. R., S. Ridgeway, and G. Early. 1995. Apocalyptic hearing: Aging, injury, disease and noise in marine mammal earls. *In* Abstracts of the 11th Biennial Conference on the Biology of Marine Mammals.

Krieger, K. J. and B. L. Wing. 1984. Hydroacoustic surveys and identification of humpback whale forage in Glacier Bay, Stephens Passage, and Frederick Sound, southeastern Alaska, summer 1983. NOAA Tech. Memo. NMFS F/NWC-66. U.S. Natl. Mar. Fish. Serv., Auke Bay, AK.

Krieger, K. J. and B. L. Wing. 1986. Hydroacoustic monitoring of prey to determine humpback whale movements. NOAA Tech. Memo. NMFS F/NWC-98. U.S. Natl. Mar. Fish. Serv., Auke Bay, AK.

Lesage, V., C. Barrette, M. C. S. Kingsley, and B. Sjare. 1999. The effect of vessel noise on the vocal behavior of belugas in the St. Lawrence River estuary, Canada. *Marine Mammal Science* 15(1): 65-84.

Lien, J., S. Todd and J. Guigne. 1990. Inferences about perception in large cetaceans, especially humpback whale, from incidental catches in fixed fishing gear, enhancement of nets by “alarm” devices, and the acoustics of fishing gear. *In*: J. A. Thomas and R. A. Kastelein (eds.), Sensory abilities of cetaceans/Laboratory and field evidence. Plenum, New York.

Lien, J., W. Barney, S. Todd, R. Seton and J. Guzzwell. 1992. Effects of adding sounds to cod traps on the probability of collisions by humpback whales. *In*: J. A. Thomas, R. A. Kastelein, and A. Ya. Supin (eds.), Marine mammal sensory systems. Plenum, New York.

Malme, C. I., P. R. Miles, C. W. Clark, and J. E. Bird. 1983. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. BBN Rep. 5366. Rep. from Bolt Beranek & Newman Inc., Cambridge, MA for U.S. Minerals Manage. Serv., Anchorage, AK.

Malme, C.I., P.W. Smith, Jr., and P.R. Miles. 1986. Study of the effects of offshore geophysical acoustic survey operations on important commercial fisheries in California. BBN Rep. 6125; OCS Study MMS 86-0032. Rep. From BBN Labs Inc., Cambridge, MA, for Battelle Labs, Ventura, CA, and U.S.Minerals Manage. Serv., Los Angeles, CA. 106 p.

Mattila, D. K., L. N. Guinee, and C. A. Mayo. 1987. Humpback whale songs on a North Atlantic feeding ground. *Journal of Mammalogy* 68(4): 880-883.

Maybaum, H. L. 1993. Responses of humpback whales to sonar sounds. *Journal of the Acoustical Society of America* 94(3, Pt. 2): 1848-1849.

McSweeney, D. J., K. C. Chu, W. F. Dolphin, and L. N. Guinee. 1989. North Pacific humpback whale songs: A comparison of southeast Alaskan feeding ground songs with Hawaiian wintering ground songs. *Marine Mammal Science* 5(2): 139-148.

Miller, P. J. O., N. Biassoni, A. Samuels, and P. L. Tyack. 2000. Whale songs lengthen in response to sonar. *Nature* 405:903.

Møhl, B. 1967. Frequency discrimination in the common seal and a discussion of the concept of upper hearing limit. *In*: V. M. Albers (ed.), Underwater acoustics, vol. 2. Plenum, New York.

Møhl, B. 1968a. Auditory sensitivity of the common seal in air and water. *Journal of Auditory Research* 8(1): 27-38.

Møhl, B. 1968b. Hearing in seals. *In*: R. J. Harrison, R. C. Hubbard, R. S. Peterson, C. E. Rice and R. J. Schusterman (eds.), The behavior and physiology of pinnipeds. Appleton-Century-Crofts, New York.

Moore, P. W. B. and W. W. L Au. 1975. Underwater localization of pulsed pure tones by the California sea lion (*Zalophus californianus*). *Journal of the Acoustical Society of America* 58(3): 721-727.

Moore, P. W. B., and R. J. Schusterman. 1976. Discriminatio of pure-tone intensities by the California sea lion. *Journal of the Acoustical Society of America* 69(6): 1405-1407.

Moore, P. W. B., and R. J. Schusterman. 1987. Audiometric assessment of northern fur seals, *Callorhinus ursinus*. *Marine Mammal Science* 3(1): 31-53.

Norris, K. S., and T. P. Dohl. 1980. Behavior of the Hawaiian spinner dolphin, *Stenella longirostris*. *Fishery Bulletin* 77(4): 821-849.

Norris, T. F. 1999. Effects of boat nose on the acoustic behavior of humpback whales. *Journal of the Acoustical Society of America Abstracts*.

Peterson, R. S. and G. A. Bartholomew. 1969. Airborne vocal communication in the California sea lion, *Zalophus californianus*. *Animal Behaviour* 17(1): 12-24.

Poulter, T. C. 1968. Underwater vocalization and behavior of pinnipeds. *In*: R. J. Harrison, R. C. Hubbard, R. S. Peterson, C. E. Rice, and R. J. Schusterman (eds.), The behavior and physiology of pinnipeds. Appleton-Century-Crofts, New York.

Renaud, D. L., and A. N. Popper. 1975. Sound localization by the bottlenose porpoise *Tursiops truncatus*. *Journal of Experimental Biology* 63(3): 569-585.

Richardson, W. J., and C. R. Greene, Jr. 1993. Variability in behavioral reaction thresholds of bowhead whales toman-made underwater sounds. *Journal of the Acoustical Society of America* 94(3, Pt. 2):1848.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, D.R. Thomson 1995. *Marine Mammals and Noise*, Academic Press, New York, 576 p.

Sandgren, F. E., E. W. chu, and J. E. Vandevere. 1973. Maternal behavior in the California sea otter. *Journal of Mammallogy* 54(3): 668-679.

Schevill, W. E., W. A. Watkins, and C. Ray. 1963. Underwater sounds of pinnipeds. *Science* 141(3575): 50-53.

Schusterman, R. J. 1981. Behavioral capabilities of seal and sea lions: A review of their hearing, visual, learning and diving skills. *The Psychological Record* 31(2): 125-143.

Schusterman, R. J. R.. Gentry, and J. Schmook. 1966. Underwater vocalization by sea lions: Social and mirror stimuli. *Science* 154(3748): 540-542.

Schusterman, R. J., R. F. Balliet, and J. Nixon. 1972. Underwater audiogram of the California sea lion by the conditioned vocalization technique. *Journal of the Experimental Analysis of Behavior* 17(3): 339-350.

Serrano, A. and J. M. Terhune. 2001. Within-call repetition may be an anti-masking strategy in underwater calls of harp seals (*Pagophilus groenlandicus*). *Canadian Journal of Zoology* 79: 1410-1413.

Smith, P.W., Jr. 1974. Averaged sound transmission in range-dependent channels. *Journal of the Acoustical Society of America* 55 (6): 1197-1204.

Terhune, J. M. 1974. Directional hearing of a harbor seal in air and water. *Journal of the Acoustical Society of America* 56(6): 1862-1865.

Thompson, R. K. R., and L. M. Herman. 1975. Underwater frequency discrimination in the bottlenosed dolphin (1-140 kHz) and the human (1-8 kHz). *Journal of the Acoustical Society of America*. 57(4): 943-948.

Thompson, T. J., H. E. Winn, and P. J. Perkins. 1979. Mysticete sounds. *In* H. E. Winn and B. L. Olla (eds), Behavior of marine animals, vol. 3: Cetaceans. Plenum, New York.

Trillmich, F. 1981. Mutual mother-pup recognition in Galápagos fur seals and sea lions: Cues used and functional significance. *Behaviour* 78(1): 21-42.

Tyack, P. 1981. Interactiosn between singing Hawaiian humpback whales and conspecifics nearby. *Behavioral Ecology and Sociobiology* 8(2): 105-116.

Tyack, P. 1986. Population biology, social behavior and communication in whales and dolphins. *Trends in Ecology and Evolution* 1(6): 144-150.

Tyack, P. L., and H. Whitehead. 1983. Male competition in large groups of wintering humpback whales. *Behaviour* 83(1/2): 132-154.

Urick, R.J. 1983. *Principles of Underwater Sound, 3rd Ed.,* McGraw Hill Book Co., New York, 423 p.

Watkins, W. A. 1980. Click sounds form animals at seal. *In*: R.-G. Busnel and J. F. Fish (eds), Animal sonar systems. Plenum, New York.

Watkins, W. A. 1981. Activities and underwater sounds of fin whales. *Scientific Report of the Whales Research Institute* 33: 83-117.

Watkins, W. A.1986. Whale reactions to human activities in Cape Cod waters. *Marine Mammal Science* 2(4): 251-262.

Weston, D.E. 1976. Propagation in water with uniform sound velocity but variable-depth lossy bottom. J*ournal of. Sound and Vibration.*47 (4): 473-483.

Würsig, B., and M. Würsig. 1980. Behavior and ecology of the dusky dolphin, *Lagenorhynchus obscurus*, in the South Atlantic. *Fishery Bulletin* 77(4): 871-890.

APPENDIX D

Air Emissions Calculation Methodology

Memo

Date: 6/25/2003

To: Louise Flynn, Ecology and Environment, Inc., Assistant Project Manager

From: Laurie Kutina, Ecology and Environment, Inc., Air Quality Specialist

RE: Appendix D: Air Emissions Calculations Methodology

Existing and projected air emissions were estimated using 2001 operation data, vessel entry and use day quotas, NPS staff and vessel operator observations, and the most recent emission factor data and emission calculation method for vessels. Projections of future air pollutant emission levels were derived based on proposed changes in vessel activity for each alternative. Emission calculations used hours of operation that were averaged from 2001 data and NPS staff and vessel operator observations to provide average vessel times at each speed classification (time-in-mode).

Vessel emission factor data and calculation methodology were obtained from documentation recently published by the U.S. Environmental Protection Agency Office of Mobile Sources (Energy and Environmental Analysis 2000). The estimation method, as described below, incorporates the latest information available from nine different emission studies and utilizes kilowatt-hour (kW-hr) emission factors to determine emissions based upon load factor (i.e. percent of engine capacity while the vessel is under power) and operational time. The load factors were estimated using this method, and projected time-in-mode for each power setting was estimated based upon observations of existing conditions and proposed speed restrictions within Glacier Bay.

The emissions factor algorithms derived are from the following equation:

$$\mathbf{E\ (g/kW\text{-}hr) = a\ (Fractional\ Load)^{-x} + b}$$

Where E is the emissions rate per unit of work. The data analysis showed no statistically significant differences in emissions rates by engine size or output range, or by two-stroke/four-stoke, subject to the caveats detailed above. Emissions rates for SO_2 are based on (fuel consumption *x* sulfur content of fuel) since all SO_2 emissions are fuel derived. The sulfur content of fuel was assumed to be 0.2% for all vessels except the cruise ships, which use marine grade fuel assumed to contain a sulfur content of 1.5%.
The SO_2 regression equation used is:

$$\mathbf{Emissions\ Rate\ (g/kW\text{-}hr) = a\ (Fuel\ Sulfur\ Flow\ in\ g/kW\text{-}hr) + b}$$

The calculation of all factors is provided in table D-1.

Computation of emissions from auxiliary engines used by cruise ships required the use of the same emission factors specified above, and are evaluated at a load factor equal to one (i.e., at full load). The equation for emission from auxiliary engines is

$$\mathbf{Emissions = (EF)(LF{=}1) \times Auxiliary\ Power\ (kW) \times Time}$$

The basic equations used for the calculation of emissions are:

$$\mathbf{EMISSIONS_{,VCC,MODE} = (EF)(LF_{MODE}) \times (HP) \times LF_{MODE} \times TIME}$$

where:

VCC - vessel class (cruise ship, or tour, charter, or private vessel)
EF - emissions factor
LF -mode specific load factor
HP I- maximum Horsepower

Load Factor and Power calculations are provided in table D-2, and the calculations of emissions rates in lbs/hr are provided in table D-3.

For this evaluation, it was assumed that the cruise ships would operate in the park for 9 hours per use day, and that tour vessels would operate in the park for 13 hours per use day (based upon 2001 average—See Tables D-4 and D-5). Charter and private vessels are assumed to operate for 9.5 hours per use day, based upon generic assumptions established by *The Energy and Environmental Analysis 2000 Report* because there was no specific operation time data available. Time-in-mode for assumptions are adjusted for alternatives 4, 5, and 6, where speed restrictions would require cruise ships to maintain a slow cruise. It was assumed that the cruise ships would therefore take twice as long to enter and leave the bay, and therefore the total time for cruise ships under alternatives 4, 5, and 6 would be 13 hours. Other vessels would not be subject to the speed restrictions. NPS staff and vessel operator observations were used to determine average time at each speed classification (time-in-mode), assuming that the majority of time would be spent at normal cruise, with some time spent at a slow cruise and maneuvering (see table D-6).

Use day data for 2001 was collected for cruise ships, tour vessels, charter vessels, and private vessels, and it was used to determine baseline annual emissions. This data is summarized in tables D-4, D-5, D-7, and D-8.

In the development of projected emissions, annual use day quotas were used to determine number of in-season use days for all vessels, and off-season entries for cruise ships and tour vessels. Off-season vessel use days for charter and private vessels were assumed to be the same as the baseline. Daily emission and annual emissions were calculated differently in this evaluation. Daily emissions were calculated assuming that the vessel use of Glacier Bay is at the maximum quota of 2 cruise ships, 3 tour vessels, 6 charter vessels, and 25 private vessels, adjusted as required for each alternative. The total provides a worst-case evaluation of daily emissions in the park on a given day, and under these conditions. Annual emissions include all emissions emitted during the calendar year, January to December, and were determined using annual seasonal quotas and 2001 use data as described above.

Baseline emissions and 2001 operating data are provided in tables D-7 and D-8. Use-day quotas and calculations for alternatives 1, 2, 3, 4, 5, and 6 are provided in tables , D-9, D-11, D-13, D-15, D-17, and D-19, respectively. Load factors are adjusted to account for speed reductions for alternatives 4, 5, and 6. Estimated daily and annual emissions for alternatives 1, 2, 3, 4, 5, and 6 are summarized in tables D-10, D-12, D-14, D-16, D-18, and D-20, respectively.

Emission Rate Calculations
Table D-1

Marine Engine Emission Factor and Fuel Consumption Algorithms			
Pollutants	**Exponent(x)**	**Intercept(b)**	**Coefficient(a)**
PM	1.5	0.2551	0.0059
NOX	1.5	10.4496	0.1255
NO2	1.5	15.5247	0.18865
SO2			2.3735
CO	1		0.8378
HC	1.5		0.0667

Emission rate (g/kW-hr) by fractional load				
Pollutants	**80%**	**40%**	**20%**	**10%**
PM	0.26	0.28	0.32	0.44
NOX	10.62	10.95	11.85	14.42
NO2	15.79	16.27	17.63	21.49
High Sulfur SO2	11.25	11.25	11.25	11.25
Low Sulfur SO3	1.69	1.69	1.69	1.69
CO	1.05	2.09	4.19	8.38
HC	0.09	0.26	0.75	2.11
Fuel consumption g/kW-hr)	223.37	241.02	276.32	346.92

All but SO2:

Emission Rate (g/kW-hr) = a(Fractional Load)$^{-x}$ + b

SO2:

Emission Rate(g/kW-hr) = a(Fuel Sulfur Flow in g/kW-hr) + b

(Sulfur Flow in g/kW-hr = 0.71

(Sulfur Flow in g/kW-hr = 4.74

Fuel Consumption (g/kW-hr) = 14.12/(Fractional Load) + 205.717

Conversion Factors for SO2 Marine Grade Fuel	
lbs sulfur/lb fuel (1.5%)	0.020
fuel wieght 7.1 lbs/gal	
0.39 lbs fuel/hp-hr	0.39
1 kW=1.34 hp	1.34
1 lb = 453.59 g	453.6

Conversion Factors for SO2 Low Sulfur Diesel Fuel	
lbs sulfur/lb fuel (0.2%)	0.003
fuel wieght 7.1 lbs/gal	
0.39 lbs fuel/hp-hr	0.39
1 kW=1.34 hp	1.34
1 lb = 453.59 g	453.59

Source: Energy and Environmental Analysis, EPA420-00-002, *Analysis of Commercial Marine Vessels Emission and Fuel Consumption Data*, Final Report, Feb 2000

Average Power Ratings (kW) and Load Factors for Vessels
Table D-2

Vessel	Horsepower[b]	kW(rated average)	Activity	Load Factor[a]	kW (weighted)	Auxiliary Loads (kW)[a]	Total kW
Cruise Ship	32000	23881	Normal Cruise	80%	19104		19104
			Slow Cruise	20%	4776	5000	9776
			Maneuvering	10%	2388	5000	7388
			Hotelling			5000	5000
Tour boats	2415	1802	Normal Cruise	80%	1442		1442
			Slow Cruise	40%	721		721
			Maneuvering	20%	360		360
			Hotelling				
Charter Vessels	1106	825	Normal Cruise	80%	660		660
			Slow Cruise	40%	330		330
			Maneuvering	20%	165		165
			Hotelling				
Private Vessels	1863	1390	Normal Cruise	80%	1112		1112
			Slow Cruise	40%	556		556
			Maneuvering	20.00%	278		278
			Hotelling				

(a) From Table 5-2, Energy and Environmental Analysis February 2000
(b) From page 5-4, Energy and Environmental Analysis, February, 2000, except Cruise Ships, which is the average of HP ratings of all cruise ships that operated in the Bay in 2001

Calculation of Emission Rates (lbs/hr)
Table D-3

				Emission Factor (g/kW-hr)					nissions lbs/hr (includes auxilliary pow				
Vessel	**Activity**	**Load Factor**	**kW (weighted)**	**PM**	**NOX**	**SO2**	**CO**	**HC**	**PM**	**NOX**	**SO2**	**CO**	**HC**
Cruise Ship	Normal Cruise	80%	19104	0.26	10.62	11.25	1.05	0.09	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	20%	9776	0.32	11.85	11.25	4.19	0.75	4.91	50.98	48.40	18.02	3.21
	Maneuvering	10%	7388	0.44	14.42	11.25	8.38	2.11	5.58	23.44	18.29	13.62	3.43
	Hotelling	10%	5000	0.44	14.42	11.25	8.38	2.11	5.34	15.86	12.38	9.22	2.32
Tour Boats	Normal Cruise	80%	1442	0.26	10.62	1.69	1.05	0.09	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	40%	721	0.28	10.95	1.69	2.09	0.26	0.18	6.94	1.07	1.33	0.17
	Maneuvering	20%	360	0.32	11.85	1.69	4.19	0.75	0.05	1.88	0.27	0.66	0.12
	Hotelling	0%	0						0.00	0.00	0.00	0.00	0.00
Charter Vessels	Normal Cruise	80%	660	0.26	10.62	1.69	1.05	0.09	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	40%	330	0.28	10.95	1.69	2.09	0.26	0.08	3.18	0.49	0.61	0.08
	Maneuvering	20%	165	0.32	11.85	1.69	4.19	0.75	0.02	0.86	0.12	0.30	0.05
	Hotelling	0%	0						0.00	0.00	0.00	0.00	0.00
Private Vessels	Normal Cruise	80%	1112	0.26	10.62	1.69	1.05	0.09	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	40%	556	0.28	10.95	1.69	2.09	0.26	0.14	5.36	0.83	1.03	0.13
	Maneuvering	20%	278	0.32	11.85	1.69	4.19	0.75	0.04	1.45	0.21	0.51	0.09
	Hotelling	0	0										

Existing Conditions Speed Assumptions
Table D-4

Vessel	Activity	Load Factor (% of full power)	Average hours at each speed	% of time at each speed	Information Source
Cruise	Normal Cruise	80.00%	5.8	65	Interpretation Division
Ship	Slow Cruise	20.00%	1.8	20	We assume transit through whale waters to be at a slow cruise speed.
	Maneuvering	10.00%	1.4	15	to pick up and drop off rangers: 15 minutes to pick up a ranger on the way up-bay, 15 minutes to drop off on the way back and 1 hour at the glacier.
	Hotelling	10.00%	0	0	
	TOTAL HOURS IN BAY		9	100%	Cruise ships stay on their schedules more than any other vessels in the bay.
Tour	Normal Cruise	80.00%	8		The amount of time spent in the bay and amount of time spent at the different speeds varies for each concessioner.. Estimates on Sheet 1 were provided by Chris Gabriele, GLBA whale biologist.
Vessels	Slow Cruise	40.00%	2		
	Maneuvering	20.00%	1		
	Hotelling	0.00%	2		
	TOTAL HOURS IN BAY		13	100%	
Charter	Normal Cruise	80.00%	3.3	35	Info from Gustavus Marine Charters (via Marilyn Trump, GLBA, 01-10-03)
Vessels	Slow Cruise	40.00%	2.4	25	
	Maneuvering	20.00%	1.4	15	
	Hotelling	0.00%	2.4	25	
	TOTAL HOURS IN BAY		9.5	100%	
Private	Normal Cruise	80.00%	5		Included here are the estimates provided by Chris Gabriele, GLBA whale biologist
Vessels	Slow Cruise	40.00%	1.5		
	Maneuvering	20.00%	1		
	Hotelling	0.00%	2		
	TOTAL HOURS IN BAY		9.5	100%	

Baseline Cruise Ship Emissions- 2001 Emissions
Table D-5

Vessel	Activity	Actual seasonal use days[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	130	89	219	2	5.80	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	130	89	219	2	1.80	4.91	50.98	48.40	18.02	3.21
	Maneuvering	130	89	219	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	130	89	219	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	257	86	343	3	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	257	86	343	3	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	257	86	343	3	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	257	86	343	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	261	55	316	6	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	261	55	316	6	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	261	55	316	6	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	261	55	316	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private Vessels	Normal Cruise	1,603	401	2,004	25	5.00	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	1,603	401	2,004	25	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	1,603	401	2,004	25	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	1,603	401	2,004	25	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by existing vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours op for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon vessel observations from NPS staff and vessel operators and existing speed restrictions.

Baseline Cruise Ship Emissions- 2001 Emissions
Table D-5

Vessel	Activity	Actual seasonal use days[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	130	89	219	2	5.80	102.71	4,144.14	4,388.92	408.47	36.36
	Slow Cruise	130	89	219	2	1.80	17.69	183.54	174.25	64.87	11.55
	Maneuvering	130	89	219	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	130	89	219	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							136.01	4,393.30	4,614.38	511.46	57.50
TOTAL (tons)											
Tour boats	Normal Cruise	257	86	343	3	8.00	16.04	647.08	102.79	63.78	5.68
	Slow Cruise	257	86	343	3	2.00	1.06	41.66	6.42	7.97	1.00
	Maneuvering	257	86	343	3	1.00	0.15	5.64	0.80	1.99	0.35
	Hotelling	257	86	343	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							17.25	694.38	110.02	73.74	7.04
TOTAL (tons)											
Charter Vessels	Normal Cruise	261	55	316	6	3.30	6.06	244.48	38.84	24.10	2.14
	Slow Cruise	261	55	316	6	2.40	1.16	45.79	7.06	8.76	1.10
	Maneuvering	261	55	316	6	1.40	0.20	7.23	1.03	2.56	0.45
	Hotelling	261	55	316	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							7.42	297.51	46.93	35.42	3.70
TOTAL (tons)											
Private Vessels	Normal Cruise	1,603	401	2,004	25	5.00	64.44	2,599.86	413.01	256.25	22.81
	Slow Cruise	1,603	401	2,004	25	1.50	5.11	200.87	30.98	38.44	4.84
	Maneuvering	1,603	401	2,004	25	1.00	0.98	36.25	5.16	12.81	2.28
	Hotelling	1,603	401	2,004	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							70.53	2,836.98	449.15	307.51	29.93
TOTAL (tons)											
GRAND TOTAL (lbs)							231.22	8,222.17	5,220.49	928.13	98.17
GRAND TOTAL (tons)											

Baseline Cruise Ship Emissions- 2001 Emissions
Table D-5

Vessel	Activity	Actual seasonal use days[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/yr, *TPY*) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	130	89	219	2	5.80	11,247.24	453,783.33	480,587.04	44,727.06	3,981.17
	Slow Cruise	130	89	219	2	1.80	1,936.61	20,098.07	19,080.42	7,103.07	1,264.49
	Maneuvering	130	89	219	2	1.40	1,709.69	7,185.19	5,607.60	4,175.09	1,051.12
	Hotelling	130	89	219	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							14,893.54	481,066.58	505,275.06	56,005.21	6,296.78
TOTAL (tons)							*7.45*	*240.53*	*252.64*	*28.00*	*3.15*
Tour boats	Normal Cruise	257	86	343	3	8.00	1,833.69	73,982.28	11,752.83	7,292.05	649.07
	Slow Cruise	257	86	343	3	2.00	121.17	4,763.45	734.55	911.51	114.74
	Maneuvering	257	86	343	3	1.00	17.47	644.77	91.82	227.88	40.57
	Hotelling	257	86	343	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							1,972.32	79,390.50	12,579.20	8,431.43	804.37
TOTAL (tons)							*0.99*	*39.70*	*6.29*	*4.22*	*0.40*
Charter Vessels	Normal Cruise	261	55	316	6	3.30	319.14	12,876.05	2,045.49	1,269.12	112.97
	Slow Cruise	261	55	316	6	2.40	61.35	2,411.76	371.91	461.50	58.09
	Maneuvering	261	55	316	6	1.40	10.32	380.86	54.24	134.60	23.96
	Hotelling	261	55	316	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							390.80	15,668.67	2,471.63	1,865.23	195.02
TOTAL (tons)							*0.20*	*7.83*	*1.24*	*0.93*	*0.10*
Private Vessels	Normal Cruise	1,603	401	2,004	25	5.00	5,164.76	208,378.47	33,103.02	20,538.78	1,828.16
	Slow Cruise	1,603	401	2,004	25	1.50	409.53	16,100.09	2,482.73	3,080.82	387.81
	Maneuvering	1,603	401	2,004	25	1.00	78.71	2,905.71	413.79	1,026.94	182.82
	Hotelling	1,603	401	2,004	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							5,653.00	227,384.28	35,999.53	24,646.53	2,398.79
TOTAL (tons)							*2.83*	*113.69*	*18.00*	*12.32*	*1.20*
GRAND TOTAL (lbs)							22,909.66	803,510.03	556,325.43	90,948.41	9,694.97
GRAND TOTAL (tons)							*11.45*	*401.76*	*278.16*	*45.47*	*4.85*

Summary of Baseline Cruise Ship Emissions- 2001 Emissions
Table D-6

Baseline Emissions lbs/day

	PM	NOX	SO2	CO	HC
Cruise Ships	136.01	4,393.30	4,614.38	511.46	57.50
Tour Boats	17.25	694.38	110.02	73.74	7.04
Charter Vessels	7.42	297.51	46.93	35.42	3.70
Private Vessels	70.53	2,836.98	449.15	307.51	29.93
Total	231.22	8,222.17	5,220.49	928.13	98.17

Baseline Emissions TPY

	PM	NOX	SO2	CO	HC
Cruise Ships	7.45	240.53	252.64	28.00	3.15
Tour Boats	0.99	39.70	6.29	4.22	0.40
Charter Vessels	0.20	7.83	1.24	0.93	0.10
Private Vessels	2.83	113.69	18.00	12.32	1.20
Total	11.45	401.76	278.16	45.47	4.85

Estimated Cruise Ship Emissions Under Alternative 1
Table D-7

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	139	122	261	2	5.80	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	139	122	261	2	1.80	4.91	50.98	48.40	18.02	3.21
	Maneuvering	139	122	261	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	139	122	261	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	276	244	520	3	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	276	244	520	3	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	552	55	607	6	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	552	55	607	6	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	1,971	493	2,464	25	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	1,971	493	2,464	25	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	1,971	493	2,464	25	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by alterative 1 vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours of operations for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon vessel observations from NPS staff and vessel operators.

Estimated Cruise Ship Emissions Under Alternative 1
Table D-7

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	139	122	261	2	5.80	102.71	4,144.14	4,388.92	408.47	36.36
	Slow Cruise	139	122	261	2	1.80	17.69	183.54	174.25	64.87	11.55
	Maneuvering	139	122	261	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	139	122	261	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							136.01	4,393.30	4,614.38	511.46	57.50
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	16.04	647.08	102.79	63.78	5.68
	Slow Cruise	276	244	520	3	2.00	1.06	41.66	6.42	7.97	1.00
	Maneuvering	276	244	520	3	1.00	0.15	5.64	0.80	1.99	0.35
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							17.25	694.38	110.02	73.74	7.04
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	6.06	244.48	38.84	24.10	2.14
	Slow Cruise	552	55	607	6	2.40	1.16	45.79	7.06	8.76	1.10
	Maneuvering	552	55	607	6	1.40	0.20	7.23	1.03	2.56	0.45
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							7.42	297.51	46.93	35.42	3.70
TOTAL (tons)											
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	64.44	2,599.86	413.01	256.25	22.81
	Slow Cruise	1,971	493	2,464	25	1.50	5.11	200.87	30.98	38.44	4.84
	Maneuvering	1,971	493	2,464	25	1.00	0.98	36.25	5.16	12.81	2.28
	Hotelling	1,971	493	2,464	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							70.53	2,836.98	449.15	307.51	29.93
TOTAL (tons)											
GRAND TOTAL (lbs)							231.22	8,222.17	5,220.49	928.13	98.17
GRAND TOTAL (tons)											

Estimated Cruise Ship Emissions Under Alternative 1
Table D-7

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	PM	NOX	SO2	CO	HC
							Emissions (lbs/yr, *TPY*)				
Cruise Ship	Normal Cruise	139	122	261	2	5.80	13,404.24	540,810.27	572,754.41	53,304.85	4,744.68
	Slow Cruise	139	122	261	2	1.80	2,308.01	23,952.49	22,739.68	8,465.30	1,507.00
	Maneuvering	139	122	261	2	1.40	2,037.58	8,563.17	6,683.03	4,975.79	1,252.70
	Hotelling	139	122	261	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							17,749.84	573,325.93	602,177.13	66,745.94	7,504.38
TOTAL (tons)							*8.87*	*286.66*	*301.09*	*33.37*	*3.75*
Tour boats	Normal Cruise	276	244	520	3	8.00	2,779.93	112,159.72	17,817.70	11,055.00	984.01
	Slow Cruise	276	244	520	3	2.00	183.69	7,221.56	1,113.61	1,381.87	173.95
	Maneuvering	276	244	520	3	1.00	26.48	977.50	139.20	345.47	61.50
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							2,990.10	120,358.78	19,070.51	12,782.34	1,219.46
TOTAL (tons)							*1.50*	*60.18*	*9.54*	*6.39*	*0.61*
Charter Vessels	Normal Cruise	552	55	607	6	3.30	613.03	24,733.42	3,929.15	2,437.84	216.99
	Slow Cruise	552	55	607	6	2.40	117.84	4,632.72	714.39	886.49	111.59
	Maneuvering	552	55	607	6	1.40	19.82	731.59	104.18	258.56	46.03
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							750.69	30,097.73	4,747.73	3,582.89	374.61
TOTAL (tons)							*0.38*	*15.05*	*2.37*	*1.79*	*0.19*
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	6,350.43	256,215.82	40,702.47	25,253.86	2,247.85
	Slow Cruise	1,971	493	2,464	25	1.50	503.55	19,796.18	3,052.68	3,788.08	476.84
	Maneuvering	1,971	493	2,464	25	1.00	96.78	3,572.78	508.78	1,262.69	224.79
	Hotelling	1,971	493	2,464	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							6,950.76	279,584.78	44,263.93	30,304.63	2,949.48
TOTAL (tons)							*3.48*	*139.79*	*22.13*	*15.15*	*1.47*
GRAND TOTAL (lbs)							28,441.39	1,003,367.22	670,259.29	113,415.80	12,047.94
GRAND TOTAL (tons)							*14.22*	*501.68*	*335.13*	*56.71*	*6.02*

Summary of Estimated Cruise Ship Emissions Under Alternative 1
Table D-8

Alternative 1 Emissions lbs/day

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	2	136.01	4,393.30	4,614.38	511.46	57.50
Tour Boats	3	17.25	694.38	110.02	73.74	7.04
Charter Vessels	6	7.42	297.51	46.93	35.42	3.70
Private Vessels	25	70.53	2,836.98	449.15	307.51	29.93
Total		231.22	8,222.17	5,220.49	928.13	98.17

Alternative 1 Emissions TPY

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	261	8.87	286.66	301.09	33.37	3.75
Tour Boats	520	1.50	60.18	9.54	6.39	0.61
Charter Vessels	607	0.38	15.05	2.37	1.79	0.19
Private Vessels	2,464	3.48	139.79	22.13	15.15	1.47
Total		14.22	501.68	335.13	56.71	6.02
Change from Baseline		2.77	99.93	56.97	11.23	1.18
% Change from baseline		24%	25%	20%	25%	24%

Estimated Cruise Ship Emissions Under Alternative 2
Table D-9

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	107	122	229	2	5.80	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	107	122	229	2	1.80	4.91	50.98	48.40	18.02	3.21
	Maneuvering	107	122	229	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	107	122	229	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	276	244	520	3	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	276	244	520	3	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	511	55	566	6	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	511	55	566	6	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	511	55	566	6	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	511	55	566	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private and	Normal Cruise	1,714	429	2,143	25	5.00	0.52	20.80	3.30	2.05	0.18
Admin Vessels	Slow Cruise	1,714	429	2,143	25	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	1,714	429	2,143	25	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	1,714	429	2,143	25	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by alternative 2 vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours of operations for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon vessel observations from NPS staff and vessel operators.

Estimated Cruise Ship Emissions Under Alternative 2
Table D-9

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	107	122	229	2	5.80	102.71	4,144.14	4,388.92	408.47	36.36
	Slow Cruise	107	122	229	2	1.80	17.69	183.54	174.25	64.87	11.55
	Maneuvering	107	122	229	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	107	122	229	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							136.01	4,393.30	4,614.38	511.46	57.50
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	16.04	647.08	102.79	63.78	5.68
	Slow Cruise	276	244	520	3	2.00	1.06	41.66	6.42	7.97	1.00
	Maneuvering	276	244	520	3	1.00	0.15	5.64	0.80	1.99	0.35
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							17.25	694.38	110.02	73.74	7.04
TOTAL (tons)											
Charter Vessels	Normal Cruise	511	55	566	6	3.30	6.06	244.48	38.84	24.10	2.14
	Slow Cruise	511	55	566	6	2.40	1.16	45.79	7.06	8.76	1.10
	Maneuvering	511	55	566	6	1.40	0.20	7.23	1.03	2.56	0.45
	Hotelling	511	55	566	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							7.42	297.51	46.93	35.42	3.70
TOTAL (tons)											
Private and	Normal Cruise	1,714	429	2,143	25	5.00	64.44	2,599.86	413.01	256.25	22.81
Admin Vessels	Slow Cruise	1,714	429	2,143	25	1.50	5.11	200.87	30.98	38.44	4.84
	Maneuvering	1,714	429	2,143	25	1.00	0.98	36.25	5.16	12.81	2.28
	Hotelling	1,714	429	2,143	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							70.53	2,836.98	449.15	307.51	29.93
TOTAL (tons)											
GRAND TOTAL (lbs)							231.22	8,222.17	5,220.49	928.13	98.17
GRAND TOTAL (tons)											

Estimated Cruise Ship Emissions Under Alternative 2
Table D-9

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/yr, *TPY*) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	107	122	229	2	5.80	11,760.81	474,504.03	502,531.65	46,769.39	4,162.96
	Slow Cruise	107	122	229	2	1.80	2,025.04	21,015.79	19,951.67	7,427.41	1,322.23
	Maneuvering	107	122	229	2	1.40	1,787.76	7,513.28	5,863.66	4,365.73	1,099.11
	Hotelling	107	122	229	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							15,573.61	503,033.09	528,346.98	58,562.53	6,584.31
TOTAL (tons)							*7.79*	*251.52*	*264.17*	*29.28*	*3.29*
Tour boats	Normal Cruise	276	244	520	3	8.00	2,779.93	112,159.72	17,817.70	11,055.00	984.01
	Slow Cruise	276	244	520	3	2.00	183.69	7,221.56	1,113.61	1,381.87	173.95
	Maneuvering	276	244	520	3	1.00	26.48	977.50	139.20	345.47	61.50
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							2,990.10	120,358.78	19,070.51	12,782.34	1,219.46
TOTAL (tons)							*1.50*	*60.18*	*9.54*	*6.39*	*0.61*
Charter Vessels	Normal Cruise	511	55	566	6	3.30	571.62	23,062.80	3,663.76	2,273.18	202.34
	Slow Cruise	511	55	566	6	2.40	109.88	4,319.80	666.14	826.61	104.05
	Maneuvering	511	55	566	6	1.40	18.48	682.18	97.15	241.09	42.92
	Hotelling	511	55	566	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							699.98	28,064.77	4,427.04	3,340.88	349.31
TOTAL (tons)							*0.35*	*14.03*	*2.21*	*1.67*	*0.17*
Private and	Normal Cruise	1,714	429	2,143	25	5.00	5,522.39	222,807.67	35,395.24	21,960.99	1,954.76
Admin Vessels	Slow Cruise	1,714	429	2,143	25	1.50	437.89	17,214.95	2,654.64	3,294.15	414.67
	Maneuvering	1,714	429	2,143	25	1.00	84.16	3,106.92	442.44	1,098.05	195.48
	Hotelling	1,714	429	2,143	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							6,044.45	243,129.54	38,492.33	26,353.19	2,564.90
TOTAL (tons)							*3.02*	*121.56*	*19.25*	*13.18*	*1.28*
GRAND TOTAL (lbs)							25,308.14	894,586.18	590,336.86	101,038.95	10,717.97
GRAND TOTAL (tons)							*12.65*	*447.29*	*295.17*	*50.52*	*5.36*

Summary of Estimated Cruise Ship Emissions Under Alternative 2
Table D-10

Alternative 2 Emissions lbs/day

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	2	136.01	4,393.30	4,614.38	511.46	57.50
Tour Boats	3	17.25	694.38	110.02	73.74	7.04
Charter Vessels	6	7.42	297.51	46.93	35.42	3.70
Private Vessels	25	70.53	2,836.98	449.15	307.51	29.93
Total		231.22	8,222.17	5,220.49	928.13	98.17

Alternative 2 Emissions TPY

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	229	7.79	251.52	264.17	29.28	3.29
Tour Boats	520	1.50	60.18	9.54	6.39	0.61
Charter Vessels	566	0.35	14.03	2.21	1.67	0.17
Private Vessels	2,143	3.02	121.56	19.25	13.18	1.28
Total		12.65	447.29	295.17	50.52	5.36
Change from Alt 1		-1.57	-54.39	-39.96	-6.19	-0.66
Change from Baseline		1.20	45.54	17.01	5.05	0.51
% Change from baseline		10%	11%	6%	11%	11%

Estimated Cruise Ship Emissions Under Alternative 3
Table D-11

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	184	122	306	2	5.80	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	184	122	306	2	1.80	4.91	50.98	48.40	18.02	3.21
	Maneuvering	184	122	306	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	184	122	306	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	368	183	551	3	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	368	183	551	3	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	368	183	551	3	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	368	183	551	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	552	55	607	6	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	552	55	607	6	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	1,971	493	2,464	25	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	1,971	493	2,464	25	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	1,971	493	2,464	25	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by alterative 3 vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours of operations for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon vessel observations from NPS staff and vessel operators.

Estimated Cruise Ship Emissions Under Alternative 3
Table D-11

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	184	122	306	2	5.80	102.71	4,144.14	4,388.92	408.47	36.36
	Slow Cruise	184	122	306	2	1.80	17.69	183.54	174.25	64.87	11.55
	Maneuvering	184	122	306	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	184	122	306	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							136.01	4,393.30	4,614.38	511.46	57.50
TOTAL (tons)											
Tour boats	Normal Cruise	368	183	551	3	8.00	16.04	647.08	102.79	63.78	5.68
	Slow Cruise	368	183	551	3	2.00	1.06	41.66	6.42	7.97	1.00
	Maneuvering	368	183	551	3	1.00	0.15	5.64	0.80	1.99	0.35
	Hotelling	368	183	551	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							17.25	694.38	110.02	73.74	7.04
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	6.06	244.48	38.84	24.10	2.14
	Slow Cruise	552	55	607	6	2.40	1.16	45.79	7.06	8.76	1.10
	Maneuvering	552	55	607	6	1.40	0.20	7.23	1.03	2.56	0.45
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							7.42	297.51	46.93	35.42	3.70
TOTAL (tons)											
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	64.44	2,599.86	413.01	256.25	22.81
	Slow Cruise	1,971	493	2,464	25	1.50	5.11	200.87	30.98	38.44	4.84
	Maneuvering	1,971	493	2,464	25	1.00	0.98	36.25	5.16	12.81	2.28
	Hotelling	1,971	493	2,464	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							70.53	2,836.98	449.15	307.51	29.93
TOTAL (tons)											
GRAND TOTAL (lbs)							231.22	8,222.17	5,220.49	928.13	98.17
GRAND TOTAL (tons)											

Estimated Cruise Ship Emissions Under Alternative 3
Table D-11

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/yr, *TPY*) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	184	122	306	2	5.80	15,715.32	634,053.42	671,505.17	62,495.34	5,562.73
	Slow Cruise	184	122	306	2	1.80	2,705.95	28,082.23	26,660.31	9,924.84	1,766.83
	Maneuvering	184	122	306	2	1.40	2,388.89	10,039.58	7,835.28	5,833.68	1,468.68
	Hotelling	184	122	306	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							20,810.15	672,175.23	706,000.77	78,253.86	8,798.24
TOTAL (tons)							*10.41*	*336.09*	*353.00*	*39.13*	*4.40*
Tour boats	Normal Cruise	368	183	551	3	8.00	2,945.66	118,846.16	18,879.91	11,714.05	1,042.67
	Slow Cruise	368	183	551	3	2.00	194.64	7,652.08	1,179.99	1,464.26	184.32
	Maneuvering	368	183	551	3	1.00	28.06	1,035.77	147.50	366.06	65.17
	Hotelling	368	183	551	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							3,168.36	127,534.02	20,207.40	13,544.37	1,292.16
TOTAL (tons)							*1.58*	*63.77*	*10.10*	*6.77*	*0.65*
Charter Vessels	Normal Cruise	552	55	607	6	3.30	613.03	24,733.42	3,929.15	2,437.84	216.99
	Slow Cruise	552	55	607	6	2.40	117.84	4,632.72	714.39	886.49	111.59
	Maneuvering	552	55	607	6	1.40	19.82	731.59	104.18	258.56	46.03
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							750.69	30,097.73	4,747.73	3,582.89	374.61
TOTAL (tons)							*0.38*	*15.05*	*2.37*	*1.79*	*0.19*
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	6,350.43	256,215.82	40,702.47	25,253.86	2,247.85
	Slow Cruise	1,971	493	2,464	25	1.50	503.55	19,796.18	3,052.68	3,788.08	476.84
	Maneuvering	1,971	493	2,464	25	1.00	96.78	3,572.78	508.78	1,262.69	224.79
	Hotelling	1,971	493	2,464	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							6,950.76	279,584.78	44,263.93	30,304.63	2,949.48
TOTAL (tons)							*3.48*	*139.79*	*22.13*	*15.15*	*1.47*
GRAND TOTAL (lbs)							31,679.96	1,109,391.76	775,219.83	125,685.75	13,414.50
GRAND TOTAL (tons)							*15.84*	*554.70*	*387.61*	*62.84*	*6.71*

Summary of Estimated Cruise Ship Emissions Under Alternative 3
Table D-12

Alternative 3 Emissions lbs/day

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	2	136.01	4,393.30	4,614.38	511.46	57.50
Tour Boats	3	17.25	694.38	110.02	73.74	7.04
Charter Vessels	6	7.42	297.51	46.93	35.42	3.70
Private Vessels	25	70.53	2,836.98	449.15	307.51	29.93
Total		231.22	8,222.17	5,220.49	928.13	98.17

Alternative 3 Emissions TPY

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	306	10.41	336.09	353.00	39.13	4.40
Tour Boats	551	1.58	63.77	10.10	6.77	0.65
Charter Vessels	607	0.38	15.05	2.37	1.79	0.19
Private Vessels	2,464	3.48	139.79	22.13	15.15	1.47
Total		15.84	554.70	387.61	62.84	6.71
Change from Alt 1		1.62	53.01	52.48	6.13	0.68
Change from Baseline		4.39	152.94	109.45	17.37	1.86
% Change from baseline		38%	38%	39%	38%	38%

Estimated Cruise Ship Emissions Under Alternative 4
Table D-13

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	92	61	153	2	0.00	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	92	61	153	2	13.40	4.91	50.98	48.40	18.02	3.21
	Maneuvering	92	61	153	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	92	61	153	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	184	183	367	2	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	184	183	367	2	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	184	183	367	2	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	184	183	367	2	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	460	55	515	5	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	460	55	515	5	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	460	55	515	5	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	460	55	515	5	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private Vessels	Normal Cruise	2,024	506	2,530	22	5.00	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	2,024	506	2,530	22	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	2,024	506	2,530	22	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	2,024	506	2,530	22	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by alterative 4 vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours of operations for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon existing vessel observations from NPS staff and vessel operators and proposed speed restrictions that would require that vessels remained at slow cruise in the Bay. Speed reductions would require additional time in the Bay, so total time spent by cruise ships entering and leaving the bay at a slow cruise was increased by 100% (doubled)

Estimated Cruise Ship Emissions Under Alternative 4
Table D-13

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	92	61	153	2	0.00	0.00	0.00	0.00	0.00	0.00
	Slow Cruise	92	61	153	2	13.40	131.66	1,366.38	1,297.20	482.91	85.97
	Maneuvering	92	61	153	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	92	61	153	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							147.28	1,432.00	1,348.41	521.04	95.57
TOTAL (tons)											
Tour boats	Normal Cruise	184	183	367	2	8.00	10.69	431.38	68.53	42.52	3.78
	Slow Cruise	184	183	367	2	2.00	0.71	27.78	4.28	5.31	0.67
	Maneuvering	184	183	367	2	1.00	0.10	3.76	0.54	1.33	0.24
	Hotelling	184	183	367	2	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							11.50	462.92	73.35	49.16	4.69
TOTAL (tons)											
Charter Vessels	Normal Cruise	460	55	515	5	3.30	5.05	203.73	32.37	20.08	1.79
	Slow Cruise	460	55	515	5	2.40	0.97	38.16	5.88	7.30	0.92
	Maneuvering	460	55	515	5	1.40	0.16	6.03	0.86	2.13	0.38
	Hotelling	460	55	515	5	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							6.18	247.92	39.11	29.51	3.09
TOTAL (tons)											
Private Vessels	Normal Cruise	2,024	506	2,530	22	5.00	56.71	2,287.87	363.45	225.50	20.07
	Slow Cruise	2,024	506	2,530	22	1.50	4.50	176.77	27.26	33.83	4.26
	Maneuvering	2,024	506	2,530	22	1.00	0.86	31.90	4.54	11.28	2.01
	Hotelling	2,024	506	2,530	22	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							62.07	2,496.55	395.25	270.60	26.34
TOTAL (tons)											
GRAND TOTAL (lbs)							227.03	4,639.39	1,856.12	870.32	129.68
GRAND TOTAL (tons)											

Estimated Cruise Ship Emissions Under Alternative 4
Table D-13

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/yr, *TPY*) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	92	61	153	2	0.00	0.00	0.00	0.00	0.00	0.00
	Slow Cruise	92	61	153	2	13.40	10,072.14	104,528.30	99,235.60	36,942.46	6,576.52
	Maneuvering	92	61	153	2	1.40	1,194.44	5,019.79	3,917.64	2,916.84	734.34
	Hotelling	92	61	153	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							11,266.58	109,548.09	103,153.24	39,859.30	7,310.86
TOTAL (tons)							*5.63*	*54.77*	*51.58*	*19.93*	*3.66*
Tour boats	Normal Cruise	184	183	367	2	8.00	1,961.99	79,158.88	12,575.19	7,802.28	694.48
	Slow Cruise	184	183	367	2	2.00	129.64	5,096.76	785.95	975.28	122.77
	Maneuvering	184	183	367	2	1.00	18.69	689.89	98.24	243.82	43.41
	Hotelling	184	183	367	2	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							2,110.32	84,945.53	13,459.38	9,021.38	860.66
TOTAL (tons)							*1.06*	*42.47*	*6.73*	*4.51*	*0.43*
Charter Vessels	Normal Cruise	460	55	515	5	3.30	520.12	20,984.70	3,333.63	2,068.35	184.10
	Slow Cruise	460	55	515	5	2.40	99.98	3,930.56	606.11	752.13	94.68
	Maneuvering	460	55	515	5	1.40	16.81	620.71	88.39	219.37	39.05
	Hotelling	460	55	515	5	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							636.91	25,535.97	4,028.14	3,039.85	317.83
TOTAL (tons)							*0.32*	*12.77*	*2.01*	*1.52*	*0.16*
Private Vessels	Normal Cruise	2,024	506	2,530	22	5.00	6,521.19	263,105.44	41,796.95	25,932.93	2,308.30
	Slow Cruise	2,024	506	2,530	22	1.50	517.09	20,328.50	3,134.77	3,889.94	489.66
	Maneuvering	2,024	506	2,530	22	1.00	99.38	3,668.85	522.46	1,296.65	230.83
	Hotelling	2,024	506	2,530	22	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							7,137.66	287,102.79	45,454.18	31,119.52	3,028.79
TOTAL (tons)							*3.57*	*143.55*	*22.73*	*15.56*	*1.51*
GRAND TOTAL (lbs)							21,151.48	507,132.37	166,094.94	83,040.05	11,518.15
GRAND TOTAL (tons)							*10.58*	*253.57*	*83.05*	*41.52*	*5.76*

Summary of Estimated Cruise Ship Emissions Under Alternative 4
Table D-14

Alternative 4 Emissions lbs/day

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	2	147.28	1,432.00	1,348.41	521.04	95.57
Tour Boats	2	11.50	462.92	73.35	49.16	4.69
Charter Vessels	5	6.18	247.92	39.11	29.51	3.09
Private Vessels	22	62.07	2,496.55	395.25	270.60	26.34
Total		227.03	4,639.39	1,856.12	870.32	129.68

Alternative 4 Emissions TPY

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	153	5.63	54.77	51.58	19.93	3.66
Tour Boats	367	1.06	42.47	6.73	4.51	0.43
Charter Vessels	515	0.32	12.77	2.01	1.52	0.16
Private Vessels	2,530	3.57	143.55	22.73	15.56	1.51
Total		10.58	253.57	83.05	41.52	5.76
Change from Alt 1		-3.64	-248.12	-252.08	-15.19	-0.26
Change from Baseline		-0.88	-148.19	-195.12	-3.95	0.91
% Change from baseline		-8%	-37%	-70%	-9%	19%

Estimated Cruise Ship Emissions Under Alternative 5
Table D-15

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	139	92	231	2	0.00	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	139	92	231	2	13.40	4.91	50.98	48.40	18.02	3.21
	Maneuvering	139	92	231	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	139	92	231	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	276	244	520	3	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	276	244	520	3	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	552	55	607	6	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	552	55	607	6	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private Vessels	Normal Cruise	2,300	575	2,875	25	5.00	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	2,300	575	2,875	25	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	2,300	575	2,875	25	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	2,300	575	2,875	25	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by alterative 5 vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours of operations for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon existing vessel observations from NPS staff and vessel operators and proposed speed restrictions that would require that vessels remained at slow cruise in the Bay. Speed reductions would require additional time in the Bay, so total time spent by cruise ships entering and leaving the bay at a slow cruise was increased by 100% (doubled)

Estimated Cruise Ship Emissions Under Alternative 5
Table D-15

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	139	92	231	2	0.00	0.00	0.00	0.00	0.00	0.00
	Slow Cruise	139	92	231	2	13.40	131.66	1,366.38	1,297.20	482.91	85.97
	Maneuvering	139	92	231	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	139	92	231	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							147.28	1,432.00	1,348.41	521.04	95.57
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	16.04	647.08	102.79	63.78	5.68
	Slow Cruise	276	244	520	3	2.00	1.06	41.66	6.42	7.97	1.00
	Maneuvering	276	244	520	3	1.00	0.15	5.64	0.80	1.99	0.35
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							17.25	694.38	110.02	73.74	7.04
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	6.06	244.48	38.84	24.10	2.14
	Slow Cruise	552	55	607	6	2.40	1.16	45.79	7.06	8.76	1.10
	Maneuvering	552	55	607	6	1.40	0.20	7.23	1.03	2.56	0.45
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							7.42	297.51	46.93	35.42	3.70
TOTAL (tons)											
Private Vessels	Normal Cruise	2,300	575	2,875	25	5.00	64.44	2,599.86	413.01	256.25	22.81
	Slow Cruise	2,300	575	2,875	25	1.50	5.11	200.87	30.98	38.44	4.84
	Maneuvering	2,300	575	2,875	25	1.00	0.98	36.25	5.16	12.81	2.28
	Hotelling	2,300	575	2,875	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							70.53	2,836.98	449.15	307.51	29.93
TOTAL (tons)											
GRAND TOTAL (lbs)							242.48	5,260.87	1,954.51	937.70	136.23
GRAND TOTAL (tons)											

Estimated Cruise Ship Emissions Under Alternative 5
Table D-15

							Emissions (lbs/yr, *TPY*)				
Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	139	92	231	2	0.00	0.00	0.00	0.00	0.00	0.00
	Slow Cruise	139	92	231	2	13.40	15,206.95	157,817.24	149,826.30	55,775.86	9,929.26
	Maneuvering	139	92	231	2	1.40	1,803.38	7,578.90	5,914.87	4,403.86	1,108.71
	Hotelling	139	92	231	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							17,010.33	165,396.13	155,741.17	60,179.72	11,037.97
TOTAL (tons)							*8.51*	*82.70*	*77.87*	*30.09*	*5.52*
Tour boats	Normal Cruise	276	244	520	3	8.00	2,779.93	112,159.72	17,817.70	11,055.00	984.01
	Slow Cruise	276	244	520	3	2.00	183.69	7,221.56	1,113.61	1,381.87	173.95
	Maneuvering	276	244	520	3	1.00	26.48	977.50	139.20	345.47	61.50
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							2,990.10	120,358.78	19,070.51	12,782.34	1,219.46
TOTAL (tons)							*1.50*	*60.18*	*9.54*	*6.39*	*0.61*
Charter Vessels	Normal Cruise	552	55	607	6	3.30	613.03	24,733.42	3,929.15	2,437.84	216.99
	Slow Cruise	552	55	607	6	2.40	117.84	4,632.72	714.39	886.49	111.59
	Maneuvering	552	55	607	6	1.40	19.82	731.59	104.18	258.56	46.03
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							750.69	30,097.73	4,747.73	3,582.89	374.61
TOTAL (tons)							*0.38*	*15.05*	*2.37*	*1.79*	*0.19*
Private Vessels	Normal Cruise	2,300	575	2,875	25	5.00	7,410.45	298,983.46	47,496.54	29,469.24	2,623.07
	Slow Cruise	2,300	575	2,875	25	1.50	587.60	23,100.57	3,562.24	4,420.39	556.44
	Maneuvering	2,300	575	2,875	25	1.00	112.93	4,169.15	593.71	1,473.46	262.31
	Hotelling	2,300	575	2,875	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							8,110.98	326,253.17	51,652.48	35,363.09	3,441.81
TOTAL (tons)							*4.06*	*163.13*	*25.83*	*17.68*	*1.72*
GRAND TOTAL (lbs)							28,862.10	642,105.82	231,211.89	111,908.05	16,073.85
GRAND TOTAL (tons)							*14.43*	*321.05*	*115.61*	*55.95*	*8.04*

Summary of Estimated Cruise Ship Emissions Under Alternative 5
Table D-16

Alternative 5 Emissions lbs/day

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	2	147.28	1,432.00	1,348.41	521.04	95.57
Tour Boats	3	17.25	694.38	110.02	73.74	7.04
Charter Vessels	6	7.42	297.51	46.93	35.42	3.70
Private Vessels	25	70.53	2,836.98	449.15	307.51	29.93
Total		242.48	5,260.87	1,954.51	937.70	136.23

Alternative 5 Emissions TPY

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	231	8.51	82.70	77.87	30.09	5.52
Tour Boats	520	1.50	60.18	9.54	6.39	0.61
Charter Vessels	607	0.38	15.05	2.37	1.79	0.19
Private Vessels	2,875	4.06	163.13	25.83	17.68	1.72
Total		14.43	321.05	115.61	55.95	8.04
Change from Alt 1		0.21	-180.63	-219.52	-0.75	2.01
Change from Baseline		2.98	-80.70	-162.56	10.48	3.19
% Change from baseline		26%	-20%	-58%	23%	66%

Estimated Cruise Ship Emissions Under Alternative 6
Table D-17

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	184	122	306	2	0.00	8.85	357.25	378.36	35.21	3.13
	Slow Cruise	184	122	306	2	13.40	4.91	50.98	48.40	18.02	3.21
	Maneuvering	184	122	306	2	1.40	5.58	23.44	18.29	13.62	3.43
	Hotelling	184	122	306	2	0.00	5.34	15.86	12.38	9.22	2.32
TOTAL(lbs)											
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	276	244	520	3	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	276	244	520	3	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	0.31	12.35	1.96	1.22	0.11
	Slow Cruise	552	55	607	6	2.40	0.08	3.18	0.49	0.61	0.08
	Maneuvering	552	55	607	6	1.40	0.02	0.86	0.12	0.30	0.05
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	0.52	20.80	3.30	2.05	0.18
	Slow Cruise	1,971	493	2,464	25	1.50	0.14	5.36	0.83	1.03	0.13
	Maneuvering	1,971	493	2,464	25	1.00	0.04	1.45	0.21	0.51	0.09
	Hotelling	1,971	493	2,464	25	2.00					
TOTAL											
TOTAL (tons)											
GRAND TOTAL (lbs)											
GRAND TOTAL (tons)											

Notes:
1. Seasonal use day numbers established by alterative 6 vessel quotas.
2. Data based upon existing totals provided by the NPS for 2001 operations. Private vessel data is assumed to be one quarter the seasonal number.
3. Assumes 9 hours of operations for cruise ships (based upon 2001 average), 13 hours for tour vessels (based upon 2001 average) and 9.5 for others.
4. Average time in mode values are based upon existing vessel observations from NPS staff and vessel operators and proposed speed restrictions that would require that vessels remained at slow cruise in the Bay. Speed reductions would require additional time in the Bay, so total time spent by cruise ships entering and leaving the bay at a slow cruise was increased by 100% (doubled)

Estimated Cruise Ship Emissions Under Alternative 6
Table D-17

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	184	122	306	2	0.00	0.00	0.00	0.00	0.00	0.00
	Slow Cruise	184	122	306	2	13.40	131.66	1,366.38	1,297.20	482.91	85.97
	Maneuvering	184	122	306	2	1.40	15.61	65.62	51.21	38.13	9.60
	Hotelling	184	122	306	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							147.28	1,432.00	1,348.41	521.04	95.57
TOTAL (tons)											
Tour boats	Normal Cruise	276	244	520	3	8.00	16.04	647.08	102.79	63.78	5.68
	Slow Cruise	276	244	520	3	2.00	1.06	41.66	6.42	7.97	1.00
	Maneuvering	276	244	520	3	1.00	0.15	5.64	0.80	1.99	0.35
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							17.25	694.38	110.02	73.74	7.04
TOTAL (tons)											
Charter Vessels	Normal Cruise	552	55	607	6	3.30	6.06	244.48	38.84	24.10	2.14
	Slow Cruise	552	55	607	6	2.40	1.16	45.79	7.06	8.76	1.10
	Maneuvering	552	55	607	6	1.40	0.20	7.23	1.03	2.56	0.45
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							7.42	297.51	46.93	35.42	3.70
TOTAL (tons)											
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	64.44	2,599.86	413.01	256.25	22.81
	Slow Cruise	1,971	493	2,464	25	1.50	5.11	200.87	30.98	38.44	4.84
	Maneuvering	1,971	493	2,464	25	1.00	0.98	36.25	5.16	12.81	2.28
	Hotelling	1,971	493	2,464	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							70.53	2,836.98	449.15	307.51	29.93
TOTAL (tons)											
GRAND TOTAL (lbs)							242.48	5,260.87	1,954.51	937.70	136.23
GRAND TOTAL (tons)											

Estimated Cruise Ship Emissions Under Alternative 6
Table D-17

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/yr, *TPY*) PM	NOX	SO2	CO	HC
Cruise Ship	Normal Cruise	184	122	306	2	0.00	0.00	0.00	0.00	0.00	0.00
	Slow Cruise	184	122	306	2	13.40	20,144.27	209,056.60	198,471.21	73,884.91	13,153.04
	Maneuvering	184	122	306	2	1.40	2,388.89	10,039.58	7,835.28	5,833.68	1,468.68
	Hotelling	184	122	306	2	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL(lbs)							22,533.16	219,096.18	206,306.49	79,718.60	14,621.73
TOTAL (tons)							*11.27*	*109.55*	*103.15*	*39.86*	*7.31*
Tour boats	Normal Cruise	276	244	520	3	8.00	2,779.93	112,159.72	17,817.70	11,055.00	984.01
	Slow Cruise	276	244	520	3	2.00	183.69	7,221.56	1,113.61	1,381.87	173.95
	Maneuvering	276	244	520	3	1.00	26.48	977.50	139.20	345.47	61.50
	Hotelling	276	244	520	3	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							2,990.10	120,358.78	19,070.51	12,782.34	1,219.46
TOTAL (tons)							*1.50*	*60.18*	*9.54*	*6.39*	*0.61*
Charter Vessels	Normal Cruise	552	55	607	6	3.30	613.03	24,733.42	3,929.15	2,437.84	216.99
	Slow Cruise	552	55	607	6	2.40	117.84	4,632.72	714.39	886.49	111.59
	Maneuvering	552	55	607	6	1.40	19.82	731.59	104.18	258.56	46.03
	Hotelling	552	55	607	6	2.40	0.00	0.00	0.00	0.00	0.00
TOTAL							750.69	30,097.73	4,747.73	3,582.89	374.61
TOTAL (tons)							*0.38*	*15.05*	*2.37*	*1.79*	*0.19*
Private Vessels	Normal Cruise	1,971	493	2,464	25	5.00	6,350.43	256,215.82	40,702.47	25,253.86	2,247.85
	Slow Cruise	1,971	493	2,464	25	1.50	503.55	19,796.18	3,052.68	3,788.08	476.84
	Maneuvering	1,971	493	2,464	25	1.00	96.78	3,572.78	508.78	1,262.69	224.79
	Hotelling	1,971	493	2,464	25	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							6,950.76	279,584.78	44,263.93	30,304.63	2,949.48
TOTAL (tons)							*3.48*	*139.79*	*22.13*	*15.15*	*1.47*
GRAND TOTAL (lbs)							33,224.71	649,137.47	274,388.66	126,388.46	19,165.28
GRAND TOTAL (tons)							*16.61*	*324.57*	*137.19*	*63.19*	*9.58*

Summary of Estimated Cruise Ship Emissions Under Alternative 6
Table D-18

Alternative 6 Emissions lbs/day

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	2	147.28	1,432.00	1,348.41	521.04	95.57
Tour Boats	3	17.25	694.38	110.02	73.74	7.04
Charter Vessels	6	7.42	297.51	46.93	35.42	3.70
Private Vessels	25	70.53	2,836.98	449.15	307.51	29.93
Total		242.48	5,260.87	1,954.51	937.70	136.23

Alternative 6 Emissions TPY

	Quota	PM	NOX	SO2	CO	HC
Cruise Ships	306	11.27	109.55	103.15	39.86	7.31
Tour Boats	520	1.50	60.18	9.54	6.39	0.61
Charter Vessels	607	0.38	15.05	2.37	1.79	0.19
Private Vessels	2,464	3.48	139.79	22.13	15.15	1.47
Total		16.61	324.57	137.19	63.19	9.58
Change from Alt 1		2.39	-177.11	-197.94	6.49	3.56
Change from Baseline		5.16	-77.19	-140.97	17.72	4.74
% Change from baseline		45%	-19%	-51%	39%	98%

ESTIMATED CUMULATIVE EMISSIONS

EMISSIONS FROM BARTLETT COVE FERRY

TABLE D-19

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/hr) PM	NOX	SO2	CO	HC
Bartlett Cove Ferry	Normal Cruise	92	0	92	1	8.00	0.67	26.96	4.28	2.66	0.24
	Slow Cruise	92	0	92	1	2.00	0.18	6.94	1.07	1.33	0.17
	Maneuvering	92	0	92	1	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	92	0	92	1	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL											
TOTAL (tons)											

ESTIMATED CUMULATIVE EMISSIONS

EMISSIONS FROM BARTLETT COVE FERRY

TABLE D-19

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/day) PM	NOX	SO2	CO	HC
Bartlett Cove	Normal Cruise	92	0	92	1	8.00	5.35	215.69	34.26	21.26	1.89
Ferry	Slow Cruise	92	0	92	1	2.00	0.35	13.89	2.14	2.66	0.33
	Maneuvering	92	0	92	1	1.00	0.05	1.88	0.27	0.66	0.12
	Hotelling	92	0	92	1	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							5.75	231.46	36.67	24.58	2.35
TOTAL (tons)											

ESTIMATED CUMULATIVE EMISSIONS

EMISSIONS FROM BARTLETT COVE FERRY
TABLE D-19

Vessel	Activity	13.65(b) Seasonal use days Max[1]	Off-season use days[2]	Total Annual use days	13.65(b) daily max	Average daily hours of operation[3,4]	Emissions (lbs/yr, *TPY*) PM	NOX	SO2	CO	HC
Bartlett Cove	Normal Cruise	92	0	92	1	8.00	491.83	19,843.64	3,152.36	1,955.88	174.09
Ferry	Slow Cruise	92	0	92	1	2.00	32.50	1,277.66	197.02	244.49	30.78
	Maneuvering	92	0	92	1	1.00	4.68	172.94	24.63	61.12	10.88
	Hotelling	92	0	92	1	2.00	0.00	0.00	0.00	0.00	0.00
TOTAL							529.02	21,294.25	3,374.01	2,261.49	215.75
TOTAL (tons)							*0.26*	*10.65*	*1.69*	*1.13*	*0.11*

Notes:

1. Emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories, Table J-1 (Armstrong Laboratory 1994).
2. Total daily fuel use and oeprational information provided by Forrest Welden by e-mail, 12/2002
3. One 275 KW generator, operated 24 hours per day
4. One 165 KW generator, operated 24 hours per day

EMISSIONS FROM DIESEL GENERATORS AT BARTLETT COVE

TABLE D-20

EMISSIONS FROM DIESEL GENERATORS AT BARTLETT COVE							
	NO_x	VOC	CO	SO_2	$PM_{2.5}$	PM_{10}	PM
Emission Factor (lbs/1000 gal)[1]	604	49.3	130	39.7	32	32	42.5
Fuel burned (gal)[2]							
Daily, May-Sept[3]	260	260	260	260	260	260	260
Daily, Oct-Sept[4]	160	160	160	160	160	160	160
Annual	73700	73700	73700	73700	73700	73700	73700
Emissions (lbs)							
Daily, May-Sept	157.04	12.818	33.8	10.322	8.32	8.32	11.05
Daily, Oct-Sept	96.64	7.888	20.8	6.352	5.12	5.12	6.8
Annual	44514.8	3633.41	9581	2925.89	2358.4	2358.4	3132.25
Annual Emissions (tons per year)	*22.26*	*1.82*	*4.79*	*1.46*	*1.18*	*1.18*	*1.57*

Notes:

1. Emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories, Table J-1 (Armstrong Laboratory 1994).
2. Total daily fuel use and oeprational information provided by Forrest Welden by e-mail, 12/2002
3. One 275 KW generator, operated 24 hours per day
4. One 165 KW generator, operated 24 hours per day

TOTAL CALCULATED CUMULATIVE EMISSIONS

	PM	NOX	SO2	CO	HC
Bartlett Cove Ferry	0.26	10.65	1.69	1.13	0.11
Generators	1.57	22.26	1.46	4.79	1.82
TOTAL	1.83	32.90	3.15	5.92	1.92

APPENDIX E

Vessel Use Data and Incident Reports

Matrix To Identify Glacier Bay Administrative Use

Unless specified in writing all park regulations apply to administrative vessel use.

Draft

Recommendation For Administrative Vessel Use	**Yes**	**No**
Category		
Project Description		
Dates Requested		
Level I (Park Goals) If Yes, go to next level. If No, consider denying use.	**Yes**	**No**
Does the requested activity meet one of the park's Government Performance and Results Act (GPRA) goals?		

Level II (Reasonable Accommodation) If Yes in any of the categories, go to next level. If No in all categories, consider denying use.	**Yes**	**No**
Is there an alternative available for conducting the activity that would not require use of an administrative vessel?		
Are there extenuating circumstances specific to this activity that justify an Administrative entry such as:		
Activity is critical to a park mission or goal.		
Alternative(s) would be cost prohibitive.		
Activity is the result of an emergency or safety related issue.		
Alternative(s) would be un-reasonable.		

Activity addresses visitor accessibility.		
Activity fosters Agency to Agency or State to State relations.		
Activity requires specific expertize that can not be found in the public sector?		

Level III (Impacts) If Yes in any category, go to next level. If No in all categories, consider authorizing the use.	**Yes**	**No**
Would the activity result in adverse effects on public health or safety?		
Would the activity result in significant adverse effects on historic or cultural resources, park lands, wilderness areas, sole or principal driking water, wetlands, floodplains, or ecologically significant critical areas, including those listed on the National Register of Natural Landmarks?		
Would the activity have highly controversial or significant environmental effects?		
Would the activity involve unique or unkown environmental risks?		
Establish a precedent for future action or represent a decision about future actions that would involve potentially significant environmental effects?		
Have adverse effects on species listed or proposed to be listed on the list of Endangered or Threatened Species, or have adverse effects on designated Critical Habitat for these species?		
Threaten to violate a federal, state, local, or tribal law or requirement imposed for the protection of the environment?		
Require compliance with Executive Order 11988 (Floodplain Management), Excecutive Order 11990 (Protection of Wetlands), or the Fish and Wildlife Coordination Act?		
Restrict access to and ceremonial use of Indian sacred sites by Indian religious practitioners or adversely affect the physical integrity of such sacred sites?		
Contribute to the introduction, continued existence, or spread of federally listed noxious weeds?		

	Yes	No
Have adverse effects on properties listed or eligible for listing on the National Register of Historic Places?		
Have the potential to violate the NPS Organic Act by impairing park resources or values?		
Be directly related to other activities with individually insignificant but cumulatively significant environmental effects?		

Level IV (Consequences) If Yes in any category, consider authorizing the use. If No, consider denying the request.	**Yes**	**No**
Would the consequences of not allowing the activity to take place result in the following…		
Greater damage to park resources?		
Loss of available information for making management decisions that would protect the park's resources or provide for visitor enjoyment?		
Detriment to public education?		
Detriment to Agency to Agency or State to State relations?		
Others???		

Recommendation For Administrative Vessel Use	**Yes**	**No**

Activities that are recommended for administrative use but also require an exception to a park regulation must also be evaluated under the Waiver to Park Regulations Decision Document.

2001 GLACIER BAY NATIONAL PARK RECREATIONAL BOATER REPORT

DAYS AT MAXIMUM USE

Month	Days at Max Use
June, 2001	0
July, 2001	1
lAugust, 2001	0

PERMIT ENTRIES BY YEAR

Year	Total Entries	General Entries	Local Entries
1998	412	348	64
1999	418	331	87
2000	414	356	58
2001	385	323	62

PERMIT ENTRY TYPES BY MONTH FOR YEAR

Year	Permit Type	Total	June	July	August
1998	General	348	104	144	100
1998	Local	64	29	28	7
1999	General	331	114	145	72
1999	Local	87	33	29	25
2000	General	356	106	146	104
2000	Local	58	26	14	18
2001	General	323	96	139	88
2001	Local	62	29	19	14

GENERAL PERMIT STATUS

Year	Permit Type	Permit Status	Total	June	July	August
2001	General	Canceled	49	13	26	9
2001	General	Denied	11	1	1	
2001	General	Departed	323	96	139	88
2001	General	No Show	27	3	10	13

LOCAL PERMIT STATUS

Year	Permit Type	Permit Status	Total	June	July	August
2001	General	Canceled	3	1	2	
2001	General	Denied				
2001	General	Departed	62	29	19	14

LOCAL CATEGORIES

Year	Local Category	Count
2001	Elfin	1
2001	GBL	8
2001	Gustavus	22
2001	NPS	30
2001	Others	1

GENERAL PERMITS GIVEN TO LOCAL BOATERS

NOTE: 33 local boaters were given general permits in 2001

Year	General locals	Count	Single Use Day Entries	Multiple Use Day Entries
2001	Elfin Cove	2	18	14
2001	Hoonah	3		
2001	Gustavus	28		

DAY BOATERS (includes General and Local Permits)

Year	Category	Total	June	July	August
2001	Boat Use Days	239	94	65	80
2001	Visitors	678	250	192	236
2001	Fuel only entries	9	6	2	1

USE DAYS BY MONTH BY YEAR

Month	General Use	Local Use	Total Use
June, 2001	428	79	507
July, 2001	604	72	676
August, 2001	355	65	420

USE DAY ENTRIES BY YEAR

Year	General Use Days	Local Use Days	Total Use Days	General Entries	Local Entries	Total Entries
1998	1440	242	1682	348	64	412
1999	1375	358	1733	331	87	418
2000	1454	213	1667	356	58	414
2001	1387	216	1603	322	62	384

GENERAL PERMITS BY STATE/PROVINCE FOR MONTH FOR YEAR

Year	Permit Type	State/ Province	Total	June	July	August
2001	General	Alaska	122	37	42	43
2001	General	Washington	79	32	34	13
2001	General	California	22	2	15	5
2001	General	Oregon	22	6	11	5
2001	General	Delaware	5		3	2
2001	General	Nevada	5	3	2	
2001	General	Florida	4		3	1
2001	General	Texas	4		3	1
2001	General	Colorado	3		2	1
2001	General	Connecticut	3			3
2001	General	British Columbia	1		1	
2001	General	Hawaii	1		1	
2001	General	Montana	1	1		
2001	General	New Mexico	1			1

GENERAL PERMITS PORT- COUNTRY

Year	Permit Type	MV Port Country	Total	June	July	August
2001	General	Canada	27	10	12	5
2001	General	United Kingdom	5	2	1	2
2001	General	Cayman Islands	4	0	4	0
2001	General	Virgin Islands (British)	4	0	1	3
2001	General	Bermuda	3	1	1	1
2001	General	Belize	2	0	1	1
2001	General	Germany	1	0	1	0
2001	General	Ireland	1	1	0	0

MOTOR VESSELL USE TYPE

Year	Permit Type	MV Use Type	Total	June	July	August
2001	General	Bareboat	49	18	16	15
2001	General	Charter	9	0	3	6
2001	General	Commercial Fishing	4	0	3	1
2001	General	Corporate	32	6	17	9
2001	General	Government	2	0	0	2
2001	General	Private	226	72	100	54
2001	Local	Bareboat	1	1	0	0
2001	Local	Charter	8	5	2	1
2001	Local	Commercial Fishing	1	0	1	0
2001	Local	Corporate	7	2	1	4
2001	Local	Government	12	7	0	5
2001	Local	Private	33	14	15	4

GENERAL PERMIT VISITOR USE DAYS BY MONTH FOR YEAR

Month	Crew	Passengers	Visitors	Visitor Use Days	Days of Stay (Average)
June, 2001	130	149	279	1254	4.79
July, 2001	309	246	555	2152	4.29
August, 2001	182	133	315	1177	3.79

GENERAL PERMIT VISITOR USE DAYS BY YEAR

Year	Crew	Passengers	Visitors	Visitor Use Days	Days of Stay	Boat Use Days	Boat Entries
1998	727	888	1615	6268	4.14	1440	348
1999	661	682	1343	5189	4.15	1375	331
2000	703	533	1236	4950	4.07	1454	356
2001	621	528	1149	4583	4.31	1387	322

LOCAL PERMIT VISITOR USE DAYS BY MONTH FOR YEAR

Month	Boat Use Days	People Use Days
June, 2001	79	196
July, 2001	72	203
August, 2001	65	184

LOCAL PERMIT USE DAYS BY YEAR

Year	Boat Use Days	People Use Days
1998	242	721
1999	358	966
2000	213	628
2001	216	583

USE DAYS BY TYPE BY MONTH FOR YEAR

Year	Permit Type	Total	June	July	August
2001	General	1387	460	597	330
2001	Local	216	79	72	65

LOCAL PERMITS BY SIZE FOR MONTH FOR YEAR

Year	Permit Type	Vessel Size	Total	June	July	August
2001	Local	1 - 20	34	15	9	10
2001	Local	21 - 30	18	10	6	2
2001	Local	31 - 40	3	1	2	0
2001	Local	41 - 50	4	1	2	1
2001	Local	51 - 60	2	1	0	1
2001	Local	61 - 70	1	1	0	0

GENERAL VESSELLS BY SIZE FOR MONTH FOR YEAR

Year	Permit Type	Vessel Size	Total	June	July	August
2001	General	1 - 20	16	2	5	9
2001	General	21 - 30	47	14	18	15
2001	General	31 - 40	102	34	38	30
2001	General	41 - 50	86	30	37	19
2001	General	51 - 60	29	9	14	6
2001	General	61 - 70	15	2	12	1
2001	General	71 - 80	7	2	3	2
2001	General	81 - 90	4	1	2	1
2001	General	91 - 200	16	2	10	4

BOAT TYPES

Year	Permit Type	MV Type	Total	June	July	August
2001	General	P-Mega	22	2	17	3
2001	General	Power	230	75	91	64
2001	General	S-Mega	6	0	2	4
2001	General	Sailing	1	19	29	17
2001	Local	P-Mega	61	1	0	0
2001	Local	Power		28	19	14

Private Vessel Characteristics of Permitted Vessels In Glacier Bay

Hull Speeds of Vessels Entering Glacier Bay (1998-2002)

Motorized Vessel Type	Hull Speed Category (Knots)	Permits Issued (1998-2002)
Power	1 to 10	565
Sail	1 to 10	333
Power	11 to 20	967
Sail	11 to 20	25
Power	21 to 30	472
Power	31 to 40	205
Power	41 to 50	104
Power	51 to 60	1

Private Vessel Characteristics of Permitted Vessels In Glacier Bay

Lengths of Private Vessels Entering Glacier Bay

Motorize Vessel Type and Size	Permits Issued	Year
Power 18'	61	1998
Power 18'	93	1999
Power 18'	105	2000
Power 18'	121	2001
Power 18'	114	2002
	Total Permits: 494	
Power 40'	193	1998
Power 40'	342	1999
Power 40'	237	2000
Power 40'	199	2001
Power 40'	217	2002
	Total Permits: 1188	
Power 80'	139	1998
Power 80'	150	1999
Power 80'	134	2000
Power 80'	119	2001
Power 80'	106	2002
	Total Permits: 648	
Power 120'	23	1998
Power 120'	9	1999
Power 120'	7	2000
Power 120'	3	2001
Power 120'	7	2002
	Total Permits: 49	
Power 160'	6	1998
Power 160'	0	1999
Power 160'	2	2000
Power 160'	0	2001
Power 160'	2	2002
	Total Permits: 10	
Power 200'	1	1998
Power 200'	0	1999
Power 200'	2	2000
Power 200'	0	2001
Power 200'	0	2002
	Total Permits: 3	

Lengths of Private Vessels Entering Glacier Bay

Motorize Vessel Type and Size	Permits Issued	Year
P-Mega 40'	0	1998
P-Mega 40'	0	1999
P-Mega 40'	0	2000
P-Mega 40'	1	2001
P-Mega 40'	1	2002
	Total Permits: 2	
P-Mega 80'	0	1998
P-Mega 80'	4	1999
P-Mega 80'	5	2000
P-Mega 80'	9	2001
P-Mega 80'	8	2002
	Total Permits: 26	
P-Mega 120'	0	1998
P-Mega 120'	11	1999
P-Mega 120'	4	2000
P-Mega 120'	9	2001
P-Mega 120'	9	2002
	Total Permits: 33	
P-Mega 160'	0	1998
P-Mega 160'	6	1999
P-Mega 160'	0	2000
P-Mega 160'	4	2001
P-Mega 160'	4	2002
	Total Permits: 10	
P-Mega 200'	0	1998
P-Mega 200'	3	1999
P-Mega 200'	0	2000
P-Mega 200'	1	2001
P-Mega 200'	1	2002
	Total Permits: 5	
P-Mega 262'	0	1998
P-Mega 262'	0	1999
P-Mega 262'	1	2000
P-Mega 262'	0	2001
P-Mega 262'	0	2002
	Total Permits: 1	

Lengths of Private Vessels Entering Glacier Bay

Motorize Vessel Type and Size	Permits Issued	Year
Sailing 40'	41	1998
Sailing 40'	45	1999
Sailing 40'	38	2000
Sailing 40'	35	2001
Sailing 40'	30	2002
	Total Permits: 189	
Sailing 80'	44	1998
Sailing 80'	26	1999
Sailing 80'	31	2000
Sailing 80'	30	2001
Sailing 80'	31	2002
	Total Permits: 162	
Sailing 120'	7	1998
Sailing 120'	0	1999
Sailing 120'	4	2000
Sailing 120'	1	2001
Sailing 120'	0	2002
	Total Permits: 12	
Sailing 160'	1	1998
Sailing 160'	0	1999
Sailing 160'	0	2000
Sailing 160'	0	2001
Sailing 160'	0	2002
	Total Permits: 1	
S-Mega 80'	0	1998
S-Mega 80'	0	1999
S-Mega 80'	1	2000
S-Mega 80'	4	2001
S-Mega 80'	2	2002
	Total Permits: 7	
S-Mega 120'	0	1998
S-Mega 120'	0	1999
S-Mega 120'	1	2000
S-Mega 120'	1	2001
S-Mega 120'	0	2002
	Total Permits: 2	
S-Mega 160'	0	1998
S-Mega 160'	1	1999
S-Mega 160'	0	2000
S-Mega 160'	1	2001
S-Mega 160'	2	2002
	Total Permits: 4	

Dundas Bay Vessel Traffic Documented during Outer Waters Vessel Activity Survey (OWVAS) Project Aerial Surveys

Vessel Use in Dundas Bay - Summer 2001

		Tourboat	Private[1]	Charter	Commercial fishing[2]	NPS	Other[3]	Total Vessels
Week 01	**June 1 - June 7**				No Data			
Week 02	**June 8 - June 14**	0	1	1	0	0	0	2
Week 03	**June 15 - June 21**	0	1	0	0	0	0	1
Week 04	**June 22 - June 28**	0	0	0	0	0	0	0
Week 05	**June 29 - July 5**	0	6	2	0	0	1	9
Week 06	**July 6 - July 12**	0	6	3	0	0	1	10
Week 07	**July 13 - July 19**	0	2	0	0	0	1	3
Week 08	**July 20 - July 26**	0	2	2	0	0	1	5
Week 09	**July 27 - Aug. 2**	0	4	0	1	0	0	5
Week 10	**Aug. 3 - Aug. 9**	0	9	0	0	0	1	10
Week 11	**Aug. 10 - Aug. 16**	0	3	1	1	0	0	5
Week 12	**Aug. 17 - Aug. 23**				No Data			
Week 13	**Aug. 24 - Aug. 30**	0	0	0	2	0	0	2
Week 14	**Aug. 31 - Sept. 6**	0	2	1	6	0	0	9
Week 15	**Sept. 7 - Sept. 13**	0	0	0	3	0	0	3
Week 16	**Sept. 14 - Sept. 20**				No Data			
Week 17	**Sept. - Sept. 27**	0	0	0	0	0	0	0
Week 18	**Sept. 28 - Oct. 4**	0	0	0	0	0	0	0
	Total	0	36	10	13	0	5	64

Vessel Use in Dundas Bay - Summer 2002

		Tourboat	Private[1]	Charter	Commercial fishing[2]	NPS	Other[3]	Total Vessels
Week 01	**June 1 - June 7**				No Data			
Week 02	**June 8 - June 14**				No Data			
Week 03	**June 15 - June 21**	2	1	0	1	0	1	5
Week 04	**June 22 - June 28**	0	6	4	0	0	2	12
Week 05	**June 29 - July 5**	0	4	2	0	0	0	6
Week 06	**July 6 - July 12**	1	6	2	0	1	16	26
Week 07	**July 13 - July 19**	0	5	0	0	1	0	6
Week 08	**July 20 - July 26**				No Data			
Week 09	**July 27 - Aug. 2**	3	6	0	0	1	3	13
Week 10	**Aug. 3 - Aug. 9**	0	1	0	0	0	0	1
Week 11	**Aug. 10 - Aug. 16**	0	0	2	2	0	0	4
Week 12	**Aug. 17 - Aug. 23**	0	1	2	3	0	0	6
Week 13	**Aug. 24 - Aug. 30**	0	0	0	0	0	0	0
Week 14	**Aug. 31 - Sept. 6**	0	0	2	1	2	0	5
Week 15	**Sept. 7 - Sept. 13**	0	0	0	5	2	0	7
Week 16	**Sept. 14 - Sept. 20**	0	0	1	5	2	0	8
Week 17	**Sept. - Sept. 27**	0	0	0	0	2	0	2
Week 18	**Sept. 28 - Oct. 4**	0	0	0	0	0	0	0
	Total	6	30	15	17	11	22	101

[1]Vessel class includes cabin cruiser style vessels and sailboats.
[2]Vessel class includes primarily trollers, one crabber and one tender.
[3]Vessel class includes kayaks, skiffs or other vessels (Pilot) that may be associated with either private or commercial vessels.

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

CASE INCIDENT RECORD

See also 930152

1. ORGANIZATION CODE	2. ORGANIZATION (PARK) NAME	3. LOCATION CODE	4. CASE/INCIDENT NO.
1 9815	Glacier Bay National Park & Pres.	02402	930135

5. LOCATION OF INCIDENT	6. WHEN DID IT OCCUR? MO.	DAY	YR.	24 HOUR TIME HRS.	MIN.	7. DAY OF WEEK
Geikie Rocks	08	18	93	15	41	4

8. OFFENSE/INCIDENT CODE	9. NATURE OF INCIDENT	10. HOW REPORTED
260313	Boating - Accident	Radio

11. REPORTED BY	12. ADDRESS	13. PHONE (HOME / BUSINESS)
Captain-Yorktown Clipper	see below	

14. RECEIVED BY	15. WHEN RECEIVED: DATE	16. TIME BROADCAST	17. WHEN INVESTIGATED
Backcountry Office	8-18-93	1541	DATE 8-18-93 TIME 1541

18. INVESTIGATED BY	19. OFFICER/RANGER NO.	20. WHEN CLEARED	DISPOSITION 21.
R.C. Young	0210	DATE 8-24-93 TIME 1200	

	22. INVOLVED PERSONS	23. ADDRESS	24. PHONE	25. SEX	26. RACE	27. AGE	28. DATE OF BIRTH
1	Michael Christian-Captain	7711 Bon Homme Ave.	1-800-325-				—
2	Clipper Cruise Lines	St. Louis, MO 63105	1933				
3	Brian E. Lowe-operating	1122 N. View, Olatha,		M	1	[redacted]	
4	ship at time of grounding (second mate)	KS					

29. DETAILS OF INCIDENT

YORKTOWN CLIPPER INCIDENT

Wednesday, Aug. 18, 1993:
At 1541 hrs., Park Dispatch at the Backcountry Office (BCO) received a call over the Marine VHF Radio that the M\V Yorktown Clipper, a 257' tour boat, had run aground on Geikie Rock and were in the process of assessing the damage.

The Yorktown Clipper is a commercial tour boat which runs multi-day trips during the summer between Juneau and Glacier Bay. It is owned by Clipper Cruise Lines of St. Louis, MO. This trip had 134 passengers and 42 crew on board at the time. The vessel had entered Glacier Bay 10 times previously during the 1993 summer season. The ship was under the command of Captain Michael Christian, however, during the time of the grounding, the second mate was operating the vessel (see investigation). The vessel had approx. 23,000 gal. of diesel aboard, 200 gal. of lube oil, and assorted paints, thinners, and solvents aboard.

30. QUANTITY	31. PROPERTY STOLEN OR DAMAGED	32. ESTIMATED VALUE	RECOVERED 33. DATE	34. VALUE

35. PROPERTY CODE OF HIGHEST VALUE | 36. TOTAL .00 | 37. TOTAL .00

INVESTIGATED BY (Signature and Date): RC Young 9-5-93

APPROVED BY (Signature and Date): Randy King 9/16/93

Form No. 10-
Rev. 3-73

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park	9 3 0 1 3 5
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks	0 8 1 8 9 3

NATURE OF INCIDENT
Boating - Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

NPS Vessels Neve, operated by Ranger Brian Flory, and Drumlin, operated by Fritz Koschmann, responded to the area from Goose Cove and the Drake Island areas respectively. NPS Vessel Serac, operated by Gene Shanks, responded from Sitakaday Narrows. NPS Vessels Arete, with Mark Foster and Joe Williams aboard and Rebound, with Randy King and Brenda Bussard aboard, responded from Bartlett Cove. A 3" diesel dewatering pump was taken with these vessels.

The US Coast Guard was also notified, and subsequently dispatched 2 helicopters and the Coast Guard Cutter Woodrush.

At 1551 hrs., the YORKTOWN broadcast a Mayday call on VHF Ch. 16, and stated that they were taking on water. They also advised BCO that they were not abandoning ship at the time, but were making preparations to do so. Also, they were attempting to make slow progress to the North end of Marble Mountain at the entrance to Geikie Inlet in the event they had to disembark passengers on the beach.

At 1617 hrs., the YORKTOWN reported they were abandoning ship, and requested assistance from vessels in the area to assist with taking on passengers. Private vessels Barbarina, Timber Queen, Laissez Faire, and Sentani Meer had also responded to the area and began taking on passengers. The cruise ship Westerdam, located in Whidbey Passage, also responded North toward the YORKTOWN. Two 150 passenger launches from the Westerdam also assisted with the evacuation. A total of 134 passengers and 4 crew were transferred without injury onto the Westerdam, which then departed for Sitka. 22 additional crew were transported by park vessels to Bartlett Cove. 16 crew stayed aboard the Yorktown to conduct damage control. All passengers had been evacuated by 1635 hrs.

At 1630 hrs., Ranger Brian Flory and Maintenance Worker Mark Foster assisted the YORKTOWN crew with damage control. The vessel had sustained damage to its hull during the grounding, and was taking on water rapidly. Flory and Foster placed two park pumps in operation, and assisted crew with other pumps which had arrived from the Coast Guard and the Westerdam. These efforts appeared to keep the flooding under control. The vessel was flooded in at least 2 compartments forward, and was listing to port bow.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RC Young 9-5-93	Randy King 9/16/93

SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park	9 3 0 1 3 5
LOCATION OF INCIDENT	**DATE OF INCIDENT** MO DA YR
Geikie rocks	0 8 1 8 9 3

NATURE OF INCIDENT

Boating - Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

~~At 1754 hrs., it was decided that the YORKTOWN would~~ make its way as slow speed to Shag Cove in Geikie Inlet. The layout of this narrow cove provided for an area that was easier to boom if the need arose. After the grounding, a small fuel sheen appeared on the water, indicating at least one fuel tank had been breached. It was later estimated that approx. 100 gal. of diesel had been released into the bay at this time. The sheen was observed floating south through Whidbey Passage over the next day, finally dissipating near the mouth of Fingers Bay.

At 1800 hrs., the Spirit of Adventure departed Bartlett Cove to assist the YORKTOWN with 900 ft. of park oil spill boom. Ranger Rick Perkins and park employee Dave Walker were on board also to assist.

Other resources dispatched to the scene included:
- -Tugboat TAGISH, from Hoonah
- ~~-Tugboat Ethan B from Juneau~~ (cancelled)
- -Tugboat Le Cheval Rouge from Sitka
- -Floatplane with 6 dewatering pumps from Pelican
- -2 Contract helicopters with boom, pumps.
- -2 Salvage divers with equipment.
- -Barge Gumption with 1.5 mi. boom from Juneau.

Airspace over the area was restricted by the FAA by request from the Coast Guard and NPS due to air ops. Additionally, boat traffic into Geikie Inlet was closed.

At 2151 hrs., the YORKTOWN reported that they had safely anchored in the south end of Shag Cove. No further evidence of fuel had been spilled. 900 ft. of boom had been deployed around the damaged part of the vessel and anchored to shore. The vessel was continuing to list to port bow, and pumps were keeping the vessel afloat. 5 damage control personnel from the Woodrush were overseeing the maintenance of the vessel and dewatering, and began to make repairs that evening.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RC Young 9-5-93	Randy King 9/16/93

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park	9 3 0 1 3 5
LOCATION OF INCIDENT	**DATE OF INCIDENT** MO DA YR
Geikie Rocks, Shag Cove	0 8 1 8 9 3

NATURE OF INCIDENT

Boating - Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

At Bartlett Cove, a Type II Incident Command organization had been established with the command center located at the Backcountry Office. Chuck Young was Incident Commander, with the following assignments: Operations Sec. Chief - Randy King, Rick Mossman; Logistics Sec. Chief - Chris Trump; Plans Sec. Chief - Bill Gabbert; Finance Section Chief - Eileen Harpell.

Thursday, August 19, 1993:

Assessment and temporary repair on the YORKTOWN continued through the night. It was confirmed that the one of the 6 fuel storage tanks, containing 6400 gal. of #2 diesel fuel had been breached during the accident, and that the hull was opened in more than one place. Dewatering operations and plugs were successful in keeping the boat afloat and in a stable position. Operations were shut down for the evening at approx. 0300 hrs.

At 0735 hrs., a light oil sheen was observed within the boomed area at the YORKTOWN. During the night, divers had observed at least 4 holes in the hull, the largest being approx. 2' x 4'. One of the holes was patched with epoxy during the night. Salvage specialists and engineers arrived during the day to consult with the company, the Coast Guard, and NPS on salvage plans. Regional Office specialists and backup personnel for the IC Overhead team were requested to come to Glacier Bay. They arrived in the park later in the day. Additionally, a portable repeater and radio technician were requested to improve the communications with the on-site personnel.

NPS continued to coordinate the communications, logistics, and operations related to the incident. Additionally, contingency plans in the event the vessel sank or leaked additional fuel were being formulated at the command center over the next few days. Research and resource management personnel were dispatched to the scene early in the morning to conduct resource assessment of Shag Cove, Geikie Inlet, and Whidbey Passage areas. Alaska Dept. of Environmental Conservation personnel arrived at the command center to participate in the incident command structure.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RCYoung 9-5-93	Randy King 9/16/93

NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park	9 3 0 1 3 5
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks, Shag Cove	0 8 1 8 9 3

NATURE OF INCIDENT
Boating Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

By 1340 hrs., it was determined that three watertight compartments within the hull of the YORKTOWN had water in them, and that some fuel had escaped into them. This contaminated water had not, however leaked into the cove.

At 1730 hrs., the Coast Guard gave approval for the YORKTOWN to begin transferring fuel from undamaged tanks to slack internal tanks, and to transfer contaminated fuel from breached tanks into external fuel storage bladders. During dewatering operations, the vessel's list corrected itself approx. 2 degrees starboard.

Ranger Tom Gage located the actual point of impact on Geikie Rocks and observed pieces of metal and paint on the rock. This location is shown on the NOAA Nautical Chart # 17318 for Glacier Bay as a rock awash symbol 42 degrees NE of Geikie Rock. (58° 41' 93" N., 136° 18' 15" W.)

At 1935 hrs., a small sheen had escaped from the stern of the vessel as overboard discharge from the bilge system pumped some escaped fuel outside the boomed area. The boom was moved to prevent more sheen from escaping. The sheen was approx. 20 x 30 yds. and dispersed rapidly. Pumping of fuel tanks and assessment of damage continued through the evening, ending at 2356 hrs. Live watches continued all night with no incidents.

Friday, August 20, 1993:

Overnight, following defueling operations from selected tanks on the YORKTOWN, a port list redeveloped. It was determined this was due to shifting of liquid in existing tanks. Fuel floating free in forward void spaces were pumped into bladders during the day. Once the ruptures in the hull were repaired, contaminated water from the bladders were pumped back into the sound tanks to maintain the stability of the vessel.

At 1001 hrs., a sheen of approx. 100 sq. yds. was reported visible in the water near the mouth of the stream at the extreme south end of Shag Cove. Some of the sheen was beginning to hit the shore. Absorbent pads were placed in the water, and efforts were made to shore up the boom around the boat. At 1430 hrs., a boom was deployed across the mouth of the stream. No further sheen was reported after this period.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RC Young 9-5-93	Randy King 9/16/93

Rev. 3-73

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER 930135
~~Glacier Bay National Park~~	~~0 8 1 8 9 3~~
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks, Shag Cove	0 8 1 8 9 3

NATURE OF INCIDENT

Boating - Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

During the day, the Pacific Strike Team of the Coast Guard had begun rectifying hazards present in the work environment aboard the YORKTOWN. Smoking restrictions, ventilation, and cleanup was conducted toward this end. Preparations were made for park personnel who came in contact with diesel during the emergency, or who entered the closed compartments with diesel fumes, to get checked and tested for benzene toxicity.

A portable repeater was installed at the mouth of Geikie Inlet to improve park radio communications with Bartlett Cove. Additionally, a radio phone patch was set up on the YORKTOWN to facilitate communications between the company, the ship, and the Coast Guard.

National Transportation and Safety Board personnel came on scene to lead the investigation of the incident. Russ Wilson of NPS and Coast Guard personnel conducted joint investigations with NTSB throughout the incident.

By the end of the day, all fuel had been pumped from tanks 1-4. Plans were being formulated for transit of the YORKTOWN out of Glacier Bay. The vessel would be accompanied by the barge Poundstone which carries the following materials: 5500 ft. of containment boom, a skim pack, 1000 ft. of absorbent mats, 800 ft. of sausage boom, 6 pumps, diesel air compressor, 8,000 gal. of internal and 500 gal. of external storage space for any fluids that needed to be stored. Operations for the day ceased at 2341 hrs.

Saturday, August 21, 1993:

Work continued on assessing and repairing the holes in the YORKTOWN. At 1322 hrs., the Woodrush left the area, leaving 2 Coast Guard personnel on scene to coordinate salvage. An underwater video survey of the ship's hull was completed, and damage was less extensive than expected. Repairs were estimated to be completed by Sunday, with a departure date set for Monday. An estimated 10,000 gal. of fuel were still on board as of Saturday. It was determined that this fuel would be left on board to enable the vessel to maintain its stability and transit under its own power to Juneau.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RC Yaeger 9-5-93	Randy King 9/16/93

NATIONAL PARK SERVICE

SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park	930135
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks, Shag Cove	08 18 93
NATURE OF INCIDENT	
Boating - Accident	
COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

Damage assessment: 5 known holes in the hull, several additional areas of "weeping" water where the hull was compromised. The largest hole was approx. 2' x 4'. Most damage occurred on the port bow.

3 of the fuel tanks (total 6 fuel tanks, 2-day tanks) had been breached, 1 of which was breached externally.

Sunday, August 22, 1993:

Epoxy patches were used to plug all hull damage. With the concurrence of the Coast Guard, no metal plates were welded over holes. Operations and Resource Contingency plans formulated by the park were delivered to the YORKTOWN.

At 1500 hrs., a meeting was conducted in Juneau to discuss contingency plans, transit plans, and scheduling of the transit. In attendance were: Commander Powers (USCG), Lts. Pennoyer, Tucci, Rodriquez (USCG), Supt. Marv Jensen, Res. Mgmt. spec. MaryBeth Moss, IC Chuck Young, OSC Randy King, Gus Van Vliet (DEC), Clipper Cruise Line VP Gary Welch, the Chief Engineer of the YORKTOWN, and an independent marine engineer with the American Bureau of Shipping. A status report on the vessel and park contingency plans were presented. At this meeting, it was determined that an additional repair was needed to a structural member in the bow before transit could safely take place. Final approval for the YORKTOWN to begin transit would lie with the Coast Guard Commander, who would fly to the vessel on Monday for a final inspection. The vessel would be accompanied by the barge Poundstone, and would have Coast Guard and NPS personnel on board. Speed not to exceed 5 knots in Glacier Bay. And a simple sea trial consisting of hard port and starboard turns would be conducted upon leaving Shag Cove. Due to poor weather forecast and need for additional repairs, the transit date was set for the morning of Tuesday, Aug. 24.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RC Young 9-5-93	Randy King 9/16/

Rev. 3-73

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park	9 3 0 1 3 5
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks, Shag Cove	0 8 1 8 9 3

NATURE OF INCIDENT

Boating - Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

Monday, August 23, 1993:

Final repairs continued on the YORKTOWN, while the incident command team at Bartlett Cove made final preparations for the transit on Tuesday. The IC and Superintendent travelled up to the vessel to meet with the captain and company vice president, and to observe preparations for transit. The Coast Guard gave final approval for the YORKTOWN to transit on Tuesday.

Tuesday, August 24, 1993:

At 0545 hrs., the YORKTOWN weighed anchors and began to exit Shag Cove. Containment boom was draped around its perimeter railing as a precaution against fuel leakage. None occurred. The vessel was accompanied by the Poundstone. Additionally, NPS vessels Arete and Neve maintained a presence in the area, along with the park Supercub. Catching the ebbing tide, the vessel followed a mid-channel course out of Geike Inlet, south of Geikie Rocks, and east of Drake and Willoughby Islands to exit Glacier Bay. The transit occurred without incident. Ranger Randy King, who was aboard the YORKTOWN during transit was transferred onto Arete west of Lester Island at 0944 hrs. The YORKTOWN exited the bay at 1005 hrs. enroute to Juneau for a stopover, then on to Seattle.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
RC Young 9-5-93	Randy King 9/16/93

SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park & Preserve.	9 3 0 1 3 5
LOCATION OF INCIDENT	**DATE OF INCIDENT** MO DA YR
Vicinity of Geikie Rock, Glacier Bay, Alaska	0 8 1 8 9 3

NATURE OF INCIDENT

Grounding of Tour Vessel Yorktown Clipper

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
FLORY NPS	GLBA

RESULTS OF INVESTIGATION STATEMENT BY BRIAN FLORY, FIRST NPS RANGER ON SCENE p. 9 of 13

At approximately 1541 on 18 August, 1993, I was on patrol assisting some kayakers in the vicinity of Rowlee Pt, in the East Arm of Glacier Bay. I overheard one side of a radio conversation on marine VHF ch 16, in which an unidentified vessel said it had hit a rock, was investigating for damage, and requested the other vessel standby in the area. I then radioed Bartlett Cove and requested if they had copied any distress traffic. Bartlett Cove replied that the Tour Vessel Yorktown Clipper had hit Geikie Rock, and was investigating for damage. I completed my present mission and immediately responded to the location of the Yorktown Clipper.

While enroute, I heard the Clipper broadcast a Mayday call on VHF ch 16, and later tell other vessels that they were making preparations to abandon ship. I arrived on scene at approximately 1622. At that time, the Yorktown Clipper was in approximate position 58 40.05N, 136 18.00W, approximatley 0.5 nm southeast of the entrance to Geikie Inlet. I wanted urgently to get aboard the vessel, but was unable to do so since I had no one to operate Neve, and it was too rough to allow a smallboat to tend alongside unattended.

Procedures to abandon ship appeared to be going smoothly. All passengers were mustere on the top deck, and several vessels were standing by to transport passengers from the Clipper to the P/V Westerdam. R/V Drumlin was the first vessel to go alongside the port s: and begin transporting passengers. Other vessels standing by included the P/C Barbarina, P/C Timber Queen, P/C Laissez Faire, the P/C Sentanimeer, and the S/V Adventuress. P/V Westerdam soon took station off the northwest corner of Drake Island, and NPS vessel Serac arrived on scene shortly after I did. Several smallboats from the Clipper were in the water off the fantail.

Weather on scene was northwest winds at approximately 12 to 14 knots, seas northwest at one to two feet.

A U.S. Coast Guard H-60 arrived o/s carrying three pumps. The master of the Clipper said he was not prepared to receive the pumps at that time, so I directed the aircraft to lower the pumps to Serac. Serac then placed the pumps aboard the Clipper, using the board: ladder on the starboard side. At some point, Naturalist Dena Matkin boarded Serac from the Clipper. Once I saw another Park employee, I quickly had her get aboard Neve, and the boarded the Clipper myself. At approximately 1655, two launches from the Westerdam arrive going alongside either side of the Clipper. The Clipper was visibly settling by the bow. I went aboard shortly thereafter.

Once aboard the vessel, events ~~more rapidly~~ moved rapidly. The following is a genera report of significant events, not necessarily in chronological order.

(CONTINUED)

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
B. Flory/213 26 August 1993	RC Young 8/29/93

Rev. 3-73

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay national Park	930135
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks, Shag Cove	08 18 93

NATURE OF INCIDENT

Grounding of Tour Vessel-Yorktown Clipper

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
Flory NPS	GLBA

RESULTS OF INVESTIGATION (continued)

Upon boarding, the First Mate transmitted a request to me from the Master to evacuate his crew and transport them to the Lodge. I replied that NPS vessels could do this. I we to the bridge to introduce myself to the Master. In all my contacts, I introduced myself as Ranger Flory, Coast Guard Officer Flory, and a Licensed Master. I did this to immediat clarify to everyone my experience and intentions. The Master was calm and composed. Afte a quick intoduction, I went below and sought out the Chief Engineer, again to introduce myself. I quickly reviewed damage with the Chief. He told me that this was a three compartment ship, and that there were already three compartments flooded (this number refers mostly to the ability of the vessel to withstnad flooding). The bilge eductor syst was online, operating at maximum capacity, tied in to the firemain system for greater capacity. He had no additional pumps aboard (although several had been delivered from outside sources by this time). Going below decks forward, I saw that the bowthruster compartment was flooded, and the water level was rising forward of frame 15, up an open ladder. A watertight door at frame 15 was closed. The Chief said that manhole covers in the compartment aft of frame 15 had started leaking as he was conducting his initial damage inspection. Crewmen from the Westerdam were attempting to rig and start several Coast Guard pumps at this ladder.

Moving aft, and below, I saw a manhole cover bubbling up fuel located centerline in the passageway aft of frame 21, indicating that teh compartment below, normally a void, had free communication with the fuel tanks on either side, and that seawater must have bee rushing into one of the tanks to cause the pressure forcing the fuel up and out above the void.

Going back to the compartment above the bowthruster room again, I began to assist Westerdam crewmen in trying to get the pumps started. They had been pulling the starting cords like mad on three pumps, to no avail. When asked if I knew how the pumps worked, I replied that we should read the instructions. Doing so, it was immediately apparent that they had been trying to start the pumps without having the fuel tanks connected. I stated that we should connect the fuel tanks, as internal combustion engines usually neede a combustible fuel, in the U.S. of A, as well as in Holland. Once this was done, the pumps started easily.

About this time, other NPS vessels arrived o/s. I had comms with Chief Ranger Randy King, and had P/V Rebound come alongside to unload a Park pump. Also about this tin Mark Foster arrived aboard. Going topside to the bow, one Park pump was set up above the hatch over the bowthruster compartment. At some point the Coast Guard MSO reps arrived.. Exhaust fumes from the pumps were filling up the spaces below decks forward, so portholes were broken out for ventilation, and some attempt was made to rig fans. The Coast Guard P-1 pumps were largely ineffective because there was not enough discharge hose or pressure to get the water up and outside the vessel. Running discharge hoses out the (

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
B. Flory/213 26 Aug 93 B. Flory	RC Young 8/29/93

SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
~~Glacier Bay National Park~~	9 3 0 7 3 5

LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Geikie Rocks , Shag Cove	0 8 1 8 9 3

NATURE OF INCIDENT

Grounding of Tour Vessel Yorktown Clipper

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
Flory NPS	GLBA

RESULTS OF INVESTIGATION (Continued)

broken portholes helped in some measure. Once both Park pumps (model 3S5 Yanmar 3" de-watering pumps) were operating, the water level in the bowthruster compartment appeared to decrease slightly. Both pumps had to be hand primed prior to them operating properly. This operation was carried out by Mark Foster and the Chief Engineer. At some point the crewmen from the Westerdam said goodbye and good luck, and we said thanks and good riddance.

While the process of abandoning ship had been smooth and orderly, the damage control efforts were largely confused, and required that I try to be in several places at once. The Chief Engineer seemed to have good knowledge, and applied it well, but I believe he was the only one on the crew who did. The Master and deck force remained calm and anxious to help, but did not seem to have much experience applicable to this situation. At some point I conferred with the Master regarding the best location to beach the vessel should that become necessary. There seems to have been some confusion on this point in the minds of other people involved in the incident. Suffice to say that the Master was taking every step proper in this situation to limit the loss of his ship. At no time did I detect any premature anxiety on his part regarding this beaching maneuver, rather, a logical informed discussion took place. I am not certain, but I may have communicated with Chief Ranger King in this selection process. We decided on Shag Cove as the most logical destination, and the vessel got underway at slow speed enroute that location.

At approximately 1743, I communicated to Bartlett Cove to notify the Coast Guard Command Center that I needed a P-250, eductor, and lots of hose o/s. This is the last recorded time I have available. The events later in the evening begin to run together in my memory. Eventually a Coast Guard H-60 delivered the requested equipment along with three crewmen from the USCGC Woodrush. Once this equipment was operating, actual significa dewatering began of the bowthruster compartment. Later in the evening I assisted one of the Woodrush crewmen in plugging a split seam in the bottom of the bowthruster compart-ment.

Dewatering had begun, but no real damage assessment had yet begun. A considerable debate raged over the need and the best method to access "H" hold, the flooded space between frames 15 and 21. The vessels stability seemed to be intact.

I departed the Clipper at approximately 0045, accompanied by Ranger Williams on Arete, enroute Blue Mouse Cove. USCGC Woodrush was just entering Geikie Inlet at that time.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
B. Flory/213 26 Aug 93	RC Young 8/29/93

REV. 3/76

U.S. DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
~~Glacier Bay National Park and Preserve~~	9 3 0 1 3 5
LOCATION OF INCIDENT	DATE OF INCIDENT MO DA YR
Near Geike Rock and in Shag Cove	0 8 1 8 9 3

NATURE OF INCIDENT

Yorktown Clipper Tour Boat Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

STATEMENT BY RANDY KING, ON SCENE COORDINATOR

On August 18, at approx. 1545 I was notified of the distress call received from the tour boat Yorktown Clipper after it struck a rock near Geike Rock. The vessel was reported to be taking on water and the captain had given the order to debark the passengers.

I spoke briefly with District Ranger Chuck Young, discussed our response options, and appointed him incident commander. Chuck requested that I respond to the scene with ranger Bussard in the patrol vessel Rebound.

Bussard and I departed from the Bartlett Cove dock at approx. 1620. We took with us the Yanmar dewatering pump and accessories that were stored on the dock. The patrol vessel Arete, with ranger Williams and maintenance mechanic Mark Foster on board, departed at the same time.

We arrived on scene at approx. 1700. Three NPS vessels, the Neve, the Serac and the Druml[illegible] were already on-scene. Brian Flory had turned the Neve over to naturalist Dena Matkin and was on board the Yorktown Clipper. There were several pleasure vessels in the area standi[illegible] by to assist. A Coast Guard helicopter had just arrived and had dropped pumps to the Sera[illegible] for transport to the Yorktown Clipper. The passenger off-loading had been completed by private vessels and a tender from the Westerdam. The Westerdam was holding off to the nor[illegible] of Drake Island. No injuries were reported.

I functioned as the park's on-scene coordinator. Bussard and I delivered the pump to Flor[illegible] on board the Yorktown. I spoke to Williams and Foster and agreed that Foster should get o[illegible] board to assist with pump setup and operations.

The captain of the Yorktown requested assistance in debarking non-essential crew members n[illegible] involved with the salvage effort. I assigned the Drumlin and Serac to transport 22 crew members to Bartlett Cove, leaving 16 on board.

Coast Guard employees from the Juneau Marine Safety Office, Lt. Tucci, Lt. Penoyer, and Petty Officer Lemay, arrived by float plane. The Coast Guard helicoper(s) ferried the additional NPS Yanmar pump from Bartlett Cove, and larger P250 pumps and a damage control crew from the Coast Guard Cutter Woodrush.

The Yorktown Clipper was down in the bow and listing to port. The ship was on emergency power. I spoke with ranger Flory who was on the bridge with the captain, Michael Christia[illegible] and the Coast Guard reps regarding a location to beach the vessel if it became necessary to do so before sinking. I requested that the vessel move into Shag Cove, which it did at low speed.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
Randy King 8/31/93	RC Young 9-5-93

SUPPLEMENTARY CASE/INCIDENT RECORD

ORGANIZATION (PARK) NAME	CASE/INCIDENT NUMBER
Glacier Bay National Park and Preserve	930135
LOCATION OF INCIDENT	**DATE OF INCIDENT** MO DA YR
Near Geike Rock and in Shag Cove	08 18 93

NATURE OF INCIDENT

Yorktown Clipper Tour Boat Accident

COMPLAINANT'S NAME	COMPLAINANT'S ADDRESS
NPS	GLBA

RESULTS OF INVESTIGATION

Private vessels were released from the scene as sufficient numbers of small boats were available to evacuate the crew on the Yorktown.

I went aboard the Yorktown Clipper after it entered Shag Cove. I met with the Coast Guard reps and the captain to discuss contingency and salvage plans; spill containment and boom deployment strategies; provide for NPS boat support for the salvage divers that arrived that evening, Coast Guard reps transport, transport supplies and equipment from the beaches, etc..

Additional coordination activities performed that afternoon and evening, into the following morning included: requesting the Spirit of Adventure for towing and/or crew transport, boc transport, etc.;requesting additional boom and absorbent materials; requesting fuel and equipment to support pumping operations; requesting SCBAs and fire fighting equipment to deal with a fuel contaminated work environment on board the Yorktown; appointing Perkins ar Walker as EMS personnel;providing periodic updates to the IC and staff.

The Spirit of Adventure was released from the scene after the Yorktown Clipper was securely anchored near the head of the cove.

The Coast Guard Cutter Woodrush arrived on scene with its full compliment of 55 crew at approx. 2330.

I remained on scene at Shag Cove until early evening on the 19th, when I was relieved and returned to Bartlett Cove.

SUBMITTED BY (SIGNATURE AND DATE)	APPROVED BY (SIGNATURE AND DATE)
8/30/93	RC Young 9-5-93

GLBA

UNITED STATES DEPARTMENT OF INTERIOR
NATIONAL PARK SERVICE
INCIDENT RECORD

Incident Number
GLBA9900000039

Incident Date
June 12, 1999

Incident time
1400 Hrs

Report date used as incident date?
Yes

Clearance
Closed (All Other Reasons)

Cleared Exceptionally
Not Applicable/Not Cleared Exceptionally

Exceptional Clearance Date

Primary Agency: NPS

Reporting Officer ID: 21100

Primary Location: DUNDAS BAY

Offense/Incident Code	Description of Offense/Incident	A/C	Location Code and Type
36-00-00	BOATING AND WATER USE ACTIVITIES	Attempted	0620

Type of Hate Crime Bias?

of Entry (If Burglary)? N/A

of Premises entered if location is a hotel/motel/lodging: N/A

Type of Criminal Activity: N/A

Type of Weapon/Force Involved

Type Code	Quantity
N/A	N/A
N/A	N/A
N/A	N/A

N/A

Witness
Name

Date of Birth

Phone Business

Address

City

State

Zipcode

Phone Residence

Name of Investigator Notified

Date

Time

Reporting Officer's Name
RICK PERKINS

Supervisor's Name (Please Print)

ing Officer's Signature

Date

Supervisor's Signature

Date

Rick P[illegible]

Wilderness Adventurer Incident
Incident Summary
June 12 - 18, 1999

Incident Commander's Summary

This incident was largely an exercise in Unified Command. The United States Coast Guard (USCG), Alaska Department of Environmental Conservation (ADEC), The Responsible Party (RP) Goldbelt Inc., and the National Park Service (NPS) were the participating entities.

The RP was responsible for salvaging the stranded vessel, containing and recovering spilled product, and transporting the vessel out of the area. USCG served as an onsite oversight agency with subject matter expertise and veto power over the RP's salvage, containment and recovery, and transportation plans. USCG approval was required before any actions could be taken. The ADEC advised the Unified Command of any State concerns. The NPS advised the RP of its concerns and prioritized the areas threatened to make the best use of protection booms and containment strategies.

The NPS also gathered pre-spill assessment data to enable accurate evaluation of damaged resources should a spill occur.

The NPS did not field many personnel. The primary NPS effort was to ensure that the NPS had a place in the Unified Command decision-making table. This was achieved by stationing a Deputy IC at the Unified Command location in Juneau. The Deputy IC communicated NPS concerns to the Unified Command Team and communicated Team concerns to the NPS. A Forward-On-Scene Command managed the actual salvage and product recovery and containment operations on scene, which was made-up of the RP commander, USCG commander, ADEC commander and an NPS spokesman.

The NPS set up an Incident Management Team at Bartlett Cove to provide a staging area for the incident and to support the NPS personnel on the incident. The team directly interfaced with their functional counterparts in the Juneau Incident Command Post.
Communication between the Forward Command Post, Juneau Incident Command Post and the NPS Command Post were by phone, fax, and radio.

Operations Section Summary

On Monday, 6/14/99, at 0800 the Alaska Incident Management Team assumed NPS responsibilities for the Wilderness Adventurer grounding incident. The NPS on scene coordinator (OSC) Chuck Young reported that the Wilderness Adventurer remained in its grounded position in Dundas Bay. Two rings of flotation boom surrounded the vessel. Due to its tilt the vessel was attached by bow and stem lines to barges in order to maintain it's stability at low tides. The expectation was that efforts to refloat the Wilderness Adventurer could occur on the afternoon high tide on Tuesday 6/15.

Communication with the OSC was primarily via the use of Iridium phones. A two-hour contact schedule was established for normal information flow. A request for a portable repeater, that had been requested by GLBA, was being implemented by logistics.

NPS involvement at the incident site in Dundas Bay involved four personnel and the MV TASK. The personnel functioned as the NPS OSC, a vessel operator and two Resource assessment staff. The NPS personnel developed risk assessments of potential beaching sites for the Wilderness Adventurer, determined the location of resource values at risk and provided bear protection for other incident personnel in case of shore work.

Based on discussions with the GLBA resource management staff, assignments were developed to conduct on site resource assessments in upper arm of Dundas Bay on 6/15. The assessments were to involve primarily the intertidal zone, marine mammals, and mussels. The purpose of the assessments was to document the values at risk in case of a serious spill and thereby assist in contingency planning. The 12 resource personnel needed to conduct the assessments were to be "self contained" and be based on the NPS vessels Nunatak and Tamnik. These personnel and vessels were redirected from other duties, with the concurrence of the GLBA Resource division chief. They departed Bartlett Cove for Dundas Bay in early evening on 6/14.

On Tuesday, 6/15/99, the NPS on site commitment involved the MV Task with four persons and the vessels Nunatak and Tamnik with 14 persons. The OSC remained Chuck Young. RM monitoring consisted of refining the priority level of resource values at risk and conducting assessments of intertidal zone, marine mammals and mussel beds. The vessel Tamnik, with seven persons, departed the area in early evening after accomplishing its marine mammals assessment.

The Wilderness Adventurer remained stable. Personnel and resources from the salvage company arrived and continued preparations to refloat the vessel at the afternoon high tide on 6/16/99. The draft plans for vessel salvage, decon and transit were all under discussion.

On Wednesday, 6/16/99, the NPS on site commitment involved the vessel Task with four persons and the vessel Nunatak with seven persons. The OSC remained Chuck Young. RM monitoring continued with identifying and prioritizing resource values at risk further down bay along with intertidal monitoring. The vessel Nunatak and its personnel were released in early evening.

At approximately 1600 the Wilderness Adventurer was refloated and moved a short distance away from the grounding site. The double containment boom was replaced and inspections and repairs necessary to tow the vessel were started.

On Thursday, 6/17/99, the NPS on site commitment consisted of the vessel Task and four personnel.
Chuck Young was replaced as the NPS OSC at approximately 1600 by GLBA Ranger Rick Perkins.

At approximately 1630 the Wilderness Adventurer was taken undertow. The vessel and it's escorts passed the GLBA boundary at approximately 1800. Contract and NPS personnel remained on site that night to continue clean up and removalof barrier boom.

On Friday, 6/18/99, the NPS on site commitment consisted of the vessel Task and two personnel. At approximately 1500 the boom removal was completed and all resources left Dundas Bay. The management of the incident was returned to the park at 1800.

Logistics Section Summary

This incident occurred on the evening of 6-12-99, Glacier Bay National Park personnel responded to this emergency and deployed supplies and equipment as needed. Ray Cozby took the lead of Logistics and started the process of documenting the location and number of equipment and materials that were needed. The Incident Management Team arrived on Sunday the 13th and officially started the tracking process of supplies, equipment and manpower. The Park Service Incident team had to coordinate with the Logistics team of the Incident Command of the Coast Guard which was located in Juneau. The Logistic branch is responsible for supporting the incident for the ordering of equipment, supplies and personnel, we also manage the communication side of the incident. Some of the items that we ordered were placing a portable repeater for better communication, arranging lodging and meals for personnel that were stranded at Barlett Cove for the night and Incident personnel that were on extended stay. The accountability for this incident was proving difficult due to the fact that park personnel raided supplies and it was not documented through the Logistics branch for this incident. It was the intent of this branch to try and develop a complete list of items that needed to be ordered to make the park whole again. RECOMMENDATIONS TO THE PARK WOULD BE TO DOCUMENT ALL SUPPLIES USED FOR SUCH INCIDENTS AT THE TIME THAT ARE TAKEN FROM A CACHE.

Finance Section Summary

The Incident Management Team Finance Section operated in a normal fashion with the exception of funding.

Due to the nature of the incident, the National Park Service funded their response through the Pollution Removal Funding Authorization (PRFA). This fund is a component of the Oil Spill Trust Fund and was administered by the US Coast Guard. Commander Eley authorized an initial ceiling of $20,000, which was later raised to $100,000. This fund will only pay for direct response and containment response activities. Incident total $84,000.

Financial documentation for PRFA is different than the incident command format. Cost accounting was completed in both formats to assist the park with the final billing process. Park administrative staff was encouraged to seek regional and national review before submittal of the final bill.

Another type of funding was sought to accomplish resource management assessment of upper Dundas Bay to provide current data in the event of a release. The authority of the Natural Resource Damage Assessment was used to seek additional funding from the responsible party.

Planning Section Summary

The planning section was responsible for compiling the Incident Action Plan, tracking resources, demobilization, and documentation. Because the incident was under a Unified command in Juneau, the incident management team provided a limited Action Plan to be included in the overall Incident Action Plan. The operations section completed the Division Assignment List daily and handed off to the planning section during the Preplanning meeting. Incident Dispatch put together the Incident Radio Communications Plan and Medical Plan. The action plan was approved daily during the planning meeting and faxed to the Unified Command in Juneau. Later in the day Unified Command would fax the completed Incident Action Plan to Glacier Bay National Park. The resource list was complied with help of Tulip Morrow, operations, and Time unit. The time unit set up a daily check-in sheet which also served as the check - in for the incident. Organizational charts were created daily, posted and a copy given to the time unit. A demobilization plan was prepared and put into effect. Documentation package was compiled to be left with the park.

The team came in without a Logistics Section Chief. One was order by the planning section to relieve Glacier Bay employee, Ray Cozby. Don Mannel from Golden Gate National Recreation Area filled the order.

Information Office Summary

The U.S. Coast Guard was the lead agency in the Unified Command System for managing the Wilderness Adventurer Incident. The primary role of information officer for the IMT was to coordinate review of interagency press releases, disseminate information to park and concessions staff as well as to the community. Daily staff updates were generated by the IO and copies distributed to each division chief, must read boards, front door bulletin board and information boards in the ICP and the headquarters conference room. Assistant Information Officers provided quick distribution of these items to staff.

Another successful tool in distributing information was the park's intranet site. Park computer specialists set up a basic, easy-to-use, template for the IO to post photographs, charts and updates. Attempts to scan the IAP for posting were problematic, however should the scanner be able to do so in the future it would cut down on the amount of paper used to distribute some information. The use of the intranet and Q drive also supported GLBA's excellent recycling program by not using extra paper in the copying of info to many staff members.

Media interest was primarily from Anchorage Daily News, Associated Press (and therefore lower 48 associated carriers), Juneau Empire and KTOO. Coverage was accurate and photos were available from an initial media pool. The IMT IO provided approximately one dozen interviews during the course of this event. The presence of the U.S.C.G. lead IO definitely lightened my interview and press release workload. Two NPS releases were issued. The first by

Vickie McMillan, NPS GLBA to report the initial grounding. The initial report by NPS staff was timely and accurate in spite of poor radio communications on scene with the dispatch. The second release was a transition release to announce the USGC as the lead agency in Unified Command.

Park staff was valuable for the IO when working as IO trainees and assistants and everyone was very professional and organized. The UC was problematic in the flow of communications between the USCG IC and the UC agency IOS. I felt that my counterparts in USCG and ADEC kept me in the loop and informed. However, in one case the NPS was not in the loop on a critical release that was issued by USCG after the successful refloat. The NPS Deputy IC and the IMT IC were very helpful in acting as liaisons to resolve the communications/review problems.

Excellent outcome, great park, great staff.

Summary of Resource Impacts Associated with WAVE Grounding

Resource staff feel that the resource protection goal was accomplished.

Release of Fuel – generally, there was very little release of fuel during the incident. Estimates range from 40-80 gallons of product were released. Resource impacts associated with this release are likely negligible.

Sunday: Resource staff noted one large contiguous sheen outside the boom surrounding the grounded vessel. Sheen was likely a result of the boom becoming "hung up" on the vessel during tide changes.

Monday: Resource staff noted that the boom problem had been fixed. Staff discovered that the sheen was reaching the beach at the head of the inlet.

Tuesday: Resource staff did not see any sheen outside of the boom surrounding the vessel. Crews on shore (Coastal Monitoring crews (3) and Intertidal Clam crew (1)) did not see any sheen onshore.

Wednesday: When the boom was released around the vessel to allow the tug to pull it off the rock, a small sheen appeared around the vessel. Resource staff collected several small clumps of seaweed floating on the surface of the water which had been contaminated with fuel. This debris was disposed of in SEAPRO plastic bags. Staff also noted that most/all large diaper pieces were removed, but some small bits of diaper may not have been recovered.

Thursday: Resource staff walked the head of the inlet and adjacent shoreline and did not see any sheen or residue of fuel on the beach. They removed one plastic sandwhich bag and bits of foam (used to seal windows and vents).

Human Activity – Resource staff felt that human activity on the shoreline was minimal and likely had little impact on resources. Human activity related to vessel traffic was significant and may have resulted in dispersal of black bears from adjacent shorelines. Numerous bears were seen early on in the event; fewer bears were noted as the salvage operation continued. There were few marine mammals or seabirds in the inlet, so it is likely that little disturbance of these species took place. Resource staff indicated that response vessels (skiffs with 2 cycle outboards especially) may have resulted the largest impact to the area.

Oil Spill Incidents at Bartlett Cove Dock[a]

Date	Volume	Cause	Corrective Action
07/02/87	10 to 20 gallons diesel	Unattended nozzle during fueling.	
08/02/87	2 cups gasoline	Unknown	Absorbents used to collect spill.
08/11/89	less than 1 gallon diesel	Leak in fuel hose.	Stopped fueling. Swept sheen with absorbent pads.
05/23/90	4 to 8 gallons diesel	Leaking fuel filter on fueling system.	Stopped fueling. Used absorbent boom (5 each 10 inches by 10 feet) and absorbent pads (350) to clean up spill. Filter o-ring replaced.
06/14/90	less than 1 gallon diesel	Overfilling 55-gallon drum at dock; fueling operation unattended.	Stopped fueling. Swept area with absorbent pads.
07/14/91	5 to 10 gallons diesel	Improperly installed fuel return line on vessel.	Stopped fueling. Used absorbent boom and absorbent pads to clean up spill.
05/28/92	1 quart diesel	Overfilling due to unattended operation.	Stopped fueling. Used absorbent pads to collect spill.
12/24/92	1 quart diesel	Leak in 4-foot diesel line.	Contained drips in a bucket. Repaired coupling.
05/16/93	2 quarts hydraulic fluid	Hydraulic line rupture on vessel during pressure testing.	Vessel skipper applied dispersant (soap).
08/14/93	1 cup motor oil	Used oil filters leaking oil into and out of dumpster.	Removed filters. Cleaned dumpster and dock.
05/14/94	1 to 7 gallons	Leak in vessel fuel system.	Depressured fuel system. Used absorbent pads to clean spill.
07/10/94	1 gallon diesel	Overfilling due to unattended operation.	
05/25/95	1 gallon diesel	Vessel bilge.	Pumping stopped. Cleaned bilge.
06/07/95	2 quarts diesel	Vessel bilge.	Pumping stopped. Cleaned bilge.
06/13/95	2 to 3 quarts diesel	Defective shutoff valve on fuel dispenser.	Dispenser shut down. Dock and water cleaned with absorbent pads. Faulty valve replaced.
06/17/95	1 pint diesel	Vessel bilge.	Stopped pump.
06/21/95	½ cup diesel	Vessel fuel vent.	
08/14/95	5 gallons diesel	Cap not tightened on bus fuel tank.	Absorbent pads used to clean ground.
06/11/96	½ cup diesel	Overfill of vessel.	Absorbent pads and dispersant (soap).
06/18/96	½ cup diesel	Vessel generator.	
06/18/96	teaspoon diesel	Vessel fuel vent.	Owner used dispersant (soap).
06/28/96	½ cup diesel	Vessel fuel vent.	Owner used dispersant (soap).
07/19/97	1 to 4 cups gasoline	Vessel fuel system.	Absorbents used to collect spill.
07/31/97	1 to 2 cups diesel	Repair to vessel fuel line.	Absorbents used to collect spill.
08/13/97	1 to 2 gallons diesel	Faulty valve on fuel dispenser.	Absorbents used to collect spill.
10/13/98	1 quart diesel	unknown.	Investigated.

Source: Fuel Transfer And Storage Facility Spill Prevent and Control Countermeasures Plan. Michael Baker, Jr., Inc. May 8, 2000

Note: a Excludes non-quantifiable spills resulting in sheen.

APPENDIX F

Fuel Spill and Spill Response Information

TABLE 1: GUIDING PROPERTIES OF EFFECTS OF FUEL OIL

	Fuel Oil Type		
Properties	**Marine Diesel (No. 2)[a]**	**IFO 380 (No. 6)[a]**	**Gas/Oil Mixture[b]**
General description	light, refined product	blend of heavy residual oil with diesel (3:1 usually)	Blended light refined product with llubricating oil (25-50:1 usually)
Classification (33 CFR 155)	Group I, non-persistent oil	Group III, persistent oil	Group I, non-persistent oil
Probability of mousse formation	low (viscosity too low)	low (viscosity too high)	low (viscosity too low)
Percent evaporated and Dispersed after 12 hours	24%	1%	86%
Percent evaporated and Dispersed after 24 hours	42%	4%	98%
Percent evaporated and Dispersed after 48 hours	67%	10%	100%
Percent evaporated and Dispersed after 5 days	87%	20%	100%
Behavior on shoreline	penetrates porous sediments, dispersed/degraded by tide, wave and microbial action	remains on surface, bath tub ring at high tide, degradation takes months to years	Dispersed/degraded by tide, wave and microbial action, readily volaitlizes with wind and warm temperatures
Environmental toxicity	acutely toxic to water column organisms, shellfish tainting, fish kills in confined shallow water, minor impacts on seabirds due to quick dissipation	primarily from physical coating of marine mammals, seabirds, intertidal organisms	acutely toxic to water column organisms, shellfish tainting, fish kills in confined shallow water, minor impacts on seabirds due to quick dissipation
Effectiveness of mechanical recovery and shoreline countermeasures	usually of limited effectiveness due to rapid dissipation, exclusion/deflection booming can be effective	open water recovery should be attempted, shoreline countermeasures can be very effective	Usually of limited effectiveness due to rapid dissipation, dispersion instead of containment is suggested because of the combustible nature of gasoline

A: Source Ely 2000
Assumes 2,500 barrel spill (100,000 gallons) in 9 degrees Celsius seawater under calm conditions with winds at 10 miles per hour.
B: Source NOAA ADIOS Software 2000
Assumes 100 gallon spill in 9 degrees Celsius seawater under calm conditions with winds at 10 miles per hour.

TABLE 2: SPILL RESPONSE EQUIPMENT AT BARTLETT OR BLUE MOUSE COVES, MARCH 1999

Location	Item Description	Amount	Time	Operations Status
Boat Dock	Deflection boom, 34-inch yellow with slide and pin connectors	400 feet (enough to encircle dock)	<1 hour	Ready
Fuel Storage Building by Tank Farm	Mini boom, SS-500, 4 booms/bale, 5 inches diameter by 10 feet	3 bales (120 feet)	<1 hour	Ready
	Sorbent mat, SS-150	2 bales	<1 hour	Ready
	Sorbent pads, 17-by-19-inch sheets, 3M, 100 sheets/bale	14 bales	<1 hour	Ready
	Type 270 boom	4 booms 10 feet by 8 inches (40 feet)	<1 hour	Ready
Fuel Barge *Petrel* at Bartlett Cove,	Deflection boom, 34-inch yellow with slide and pin connectors	3 segments	1 hour	Ready
October to May	Mini boom, SS-500, 5-inch diameter by 10 feet	4 booms (40 feet)	1 hour	Ready
At Blue Mouse Cove, May to October	Sorbent pads, 17-by-19 inches, 100 sheets/ bale	½ bale	1 hour	Ready
At Blue Mouse Cove, May to October	Diesel America 3-inch trash pump	1 each	1 hour	Ready
At Blue Mouse Cove May to October	Floating Hale pump with hose for fire	1 each	1 hour	Ready
Containment pad adjacent to fuel tank farm	2,000 gallon tanker truck	1 each	15 minutes	Ready
Boat Dock, April to May	15.5-foot Boston Whaler boat	1 each	30 minutes	Ready
Park Maintenance Shop	Front-end loader Caterpillar IT-18	1 each	30 minutes	Ready

Source: Baker 2000.
Additional equipment is readily available at the Power Plant and Park Landfill.

TABLE 3: PROBABLE SPILL SCENARIOS – BARTLETT COVE FUEL STORAGE AND TRANSFER FACILITY

Most likely discharge	Occurs during dispensing of fuel to the boats. The average most probable spill is 1 pint of gasoline or diesel fuel waterborne in any single incident, however, if the pumping operation continues without observation, a spill of around 150 gallons may occur.
Maximum most probable discharge	Failure of piping, hoses, or coupling during transfer. This can occur from a split hose, coupling, pipe fitting, or pipe while fuel is being transferred from the barge to shore. This would likely spill several hundred gallons of product before flow could be stopped.
Worst case discharge	The worst case discharge at this facility would come from a rupture of one of four 3,000 gallon fuel oil tanks. Three of these tanks are used for fuel storage at the Glacier Bay Lodge, and one is used for fuel storage at the Utility Service Building.

Source: Baker 2000.

APPENDIX G

Vessel Wakes Technical Memorandum

(Note: This memorandum was prepared prior to development of the DEIS. Subsequent analysis resulted in some minor changes in conclusions, but overall methods and analysis are the same.)

Peratrovich, Nottingham, & Drage, Inc.
engineering consultants

DRAFT Technical Memorandum

Vessel Wakes

Glacier Bay Environmental Impact Statement
Glacier Bay National Park And Preserve, Alaska

November 2002

Prepared By
Peratrovich, Nottingham & Drage, Inc.
1506 West 36th Avenue
Anchorage, Alaska 99503

Prepared For
Ecology and Environment, Inc.
840 “K’ Street,
Anchorage, Alaska 99501

PN&D Project No. 02056

Table of Contents

Tables

Figures

Plates

Attachments

1 INTRODUCTION

The purpose of this technical memorandum is to describe the nature of vessel generated waves, referred to as wakes, in Glacier Bay National Park and Preserve, Gustavus, Alaska. The analysis compares the effects of vessel generated surface waves to the effect of natural wind generated surface waves. This analysis was applied to selected sites on the Glacier Bay proper shoreline. The reason for the analysis is to identify where vessel wakes could cause adverse effects to the resources and/or users of the park. This information will be used as one element in determining the appropriate number of vessels and vessel operating requirements in the park. The technical memorandum presents a method to evaluate the different physical effects caused by wakes for each respective alternative in the Environmental Impact Statement on Vessel Quotas and Operating Requirements (EIS). Other effects of vessel generated waves on park users and animal inhabitants of Glacier Bay proper are discussed in other sections of the Environmental Impact Statement. Many terms used in this memorandum have specific meaning in coastal engineering. Please see section 6 for definitions.

2 EXECUTIVE SUMMARY

An extensive literature search was conducted to identify any existing evaluation models that were directly applicable to this project. None were found so the theory behind several existing models was utilized in developing the models used for this study. The process used to determine the sites was to identify where vessels travel within 2,000 feet of the shoreline. This distance was based on research and the accuracy of the vessel traffic data. The next step was to conduct a wind analysis and derive the wave climatology for each site. The wave climatology provides the energy imparted to the site over a one-year period due to natural wind waves. An energy index was calculated for each site by comparing the energy imparted by vessel wakes to natural wind waves. This index makes it possible to discern the effect due to natural wind wave energy from the effect due to vessel wakes despite differences in wind energy at all sites. The potential erodability of the site was evaluated by examining existing data on substrate size and beach slope. The site was assigned an overall erosion potential based on the site erosion potential due to substrate and the vessel wake energy index.

3 BACKGROUND

This section provides the theoretical basis for the analysis of waves. It is intended to provide the reader with an understanding of the various wave models available, which model(s) were used, and how those models were used in the evaluation of waves and wakes on the shoreline of Glacier Bay proper.

3.1 BASIC ASSUMPTIONS AND INFORMATION

There are many causes of waves across a water body. These include tides, wind, tsunamis, and vessels. The technical memorandum evaluates two generators of waves, wind and vessels.

Wave energy is a quantifiable parameter and is equal to the ability of the wave to do work on the shoreline. The energy that a wave contains determines if and how much effect the wave can have on a shoreline. The energy contained in a wave that can act on a shoreline can be measured many ways. For this memorandum, the wave height is the measure for the energy contained within a wave.

A site visit to Glacier Bay revealed no observable signs of erosion or effects of vessel wakes on the shoreline. However, wave energy from vessels could have an impact over time which is not readily observable.

3.2 WIND WAVE CLIMATOLOGY

The wind wave climate is a description of the waves that are a result of the wind and is similar to describing the general weather pattern for an area. It provides wave heights and periods of typical waves. Identifying the wind wave climate at each site provides a way to analyze the effects of waves on that site. Wind induced waves are natural, or background, levels of energy that interact with the shoreline and the energy contained in a wave may act to change the shoreline.

There are several pieces of information necessary to analyze the natural wind wave climate in the park or any other location. The most important is the wind conditions. The wind speed, duration, and direction need to be measured over a period of time, preferable many years. After evaluating the wind speed, duration, and direction, the size of the natural waves can be determined. The orientation of the open water body plus its size, fetch, and depth determines the size of waves that can be generated by the wind. The typical period of a wind-generated wave in Glacier Bay proper is 1-3 seconds.

3.3 VESSEL WAKE CLIMATOLOGY

Vessels can generate two types of waves, surface and internal waves. Large vessels generate waves that generally affect the top 40 feet of the water column for the largest vessels in Glacier Bay proper. Smaller vessels' effect will be shallower. The first type of wave is surface waves. Surface waves are visible on the surface of the water body. These surface waves have the potential to affect other boaters and the shoreline environment. Surface waves would not be expected to cause mixing of nutrients in the water column. The second type of wave, internal waves, is created by vessels under specific conditions and is capable of causing mixing in the water column. Internal waves are density dependent, which means that there must be stratification in the water column that the vessel directly affects. Internal waves do not act on the shoreline and will not be discussed further in this technical memorandum.

The vessel wake climate is the effect of vessel operation on the waterway. The vessel wake climate is compared to the wind wave climate to analyze how vessel wakes affect the shoreline in excess of natural processes. Various parameters including the vessel's hull shape and displacement, and the distance to where the wave energy is no longer capable of changing the coastline were looked at to determine the size and number of vessel wakes to strike each site. The vessel wake climate pictured in Figure 1 is not capable of affecting the coastline because it is too far away from the shoreline.

FIGURE 1 PASSING BOAT'S WAKE.

3.3.1 Literature Review and Discussion of Models

The literature on vessel wave generation describes models with widely varying inputs and even more widely varying outputs. Models presented by Sorenson (1989), Blaauw et al (1983) and PIANC (1987) were analyzed to determine their applicability to Glacier Bay proper conditions. Examples of their outputs are in Attachment "Wave generation model calculations". No models were found to be directly applicable to this evaluation but the models do provide the basis for the assumptions made in analyzing the available information. A discussion of the models for wave generation and how a shoreline is affected by waves is presented here.

Generation of Surface Waves by Vessels

Vessels displace water in their passage and generate waves on the surface. This phenomenon is directly related to the water resistance encountered by the vessel due to its speed. Vessels generate surface waves in two waveforms: diverging wakes and transverse wakes (Figure 2). The crests of these waves converge at a "cusp line" where their superposition causes maximum amplitude. This means that the wake will be highest at the cusp line due to the addition of the transverse and diverging wakes. Theory and experiments indicate that the angle of the cusp line range from 19 to 22 degrees off the ship track line. The ship track is the route that a particular vessel takes on a specific trip. The energy imparted by the vessel to the water spreads laterally along the lengthening crest lines with correspondingly reduced wave height (Sorenson 1973).

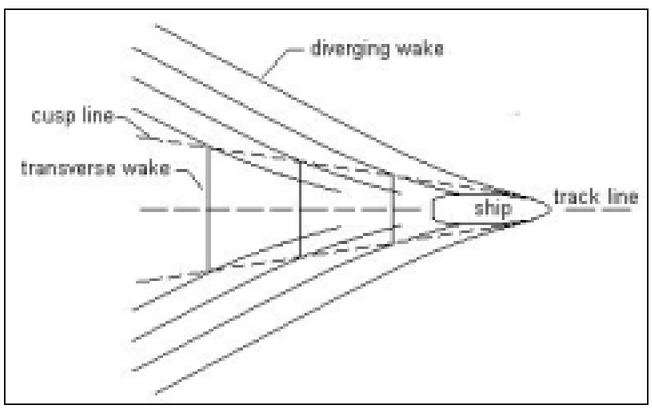


FIGURE 2 PATTERN OF VESSEL-GENERATED WAVES.

The relationship of the vessel speed to the water depth determines the behavior of the wake. A vessel traveling at the same speed through areas with different water depths will produce different wakes. The Froude Number, F, is an accepted measure to define this relationship, defined as

$$F = \frac{V}{\sqrt{gd}}$$ **, where** **Equation 1**

V = the vessel speed through the water,
g = acceleration of gravity (32.2 ft/sec2 or 9.81 m/sec2), and
d = water depth.

The transverse wake is longer than the diverging wake, in terms of the horizontal distance between adjacent wave crests, and therefore is first affected by shallow water. When F exceeds 0.6 to 0.7, the transverse wake is transformed through interaction with the bottom and its propagation speed is constrained. This means that transverse wakes are more quickly dissipated and less likely to reach a shore or any great distance from the vessel when the water body is shallow. Waves cannot exceed a propagation speed of $\sqrt{gd}$, so no transverse waves are possible when F is greater than one. Only diverging wakes are generated when vessels, like small powerboats on plane or larger high-speed catamaran excursion boats, are at higher speeds. Diverging waves have shorter wavelengths than transverse wakes and are less prone to water depth effects. Their propagation speed, C, is predicted by:

$C = V \cos\theta$, where **Equation 2**

$\cos\theta$ = the trigonometric cosine of the angle of wave propagation to the ship's track line.

V = the vessel speed through the water

The pattern of a group of diverging waves from a single ship passage experienced at some point away from the track line is typically 15 waves with increasing wave heights to a central maximum height, as illustrated in Figure **3** (Sorensen 1973 and 1989, Weggel and Sorensen 1986, and Maynard 2001). The maximum height of the wake is initially a function of ship speed, displacement, and underwater shape. The wake height decreases with distance from the track line.

FIGURE 3 GROUP PATTERN OF 15-20 WAVES. THE WAVES ARE GENERATED BY A SINGLE VESSEL PASSAGE, EXPERIENCED AT A POINT ON THE WATER OFFSET FROM THE TRACK LINE.

Predictions of maximum wave height at a given distance from the track line are based on empirical findings. Weggel and Sorensen (1986) predict maximum wave height, H_m, at track offset distance, x, on the basis of F, water depth, d, and the cube root of ship displacement, $\cancel{V}^{1/3}$. See pages 4, 5 and 6 of Attachment "Wave generation model calculations" for details of the formulation. Figure 4 illustrates an example application for a cruise ship. Note that the predicted maximum wave height decreases as the wake travels farther from the vessel that produced the wake. This equation is conservative in comparison to other similar formulations and measurements (Blaauw et al 1984, PIANC 1987, Sorensen 1989, Hüsig et al 2000, and Veri-Tech 2002).

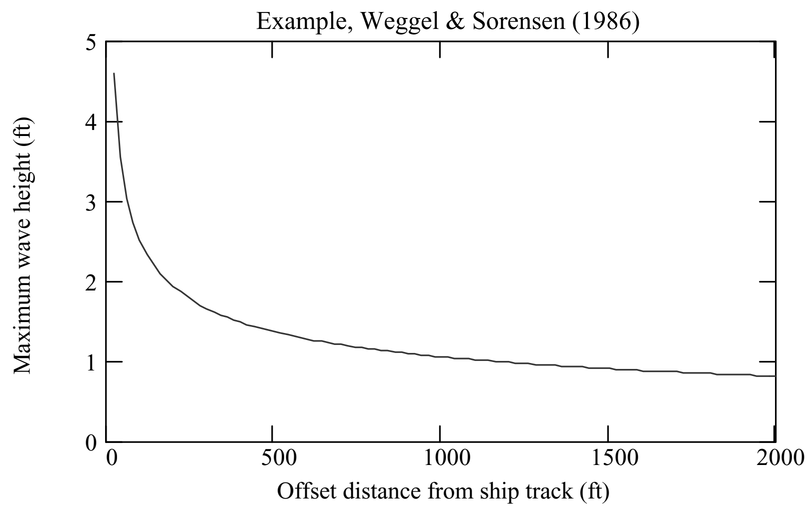


FIGURE 4 EXAMPLE APPLICATION OF WEGGEL AND SORENSEN (1986). GIVEN A SHIP OF 1000 TONS DISPLACEMENT WITH A SPEED OF 15 KNOTS THROUGH THE WATER IN 100 FATHOMS DEPTH. THE WAKE IS PREDICTED TO PROPAGATE AT C = 12.2 KNOTS WITH AN ANGLE θ = 35.3 DEGREES TO THE SHIP TRACK AND TO HAVE A PERIOD T = 4.0 SECONDS AND WAVELENGTH L = 83.4 FT. WAVE HEIGHTS BEFORE AND AFTER THE MAXIMUM WILL BE DIMINISHED AS SHOWN IN FIGURE 3.

Table 1 provides the maximum wave height generated by a series of vessels at a speed of 10 knots, as presented in Sorensen (1973). Sorensen's measurements demonstrate that vessels of varying sizes all had wakes with maximum wave heights of less than 1-foot at a distance of 500 feet from the sailing line. Similar findings were reported in a study which measured vessel wakes on the Kenai River and Johnson Lake (Maynord 2001). In this study Maynord looked at the vessel wakes of 16 to 20-foot long boats of various hull shapes and beams. He found that these vessels generated maximum waves at speeds of approximately 8-knots. The waves were less than one foot measured between 30 and 50 feet from the track line. Although the wave height dropped off rapidly with distance from the track line, the wave's periods remained constant.

TABLE 1 MAXIMUM WAVE AMPLITUDES GENERATED BY A SERIES OF VESSELS AT A SPEED OF 10 KNOTS AS PRESENTED BY SORENSEN (1973).

Vessel	Length ft	Beam ft	Draft ft	Displacement tons	Distance from sailing line 100 ft Height ft	500 ft Height ft
Cabin Cruiser	23	8.25	1.7	3	1.1	0.8
Coast Guard Cutter	40	10	3.5	10	1.6	1
Tugboat	45	13	6	29	1.6	0.9
Fishing boat	64	12.8	3	35	1.8	0.7
Fireboat	100	28	10.5	343	1.6	1

3.4 DESIGN WAKE ASSUMPTIONS

- Design Wake height is 1 foot. This is the maximum wave height expected for any of the vessels permitted in Glacier Bay proper and therefore is protective of the coastline.
- All vessels within 2,000 feet of the shoreline will have a design wake of 1-foot. (See "Vessel Track Analysis Methodology" for information on the selection of 2,000 feet from the shoreline for analysis purposes).
- Vessels generate 15 wake waves. This is the maximum number of waves that will intercept the shoreline at any one point from a passing vessel.
- All wake energy is assumed to be directed perpendicular to the shore.

4 GLACIER BAY PROPER ANALYSIS METHODOLOGY

4.1 METHODOLOGY FOR CONDUCTING WAKE ANALYSIS OF GLACIER BAY PROPER

PN&D analyzed the collected data and chose specific sites that will require detailed evaluation. This was done by:

- evaluating vessel track data for proximity to shoreline to determine the number of vessels that come within 2,000 feet of the shoreline for the energy index calculation

- evaluating Gustavus, Alaska wind data to determine the natural wind patterns including strength (wind speed) and direction
- examination of the physical features of Glacier Bay proper to determine the physical restrictions and limitations in wave development,
- evaluating the fetch geometries of the chosen sites to determine the amount of wind wave energy that will assault the site and compare that to the vessel wake energy at the same site, and
- evaluation of material size at beaches to determine risk of erosion.

4.2 GLACIER BAY PROPERPHYSICAL FEATURES

The mouth of Glacier Bay proper is located near Gustavus, Alaska, which is 50 miles due west of Juneau, Alaska. Glacier Bay proper (Plate 1) is approximately 60 miles long and consists of a 4-mile wide entrance narrows, Sitakaday Narrows, which opens up into an approximately 12-mile wide main body. North of the main body, the East Arm creates a north-south fetch of approximately 55miles. The West Arm also creates a maximum fetch of 55 miles, oriented at 140 degrees. Fetches are distances over which waves are generated when sustained winds blow. These long fetches, over deep waters of Glacier Bay proper, create a wave climate similar to the open sea. Water depths in mid-channel range from 200 feet in Sitakaday Narrows to 1,400 feet in the upper West Arm. Glacier Bay proper also contains many protected waterways in various orientations and the wave climate will differ substantially from the open areas. Analysis with restricted fetches (narrow channels) applies to the waves generated in these protected waterways.

Tidal currents and waves are major influences over the shape of beaches. This is a relatively new method of influence in Glacier Bay proper due to the long period of glacial ice coverage. Glacier Bay proper is an example of a secondary coast, in that terrestrial forces, in this case, glacial activity, formed it. The tidal range in Glacier Bay proper is large at approximately 24 feet. Tidal currents act on the shoreline primarily as long shore transport. In addition, wave action acts both perpendicular to the shore and parallel to the shore; something that was absent until recently due to glacial ice covering the bay.

4.3 SITE VISIT

PN&D conducted a site visit to Glacier Bay proper on June 12, 2002. One of the purposes of the site visit was to observe maximum tides and currents. The site reconnaissance consisted of taking photographs and recording the vessels path using a global positioning system (GPS) unit during an eight hour Spirit of

Adventure Tour Vessel Cruise from Bartlett Cove to Grand Pacific Glacier at the head of the West Arm. The GPS record for the cruise is shown in Plate 1. The vessel positions and speed between waypoints is provided in Attachment "Spirit of Adventure positions and speeds". During the trip around the bay, a negative 2.7-foot (extreme low) tide was observed at approximately 9:30 am. A brown bear was observed foraging at the waterline on the exposed food supply at the extreme low water mark (see concentration of waypoints just north of Tidal Inlet, Plate 1).

The data collected by the GPS during the site visit included vessel track (route) and speed. Vessel track information is necessary to estimate the number of vessels that are close enough to the shore to affect the shoreline. GPS provides a speed relative to the ground; much like a speedometer provides the speed of a car. This does not provide the speed of the vessel in relation to the water when there are currents. To identify the speed of Spirit of Adventure in relation to the water, PN&D used coastal prediction tables available at NOAA/OPS online. The maximum ebb current was 5.2 knots west of Beardslee Island and the maximum flood current was 6.1 knots for the day of the site visit. These values corresponded with the 4-knot flood current observed by the ship captain at 2:15 pm, which should have been the time of maximum flood current adjusted to that location. By using the GPS record made during the cruise, Spirit of Adventure speed relative to the water at any time can be inferred using its GPS speed log (speed relative to the ground) and tidal currents predictions for each location. The GPS record also provides the distance from the shore that the vessel traveled. This is necessary information to determine which sites to investigate further.

FIGURE 5 DAWN PRINCESS, CRUISE SHIP CLASS

The investigators observed that the cruise ship Swan Princess (Figure 5) appeared to be traveling at top speed up Glacier Bay proper at 1pm on June 12, and appeared to have generated a wake of less than 1 foot height at a distance of 2,000 feet, when Spirit of Adventure crossed its wake. The period of the wake was between 1 and 2 seconds. The period and distance were estimated by timing the sound and motion induced in the video recording of the wake crossing.

4.3.1 Ship Captains Interview

One of the purposes of the trip was to observe the wake produced by catamaran tour vessels, such as Spirit of Adventure. This vessel has very desirable characteristics for a tour vessel because it accelerates rapidly and produces minimum wake and noise. The maximum wake, according to Spirit of Adventure Captain Kanoi Taylor, occurs when the boat is at the speed of 12 to13 knots relative to the water. The maximum water height generated by Spirit of Adventure is not in the form of a wave. The frothy convergence centered behind the stern quickly dissipates energy without contributing energy to formation of waves. See Figure 6, Spirit of Adventure wake. This type of wake is advantageous for a vessel which makes frequent stops along beaches, as waves from the departure wake are minimized.

FIGURE 6 SPIRIT OF ADVENTURE WAKE

4.4 WIND WAVE ANALYSIS METHODOLOGY

The wind wave analysis calculates the natural wind wave heights and periods for sites in Glacier Bay proper. Site-specific wind measurements are unavailable for Glacier Bay; however it is available for Gustavus Airport, Alaska. Several coastal cities in southeast Alaska have first order stations, including Juneau (1987-1999), Sitka (March-December 1999), Ketchikan (March-December 1999), and Cordova (December 1999). Wind summaries and wind roses for Juneau, Ketchikan, Sitka and Cordova are presented in Attachment "Wind summaries for Sitka, Ketchikan, Juneau, and Cordova (1987-1999)". Weather data collection stations have different ratings based on collection methods and accuracy standards with first order stations having the most reliable data. Plate 2 compares Gustavus to its nearest first order station and demonstrates that the wind patterns in Gustavus are similar to Juneau and sufficient for this evaluation. Therefore, data from the Gustavus Airport from 1987 to 2002 was used as the baseline data for the Glacier Bay wind analysis. The airport anemometer in Gustavus is on a flat, sparsely treed delta and is likely to share its wind climate with Glacier Bay proper. National Climate Data Center provided raw wind data for Gustavus.

As in all of southeast Alaska, wind directions induced by large-scale weather patterns prevail along the main channels of the bay. The dominant NW-SE winds at Gustavus (Plate 2), for example, have a similar speed distribution to N-S prevailing winds in the main channel of the lower bay (Plate 1). Similarly, the distributions of wind speeds in the prevailing directions at Glacier Bay proper and Gustavus are expected to be similar to the speed distribution in the prevailing directions at Juneau, 50 miles east, as seen in Plate 5. A pattern of wind speeds and directions in selected parts of Glacier Bay proper was constructed following this above logic.

For the wave analysis, below, PN&D used the Gustavus wind rose to combine related sectors of winds. This is done to determine the directions to use for the wave analysis. Five categories appear to be most significant and winds from combining related sectors are shown in Plate 3. The related groups were assigned the values of 50^o, 130^o, 200^o, 260^o and 340^o.

4.4.1 Fetch Restrictions and Wind Duration Analysis Methodology

Wave analysis requires predicting the height and period of the waves. The length of the fetch, duration and intensity of wind determine the height and period of the waves. Glacier Bay proper has both open fetch areas and restricted fetch areas. In open areas, like the midsection of the main body of water, the fetch is less important than the duration of a particular wind event in generating waves. When this condition exists, the wave growth is said to be duration limited. In a narrow area, like protected inlets and near protecting islands, wave growth will be fetch limited. There is not sufficient fetch length (depending on the direction of the particular wind) in some parts of Glacier Bay proper to generate large waves even if the wind blows strongly for a long time.

In the wave analysis, fetch restrictions were modeled using CEDAS (Veritech, Inc) wind generated wave growth model. Deep water wave growth was used since $d/L>0.7$ for wind waves in Glacier Bay proper. Glacier Bay proper has deep water waves, which means the wave energy does not interact with the bottom. This is similar to the ocean. For a diagram showing application in restricted fetches see Attachment “Technical References”, Aces Technical Reference, pages 8 and 9.

The wind duration used for the wave growth model was one hour. This assumption will predict smaller waves than would actually exist during wind events as a typical storm event lasts longer than one hour. A wind event is a period of sustained wind in both speed and direction. This is a conservative assumption from this discussion because the analysis will be biased towards the vessel wakes causing an effect.

4.4.2 Wave Analysis Methodology

The wave analysis includes information from the weather stations and the vessel track information. The information from the weather stations is used to create the natural wind wave climate at each site. The vessel track information is used with the vessel wave design height to create the vessel wave climate at each site. The energy, or ability to do work, of the two climates is compared against each other in the energy index. The number of waves that strike the shore, whether it is a storm or vessel passing, is one measure of the amount of energy in a single event.

According to the Airy (linear wave) theory, if all waves are propagated in the same direction, the total energy for each wave is:

To get the total energy, we multiply the energy per wave by the number of waves. In this report, it is convenient for comparison purposes to define the energy index, N, for a particular coastal site. N is the cumulative energy of the design height (one foot) vessel waves to strike the shore in a year divided by the cumulative energy of wind-generated waves to strike the same shore in a year.

Assumed Wave Height

The approach used for this technical memorandum is to select a conservative wave height based on the vessels which are permitted in the bay and use this height for all calculations. This will provide an increased safety factor in calculating the energy contained within a vessel wake. The conservative wave height value provides a worst-case scenario as this is the maximum wave height expected to be produced by any of the vessels permitted to enter Glacier Bay proper. Further justification of this approach is given at II-7-61, Coastal Engineering Manual (30 Sep 96), see Attachment “Technical References”.

Vessel Track Analysis Methodology

Vessel traffic information is required to determine the number of vessel waves at any site. PN&D used the track logged during the site visit on June 12, 2002 and the vessel tracks provided by NPS in order to determine the number of vessel waves. During the site visit on the Spirit of Adventure, this vessel appeared to be traveling closer to shore than any other vessel observed during the trip. According to the GPS record, the Spirit of Adventure maintained an average distance of approximately 1,000 feet when it was closest to shore.

Vessel track data provided by NPS contains shape file data for cruise vessels, tour vessels and charter vessels. There was no information for private vessels. The vessel track data set was used to predict the number of vessels that passed within 2,000 feet of the shore. The tracks within 2,000 feet of the coastline were counted. The analysis uses 2,000 feet because the literature indicates that wakes from vessels are found to have attenuated to approximately 1-foot at a distance of 1,000 feet from the vessels track. The 2,000-foot distance provides an acceptable margin of error and is protective of the coastline against erosion. It is important to note that the NPS stated that their track data is only accurate to ±3,000 feet. NPS track data provides the only information available with which to make a prediction on vessel traffic patterns. Plate 4 Glacier Bay vessel traffic is an example of one of the vessel track datasets from NPS.

Wave and Wake Energy Analysis Methodology

To complete the shoreline effect analysis for Glacier Bay proper, the energy levels for wind-induced waves and vessel wakes are divided to give a comparison index. The following assumptions were made:

- A design vessel wake represented all vessel wakes at each shore site.
- This design vessel wake is conservative as most vessel wakes will have less energy than the design wake.
- The design boat wake maximum height is 1-foot.

- 100% of the vessel wake energy is directed at the shore.
- Wind duration for a storm event is set at 1 hour.

A design boat wake was chosen to represent every vessel wake because reliable statistical information about each particular class of vessels wakes is not available and the vessel wake attenuation through the water has a significant effect on its energy at the shore site. The 1-foot design wake is conservative and biased towards showing an affect on the shoreline. The wind duration for wind-induced waves is conservative as storms typically last longer than 1-hour.

4.4.3 Site Selection for Analysis

Energy levels were generated at 22 study areas (see Figure 9). Details of the selected sites are shown in Attachment "Areas identified for detailed study". These areas were selected by analyzing vessel track information as provided above.

An energy index value (N value) was generated for each of the 22 sites, and the sites were divided into the following categories to compare the ability of vessel-generated waves against natural conditions. This does not consider the substrate material so it is not the effects analysis.

- High – if the energy of the vessel waves is of the same order of magnitude as the wind waves (1/1). This means that all the vessel wake energy over the year has the same amount or more energy as natural background conditions and is highly likely to change (erode) the coastline.
- Moderate – if the energy of the vessel waves is one-tenth of the energy of the wind waves. This means that all the vessel wake energy over the year has one-tenth (1/10) the amount of energy as a natural background conditions and is moderately likely to change (erode) the coastline.
- Minor – if the energy of the vessel waves is one-hundredth of the energy of the wind waves. This means that all the vessel wake energy over the year has one-hundredth (1/100) the amount of energy as a natural background conditions and has a low likelihood of changing (eroding) the coastline.
- Negligible – if the energy of the vessel waves in one-thousandth of the energy of the wind waves. This means that all the vessel wake energy over the year has one-thousandth (1/1000) the amount of energy as a natural background conditions and is highly unlikely to change (erode) the coastline.

The period chosen for the evaluation is one year. This allows for the use of a full year of wind data. Any shorter period would not correctly interpret cumulative effects of wind waves. A longer period would be necessary to correctly predict the effect of climate cycles, for example El Nino. The vessel analysis evaluates a single permit-required season, which generally runs from June through October.

4.4.4 Wind Wave and Vessel Wake Comparison

This section discusses the probability that a design vessel's wake height will exceed a typical summer storm's wave height. This probability is important to discuss because it provides a summary of how strong a wake is compared to a wave. The probability varies from site to site and from beach to beach due to different angles to the wind and the fetch length. Wind direction is an important factor in evaluating the natural wind waves because there must be sufficient fetch to create a wave and the wave needs to be nearly perpendicular to the shore for the wave to act on the beach.

Site 11, see plate 4, provides an example of calculating probabilities. Site 11 has two beaches as it includes the shoreline on each side of Tidal Inlet. Beach A is to the northwest of Tidal Inlet and Beach B is to the southeast of Tidal Inlet. For the same wind intensity and direction, the wind waves along Beach B will be higher because the fetches are longer. As discussed above, wind direction was grouped into five related sectors. For Site 11, the only two sectors of concern are 260° and 340°. Table 2 shows the number of observations when a summer (June through August) wind event created a wave of 1-foot or higher. Table 3 shows the probability of a wind event creating a wave that exceeds the 1-foot design height for selected wind speeds and durations. For example, at Beach A, a 14-knot wind blowing for an hour from 340 degrees can be expected to occur one time in 5 summers and will produce waves of the same height as the design vessel wake. As a comparison, a 10-knot wind from the same direction (340 degrees) for two hours would produce the same wind waves. These two scenarios exert the same amount of energy on the beach. The differing fetches account for the differing probabilities between Beach A and Beach B.

TABLE 2 NUMBER OF OBSERVATIONS WHEN WIND WAVES EXCEEDED 1-FOOT FOR SITE 11. LIMITED TO SUMMER OBSERVATIONS (JUNE, JULY AND AUGUST), GUSTAVUS, AK.[1]

Wind Speed In Knots	Number of Observations with Wind Direction 260°	Number of Observations with Wind Direction 340°
16	1	0
15	1	1
14	2	1
13	9	3
12	12	16
11	27	30
10	59	56
9	105	111
8	158	215
7	276	383

TABLE 3 PROBABILITY OF SELECTED WIND SPEEDS AND DURATIONS PRODUCING 1-FOOT WAVES AT SITE 11.[2]

Wind		Beach A			Beach B		
Duration (Hours)	Direction (Degrees)	Wind Speed (Knots)	Probability of exceeding 1-Foot wave (%)	Average Number of times exceeding 1-foot wave	Wind speed* (Knots)	Probability of exceeding 1-Foot wave (%)	Average Number of times exceeding 1-foot wave
1	340	14	0.0087	0.2	13	0.0260	0.6
2	340	10	0.4858	nc[3]	9	0.9630	nc
3	340	8	1.8652	nc	7	3.3226	nc
1	260	16	0.0087	0.2	14	0.0174	0.4
2	260	12	0.1041	nc	11	0.2342	nc
3	260	11	0.2342	nc	9	0.9109	nc

4.4.5 Wind/Wave Model Assumptions

- Design wake assumptions stated above. The design wake represents all vessels, regardless of size and speed, that come within 2,000 feet of the shoreline.
- Wind wave growth event is 1 hour.
- Glacier Bay is a deep-water environment in terms of wind wave growth and characteristics.
- Analysis period is one-year.

[1] Total Observations equal 11,527.
[2] The wind speed and duration shown are required to produce at least 1-foot waves.
[3] NC = Not calculated (duration analysis not performed)

4.5 PHYSICAL ATTRIBUTE DEFINITIONS

The substrate is the size of material present in the tidal zone. Table 4 provides the definition of the various material types and their potential for erosion.

TABLE 4 SUBSTRATE SIZE CHART

Substrate	Material Size	Comparison Size	Erosion Potential
Bedrock	Continuous rock	Continuous rock	Negligible
Boulder	>256 mm	human head size	Minor
Cobble	64-256 mm	Billiard ball to human head	Minor
Pebble	4-64 mm	Pea to billiard ball	Minor
Granule	2-4 mm	BB to pea	Moderate
Coarse sand	1-2 mm	Pinhead to BB	Moderate
Fine sand	0.0625-1 mm	Gritty (sugar/salt) to pinhead	High
Silt	>0.0625 mm	Smooth; forms clumps/balls	High
Shell	4-256 mm shells/fragments	Shells/fragments	Minor

The CoastWalkers database defines the substrate in terms of primary and secondary substrate. The primary substrate is the material size most commonly found at the site. The secondary substrate is the second most common material size and it has at least 10% coverage.

The slope that a beach can maintain is a function of the material size. Generally, large material also has a steep slope and small material has a gentler slope. The slope of beach is important for analysis because this defines how widely the energy is distributed across the beach (see Figure 8).

The erosion potential of a site is a function of the size of material and the amount of energy it receives. Bedrock has negligible erosion potential. Boulders, cobbles, and pebbles have minor erosion potential and require high energy levels to erode. Granules and coarse sand have moderate erosion potential and fine sand and silt have a high erosion potential. The amount of erosion visible for smaller materials depends on recruitment of new materials. A beach could have a very high erosion potential, yet not erode with a storm because it has a strong source (recruitment point) of new materials.

4.6 OVERALL ANALYSIS METHODOLOGY

Each site is assigned an erosion potential based on the site's potential for erosion. Each site is also assigned a rating for the energy index, which indicates the amount of energy imparted on the site by vessel wakes in comparison to the natural wind wave energy. How these two ratings are obtained and calculated is described above.

Reaching an overall potential effect at a site requires evaluation of the erosion potential rating and the energy index (vessel wake potential) rating. The highest, or more severe, rating common to both categories is the overall rating. For example, Site 1 has a high to moderate rating for erosion potential and a vessel wake potential of negligible. This means that the overall potential effect is negligible. What is instructive by showing both the erosion potential and vessel wake potential ratings is that it is clear how a change in vessel usage near a site could change the overall potential effect. Site 1 is susceptible to an increase in erosion should there be an increase in vessel traffic due to the small substrate. Under the current conditions, vessel traffic is limited and therefore does not significantly affect the shoreline at Site 1. In contrast, Site 4 has an overall rating of minor because both the erosion potential and vessel wake potential ratings are minor. An increase in vessel traffic will not affect the overall rating at this site because the substrate is resistant to erosion.

4.6.1 Assumptions

- No compound wakes occur due to two vessels traveling so closely that their wakes become additive.
- The beach material is assumed to be consistent throughout the tidal zone so tide height is not factored into the analysis. The height of the tide is important for other considerations include near shore and intertidal users.

5 GLACIER BAY PROPER ANALYSIS

5.1 INTRODUCTION

As stated above, there is a two-prong approach to analyzing a site for potential affect due to vessel wakes. The first evaluation is the comparison between the natural wind wave climate and the vessel wake climate. This analysis provides an index of how much energy above the natural wind environment that vessel wakes impart on the coastline. The second evaluation is of the substrate present at the site. The amount of energy necessary to affect a shoreline depends on the type and size of material. The analysis is complete when the energy potential from the vessel wakes is considered with the substrate material.

5.2 ANALYSIS EXAMPLE SITES

Two sites were selected to show the analysis process. The first site, Site 20, is in upper Muir Inlet near Stump Cove (Figure 7) and the second site, Site 11, is in the Lower West Arm (see Plate 4).

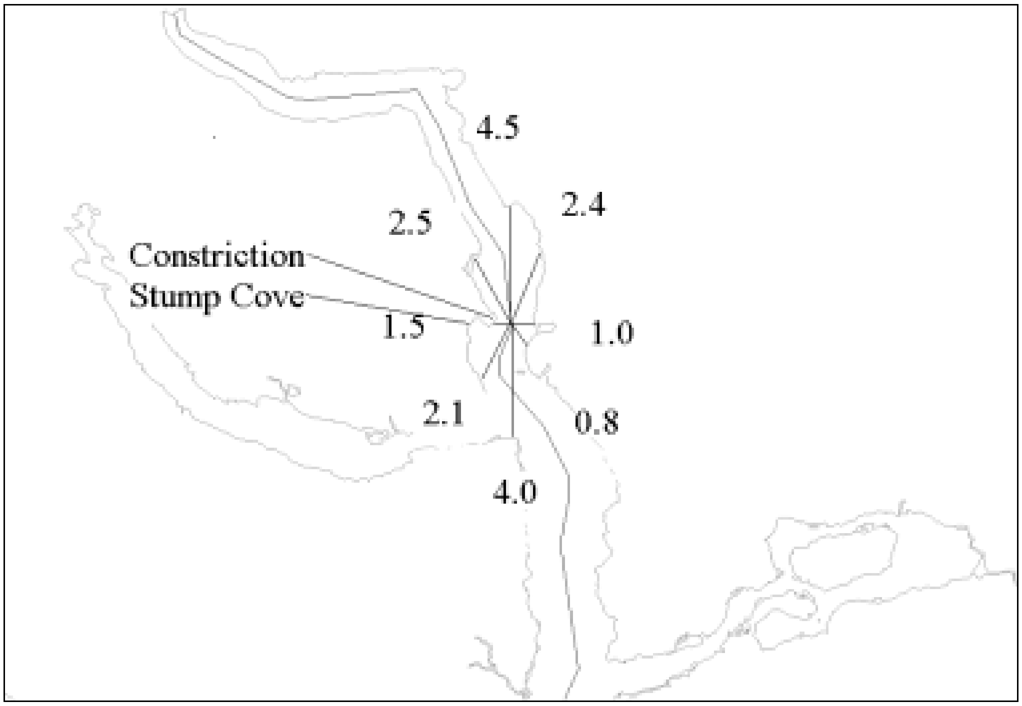


FIGURE 7 FETCH LENGTHS IN MILES IN UPPER MUIR INLET NEAR STUMP COVE, SITE 20.

Site Descriptions

Stump Cove has a narrow and curving channel that is likely to force traffic closer to shore. The Lower West Arm site is moderately well sheltered. The fetch lengths, in miles, near Stump Cove are shown in Figure 7. Site 11 and 20 are representative of the types of areas most likely to be adversely affected by vessel wakes and thus requiring the most attention when evaluating vessel quotas and operating requirements. Due to the size of the vessels and safe vessel traffic management standards, it is assumed that vessels would not travel in the same track at the same time to produce compounded wakes. Additionally, this analysis does not distinguish between the times of day or tidal cycle. The energies calculated are for a square foot of shoreline perpendicular to the shore. The energies due to tide and the part of wave energy which is directed parallel to shore are pictured with the second arrow in Figure 8. Energy parallel to shore is responsible for long shore sediment transport and was not considered in computing the energy index, N.

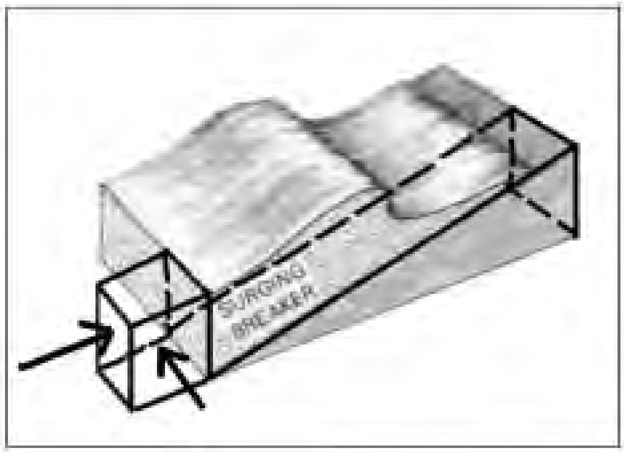


FIGURE 8 WAVE ENERGIES RELATED TO THE SHORE

Wind and Wake Example Analysis
Attachment "Example calculations" provides the calculation of the energy index for the Stump Cove site (Site 20). The example follows all the assumptions listed previously. The Stump Cove site is one of the more sheltered areas in Glacier Bay proper where motorized vessels are permitted. This site experiences little to no vessel traffic according to the NPS vessel track data. With the current vessel traffic, this site has an energy index of N=0.008, which is below the negligible significance level. In other words, vessel wakes impart less than one thousandth (1/1000) the amount of energy on this site than natural wind waves.

The second example analysis is a moderately well sheltered site in the lower West Arm (Site 11). With the current vessel traffic, this site has an energy index of N=0.02, which is minor significance level. In other words, vessel wakes impart less than one tenth (1/10) but more than one hundredth (1/100) the amount of energy on this site than natural wind waves. See Table 5 for a comparison of the two sites.

TABLE 5 VESSEL WAKE AND WIND WAVE ENERGY COMPARISON AT 2 SITES

Site	Vessels		Wind	Energy Index (N)[4]	Significance Level
	# of vessel wakes	Energy	Energy		
Stump Cove (site 20), Beach A	362	112	148,000	0.008	Negligible
Lower West Arm (site 11), Beach A	6,515	2,014	108,000	0.02	Minor

Wave energy at a site is expressed in units of square feet perpendicular to the shore. However, the actual energy transfer takes place on the face of the shore, which is the long rectangular area under the breaker in Figure 8. A steep beach will have a much larger concentration of energy upon its face than a gentler sloping beach as shown in Figure 8. The range of beach slopes in Glacier Bay proper is approximately 1/10 of one degree to 75 degrees. For the range of beach slopes here, there is a range of between 1 and 600 square feet of beach area influenced by the waves. Thus the concentration of energy on the steepest beaches is 600 times the concentration of energy on the gentlest beaches for one given wave climate.

TABLE 6 POTENTIAL AFFECT ON 22 SITES BY VESSEL WAKES WITH CURRENT QUOTAS.

Site	Beach potential[5]	Assigned Site Total potential[6]
1	Negligible	Negligible
2	Minor	Minor
3	Negligible	Negligible
4	Minor	Minor
5	Minor	Minor
	Minor	
6	Negligible	Negligible
7	Negligible	Negligible
	Negligible	
	Negligible	
8	Negligible	Negligible
	Negligible	
9	Negligible	Minor
	Negligible	
	Minor	
10	Negligible	Negligible

[4] Energy Index (N) is equal to the vessel wake energy divided by the wind wave energy.
[5] Each site is divided into one or more beaches. This is due to the different fetches and variations in the shoreline, which affect the waves that can strike the shore.
[6] To be conservative, the highest potential level for a beach is also the total potential.

Site	Beach potential[5]	Assigned Site Total potential[6]
11	Minor	Minor
	Negligible	
12	Minor	Minor
	Minor	
	Negligible	
13	Negligible	Negligible
	Negligible	
14	Negligible	Minor
	Minor	
	Negligible	
15	Minor	Minor
	Minor	
16	Negligible	Moderate
	Moderate	
	Moderate	
17	Minor	Minor
18	Minor	Minor
	Negligible	
	Minor	
19	Negligible	Negligible
	Negligible	
20	Negligible	Negligible
	Negligible	
	Negligible	
21	Negligible	Negligible
22	Minor	Minor

5.3 PHYSICAL ATTRIBUTES OF THE 22 SITES BEING ANALYZED

The vessel wake analyses identified 22 sites where vessels travel close enough to the shoreline to potentially cause change on that shoreline (see Figure 9). This section provides a summary of the physical attributes of the 22 sites identified as presented in the CoastWalkers database. The physical attributes summarized below include the primary substrate, secondary substrate, and the slope. These attributes are important in evaluating the potential for erosion.

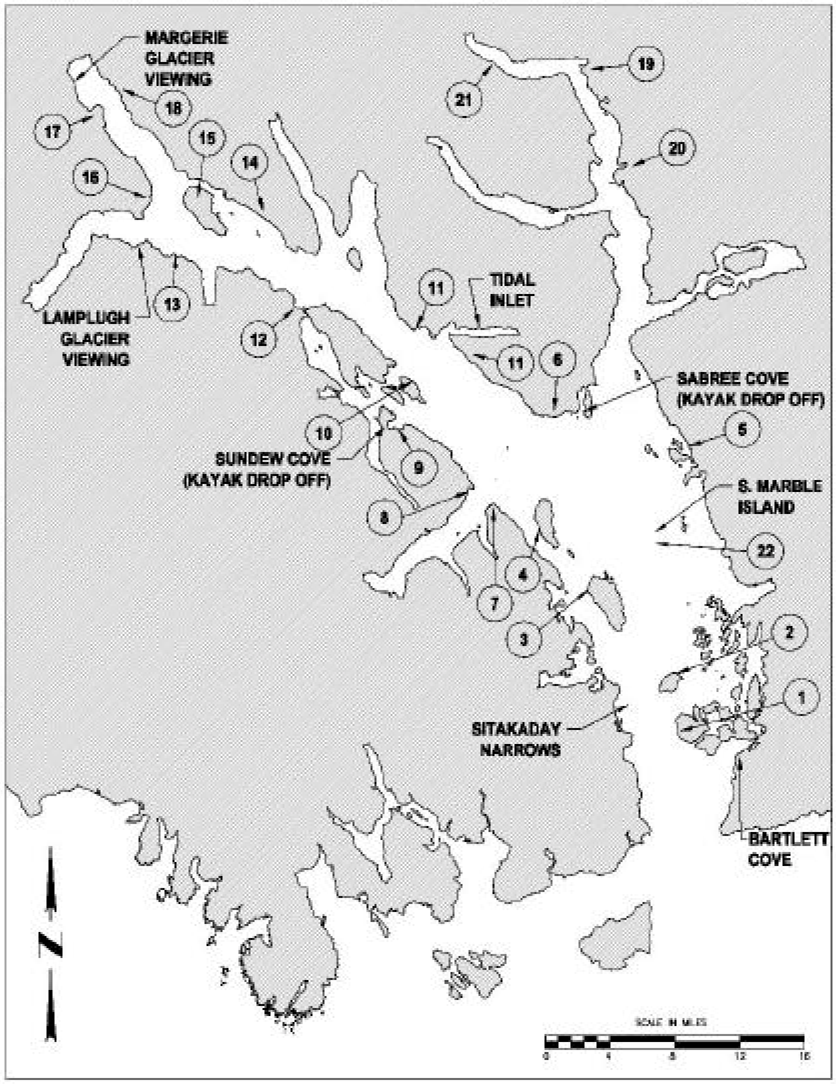


FIGURE 9 SITES SELECTED FOR VESSEL WAKE ANALYSIS.

5.3.1 Physical Attributes of the 22 Sites

The NPS CoastWalker database provides substrate and slope information for each polygon mapped. The polygons are based on changes in substrate material size and the slope. Table 7 provides site information based on the CoastWalker database by summarizing the substrate information for all polygons in the site. See Attachment "CoastWalkers Polygon Table" for a list of the polygons included in each site. The sites have anywhere from eight polygons to 119 polygons representing a single beach in this technical memorandum. The average number of polygons for a single site is approximately 40.

TABLE 7 SUBSTRATE TYPES AND SLOPE FOR EACH SITE.

Site	Primary Substrate	Secondary Substrate	Slope (degrees)	Erosion Potential
1	coarse sand	granule	2.9	High
2	pebble	pebble	5.2	Moderate
3	cobble	cobble	16.4	Minor
4	cobble	boulder	11.8	Minor
5	pebble	pebble	8.8	Moderate
6	pebble	cobble	8.2	Moderate to Minor
7	boulder	cobble	18.0	Minor
8	cobble	cobble	11.5	Minor
9	granule	pebble	7.8	High to Moderate
10	boulder	cobble	13.1	Minor
11	cobble	cobble	16.5	Minor
12	cobble	cobble	13.9	Minor
13	cobble	cobble	16.2	Minor
14	granule	pebble	6.7	High to Moderate
15	cobble	boulder	15.4	Minor
16	boulder	boulder	31.9	Minor
17	boulder	boulder	27.0	Minor
18	pebble	pebble	11.7	Moderate to Minor
19	Not mapped			N/A
20	Granule	granule	8.1	High
21	Not mapped			N/A
22	Not mapped			N/A

Site 1

The average material size for site 1 is coarse sand. The minimum size material is silt and the largest is cobble. The median and mode material size is fine sand. The average secondary substrate size is granule. The minimum size material for secondary substrate is silt and the largest is cobble. The median and mode material size for secondary substrate is pebble. The average slope is 2.9 degrees. The minimum slope is 1 degree and the maximum slope is 5 degrees. The median slope is 2.75 degrees and the mode is 2.5 degrees.

Site 2

The average material size for site 2 is pebble. The minimum size material is granule and the largest is cobble. The median and mode material size is cobble. The average secondary substrate size is pebble. The minimum size material for secondary substrate is pebble and the largest is boulder. The median and mode material size for secondary substrate is pebble. The average slope is 5.2 degrees. The minimum slope is 0 degrees and the maximum slope is 8 degrees. The median slope is 5.75 degrees and the mode is 7 degrees.

Site 3

The average material size for site 3 is cobble. The minimum size material is coarse sand and the largest is bedrock. The median material size is boulder and mode material size is bedrock. The average secondary substrate size is cobble. The minimum size material for secondary substrate is coarse sand and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 16.4 degrees. The minimum slope is 4 degrees and the maximum slope is 66 degrees. The median slope is 12 degrees and the mode is 7 degrees.

Site 4

The average material size for site 4 is cobble. The minimum size material is granule and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is boulder. The minimum size material for secondary substrate is granule and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 11.8 degrees. The minimum slope is 2.5 degrees and the maximum slope is 26 degrees. The median slope is 10 degrees and the mode is 8 degrees.

Site 5

The average material size for site 5 is pebble. The minimum size material is fine sand and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is pebble. The minimum size material for secondary substrate is silt and the largest is boulder. The median material size for secondary substrate is pebble and mode material size is cobble. The average slope is 8.8 degrees. The minimum slope is 2.5 degrees and the maximum slope is 21.5 degrees. The median slope is 7.5 degrees and the mode is 12 degrees.

Site 6

The average material size for site 6 is pebble. The minimum size material is silt and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is cobble. The minimum size material for secondary substrate is fine sand and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 8.2 degrees. The minimum slope is 1 degree and the maximum slope is 33 degrees. The median slope is 7.5 degrees and the mode is 6 degrees.

Site 7

The average material size for site 7 is boulder. The minimum size material is pebble and the largest is bedrock. The median material size is boulder and mode material size is bedrock. The average secondary substrate size is cobble. The minimum size material for secondary substrate is granule and the largest is boulder. The median and mode material size for secondary substrate is cobble. The average slope is 18 degrees. The minimum slope is 3 degrees and the maximum slope is 75 degrees. The median slope is 12 degrees and the mode is 6 degrees.

Site 8

The average material size for site 8 is cobble. The minimum size material is silt and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is cobble. The minimum size material for secondary substrate is fine sand and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 11.5 degrees. The minimum slope is 1.5 degrees and the maximum slope is 70 degrees. The median slope is 9 degrees and the mode is 8 degrees.

Site 9

The average material size for site 9 is granule. The minimum size material is silt and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is pebble. The minimum size material for secondary substrate is fine sand and the largest is bedrock. The median and mode material size for secondary substrate is pebble. The average slope is 7.5 degrees. The minimum slope is 2.5 degrees and the maximum slope is 22 degrees. The median slope is 7.8 degrees and the mode is 9 degrees.

Site 10

The average material size for site 10 is boulder. The minimum size material is pebble and the largest is bedrock. The median and mode material size is boulder. The average secondary substrate size is cobble. The minimum size material for secondary substrate is pebble and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 13.1 degrees. The minimum slope is 5 degrees and the maximum slope is 44.5 degrees. The median slope is 8.3 degrees and the mode is 6.5 degrees.

Site 11

The average material size for site 11 is cobble. The minimum size material is fine sand and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is cobble.

The minimum size material for secondary substrate is fine sand and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 16.5 degrees. The minimum slope is 3 degrees and the maximum slope is 90 degrees. The median slope is 9 degrees and the mode is 8 degrees.

Site 12

The average material size for site 12 is cobble. The minimum size material is silt and the largest is bedrock. The median material size is cobble and mode material size is pebble. The average secondary substrate size is cobble. The minimum size material for secondary substrate is silt and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 13.9 degrees. The minimum slope is 2 degrees and the maximum slope is 65 degrees. The median slope is 8 degrees and the mode is 5 degrees.

Site 13

The average material size for site 13 is cobble. The minimum size material is fine sand and the largest is bedrock. The median material size is cobble and mode material size is bedrock. The average secondary substrate size is cobble. The minimum size material for secondary substrate is coarse sand and the largest is bedrock. The median material size for secondary substrate is cobble and mode material size is bedrock. The average slope is 16.2 degrees. The minimum slope is 2 degrees and the maximum slope is 45 degrees. The median slope is 8.8 degrees and the mode is 7 degrees.

Site 14

The average material size for site 14 is granule. The minimum size material is silt and the largest is cobble. The median and mode material size is pebble. The average secondary substrate size is pebble. The minimum size material for secondary substrate is silt and the largest is boulder. The median and mode material size for secondary substrate is cobble. The average slope is 6.7 degrees. The minimum slope is 1.5 degrees and the maximum slope is 15.5 degrees. The median slope is 6.5 degrees and the mode is 7.5 degrees.

Site 15

The average material size for site 15 is cobble. The minimum size material is silt and the largest is bedrock. The median and mode material size is cobble. The average secondary substrate size is boulder. The minimum size material for secondary substrate is silt and the largest is bedrock. The median material size for secondary substrate is boulder and mode material size is bedrock. The average slope is 15.4

degrees. The minimum slope is 4 degrees and the maximum slope is 55 degrees. The median slope is 10 degrees and the mode is 8 degrees.

Site 16

The average material size for site 16 is boulder. The minimum size material is granule and the largest is bedrock. The median material size is boulder and mode material size is bedrock. The average secondary substrate size is boulder. The minimum size material for secondary substrate is granule and the largest is bedrock. The median material size for secondary substrate is boulder and mode material size is bedrock. The average slope is 31.9 degrees. The minimum slope is 4 degrees and the maximum slope is 89 degrees. The median slope is 26 degrees and the mode is 35 degrees.

Site 17

The average material size for site 17 is boulder. The minimum size material is pebble and the largest is bedrock. The median material size is bedrock and mode material size is bedrock. The average secondary substrate size is boulder. The minimum size material for secondary substrate is pebble and the largest is bedrock. The median material size for secondary substrate is boulder and mode material size is bedrock. The average slope is 27 degrees. The minimum slope is 4 degrees and the maximum slope is 50 degrees. The median slope is 26 degrees and the mode is 50 degrees.

Site 18

The average material size for site 18 is pebble. The minimum size material is silt and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is pebble. The minimum size material for secondary substrate is silt and the largest is bedrock. The median and mode material size for secondary substrate is cobble. The average slope is 11.7 degrees. The minimum slope is 1.5 degrees and the maximum slope is 70 degrees. The median slope is 9 degrees and the mode is 6 degrees.

Site 19

This site was not mapped as part of the CoastWalkers program.

Site 20

The average material size for site 20 is granule. The minimum size material is silt and the largest is bedrock. The median and mode material size is pebble. The average secondary substrate size is granule. The minimum size material for secondary substrate is silt and the largest is bedrock. The median material size for secondary substrate is pebble and mode material size is cobble. The average slope is 8.1 degrees.

The minimum slope is 0.5 degrees and the maximum slope is 55 degrees. The median slope is 7.5 degrees and the mode is 10 degrees.

Site 21

This site was not mapped as part of the CoastWalkers program.

Site 22

This site was not mapped as part of the CoastWalkers program.

5.4 SUMMARY OF POTENTIAL EFFECTS ON THE 22 SITES

This section summarizes the information provided above for each site. It is intended to provide the reader with an understanding of the vessel wake effects on the specific beaches. This evaluation is for the current quota and vessel restrictions so the evaluation of a site could change if the number of vessels permitted to enter Glacier Bay proper increases or decreases. See Table 8 for a summary of the overall potential affect to Glacier Bay National Park and Preserve due to vessels.

Site 1

Site 1 is generally a sandy beach with some larger material. This means that the beach has a high to moderate potential for erosion. However, the potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 2

Site 2 is generally a pebbled beach with cobbles. This means that the beach has a moderate potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 3

Site 3 is generally a cobbled to sandy beach that also has a significant amount of boulders and bedrock. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 4
Site 4 is generally a cobbled beach with larger material including boulders. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 5
Site 5 is generally a pebbled beach. This means that the beach has a moderate potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 6
Site 6 is generally a pebbled beach with larger material including cobbles. This means that the beach has a moderate to minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 7
Site 7 is generally a boulder beach. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 8
Site 8 is generally a cobbled beach with both larger material including bedrock and some smaller material including silt. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 9
Site 9 is generally a granular beach with pebbles. This means that the beach has a high to moderate potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible to minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 10
Site 10 is generally a boulder beach with cobbles. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 11
Site 11 is generally a cobbled beach. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor to negligible. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 12
Site 12 is generally a cobbled beach. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor to negligible. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 13
Site 13 is generally a cobbled beach with exposed bedrock. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 14
Site 14 is generally a granular beach with pebbles and cobbles. This means that the beach has a high to moderate potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible to minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 15
Site 15 is generally a cobble beach with larger material including boulders and bedrock. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 16
Site 16 is generally a boulder beach with bedrock. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is moderate to

negligible. Therefore, this site has a minor potential for adverse affects at the current quota due to the larger material size of the substrate.

Site 17

Site 17 is generally a boulder beach with bedrock. This means that the beach has a minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 18

Site 18 is generally a pebbled beach with some cobbles. This means that the beach has a moderate to minor potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is minor to negligible. Therefore, this site has a minor potential for adverse affects at the current quota.

Site 19

Physical attribute information is not available for Site 19. This site is in Muir Inlet and outside the area mapped for the NPS during the CoastWalkers project. A glacier covered the site as recently as 40 years ago. The potential for vessel wakes to adversely affect the site at the current quota is negligible. More information on the shoreline material is necessary to determine the overall potential affect.

Site 20

Site 20 is generally a granular beach with some pebbles. This means that the beach has a high potential for erosion. The potential for vessel wakes to adversely affect the site at the current quota is negligible. Therefore, this site has a negligible potential for adverse affects at the current quota.

Site 21

Physical attribute information is not available for Site 21. This site is in the upper reaches of Muir Inlet and outside the area mapped for the NPS. A glacier covered the site as recently as 30 years ago. The potential for vessel wakes to adversely affect the site at the current quota is negligible. More information on the shoreline material is necessary to determine the overall potential affect.

Site 22

Physical attribute information is not available for Site 22. This site is on South Marble Island and outside the area mapped for the NPS. Seabird activity on the island was noted during the cruise tour and maps indicate that this site is a seabird nesting area. The potential for vessel wakes to adversely affect the site at the current quota is minor. More information on the shoreline material is necessary to determine the overall potential affect.

TABLE 8 POTENTIAL FOR ADVERSE AFFECTS AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE WITH THE 1996 VESSEL "USE DAYS".

Site	Erosion Potential at the Site	Vessel Wake Potential Effect[7]	Overall Potential Effect[8]
1	High to moderate	Negligible	Negligible
2	Moderate	Minor	Minor
3	Minor	Negligible	Negligible
4	Minor	Minor	Minor
5	Moderate	Minor	Minor
6	Moderate to minor	Negligible	Negligible
7	Minor	Negligible	Negligible
8	Minor	Negligible	Negligible
9	High to moderate	Negligible to minor	Minor
10	Minor	Negligible	Negligible
11	Minor	Minor to negligible	Minor
12	Minor	Minor to negligible	Minor
13	Minor	Negligible	Negligible
14	High to moderate	Negligible to minor	Minor
15	Minor	Minor	Minor
16	Minor	Moderate to negligible	Minor
17	Minor	Minor	Minor
18	Moderate to minor	Minor to negligible	Minor
19	Not mapped	Negligible	*Need additional information*
20	High	Negligible	Negligible
21	Not mapped	Negligible	*Need additional information*
22	Not mapped	Minor	*Need additional information*

5.5 WAKE EFFECTS ON WATERWAY USERS

The tide range in Glacier Bay proper is approximately 24 feet. With mixed tides the bay daily experiences two different high tide levels and two different low tide levels (see Figure 12). A high tide is followed by a higher low, which is followed by a higher high, which is followed by a lower low. Twice a month, due to alignment of the sun and moon, spring tides occur. For approximately two days, both higher highs and lower lows are exaggerated. Although spring tides occur twice a month, the most exaggerated spring tides occur in the spring season when large vessel traffic is absent in Glacier Bay proper.

---

[7] 1996 vessel quotas.
[8] 1996 vessel quotas.

There are many waterway users that may be in the vicinity of the shoreline. These users can include nesting birds, kayakers, and campers. For this section, shore nesting birds will be used as an example of potentially affected users. Most shore nesting birds establish their nests to minimize swamping due to waves and with consideration of the tides and typical storms during the nesting season. Some birds may be forced into the marginal areas and be at higher risk for swamping during natural conditions and when vessels are not present. Swamping of shore nesting birds is most likely to occur when boat wakes occur simultaneously with higher high spring tides. The probability that a vessel wake will wash over a nest is equal to the probability of a spring tide occurring times the probability that the nests are placed low on the beach and "too close to the high water level."

The probability of a higher high spring tide is equal to the number of hours of higher high spring tides a season divided by the number of hours in the season. This probability is 0.56%, calculated as follows:

$$\frac{1\text{hr}}{(\text{higher}-\text{high})\text{tide}}\cdot\frac{1\,(\text{higher}-\text{high})\text{tide}}{\text{day}}\cdot\frac{4\text{day}}{\text{month}}\cdot\frac{3\text{month}}{\text{season}} \div \frac{24\text{hr}}{\text{day}}\cdot\frac{30\text{day}}{\text{month}}\cdot\frac{3\text{month}}{\text{season}}$$

The analysis of whether a nest will be swamped due to vessel wakes can be carried over to any shoreline user. For example, if a kayaker pulls their kayak above the higher high tide line, the probability that the kayak will be swamped and possible pulled out into the bay is the same as the example above, 0.56%. However, if the kayak is not pulled up to this point on the beach, then the probability of the kayak being swamped will increase depending on the location of the kayak and the tide range during that time.

5.6 WAVE PARAMETERS CONSIDERED BUT NOT SELECTED FOR THE DETAILED ANALYSIS

Another parameter besides energy was calculated and compared to wave energy at selected sites to provide an alternative method of evaluating vessel wake impacts to the Glacier Bay proper ecosystem. This wave parameter is water particle velocity and it relates to long shore transport.

Maximum water particle velocities were considered. Water particle velocities stir up the sediments by exerting drag on the sediment particles. The motion of the water under surface waves (for which gravity is the restoring force) is circular near the surface. As the depth increases, the motion becomes elliptical. Very near the bottom, the water can be imagined as moving back and forth.

Example calculations of water particle velocities showed that for the wave heights and periods typical of the wave climate in Glacier Bay proper, the velocities would be more difficult to compare in the various sites of interest because additional input parameters are required. These include the wave speed, C, and the period of the vessel waves. The calculations performed show that the typical particle velocities were smaller than the design velocity of 10 feet per second (fps), which is used in aquariums to prevent marine fouling. Velocities of less than 10 fps are inferred to be required to allow marine growth. Velocities in the range of 10 fps do routinely occur in the shallow surf zone during wind wave events. Even in the shallowest water, as predicted by Airy theory, the maximum horizontal water particle velocity caused by the design boat wake is approximately 3 fps.

Water particle velocity was not as suitable a parameter for analysis of vessel wake effects in Glacier Bay proper. The additional input information required is not readily available and would require making additional assumptions.

6 CONCLUSIONS AND SUGGESTIONS FOR FURTHER STUDY

The purpose of this technical memorandum is to provide a method to evaluate existing and proposed vessel quotas and operating requirements in Glacier Bay National Park and Preserve. The method detailed in this technical memorandum will be used to classify all sites selected for full evaluation in the EIS. Some conclusions can be drawn based on our work so far and on the information contained within this technical memorandum. These include:

- For most of Glacier Bay proper, vessel wakes pose little threat to the coastline.
- There are specific locations where operating requirements may be necessary to prevent adverse effect to the shoreline. This may include creating a no-wake zone near the shoreline. See the Environmental Impact Statement for specific sites and evaluations.
- The potential effect of vessel generated internal waves to all aspects of the environment is not known. Research indicates that internal waves have the potential to mix stratified layers of water. This could affect stratification of pelagic organisms like algae. Further scientific study is required to determine if they exist and their affects on the environment. It is likely that naturally occurring internal waves occur in Glacier Bay proper and would not be affected by vessels due to the shallow extent of influence by the vessel.
- Vessel wake disturbance occurs close to the vessel producing the wake. Wakes are essentially dissipated within 2,000 feet of the vessel.

- Requiring vessels to stay farther from shore during the hour of higher-high spring tides will guard against the possibility of wakes washing over nesting sites.
- Wave climates (both natural and vessel induced) affect near shore and tidal users. The height of the tide is an important factor in whether the vessel-induced wake would affect the user.
- Erosion due to beaching vessels is more likely to cause erosion at a specific site than vessel wakes.

Data is needed in the following areas:

- Wind data in several key locations throughout the park. Wind data used in this memorandum is not specific for Glacier Bay and thus only extrapolated.
- Accurate vessel track data is needed. This is the weakest element in the analysis.
- Waves should be measured in the bay to provide validation of the energy indices, N values.
- Effects of ship induced internal waves on the water column.

7 DEFINITIONS

Average – This is the typical quantity, also known as the mean.

Beach – In coastal engineering a beach or shore encompasses the extents shown in Figure 10. Rocky beaches (for instance) will not have all the features, but will have the same zones that are defined by the water levels shown in the figure.

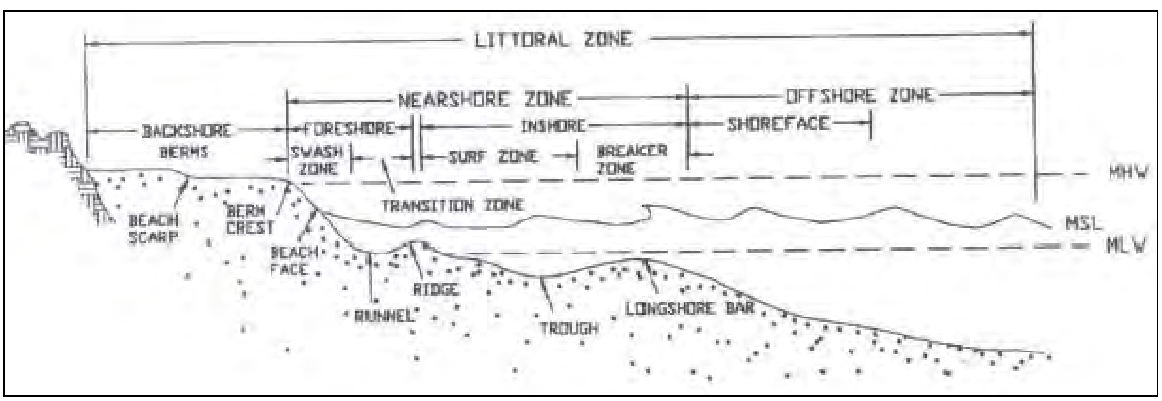


FIGURE 10 BEACH TERMINOLOGY AND EXTENTS.

Beam – vessel maximum width normal to flow, see Figure 11 (B on the drawing).

Blockage Ratio – cross sectional area of waterway divided by the maximum submerged cross section of the vessel. A maximum blockage ratio of 60 in Glacier Bay proper would occur if a cruise ship traversed the 0.25 mile wide channel north of Russell Island.

Constricted waterway – a navigated waterway with blockage ratio less than 20.

Deep water – related to a wave's position in the water, where d satisfies $0.5 < \frac{d}{L} <$ infinity, see Figure 13.

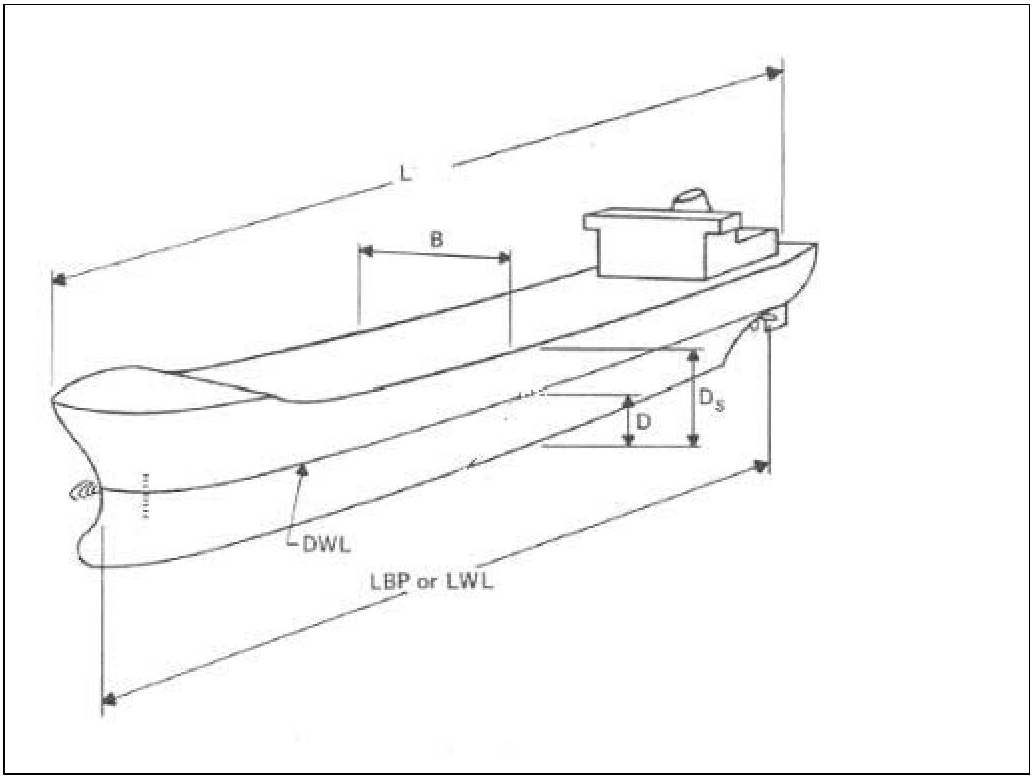


FIGURE 11 VESSEL DIMENSIONS

Diverging Wake – the wave which spreads outward from the boats bow and is always present

Fetch – the unobstructed area in which waves are generated by a wind having a rather constant direction and speed

Mean Lower Low Water (MLLW) is the 0 water level in Figure 12, and is the datum referenced in coastal engineering. Glacier Bay has what is called mixed tides, with one small and one large tide a day. Referenced water levels are averaged over a period of years to establish the datum.

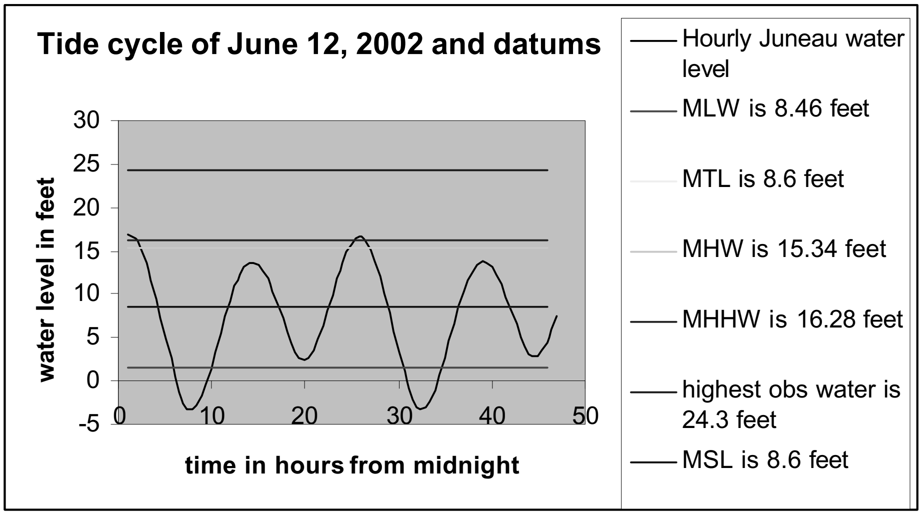


FIGURE 12 TIDES IN JUNEAU.

Median – The middle number of a given sequence of numbers, as used in statistical analysis.

Mode – The number that occurs most frequently in a given sequence of numbers, as used in statistical analysis.

Negative tide - when the water is below the usual low water mark (0 MLLW), as on the day of June 12 in Gustavus, see Figure 12. This occurs twice monthly.

Orographic effects - effects attributed to mountains.

Propagation Speed – the same as wave speed, or celerity.

Ship (Vessel) Track Line – the path over the water.

Spring Tide – Tides which occur twice monthly and have both higher highs and lower lows. The most extreme spring tides do occur during the spring before boats begin to enter Glacier Bay, but the term is used throughout the seasons.

Transverse Wake – the wave which is directed opposite the boats motion, is caused by the boats stern and is sometimes present.

Wave height or amplitude – Shown as H in Figure 13.

Wave period – the length of time which a stationary observer on the surface of the water observes between two successive crests.

Wave length – L in Figure 13

Wave speed – the speed at which the wave propagates or advances, usually referred to as C, or wave celerity. See Figure 13.

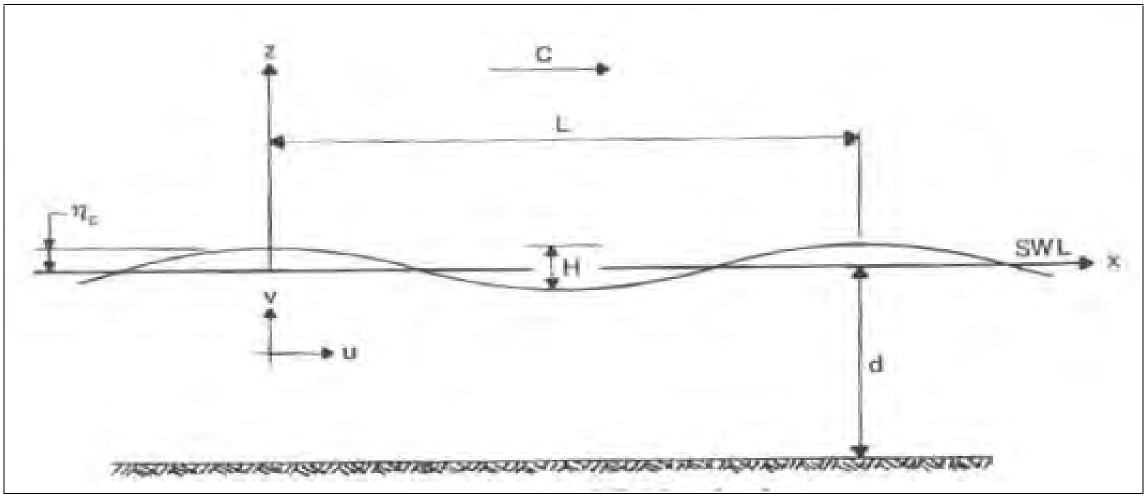


FIGURE 13 WAVE PARAMETER DEFINITIONS

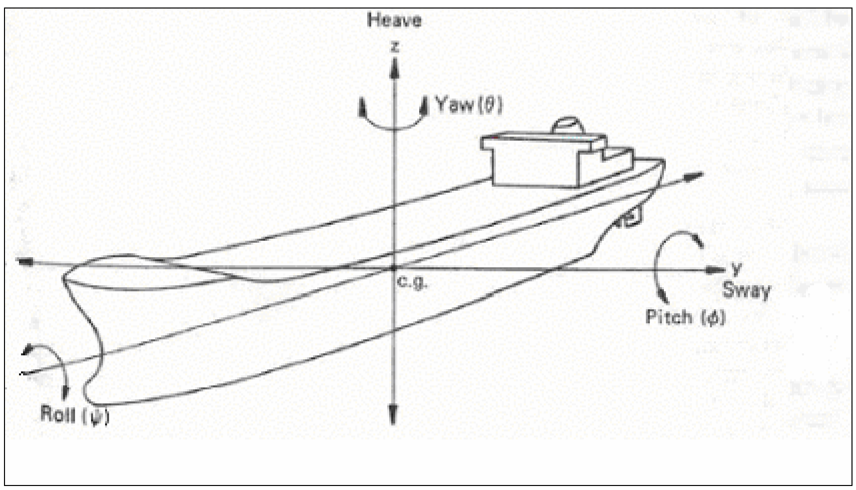


FIGURE 14 VESSEL MOTION DEFINITIONS

8 REFERENCES

Alaska Sea Atlas Website (under construction during July, 2002), http://holmes-iv.engr.uaa.alaska.edu/

Arctic Environmental Information and Data Center. 1984, "Extreme wind predictions for first order weather stations in Alaska", Alaska Climate Center Technical Note No 1, University of Alaska Fairbanks, Fairbanks, AK

Avitol, E., and Miloh, T., 1999. "On an inverse problem of ship-induced internal waves," Ocean Engineering, v. 26, Pergammon, pp. 99-110.

Blaauw H., de Groot, M., van der Knaap, F., and Pilarczyk, K., 1984. "Design of Bank Protection for Inland Navigation Fairways," Proc., Flexible Armour Revetments Incorporating Geotextiles Conference, Inst. Civil Engineers, London

Cushman-Roisin, B., 1994. Introduction to Geophysical Fluid Dynamics, Prentice Hall, Englewood Cliffs, NJ

Ekman, V., 1904. "On Dead Water," Scientific Results, Norwegian Polar Expedition 1893-96, v. 5, no. 15.

Froude, W., 1877. "On experiments upon the effect produced on the wave-making resistance of ship by length of parallel middle body," Transactions, Institute of Naval Architects, v. 22, London, pp. 220-224.

Gates, E.T. and Herbich, J.B. 1977. "*Mathematical Model to Predict the Behavior of Deep-draft Vessels in Restricted Waterways*". Report TAMU-SG-77-206, Texas A & M University, College Station, TX.

Hooge, P. and Hooge, E., 2001. "Fjord Oceanographic Processes in Glacier Bay, Alaska," USGS-Alaska Biological Science Center, Glacier Bay Field Station, Gustavus, AK, for National Park Service, Glacier Bay National Park and Preserve

Gaythwaite, J.W., 1990, Design of marine facilities for berthing, mooring and repair of vessels, Von Nostrand Reinhold, New York, NY

Gross, M.G. 1972, Oceanography a view of the earth, Prentice-Hall, Inc, Englewood Cliffs, NJ

Hüsig, A., Linke, T., and Zimmerman, C., (May) 2000. "Effects from Supercritical Ship Operation on Inland Canals," J. Waterway, Port, Coastal, and Ocean Engineering, American Society of Civil Engineers, NY, pp. 130-135.

Maynord, S.T. 2001. "B*oat Waves on Johnson Lake and Kenai River, Alaska*". United States Army Corp of Engineers Engineering Research and Development Center Technical Report, Vicksburg, MS.

National Park Service, Glacier Bay National Park, 20020527, Glacier Bay Coastal Inventory segments, polygons, shapefiles, Gustavus, Alaska. "CoastWalkers". See also \\barco\SCIENCE\eco_data\data\glba\COASTAL\Coast_97\Gis\ToAKSO\2002-05-27\Shapefiles

National Park Service, Glacier Bay National Park, 2002. NOAA_cst.shp, csroutes_2002-09-17.shp, and charters-2002-07-15.shp. Gustavus, AK.

PIANC, 1987. "Guidelines for the Design and Construction of Flexible Revetments Incorporating Geotextiles for Inland Waterways," International Navigation Association (PIANC), Brussels

Short, A.D. 1991. "Macro-meso Tidal Beach Morphodynamics – An Overview", Journal of Coastal Research, Vol 7, No. 2. pp 417-436**.**

Smith, O.P. 1987. "Hydraulic Force Parameters Associated with Internal Waves", unpublished term paper for CE 681.

Sorensen, R. M. 1973. *"Ship Generated Waves*". Advances in Hydroscience. Vol 9, Academic Press, NY, NY Vol 9, pp49-83.

Sorensen, R. M. 1989. "*Port and Channel Bank Protection from Ship Waves*". Proceedings, Ports 89 Conference, American Society of Civil Engineers, Oakland, CA.

Thompson, W. (Lord Kelvin), 1887. "On Ship Waves," Transactions, Institute of Mechanical Engineering, London, pp. 409-433.

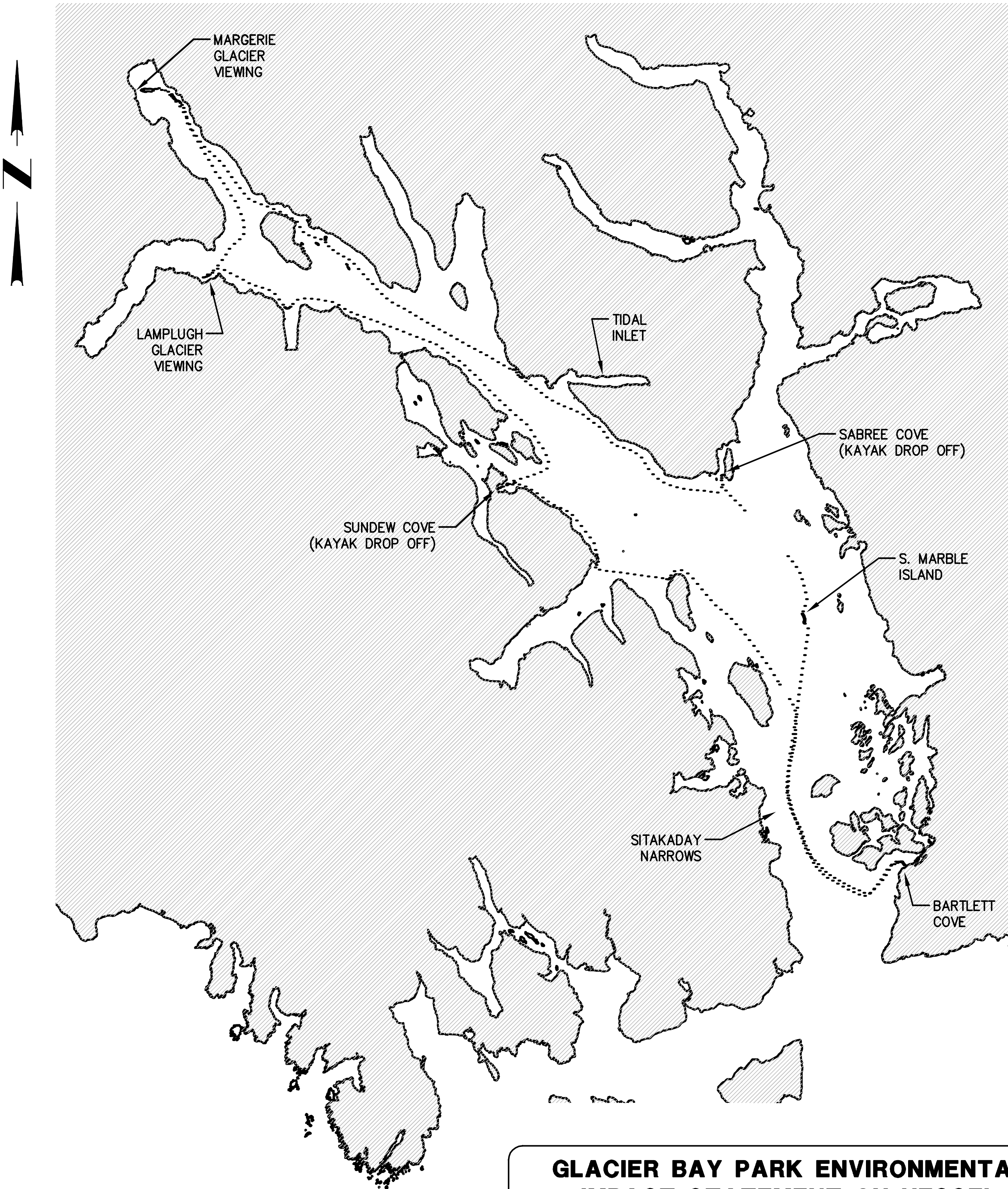
Umeyama, Mothiko, 2002. "Experimental and Theoretical Analyses of Internal Waves of Finite Amplitude," J. Waterway, Port, Coastal, and Ocean Engineering, 128/3, American Society of Civil Engineering, NY

United States Army Corp of Engineers. 2002. *Coastal Engineering Manual (Draft as of May 2002)*

Veri-Tech, 2002. "Vessel-Generated Waves," CEDAS, ACES software system, v. 2.01 (Harbor Design Module), Veri-Tech, Inc., Jackson, MS

Weggel, J.R. and Sorensen, R.M. 1986. "*Ship Wave Prediction for Port and Channel Design".* Proceedings, Ports 86 Conference, ASCE, Oakland, CA., pp 794-814

Wuebben, J., Hunter, L., Lawson, D., and Bigl, S., 2000. "Impact Study of Vessel Effects on the Marine and Nearshore Zone, Glacier Bay, Alaska," ERDC/CRREL LR-00-01, US Army Cold Regions Research and Engineering Laboratory, Hanover, NH, for National Park Service, Glacier Bay National Park and Preserve and Preserve



GLACIER BAY PARK ENVIRONMENTAL IMPACT STATEMENT ON VESSEL QUOTAS AND OPERATING REQUIREMENTS

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants

1506 West 36th Avenue,
Anchorage, Alaska 99503 (907) 561-1011 FAX (907) 563-4220

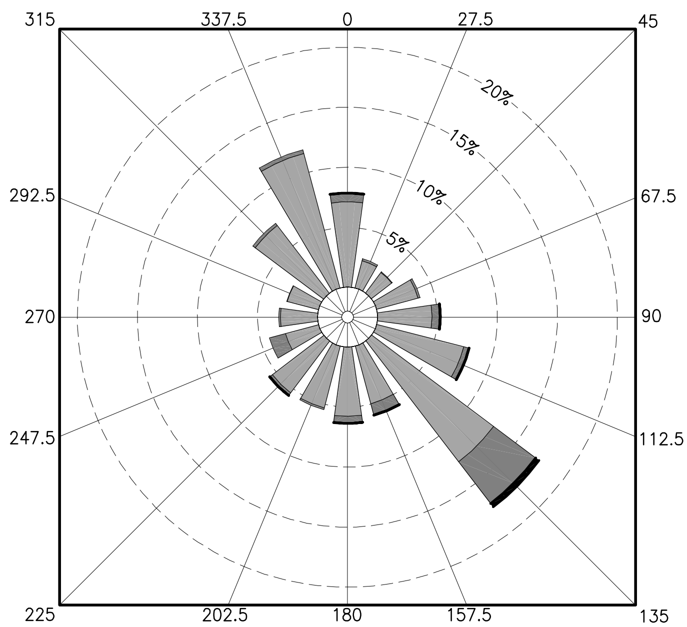
SPIRIT OF ADVENTURE CRUISE WAY POINTS - JUNE 12, 2002

PLATE 1

VICINITY MAP

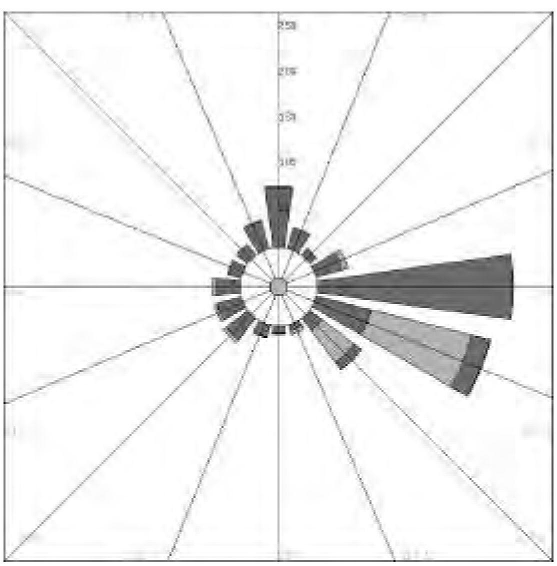
STATION: GUSTAVUS, AK
YEARS: 1987 – 2001
MONTHS: ALL
DAYS: ALL
HOURS: ALL
SOURCE: NATIONAL CLIMATE DATA CENTER – HOURLY

NOTE:
RADIAL BANDS INDICATE 10 KNOT INCREMENTS OF WIND ACTING TOWARD THE CENTER OF THE WIND ROSE.



GUSTAVUS, ALASKA

STATION: JUNEAU, AK
YEARS: 1987 – 1999
MONTHS: ALL
DAYS: ALL
HOURS: ALL
SOURCE: AK SEA ATLAS WEBSITE, TDF14, TD3280 – HOURLY



JUNEAU, ALASKA

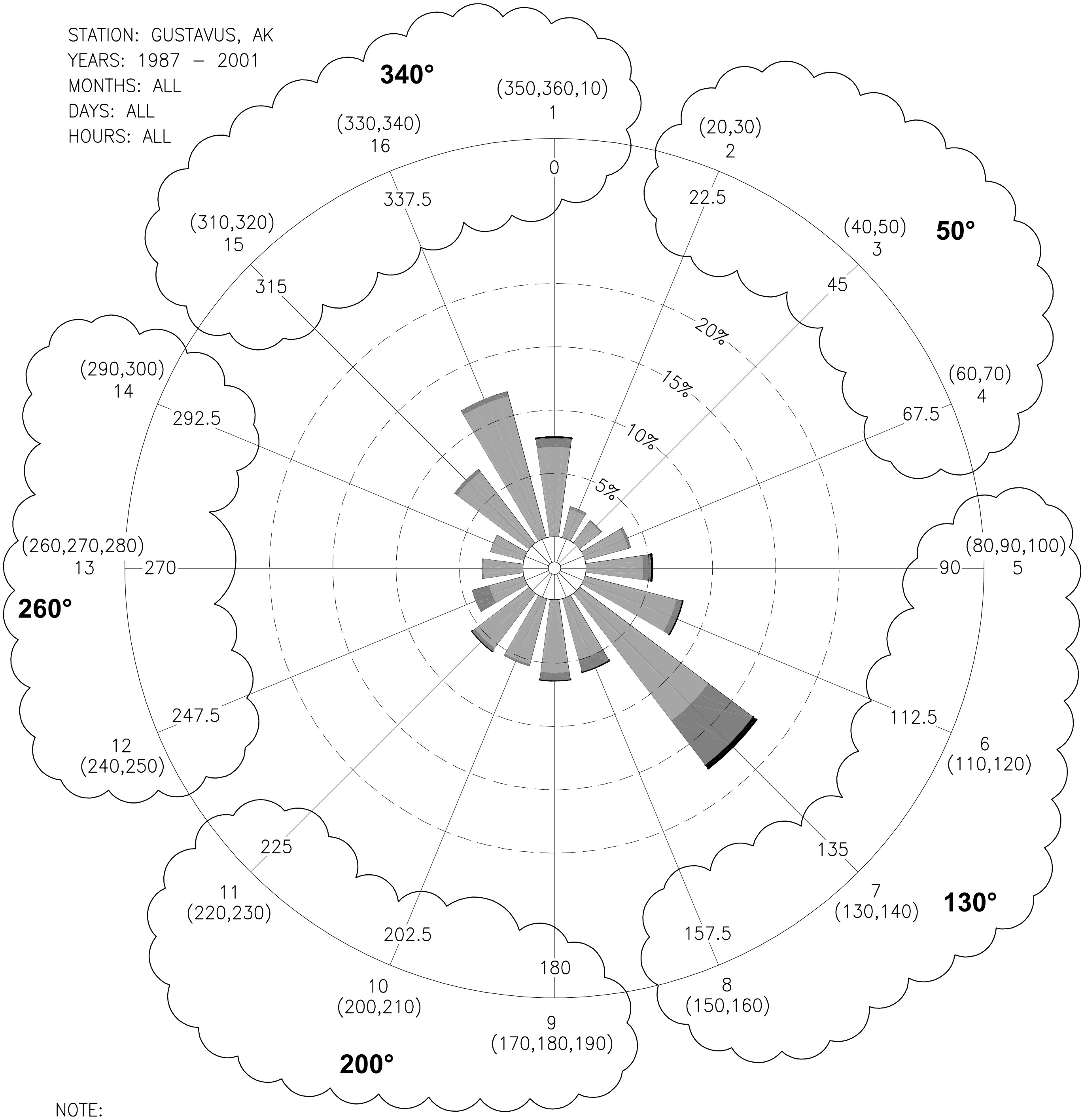
GLACIER BAY PARK ENVIRONMENTAL IMPACT STATEMENT ON VESSEL QUOTAS AND OPERATING REQUIREMENTS

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants

**1506 West 36th Avenue,
Anchorage, Alaska 99503 (907) 561-1011 FAX (907) 563-4220**

WIND ROSE COMPARSION

PLATE 2



NOTE:

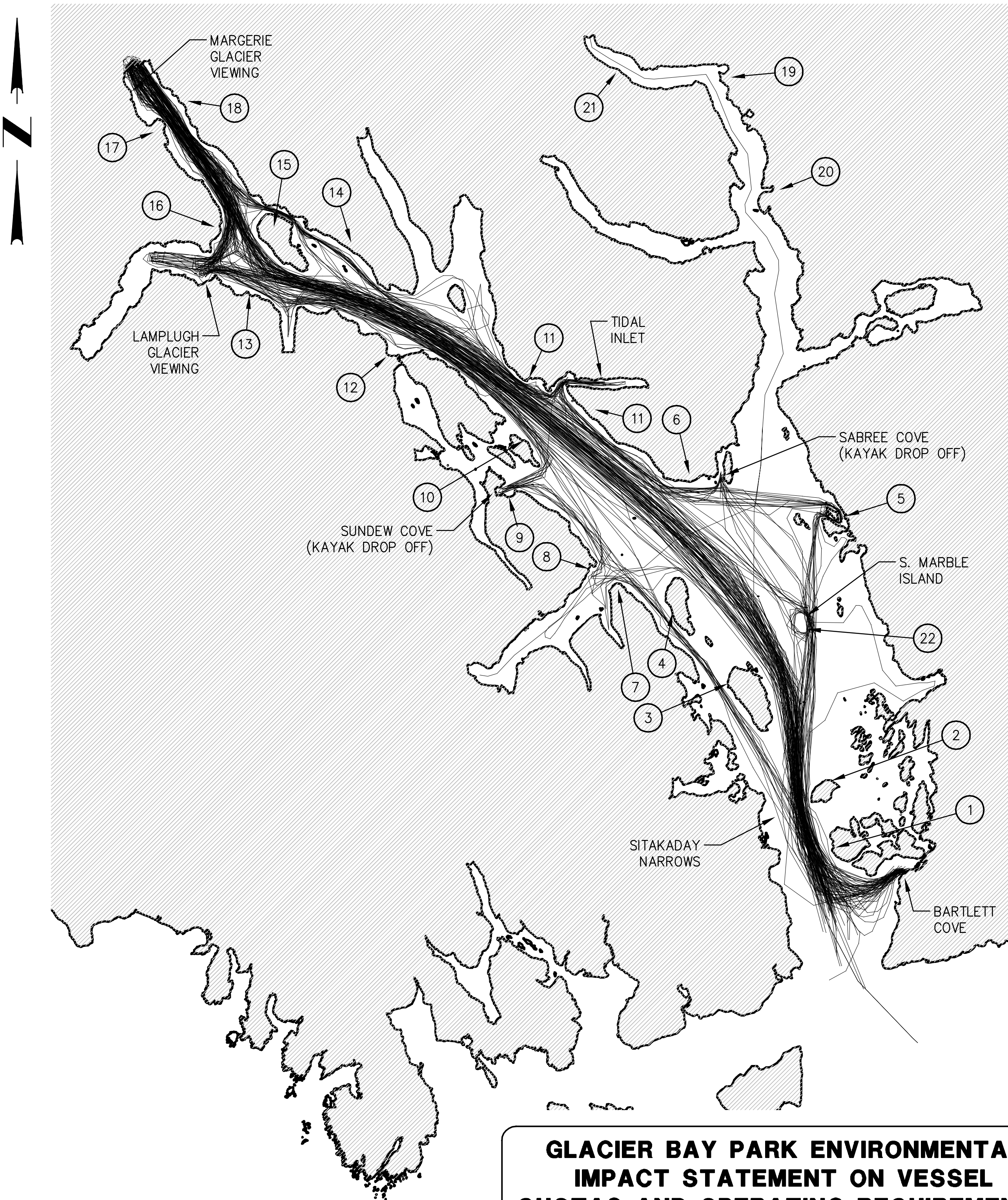
1. RADIAL BANDS INDICATE 10 KNOT INCREMENTS OF WIND ACTING TOWARD THE CENTER OF THE WIND ROSE.
2. NUMBERS 1 TO 16 REPRESENT SECTOR BINS.
3. NUMBERS IN PARENTHESIS REPRESENT THE WIND DIRECTIONS REPORTED BY NCDC WHICH WERE ASSIGNED TO EACH SECTOR BIN.
4. BOLD NUMBERS IN OUTER CLOUDS REPRESENT THE WIND ASSIGNED TO THE CLOUDED SECTORS FOR WAVE GROWTH ANALYSIS.

GLACIER BAY PARK ENVIRONMENTAL IMPACT STATEMENT ON VESSEL QUOTAS AND OPERATING REQUIREMENTS

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue,
Anchorage, Alaska 99503 (907) 561-1011 FAX (907) 563-4220

BIN ARRANGEMENT FOR WIND ANALYSIS

PLATE
3



GLACIER BAY PARK ENVIRONMENTAL IMPACT STATEMENT ON VESSEL QUOTAS AND OPERATING REQUIREMENTS

SCALE IN MILES

0 4 8 12 16

NOTES:
NUMBERS INDICATE SHORELINE IDENTIFIED FOR DETAILED STUDY.

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants

1506 West 36th Avenue,
Anchorage, Alaska 99503 (907) 561-1011 FAX (907) 563-4220

GLACIER BAY VESSEL TRAFFIC

PLATE
4

assigned angle	sector		calm	1-9kn	10-19kn	20-29kn	30-39kn	40-49kn	50-max
				Gustavus probabilities summarized as described in technical memo					
	1*	0	0.30	4.9707	0.5096	0.0056	0.0000	0.0000	0.0000
	2	22.5		1.6352	0.1333	0.0011	0.0000	0.0000	0.0000
	3	45		1.4919	0.0605	0.0011	0.0000	0.0000	0.0000
	4	67.5		2.4966	0.1434	0.0011	0.0000	0.0000	0.0000
50				**5.6237**	**0.3371**	**0.0034**	**0.0000**	**0.0000**	**0.0000**
	5	90		3.1708	0.4839	0.0056	0.0000	0.0000	0.0000
	6	112.5		5.2451	0.3125	0.0123	0.0000	0.0000	0.0000
	7	135		8.8976	3.0633	0.2464	0.0011	0.0011	0.0000
	8	157.5		3.4878	0.6843	0.0202	0.0000	0.0000	0.0000
135				**20.8013**	**4.5440**	**0.2845**	**0.0011**	**0.0011**	**0.0000**
	9	180		4.0467	0.4077	0.0090	0.0000	0.0000	0.0000
	10	202.5		3.7208	0.0997	0.0022	0.0000	0.0000	0.0011
	11	225		3.7824	0.1904	0.0056	0.0000	0.0022	0.0000
200				**11.5498**	**0.6978**	**0.0168**	**0.0000**	**0.0022**	**0.0011**
	12	247.5		2.0037	0.9554	0.0022	0.0000	0.0022	0.0022
	13	270		2.1684	0.0918	0.0011	0.0000	0.0000	0.0000
	14	292.5		1.8805	0.0202	0.0000	0.0011	0.0011	0.0011
260				**6.0527**	**1.0674**	**0.0034**	**0.0011**	**0.0034**	**0.0034**
	15	315		4.9741	0.1736	0.0000	0.0000	0.0000	0.0000
	16	337.5		8.1247	0.2363	0.0034	0.0000	0.0000	0.0000
340				**18.0695**	**0.9195**	**0.0090**	**0.0000**	**0.0000**	**0.0000**
		% totals	30.34	62.0969	7.5658	0.3170	0.0022	0.0067	0.0045

assigned angle	sector		calm	1-9kn	10-19kn	20-29kn	30-39kn	40-49kn	50-max
				Juneau summaried as Gustavus					
	1*	0	0.22	6.6959	0.0827	0.0018	0.0000	0.0000	0.0000
	2	22.5		2.4436	0.0361	0.0018	0.0000	0.0000	0.0000
	3	45		0.9329	0.0774	0.0026	0.0000	0.0000	0.0000
	4	67.5		2.9448	0.7131	0.0149	0.0000	0.0000	0.0000
50				**6.3213**	**0.8265**	**0.0193**	**0.0000**	**0.0000**	**0.0000**
	5	90		10.4469	6.7407	0.2814	0.0009	0.0009	0.0000
	6	112.5		6.2193	11.4397	2.0681	0.0985	0.0009	0.0000
	7	135		1.7498	4.4018	1.0446	0.0440	0.0000	0.0000
	8	157.5		0.7131	0.4282	0.0457	0.0000	0.0000	0.0000
135				**19.1291**	**23.0104**	**3.4398**	**0.1433**	**0.0018**	**0.0000**
	9	180		0.8942	0.1196	0.0070	0.0000	0.0000	0.0000
	10	202.5		1.4095	0.1337	0.0035	0.0000	0.0000	0.0000
	11	225		3.0855	0.3816	0.0009	0.0000	0.0000	0.0000
200				**5.3892**	**0.6349**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	12	247.5		2.7795	0.3878	0.0000	0.0000	0.0000	0.0000
	13	270		2.7258	0.4185	0.0000	0.0000	0.0000	0.0000
	14	292.5		1.4420	0.1196	0.0000	0.0000	0.0000	0.0000
260				**6.9473**	**0.9259**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
	15	315		1.5414	0.0404	0.0000	0.0000	0.0000	0.0000
	16	337.5		3.2745	0.0431	0.0000	0.0000	0.0000	0.0000
340				**11.5118**	**0.1662**	**0.0018**	**0.0000**	**0.0000**	**0.0000**
		% totals	21.52	49.2987	25.5639	3.4609	0.1433	0.0018	0.0000

* sector 1 added to direction assigned 340 degrees

records total Gustavus 1987-2001

calm	1-9kn	10-19kn	20-29kn	30-39kn	40-49kn	50-max	
27091	4438	455	5	0	0	0	4898
	1460	119	1	0	0	0	1580
	1332	54	1	0	0	0	1387
	2229	128	1	0	0	0	2358
50	**5021**	**301**	**3**	**0**	**0**	**0**	**5325**
	2831	432	5	0	0	0	3268
	4683	279	11	0	0	0	4973
	7944	2735	220	1	1	0	10901
	3114	611	18	0	0	0	3743
135	**18572**	**4057**	**254**	**1**	**1**	**0**	**22885**
	3613	364	8	0	0	0	3985
	3322	89	2	0	0	1	3414
	3377	170	5	0	2	0	3554
200	**10312**	**623**	**15**	**0**	**2**	**1**	**10953**
	1789	853	2	0	2	2	2648
	1936	82	1	0	0	0	2019
	1679	18	0	1	1	1	1700
260	**5404**	**953**	**3**	**1**	**3**	**3**	**6367**
	4441	155	0	0	0	0	4596
	7254	211	3	0	0	0	7468
340	**16133**	**821**	**8**	**0**	**0**	**0**	**16962**
	55442	6755	283	2	6	4	62492
						grand tot	89583

records total Juneau 1987-1999 (first order station)

calm	1-9kn	10-19kn	20-29kn	30-39kn	40-49kn	50-max	
24474	7615	94	2	0	0	0	7711
	2779	41	2	0	0	0	2822
	1061	88	3	0	0	0	1152
	3349	811	17	0	0	0	4177
50	**7189**	**940**	**22**	**0**	**0**	**0**	**8151**
	11881	7666	320	1	1	0	19869
	7073	13010	2352	112	1	0	22548
	1990	5006	1188	50	0	0	8234
	811	487	52	0	0	0	1350
135	**21755**	**26169**	**3912**	**163**	**2**	**0**	**52001**
	1017	136	8	0	0	0	1161
	1603	152	4	0	0	0	1759
	3509	434	1	0	0	0	3944
200	**6129**	**722**	**13**	**0**	**0**	**0**	**6864**
	3163	441	0	0	0	0	3604
	3100	476	0	0	0	0	3576
	1640	136	0	0	0	0	1776
260	**7903**	**1053**	**0**	**0**	**0**	**0**	**8956**
	1753	46	0	0	0	0	1799
	3724	49	0	0	0	0	3773
340	**13092**	**189**	**2**	**0**	**0**	**0**	**13283**
	56068	29073	3949	163	2	0	89255
						grand tot	113729

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907) 561-1011 Fax (907) 563-4220

Memorandum

To: File | Project No.: 02056.02

From: Jennifer Wilson | Date: October 3, 2002

Re: *Wave Generation Model Calculations*

Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum

---

The attached document, *Wave Generation Model Calculations*, provides the wave generation models used to calculate wave energy. The models calculate wave heights in restricted and unrestricted channels, deep versus shallow water, and the type of wave considering the shape of the vessel hull. Document created July 2002.

Ref. Sorensen, R. M., 1973. "Ship-Generated Waves," Advances in Hydroscience," v. 9, pp. 49-83.
(deep water)

$$C = V \cdot \cos(\theta)$$

C = ship wave propagation speed
V = ship velocity relative to the water
θ = angle between ship track and wave direction of propagation (wave ray)

$$\lambda = \frac{2 \cdot \pi \cdot V^2 \cdot \cos^2 \cdot (\theta)}{g} \qquad T = \frac{2 \cdot \pi \cdot V \cdot \cos(\theta)}{g}$$

λ = wavelength (horizontal distance between crests along wave propagation direction)
g = acceleration of gravity

$$x = \left(\frac{n \cdot \pi \cdot V^2}{2 \cdot g}\right) \cdot (\sin(\alpha) + \sin(3 \cdot \alpha)) \qquad y = \left(\frac{-n \cdot \pi \cdot V^2}{2 \cdot g}\right) \cdot (5 \cdot \cos(\alpha) - \cos(3 \cdot \alpha))$$

x and y = coordinates of wave crest
α = angle between ship track and a line to the point (x,y)

$$F = \frac{V}{\sqrt{g \cdot d}} = \frac{\sqrt{\frac{g \cdot \lambda}{2 \cdot \pi}}}{\sqrt{g \cdot d}} = 0.56$$

F = Froude number limit for deep water transverse waves (d/λ = 0.5)

d = still water depth

at F > 0.6 - 0.7, ship waves respond to bottom (no longer deep water)

(shallow water)

$$\cos^2(\alpha) = \frac{8\cdot\left[1 - \left(\frac{2\cdot k\cdot d}{\sinh(2\cdot k\cdot d)}\right)\right]}{\left(3 - \frac{2\cdot k\cdot d}{\sinh(2\cdot k\cdot d)}\right)^2}$$ α = cusp locus angle

$$k = \frac{2\cdot\pi}{\lambda}$$ wave number

at F = 1, $V = C = C_g = \sqrt{g\cdot d}$ and $\alpha = 90\cdot deg$

at F > 1, only diverging waves exist and transverse waves are no longer generated

$$\alpha = \operatorname{asin}\left(\frac{\sqrt{g\cdot d}}{V}\right)$$

$$V\cdot\cos(\theta) = \left(\frac{g\cdot T}{2\cdot\pi}\right)\tanh\left(\frac{2\cdot\pi\cdot d}{V\cdot T\cdot\cos(\theta)}\right)$$ general relation, V, θ, d, and T

ref. Sorensen, R.M., 1989. "Port and Channel Bank Protection from Ship Waves," Proc., Ports '89, ASCE, pp. 393-401

$\theta = 35.3 \cdot \left[1 - e^{12 \cdot (F-1)}\right]$ θ = wave propogation direction

$C = \sqrt{\frac{g \cdot C \cdot T}{2 \cdot \pi} \cdot \tanh\left(\frac{2 \cdot \pi \cdot d}{C \cdot T}\right)} = V \cdot \cos(\theta)$ (requires trial and error solution for T)

Unconstricted channels, deep water:
(from Gates and Herbich 1977)

$$H_{max} = 1.11 \cdot \left(\frac{K_w \cdot B}{L_e}\right) \cdot \frac{V^2}{2 \cdot g} \cdot \left(2 \cdot N + \frac{3}{2}\right)^{\frac{-1}{3}}$$

distance from the sailing line to channel bank

$$x = \frac{2 \cdot V^2}{g} \cdot \frac{\left(2 \cdot N + \frac{3}{2}\right) \cdot \pi}{\sqrt{3}} \cdot \sin(19.467 \cdot deg)$$

B = ship beam
L_e = the distance from the ship bow back to midship = LWL/2
N = the cusp number = 1, 2, 3...
K_w = coefficient (function of ship waterline length, LWL, and ship speed V)

= $-6.2(V/(LWL)^{1/2}) + 72$ for $V/L^{1/2} < 0.95$
= 1.13 for $V/(LWL)^{1/2} > 1.0$

Canal (from Blaauw et al 1984):

$$H_{max} = A \cdot d \cdot \left(\frac{S}{d}\right)^{-0.33} \left(\frac{V}{\sqrt{g \cdot d}}\right)^{2.67}$$

S = distance from the ship's side to the channel bank
A = a coefficient for ship type and loading
= 0.8 (pushing type)
= 0.35 (empty pushing type and tugboat)
= 0.25 (conventional European inland vessel)

from PIANC 1987 (**navigation channel bank** design): $H_{max} = d \cdot \left(\frac{S}{d}\right)^{-0.33} \cdot \left(\frac{V}{\sqrt{g \cdot d}}\right)^{4}$

ref. Weggel, J., and Sorensen, R., 1986, "Ship Wave Prediction for Port and Channel Design," Proc., Ports '86, American Society of Civil Engineers, NY, pp. 797-814.

dimensionless parameters: $F = \frac{V}{\sqrt{g \cdot d}}$ $F < 0.7$ deep water condition

F = 1, θ = 0

wave height $H_x = \frac{H}{Displ^{\frac{1}{3}}}$ H = max. ship wave height

Displ = ship displacement volume

offset distance (from track) $x_x = \frac{x}{Displ^{\frac{1}{3}}}$

depth $d_x = \frac{d}{Displ^{\frac{1}{3}}}$

block coefficient $c_x = \frac{Displ}{L \cdot B \cdot D}$

L = ship length

B = beam

D = draft

length $L_x = \frac{L}{Displ^{\frac{1}{3}}}$

beam $B_x = \frac{B}{Displ^{\frac{1}{3}}}$ draft $D_x = \frac{D}{Displ^{\frac{1}{3}}}$

model: $H_x = \alpha \cdot x_x^{\,n}$ $n = \beta \cdot d_x^{\,\delta}$

$\log(\alpha) = a + b \cdot \log(d_x) + c \cdot \log(d_x)$ $\alpha = 10^{(a + b \cdot \log(d_x) + c \cdot \log(d_x))}$

$a = \frac{-0.6}{F}$ $b = 0.75 \cdot F^{-1.126}$ $c = 2.6531 \cdot F - 1.95$ $\alpha = 10^{\left[a + 0.43429 \cdot b \cdot \log(d_x) + .1886 \cdot c \cdot \left(\log(d_x)^2\right)\right]}$

$\beta = -0.225 \cdot F^{-0.699}$ $\delta = -0.118 \cdot F^{-0.366}$ for $0.20 < F < 0.55$

$\beta = -0.342$ $\delta = -0.146$ for $0.55 < F < 0.8$

$C_{div} = V \cdot \cos(\theta)$ phase speed of diverging ship waves

$\theta = 35.267 \cdot \left(1 - e^{-12 + 12 \cdot F}\right)$ angle θ in degrees

$C_{div} = \frac{g \cdot T_{div}}{2 \cdot \pi}$ for $F \le 0.7$

$C_{div} = \sqrt{\frac{g \cdot L_{div}}{2 \cdot \pi} \cdot \tanh\left(\frac{2 \cdot \pi \cdot d}{L_{div}}\right)}$ for $F > 0.7$

$T_{div} = \frac{L_{div}}{C_{div}}$

$knots \equiv 6076 \cdot \frac{ft}{hr}$ $tons \equiv 2240 \cdot lbf$ $fathoms \equiv 6 \cdot ft$

Example execution: use characteristics of cruise ship $L := 700 \cdot ft \quad B := 80 \cdot ft \quad D := 24 \cdot ft$

$DWT := 1000 \cdot tons$

$$Displ := \frac{DWT}{100 \cdot \frac{lbf}{ft^3}} \qquad Displ = 2.24 \times 10^4\, ft^3 \qquad Displ^{\frac{1}{3}} = 28.189\, ft$$

$$d := 100 \cdot fathoms \qquad d_x := \frac{d}{Displ^{\frac{1}{3}}} \qquad d_x = 21.285$$

$$V := 15 \cdot knots \qquad F := \frac{V}{\sqrt{g \cdot d}} \qquad F = 0.182$$

$$a := \frac{-0.6}{F} \qquad a = -3.293$$

$$b := 0.75 \cdot F^{-1.125} \qquad b = 5.092$$

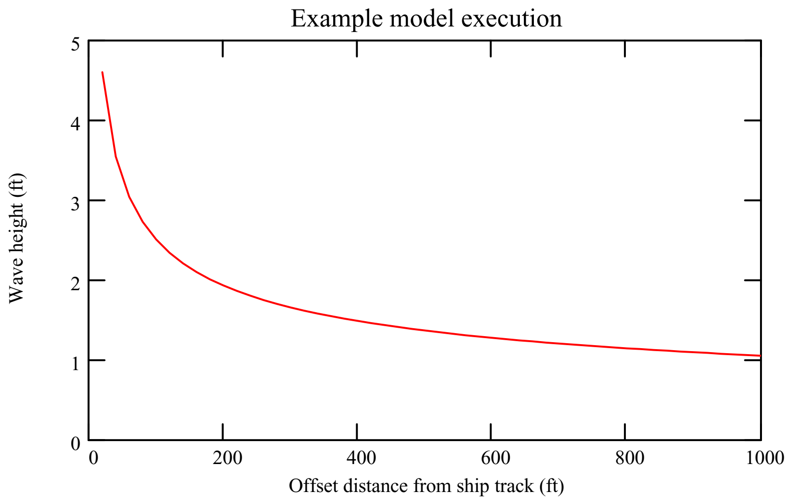
$$c := 2.6531 \cdot F - 1.95 \qquad c = -1.467$$

$$\alpha := 10^{\left[a + 0.43429 \cdot b \cdot \log\left(d_x\right) + .1886 \cdot c \cdot \left(\log\left(d_x\right)^2\right)\right]} \qquad \alpha = 0.143$$

$$\beta := -0.225 \cdot F^{-0.699} \qquad \delta := -0.118 \cdot F^{-0.366} \quad \text{for} \quad 0.20 < F < 0.55$$

$$n := \beta \cdot d_x^{\,\delta} \qquad n = -0.377 \qquad i := 1, 2 .. 100 \qquad x_i := 20 \cdot i \cdot ft$$

$$x_{x_i} := \frac{x_i}{Displ^{\frac{1}{3}}} \qquad H_{x_i} := \alpha \cdot \left(x_{x_i}\right)^n \qquad H_i := H_{x_i} \cdot Displ^{\frac{1}{3}}$$



x_i = (ft)	x_{x_i} =	H_{x_i} =	H_i = (ft)
20	0.709	0.163	4.599
40	1.419	0.126	3.541
60	2.128	0.108	3.038
80	2.838	0.097	2.726
100	3.547	0.089	2.505
120	4.257	0.083	2.339
140	4.966	0.078	2.207
160	5.676	0.074	2.098
180	6.385	0.071	2.007
200	7.095	0.068	1.929
220	7.804	0.066	1.861
240	8.514	0.064	1.8
260	9.223	0.062	1.747
280	9.933	0.06	1.699
300	10.642	0.059	1.655
320	11.352	0.057	1.615

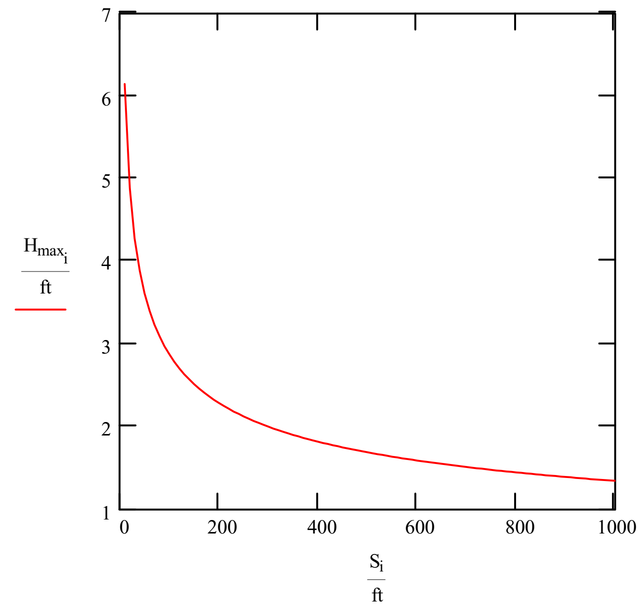
Canal (from Blaauw et al 1984):

S = distance from the ship's side to the channel bank
A = a coefficient for ship type and loading
= 0.8 (pushing type)
= 0.35 (empty pushing type and tugboat)
= 0.25 (conventional European inland vessel)

$A := 0.25 \qquad S_i := 10 \cdot i \cdot ft$

$$H_{max_i} := A \cdot d \cdot \left(\frac{S_i}{d}\right)^{-0.33} \left(\frac{V}{\sqrt{g \cdot d}}\right)^{2.67}$$

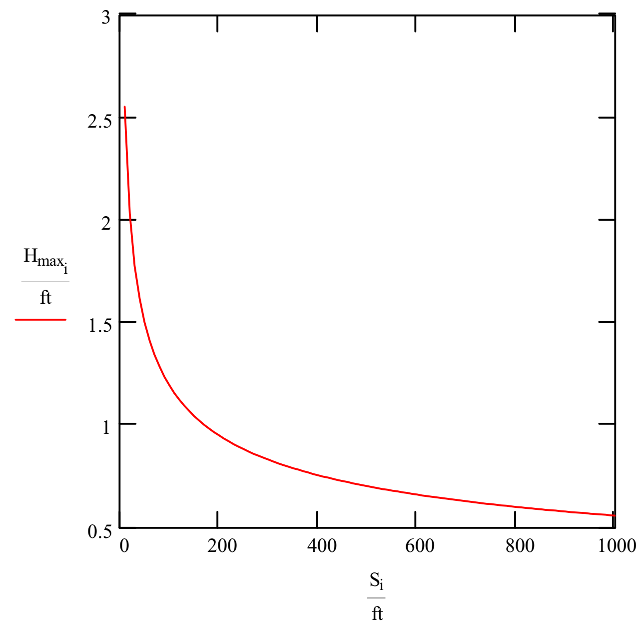
$S_i =$ (ft)	$H_{max_i} =$ (ft)
10	6.146
20	4.89
30	4.277
40	3.89
50	3.614
60	3.403
70	3.234
80	3.095
90	2.977
100	2.875
110	2.786
120	2.707
130	2.636
140	2.573
150	2.515
160	2.462



from PIANC 1987 (**navigation channel bank** design):

$$H_{max_i} := d \cdot \left(\frac{S_i}{d}\right)^{-0.33} \cdot \left(\frac{V}{\sqrt{g \cdot d}}\right)^4$$

$S_i =$ (ft)	$H_{max_i} =$ (ft)
10	2.554
20	2.032
30	1.777
40	1.616
50	1.502
60	1.414
70	1.344
80	1.286
90	1.237
100	1.195
110	1.158
120	1.125
130	1.096
140	1.069
150	1.045
160	1.023



Unconstricted channels, deep water:
(from Gates and Herbich 1977)

$$H_{max} = 1.11\cdot\left(\frac{K_w\cdot B}{L_e}\right)\cdot\frac{V^2}{2\cdot g}\cdot\left(2\cdot N + \frac{3}{2}\right)^{\frac{-1}{3}}$$

distance from the sailing line to channel bank

$$x = \frac{2\cdot V^2}{g}\cdot\frac{\left(2\cdot N + \frac{3}{2}\right)\cdot\pi}{\sqrt{3}}\cdot\sin(19.467\cdot deg)$$

B = ship beam
L_e = the distance from the ship bow back to midship = LWL/2
N = the cusp number = 1, 2, 3...
K_w = coefficient (function of ship waterline length, LWL, and ship speed V)
= -6.2(V/(g*LWL)$^{1/2}$) + 72 for V/L$^{1/2}$ < 0.95
= 1.13 for V/(g*LWL)$^{1/2}$ > 1.0

$B = 80\,ft \qquad L = 700\,ft \qquad LWL := L \qquad L_e := \frac{LWL}{2}$

$V = 15\,knots \qquad \frac{V}{\sqrt{g\cdot LWL}} = 0.169 \qquad K_w := -6.2\cdot\frac{V}{\sqrt{g\cdot LWL}} + 72$

$N := 1, 2 .. 20$

$K_w = 70.954$

$$x_N := \frac{2\cdot V^2}{g}\cdot\frac{\left(2\cdot N + \frac{3}{2}\right)\cdot\pi}{\sqrt{3}}\cdot\sin(19.467\cdot deg) \qquad H_{max_N} := 1.11\cdot\left(\frac{K_w\cdot B}{L_e}\right)\cdot\frac{V^2}{2\cdot g}\cdot\left(2\cdot N + \frac{3}{2}\right)^{\frac{-1}{3}}$$

N =	x_N = (ft)	H_{max_N} = (ft)
1	84.291	118.098
2	132.458	101.581
3	180.624	91.604
4	228.791	84.663
5	276.957	79.439
6	325.124	75.305

NOTE: apparent errors in transcription of formulae!

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue   Anchorage, Alaska 99503   (907) 561-1011   Fax (907) 563-4220

Memorandum

To: File Project No.: 02056.02

From: Jennifer Wilson Date: October 3, 2002

Re: *Spirit of Adventure Positions and Speeds* document

Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum Concerning Vessel Wakes

---

The attached document, *Spirit of Adventure Positions and Speeds*, maps the GPS route taken during the site visit to Glacier Bay proper on June 12, 2002. This site visit included a cruise by Sandra Donohue (PN&D Engineers) and Orson Smith, PE. The purpose of the visit was to collect information on the shoreline structure and vessel tracks. The cruise also provided information on different vessel wakes including height, period, and differences due to type of vessel hull.

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5827.30554	W13553.24518	15:33:32	7.56	80.3	1.0
N5827.30876	W13553.26965	15:34:18	7.57	146.6	1.9
N5827.33129	W13553.28606	15:35:03	7.58	11.9	0.2
N5827.33193	W13553.28960	15:35:49	7.60	371.2	4.8
N5827.37925	W13553.36331	15:36:35	7.61	487.7	6.3
N5827.43139	W13553.47982	15:37:21	7.62	486.6	6.3
N5827.46165	W13553.62144	15:38:07	7.64	515.7	6.8
N5827.47323	W13553.78206	15:38:52	7.65	750.7	9.9
N5827.47001	W13554.01798	15:39:37	7.66	1474.9	19.0
N5827.32324	W13554.38716	15:40:23	7.67	1698.6	21.9
N5827.07605	W13554.63596	15:41:09	7.69	1659.5	21.8
N5826.83562	W13554.88283	15:41:54	7.70	1689.8	21.8
N5826.60709	W13555.18507	15:42:40	7.71	1684.3	21.7
N5826.40271	W13555.54234	15:43:26	7.72	1689.0	21.8
N5826.20347	W13555.91216	15:44:12	7.74	1671.8	22.0
N5826.00006	W13556.26557	15:44:57	7.75	1657.4	21.3
N5825.86230	W13556.71489	15:45:43	7.76	1647.8	21.7
N5825.92184	W13557.21990	15:46:28	7.77	1681.1	22.1
N5826.02387	W13557.71074	15:47:13	7.79	1707.9	22.0
N5826.14071	W13558.19869	15:47:59	7.80	1714.5	22.1
N5826.27203	W13558.67537	15:48:45	7.81	1685.1	21.7
N5826.41365	W13559.13049	15:49:31	7.83	1651.8	21.7
N5826.54176	W13559.58818	15:50:16	7.84	1639.8	21.1
N5826.66664	W13600.04491	15:51:02	7.85	1540.7	19.8
N5826.82339	W13600.42535	15:51:48	7.86	1454.2	19.1
N5826.99977	W13600.73402	15:52:33	7.88	1438.2	18.5
N5827.17036	W13601.04719	15:53:19	7.89	1375.3	18.1
N5827.35028	W13601.30919	15:54:04	7.90	1372.2	17.7
N5827.55885	W13601.47399	15:54:50	7.91	1313.6	17.3
N5827.75873	W13601.63074	15:55:35	7.93	1322.5	17.4
N5827.95474	W13601.81098	15:56:20	7.94	1317.5	17.3
N5828.14207	W13602.01923	15:57:05	7.95	1343.9	17.3
N5828.34871	W13602.16922	15:57:51	7.96	1393.5	17.9
N5828.57176	W13602.26996	15:58:37	7.98	1416.8	18.7
N5828.79449	W13602.40096	15:59:22	7.99	1420.8	18.3
N5829.00434	W13602.59762	16:00:08	8.00	1440.1	18.5
N5829.21452	W13602.80651	16:00:54	8.02	1428.0	18.8
N5829.42148	W13603.01894	16:01:39	8.03	1444.9	19.0
N5829.63230	W13603.22880	16:02:24	8.04	1486.5	19.1
N5829.85632	W13603.41612	16:03:10	8.05	1470.0	19.4
N5830.08839	W13603.54583	16:03:55	8.07	1527.3	19.7
N5830.33333	W13603.65237	16:04:41	8.08	1533.1	19.7
N5830.58148	W13603.73799	16:05:27	8.09	1513.1	19.9
N5830.82964	W13603.77339	16:06:12	8.10	1536.5	19.8
N5831.08231	W13603.76599	16:06:58	8.12	1517.4	20.0
N5831.33079	W13603.72157	16:07:43	8.13	1518.9	20.0
N5831.57959	W13603.67844	16:08:28	8.14	1567.4	20.2

* speed measured relative to the ground

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5831.83611	W13603.62952	16:09:14	8.15	1603.3	21.1
N5832.09908	W13603.59218	16:09:59	8.17	1850.2	23.8
N5832.40131	W13603.52427	16:10:45	8.18	1831.1	24.1
N5832.69807	W13603.42610	16:11:30	8.19	1870.8	24.1
N5833.00320	W13603.35014	16:12:16	8.20	1880.0	24.2
N5833.31026	W13603.28062	16:13:02	8.22	1882.9	24.3
N5833.61603	W13603.18663	16:13:48	8.23	1836.3	24.2
N5833.91536	W13603.10971	16:14:33	8.24	1855.4	24.4
N5834.21695	W13603.02055	16:15:18	8.26	1886.0	24.3
N5834.52497	W13602.95038	16:16:04	8.27	1891.2	24.4
N5834.83461	W13602.89373	16:16:50	8.28	1872.4	24.1
N5835.14135	W13602.84127	16:17:36	8.29	1835.1	24.2
N5835.44068	W13602.76724	16:18:21	8.31	1853.2	24.4
N5835.74323	W13602.69643	16:19:06	8.32	1895.9	24.4
N5836.05287	W13602.62594	16:19:52	8.33	1861.5	24.5
N5836.35735	W13602.56447	16:20:37	8.34	1912.7	24.6
N5836.66827	W13602.47273	16:21:23	8.36	1867.6	24.6
N5836.96954	W13602.35783	16:22:08	8.37	1906.9	24.6
N5837.28143	W13602.29474	16:22:54	8.38	1873.0	24.7
N5837.58720	W13602.22297	16:23:39	8.39	1902.4	24.5
N5837.89812	W13602.15570	16:24:25	8.41	1888.5	24.3
N5838.20776	W13602.10903	16:25:11	8.42	1633.5	21.0
N5838.42920	W13602.40128	16:25:57	8.43	282.6	3.7
N5838.46106	W13602.46630	16:26:42	8.45	107.4	1.4
N5838.47748	W13602.47885	16:27:28	8.46	162.4	2.1
N5838.50419	W13602.47949	16:28:14	8.47	67.3	0.9
N5838.51514	W13602.47628	16:28:59	8.48	38.8	0.5
N5838.52093	W13602.47113	16:29:45	8.50	22.1	0.3
N5838.52318	W13602.46565	16:30:31	8.51	14.5	0.2
N5838.52415	W13602.46147	16:31:17	8.52	15.4	0.2
N5838.52318	W13602.45696	16:32:02	8.53	219.7	2.9
N5838.55537	W13602.42542	16:32:47	8.55	319.2	4.1
N5838.60783	W13602.42156	16:33:33	8.56	313.1	4.1
N5838.65837	W13602.44055	16:34:18	8.57	293.4	3.8
N5838.70343	W13602.47370	16:35:04	8.58	254.8	3.3
N5838.74366	W13602.49623	16:35:50	8.60	232.0	3.0
N5838.77778	W13602.52906	16:36:36	8.61	185.7	2.4
N5838.80385	W13602.55964	16:37:21	8.62	117.7	1.5
N5838.81962	W13602.58120	16:38:07	8.64	124.2	1.6
N5838.83668	W13602.60277	16:38:52	8.65	89.7	1.2
N5838.84794	W13602.62111	16:39:37	8.66	239.5	3.1
N5838.88689	W13602.63238	16:40:23	8.67	637.9	8.4
N5838.98796	W13602.57831	16:41:08	8.69	1675.2	22.1
N5839.24867	W13602.40707	16:41:53	8.70	1931.0	24.9
N5839.55830	W13602.27125	16:42:39	8.71	1941.8	25.0
N5839.87180	W13602.38841	16:43:25	8.72	1941.3	25.0
N5840.18014	W13602.54773	16:44:11	8.74	1904.1	25.1
N5840.48205	W13602.70770	16:44:56	8.75	1906.2	25.1
N5840.77366	W13602.92914	16:45:41	8.76	1925.4	25.4

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5841.04821	W13603.23266	16:46:26	8.77	1907.8	25.1
N5841.29251	W13603.61149	16:47:11	8.79	1924.8	25.3
N5841.53906	W13603.99355	16:47:56	8.80	17685.0	25.0
N5843.61541	W13607.91322	16:54:55	8.92	1944.3	25.0
N5843.85359	W13608.32424	16:55:41	8.93	1945.1	25.1
N5844.07536	W13608.76842	16:56:27	8.94	1913.5	25.2
N5844.29487	W13609.20293	16:57:12	8.95	1906.6	25.1
N5844.52822	W13609.60655	16:57:57	8.97	1880.3	24.8
N5844.79215	W13609.91715	16:58:42	8.98	1919.6	24.7
N5845.10339	W13610.01918	16:59:28	8.99	704.6	9.1
N5845.21926	W13610.02305	17:00:14	9.00	55.0	0.7
N5845.21057	W13610.01822	17:01:00	9.02	258.5	3.3
N5845.23729	W13609.95449	17:01:46	9.03	164.6	2.1
N5845.24051	W13609.90267	17:02:32	9.04	20.3	0.3
N5845.24051	W13609.89623	17:03:18	9.06	10.3	0.1
N5845.23890	W13609.89720	17:04:03	9.07	4.1	0.1
N5845.23825	W13609.89687	17:04:49	9.08	2.2	0.0
N5845.23793	W13609.89720	17:05:34	9.09	9.3	0.1
N5845.23890	W13609.89494	17:06:19	9.11	7.8	0.1
N5845.23793	W13609.89655	17:07:05	9.12	7.8	0.1
N5845.23890	W13609.89816	17:07:51	9.13	192.9	2.5
N5845.23954	W13609.95932	17:08:36	9.14	64.3	0.8
N5845.22956	W13609.96608	17:09:22	9.16	1427.5	18.8
N5844.99686	W13610.02626	17:10:07	9.17	1981.3	25.5
N5844.67113	W13610.00888	17:10:53	9.18	1796.8	23.7
N5844.43488	W13610.35103	17:11:38	9.19	1866.7	24.6
N5844.45548	W13610.94133	17:12:23	9.21	1940.0	25.0
N5844.50408	W13611.54901	17:13:09	9.22	1906.1	25.1
N5844.51406	W13612.15283	17:13:54	9.23	1923.3	25.3
N5844.53176	W13612.76147	17:14:39	9.24	1967.1	25.3
N5844.57457	W13613.37945	17:15:25	9.26	1964.1	25.3
N5844.63411	W13613.99132	17:16:11	9.27	1969.8	25.4
N5844.72939	W13614.58806	17:16:57	9.28	1950.6	25.1
N5844.84236	W13615.16677	17:17:43	9.30	1935.0	24.9
N5845.01552	W13615.68143	17:18:29	9.31	1908.0	25.1
N5845.21991	W13616.14041	17:19:14	9.32	1938.6	25.0
N5845.45905	W13616.54693	17:20:00	9.33	1894.4	24.9
N5845.72170	W13616.87008	17:20:45	9.35	1902.5	25.1
N5845.98466	W13617.19710	17:21:30	9.36	1926.0	24.8
N5846.18003	W13617.67796	17:22:16	9.37	1879.4	24.7
N5846.31779	W13618.21162	17:23:01	9.38	1911.0	24.6
N5846.41242	W13618.78969	17:23:47	9.40	1903.4	24.5
N5846.48902	W13619.37516	17:24:33	9.41	1905.5	24.5
N5846.64674	W13619.89754	17:25:19	9.42	1843.5	24.3
N5846.88298	W13620.26415	17:26:04	9.43	1920.8	24.7
N5847.14498	W13620.60468	17:26:50	9.45	1878.7	24.7
N5847.37254	W13621.00798	17:27:35	9.46	1878.9	24.7
N5847.54731	W13621.49979	17:28:20	9.47	1911.2	24.6
N5847.73110	W13621.99192	17:29:06	9.49	1883.9	24.8

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5847.91553	W13622.47247	17:29:51	9.50	1931.8	24.9
N5848.05329	W13623.02511	17:30:37	9.51	1895.6	25.0
N5848.16787	W13623.58483	17:31:22	9.52	1926.5	24.8
N5848.28278	W13624.15485	17:32:08	9.54	1878.3	24.7
N5848.40605	W13624.70170	17:32:53	9.55	1874.2	24.7
N5848.53801	W13625.23954	17:33:38	9.56	1899.6	24.5
N5848.68833	W13625.76836	17:34:24	9.57	1855.8	24.4
N5848.87855	W13626.22927	17:35:09	9.59	1905.1	24.5
N5849.06201	W13626.71980	17:35:55	9.60	1850.1	24.4
N5849.23357	W13627.20517	17:36:40	9.61	1770.4	22.8
N5849.40254	W13627.66318	17:37:26	9.62	1441.6	19.0
N5849.56219	W13628.00179	17:38:11	9.64	392.8	5.1
N5849.59663	W13628.10736	17:38:57	9.65	97.4	1.3
N5849.60307	W13628.13568	17:39:42	9.66	31.5	0.4
N5849.60339	W13628.14566	17:40:28	9.67	12.7	0.2
N5849.60178	W13628.14823	17:41:13	9.69	21.9	0.3
N5849.59824	W13628.14695	17:41:58	9.70	74.0	1.0
N5849.59792	W13628.17044	17:42:44	9.71	777.6	10.0
N5849.68643	W13628.34876	17:43:30	9.73	886.4	11.4
N5849.81196	W13628.49199	17:44:16	9.74	777.1	10.0
N5849.91978	W13628.62459	17:45:02	9.75	275.6	3.6
N5849.94778	W13628.69347	17:45:48	9.76	91.3	1.2
N5849.94457	W13628.72180	17:46:33	9.78	59.3	0.8
N5849.93620	W13628.73145	17:47:18	9.79	248.4	3.2
N5849.93427	W13628.81031	17:48:04	9.80	965.9	12.7
N5849.97482	W13629.10707	17:48:49	9.81	1863.1	24.0
N5850.11902	W13629.62946	17:49:35	9.83	1864.0	24.5
N5850.26546	W13630.14991	17:50:20	9.84	1906.4	24.6
N5850.41996	W13630.67713	17:51:06	9.85	1917.6	24.7
N5850.56866	W13631.21464	17:51:52	9.86	1867.2	24.6
N5850.70610	W13631.74540	17:52:37	9.88	1907.5	24.6
N5850.84740	W13632.28678	17:53:23	9.89	1867.8	24.6
N5850.98580	W13632.81689	17:54:08	9.90	1905.4	24.5
N5851.13160	W13633.35311	17:54:54	9.92	1913.3	24.6
N5851.28449	W13633.88484	17:55:40	9.93	1916.4	24.7
N5851.43577	W13634.41945	17:56:26	9.94	1909.6	24.6
N5851.57803	W13634.96083	17:57:12	9.95	1880.1	24.8
N5851.71482	W13635.49706	17:57:57	9.97	1928.3	24.8
N5851.86352	W13636.03876	17:58:43	9.98	1875.9	24.7
N5852.01351	W13636.56018	17:59:28	9.99	1916.0	24.7
N5852.17219	W13637.08675	18:00:14	10.00	1878.0	24.7
N5852.32733	W13637.60334	18:00:59	10.02	1884.9	24.8
N5852.47957	W13638.12573	18:01:44	10.03	1913.4	24.6
N5852.62731	W13638.66324	18:02:30	10.04	1885.5	24.8
N5852.76571	W13639.20012	18:03:15	10.05	1923.8	24.8
N5852.90251	W13639.75211	18:04:01	10.07	1876.7	24.7
N5853.08372	W13640.23556	18:04:46	10.08	1916.0	24.7
N5853.29100	W13640.69486	18:05:32	10.09	1882.8	24.8
N5853.50214	W13641.13324	18:06:17	10.10	1926.0	24.8

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5853.73581	W13641.54716	18:07:03	10.12	1908.3	25.1
N5853.96048	W13641.97137	18:07:48	10.13	1919.5	25.3
N5854.18546	W13642.40010	18:08:33	10.14	1963.5	25.3
N5854.42300	W13642.82367	18:09:19	10.16	1927.8	25.4
N5854.65313	W13643.24596	18:10:04	10.17	1857.2	23.9
N5854.84271	W13643.70977	18:10:50	10.18	1756.1	22.6
N5854.98272	W13644.19900	18:11:36	10.19	1749.0	22.5
N5855.11501	W13644.69371	18:12:22	10.21	1712.5	22.5
N5855.26113	W13645.16009	18:13:07	10.22	1638.7	21.6
N5855.43526	W13645.55856	18:13:52	10.23	1432.4	18.4
N5855.61905	W13645.84405	18:14:38	10.24	593.5	7.6
N5855.71561	W13645.87173	18:15:24	10.26	297.5	3.8
N5855.76453	W13645.86948	18:16:10	10.27	292.7	3.9
N5855.81249	W13645.86144	18:16:55	10.28	140.5	1.9
N5855.83534	W13645.85468	18:17:40	10.29	75.7	1.0
N5855.84757	W13645.85017	18:18:26	10.31	54.9	0.7
N5855.85658	W13645.84888	18:19:12	10.32	31.9	0.4
N5855.86173	W13645.85081	18:19:57	10.33	13.7	0.2
N5855.86366	W13645.85307	18:20:43	10.35	5.6	0.1
N5855.86431	W13645.85435	18:21:28	10.36	19.8	0.3
N5855.86688	W13645.85822	18:22:14	10.37	21.8	0.3
N5855.86946	W13645.86304	18:23:00	10.38	16.2	0.2
N5855.87075	W13645.86755	18:23:45	10.40	3.9	0.1
N5855.87139	W13645.86755	18:24:30	10.41	11.9	0.2
N5855.86946	W13645.86691	18:25:16	10.42	109.3	1.4
N5855.85497	W13645.84631	18:26:02	10.43	126.3	1.6
N5855.83534	W13645.83311	18:26:48	10.45	201.9	2.7
N5855.81249	W13645.87978	18:27:33	10.46	1312.6	16.9
N5855.74425	W13646.27664	18:28:19	10.47	1786.4	23.0
N5855.82118	W13646.82606	18:29:05	10.48	1798.7	23.2
N5855.91838	W13647.36744	18:29:51	10.50	1778.4	22.9
N5856.05839	W13647.86505	18:30:37	10.51	1743.1	22.5
N5856.29014	W13648.19206	18:31:23	10.52	1672.2	22.0
N5856.53121	W13648.44859	18:32:08	10.54	1727.4	22.7
N5856.68120	W13648.91626	18:32:53	10.55	1890.5	24.9
N5856.82218	W13649.45345	18:33:38	10.56	1897.5	25.0
N5856.96541	W13649.99096	18:34:23	10.57	1943.2	25.0
N5857.08546	W13650.56517	18:35:09	10.59	1897.9	25.0
N5857.19168	W13651.13423	18:35:54	10.60	1912.0	25.2
N5857.29017	W13651.71326	18:36:39	10.61	1963.3	25.3
N5857.40057	W13652.30163	18:37:25	10.62	1890.1	24.9
N5857.53382	W13652.84623	18:38:10	10.64	1906.8	25.1
N5857.76782	W13653.25114	18:38:55	10.65	1944.0	25.0
N5858.01404	W13653.64671	18:39:41	10.66	1945.3	25.1
N5858.26446	W13654.03295	18:40:27	10.67	1901.5	25.0
N5858.51004	W13654.40856	18:41:12	10.69	1898.6	25.0
N5858.76270	W13654.76455	18:41:57	10.70	1948.8	25.1
N5859.02052	W13655.13405	18:42:43	10.71	1890.6	24.9
N5859.24679	W13655.54796	18:43:28	10.72	1935.8	24.9

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5859.46051	W13656.00598	18:44:14	10.74	1942.3	25.0
N5859.66521	W13656.48202	18:45:00	10.75	1893.9	24.9
N5859.86895	W13656.93939	18:45:45	10.76	1932.1	24.9
N5900.11293	W13657.33464	18:46:31	10.78	1925.7	24.8
N5900.36623	W13657.70382	18:47:17	10.79	1878.1	24.7
N5900.61761	W13658.05240	18:48:02	10.80	1931.9	24.9
N5900.90150	W13658.32952	18:48:48	10.81	1861.9	24.5
N5901.17476	W13658.59796	18:49:33	10.83	1928.2	24.8
N5901.45221	W13658.89633	18:50:19	10.84	1905.5	24.5
N5901.70906	W13659.24523	18:51:05	10.85	1750.7	22.5
N5901.92728	W13659.61022	18:51:51	10.86	730.6	9.4
N5902.03607	W13659.70936	18:52:37	10.88	441.4	5.7
N5902.09626	W13659.78822	18:53:23	10.89	334.0	4.3
N5902.14229	W13659.84647	18:54:09	10.90	271.7	3.6
N5902.17351	W13659.90859	18:54:54	10.92	337.8	4.4
N5902.21953	W13659.96910	18:55:39	10.93	335.4	4.3
N5902.26942	W13700.01481	18:56:25	10.94	1195.4	15.7
N5902.37821	W13700.33313	18:57:10	10.95	1904.3	25.1
N5902.44935	W13700.92601	18:57:55	10.97	1363.1	17.6
N5902.48861	W13701.35505	18:58:41	10.98	488.6	6.3
N5902.48572	W13701.51116	18:59:27	10.99	538.8	7.1
N5902.47606	W13701.68239	19:00:12	11.00	656.4	8.5
N5902.48636	W13701.89128	19:00:58	11.02	370.7	4.8
N5902.49312	W13702.00908	19:01:44	11.03	414.1	5.3
N5902.47413	W13702.13622	19:02:30	11.04	540.7	7.0
N5902.47316	W13702.30906	19:03:16	11.05	296.1	3.8
N5902.48024	W13702.40273	19:04:02	11.07	197.8	2.5
N5902.48636	W13702.46485	19:04:48	11.08	328.8	4.3
N5902.46351	W13702.56012	19:05:33	11.09	202.0	2.6
N5902.45932	W13702.62417	19:06:19	11.11	169.1	2.2
N5902.44420	W13702.66955	19:07:05	11.12	204.3	2.7
N5902.42070	W13702.71622	19:07:50	11.13	134.7	1.7
N5902.39978	W13702.73038	19:08:36	11.14	38.0	0.5
N5902.39559	W13702.72137	19:09:21	11.16	52.7	0.7
N5902.39302	W13702.70528	19:10:06	11.17	41.5	0.5
N5902.39141	W13702.69240	19:10:52	11.18	37.2	0.5
N5902.39141	W13702.68050	19:11:38	11.19	34.3	0.5
N5902.39109	W13702.66955	19:12:23	11.21	38.1	0.5
N5902.38980	W13702.65764	19:13:08	11.22	39.3	0.5
N5902.38980	W13702.64509	19:13:54	11.23	4.4	0.1
N5902.38916	W13702.64445	19:14:39	11.24	9.3	0.1
N5902.38883	W13702.64734	19:15:25	11.26	13.3	0.2
N5902.38723	W13702.64445	19:16:11	11.27	42.7	0.5
N5902.38304	W13702.63350	19:16:57	11.28	35.6	0.5
N5902.38143	W13702.62256	19:17:42	11.30	76.7	1.0
N5902.37435	W13702.60228	19:18:28	11.31	41.6	0.5
N5902.36791	W13702.59778	19:19:13	11.32	26.0	0.3
N5902.36405	W13702.59424	19:19:59	11.33	18.2	0.2
N5902.36373	W13702.58844	19:20:45	11.35	19.7	0.3

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5902.36630	W13702.58458	19:21:30	11.36	30.0	0.4
N5902.37113	W13702.58265	19:22:16	11.37	6.3	0.1
N5902.37145	W13702.58072	19:23:02	11.38	4.4	0.1
N5902.37210	W13702.58136	19:23:48	11.40	19.8	0.3
N5902.36952	W13702.57750	19:24:34	11.41	17.0	0.2
N5902.36824	W13702.57267	19:25:19	11.42	21.7	0.3
N5902.36470	W13702.57170	19:26:05	11.43	15.6	0.2
N5902.36309	W13702.57557	19:26:50	11.45	18.6	0.2
N5902.36598	W13702.57750	19:27:36	11.46	37.6	0.5
N5902.36437	W13702.56591	19:28:21	11.47	40.7	0.5
N5902.36341	W13702.55304	19:29:07	11.49	42.9	0.6
N5902.36148	W13702.53984	19:29:52	11.50	49.3	0.6
N5902.35987	W13702.52439	19:30:38	11.51	61.9	0.8
N5902.35568	W13702.50637	19:31:23	11.52	42.1	0.5
N5902.36051	W13702.51602	19:32:09	11.54	11.7	0.2
N5902.36148	W13702.51280	19:32:55	11.55	15.2	0.2
N5902.36019	W13702.50862	19:33:40	11.56	22.0	0.3
N5902.35922	W13702.50186	19:34:26	11.57	29.5	0.4
N5902.35568	W13702.49542	19:35:11	11.59	36.8	0.5
N5902.35246	W13702.48544	19:35:56	11.60	23.1	0.3
N5902.35246	W13702.47804	19:36:42	11.61	41.4	0.5
N5902.35085	W13702.46517	19:37:27	11.62	66.7	0.9
N5902.34281	W13702.45068	19:38:13	11.64	28.8	0.4
N5902.34538	W13702.44296	19:38:58	11.65	31.8	0.4
N5902.34377	W13702.43330	19:39:44	11.66	25.2	0.5
N5902.34345	W13702.42526	19:40:12	11.67	23.3	0.3
N5902.34152	W13702.41882	19:40:57	11.68	24.5	0.3
N5902.34216	W13702.41109	19:41:42	11.70	27.3	0.4
N5902.34184	W13702.40240	19:42:28	11.71	16.2	0.2
N5902.34216	W13702.39725	19:43:13	11.72	12.7	0.2
N5902.34281	W13702.39339	19:43:59	11.73	28.0	0.4
N5902.34023	W13702.38599	19:44:45	11.75	23.2	0.3
N5902.33991	W13702.37859	19:45:30	11.76	31.8	0.4
N5902.33895	W13702.36861	19:46:16	11.77	27.5	0.4
N5902.33830	W13702.35992	19:47:01	11.78	74.3	1.0
N5902.34377	W13702.33867	19:47:47	11.80	351.1	4.5
N5902.36244	W13702.23246	19:48:33	11.81	468.3	6.0
N5902.36405	W13702.08279	19:49:19	11.82	624.1	8.0
N5902.35118	W13701.88484	19:50:05	11.83	677.8	8.7
N5902.40074	W13701.69076	19:50:51	11.85	911.6	11.7
N5902.49441	W13701.46320	19:51:37	11.86	967.2	12.7
N5902.53367	W13701.16354	19:52:22	11.87	1850.5	24.4
N5902.42810	W13700.60865	19:53:07	11.89	1831.1	23.6
N5902.22983	W13700.16802	19:53:53	11.90	627.2	8.1
N5902.16449	W13700.01288	19:54:39	11.91	623.8	8.0
N5902.10237	W13659.85420	19:55:25	11.92	397.3	5.2
N5902.05410	W13659.76858	19:56:10	11.94	350.9	4.6
N5902.01740	W13659.68200	19:56:55	11.95	355.5	4.7
N5901.99101	W13659.58061	19:57:40	11.96	267.7	3.4

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5901.98264	W13659.49661	19:58:26	11.97	357.4	4.7
N5901.96526	W13659.38749	19:59:11	11.99	369.9	4.9
N5901.93629	W13659.28353	19:59:56	12.00	460.6	5.9
N5901.87771	W13659.19019	20:00:42	12.01	676.5	8.7
N5901.78920	W13659.05919	20:01:28	12.02	1019.7	13.1
N5901.64661	W13658.88764	20:02:14	12.04	1131.5	14.9
N5901.46862	W13658.78207	20:02:59	12.05	1418.6	18.3
N5901.24782	W13658.63562	20:03:45	12.06	1894.2	24.9
N5900.94205	W13658.51975	20:04:30	12.08	1939.6	25.5
N5900.66621	W13658.20850	20:05:15	12.09	1996.0	25.7
N5900.38651	W13657.87473	20:06:01	12.10	2001.7	25.8
N5900.10842	W13657.53258	20:06:47	12.11	1955.7	25.8
N5859.82936	W13657.22199	20:07:32	12.13	2006.7	25.8
N5859.55159	W13656.87598	20:08:18	12.14	1987.4	25.6
N5859.28284	W13656.51485	20:09:04	12.15	1955.5	25.7
N5859.01054	W13656.18268	20:09:49	12.16	2010.3	25.9
N5858.71732	W13655.88625	20:10:35	12.18	1990.2	25.6
N5858.46433	W13655.48327	20:11:21	12.19	1930.8	25.4
N5858.21199	W13655.10926	20:12:06	12.20	1992.9	25.7
N5857.93583	W13654.76680	20:12:52	12.21	1968.4	25.4
N5857.66192	W13654.43206	20:13:38	12.23	1983.6	25.5
N5857.40508	W13654.04196	20:14:24	12.24	1992.0	25.7
N5857.11540	W13653.74520	20:15:10	12.25	1975.7	25.4
N5856.81767	W13653.49286	20:15:56	12.27	1922.5	25.3
N5856.52252	W13653.27302	20:16:41	12.28	1950.2	25.1
N5856.20516	W13653.18290	20:17:27	12.29	1908.6	25.1
N5855.89134	W13653.19706	20:18:12	12.30	1873.1	24.7
N5855.64319	W13653.55079	20:18:57	12.32	1938.3	25.0
N5855.42464	W13654.00044	20:19:43	12.33	1922.3	24.8
N5855.19644	W13654.42433	20:20:29	12.34	1920.0	24.7
N5854.92060	W13654.72206	20:21:15	12.35	1907.1	25.1
N5854.66053	W13655.06163	20:22:00	12.37	1940.0	25.0
N5854.40175	W13655.42308	20:22:46	12.38	1899.3	25.0
N5854.16261	W13655.81222	20:23:31	12.39	1914.4	25.2
N5853.97432	W13656.30081	20:24:16	12.40	1390.4	17.9
N5853.84042	W13656.65969	20:25:02	12.42	78.6	1.0
N5853.83334	W13656.68061	20:25:47	12.43	33.4	0.4
N5853.82787	W13656.68157	20:26:32	12.44	295.8	3.8
N5853.83817	W13656.58952	20:27:18	12.46	470.2	6.1
N5853.86553	W13656.44951	20:28:04	12.47	476.2	6.1
N5853.89997	W13656.31336	20:28:50	12.48	366.2	4.7
N5853.93086	W13656.21326	20:29:36	12.49	415.7	5.4
N5853.97689	W13656.11541	20:30:22	12.51	859.4	11.1
N5854.06347	W13655.89912	20:31:08	12.52	1845.5	23.8
N5854.25112	W13655.43724	20:31:54	12.53	1918.1	24.7
N5854.20252	W13654.83375	20:32:40	12.54	1979.5	25.5
N5854.05704	W13654.26984	20:33:26	12.56	1977.7	25.5
N5853.91670	W13653.70175	20:34:12	12.57	1985.3	25.6
N5853.77186	W13653.13526	20:34:58	12.58	2000.3	25.8

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5853.61962	W13652.57071	20:35:44	12.60	1949.0	25.7
N5853.51212	W13651.98621	20:36:29	12.61	1987.4	25.6
N5853.42715	W13651.37531	20:37:15	12.62	1950.3	25.7
N5853.33928	W13650.77825	20:38:00	12.63	1934.6	25.5
N5853.16483	W13650.26326	20:38:45	12.65	2001.6	25.8
N5852.91345	W13649.85192	20:39:31	12.66	1875.5	24.7
N5852.66787	W13649.49079	20:40:16	12.67	815.4	10.5
N5852.56165	W13649.33243	20:41:02	12.68	310.5	4.1
N5852.52335	W13649.26709	20:41:47	12.70	387.1	5.0
N5852.49760	W13649.15444	20:42:33	12.71	366.2	4.8
N5852.50758	W13649.03953	20:43:18	12.72	360.4	4.6
N5852.53848	W13648.94168	20:44:04	12.73	507.8	6.7
N5852.58804	W13648.81165	20:44:49	12.75	961.2	12.4
N5852.71647	W13648.63334	20:45:35	12.76	1795.0	23.1
N5852.91635	W13648.21298	20:46:21	12.77	1981.1	25.5
N5852.98555	W13647.59693	20:47:07	12.79	1980.3	25.5
N5852.98780	W13646.96672	20:47:53	12.80	1952.2	25.7
N5852.96205	W13646.34745	20:48:38	12.81	1988.3	25.6
N5852.91570	W13645.72110	20:49:24	12.82	1994.1	25.7
N5852.86002	W13645.09572	20:50:10	12.84	1992.8	25.7
N5852.73288	W13644.51121	20:50:56	12.85	2001.5	25.8
N5852.55553	W13643.97466	20:51:42	12.86	1995.9	25.7
N5852.41359	W13643.40206	20:52:28	12.87	1918.1	25.3
N5852.29965	W13642.83301	20:53:13	12.89	1977.6	25.5
N5852.20277	W13642.23241	20:53:59	12.90	1991.7	25.7
N5852.09945	W13641.63116	20:54:45	12.91	1954.0	25.7
N5851.99678	W13641.04215	20:55:30	12.93	2001.1	25.8
N5851.88541	W13640.44316	20:56:16	12.94	1951.6	25.7
N5851.78113	W13639.85608	20:57:01	12.95	2000.2	25.8
N5851.67266	W13639.25548	20:57:47	12.96	1964.9	25.9
N5851.56516	W13638.66614	20:58:32	12.98	1965.6	25.9
N5851.45186	W13638.08067	20:59:17	12.99	2007.2	25.9
N5851.33824	W13637.48136	21:00:03	13.00	1959.4	25.8
N5851.23363	W13636.89202	21:00:48	13.01	2001.0	25.8
N5851.12839	W13636.28917	21:01:34	13.03	1941.4	25.6
N5851.01251	W13635.71399	21:02:19	13.04	1995.0	25.7
N5850.83259	W13635.18356	21:03:05	13.05	1961.0	25.8
N5850.64913	W13634.67083	21:03:50	13.06	1960.1	25.8
N5850.46406	W13634.16067	21:04:35	13.08	2008.2	25.9
N5850.27737	W13633.63410	21:05:21	13.09	1959.6	25.8
N5850.07814	W13633.14455	21:06:06	13.10	2006.7	25.8
N5849.85412	W13632.67623	21:06:52	13.11	1977.2	26.0
N5849.64169	W13632.20052	21:07:37	13.13	2012.4	25.9
N5849.42411	W13631.71868	21:08:23	13.14	1959.8	25.8
N5849.18142	W13631.30895	21:09:08	13.15	1979.7	26.1
N5848.94228	W13630.88216	21:09:53	13.16	2031.5	26.2
N5848.71601	W13630.40741	21:10:39	13.18	1976.7	26.0
N5848.49875	W13629.94038	21:11:24	13.19	2031.6	26.2
N5848.27730	W13629.45726	21:12:10	13.20	2040.8	26.3

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5848.05103	W13628.97865	21:12:56	13.22	2048.9	26.4
N5847.82895	W13628.48941	21:13:42	13.23	2015.1	26.5
N5847.62006	W13627.99277	21:14:27	13.24	2013.6	26.5
N5847.40795	W13627.50193	21:15:12	13.25	2045.7	26.3
N5847.14627	W13627.09380	21:15:58	13.27	2065.6	26.6
N5846.85659	W13626.75134	21:16:44	13.28	2055.1	26.5
N5846.57914	W13626.37894	21:17:30	13.29	2011.3	26.5
N5846.31457	W13625.99592	21:18:15	13.30	2071.0	26.7
N5846.01009	W13625.70142	21:19:01	13.32	2009.4	26.5
N5845.69916	W13625.48544	21:19:46	13.33	1940.3	25.0
N5845.38696	W13625.61290	21:20:32	13.34	1940.5	25.5
N5845.21283	W13626.12853	21:21:17	13.35	2016.6	26.0
N5845.09116	W13626.72334	21:22:03	13.37	1960.2	25.8
N5844.97980	W13627.30656	21:22:48	13.38	2003.4	25.8
N5844.88452	W13627.91456	21:23:34	13.39	2012.9	25.9
N5844.78668	W13628.52417	21:24:20	13.41	1974.3	26.0
N5844.65375	W13629.09516	21:25:05	13.42	1950.6	25.1
N5844.48670	W13629.62302	21:25:51	13.43	700.6	9.2
N5844.44325	W13629.82869	21:26:36	13.44	299.2	3.9
N5844.42651	W13629.91785	21:27:22	13.46	254.6	3.3
N5844.41106	W13629.99284	21:28:08	13.47	78.1	1.0
N5844.40655	W13630.01602	21:28:53	13.48	18.3	0.2
N5844.40655	W13630.02181	21:29:39	13.49	2.8	0.0
N5844.40688	W13630.02117	21:30:24	13.51	2.2	0.0
N5844.40655	W13630.02085	21:31:10	13.52	9.0	0.1
N5844.40720	W13630.02342	21:31:55	13.53	7.1	0.1
N5844.40816	W13630.02213	21:32:41	13.54	26.6	0.3
N5844.40945	W13630.01409	21:33:26	13.56	245.4	3.2
N5844.42329	W13629.94102	21:34:12	13.57	105.0	1.4
N5844.43263	W13629.91302	21:34:57	13.58	120.7	1.6
N5844.42007	W13629.88341	21:35:42	13.60	421.3	5.4
N5844.43166	W13629.75177	21:36:28	13.61	1020.6	13.4
N5844.51180	W13629.46756	21:37:13	13.62	1867.2	24.1
N5844.62800	W13628.91974	21:37:59	13.63	1608.5	21.2
N5844.70074	W13628.42954	21:38:44	13.65	120.6	1.6
N5844.70685	W13628.39317	21:39:29	13.66	326.4	4.3
N5844.68336	W13628.48619	21:40:14	13.67	1666.7	21.5
N5844.62220	W13629.00118	21:41:00	13.68	453.1	5.8
N5844.60289	W13629.13990	21:41:46	13.70	166.0	2.2
N5844.57650	W13629.12638	21:42:31	13.71	1596.7	20.6
N5844.61190	W13628.62492	21:43:17	13.72	1896.4	24.4
N5844.61931	W13628.02399	21:44:03	13.73	1853.7	23.9
N5844.53144	W13627.46137	21:44:49	13.75	1859.6	24.5
N5844.39271	W13626.93609	21:45:34	13.76	1919.7	24.7
N5844.23114	W13626.41338	21:46:20	13.77	1946.4	25.1
N5844.04381	W13625.91320	21:47:06	13.79	1905.4	25.1
N5843.86132	W13625.42236	21:47:51	13.80	1949.9	25.1
N5843.70650	W13624.88130	21:48:37	13.81	1955.6	25.2
N5843.57325	W13624.31740	21:49:23	13.82	1970.6	25.4

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5843.44257	W13623.74609	21:50:09	13.84	1928.6	25.4
N5843.25621	W13623.25170	21:50:54	13.85	2001.9	25.8
N5843.01030	W13622.83006	21:51:40	13.86	1999.9	25.8
N5842.75571	W13622.42901	21:52:26	13.87	2008.7	25.9
N5842.49725	W13622.03280	21:53:12	13.89	2015.2	26.0
N5842.24137	W13621.62725	21:53:58	13.90	1978.7	26.1
N5841.97808	W13621.25903	21:54:43	13.91	2002.4	25.8
N5841.65815	W13621.10872	21:55:29	13.92	1250.0	16.5
N5841.45666	W13621.03019	21:56:14	13.94	501.8	6.5
N5841.37459	W13621.01345	21:57:00	13.95	227.1	3.0
N5841.33725	W13621.01442	21:57:45	13.96	30.0	0.4
N5841.33242	W13621.01249	21:58:31	13.98	27.5	0.4
N5841.32920	W13621.00637	21:59:17	13.99	50.2	0.6
N5841.32373	W13620.99446	22:00:03	14.00	64.6	0.9
N5841.31697	W13620.97869	22:00:48	14.01	192.6	2.5
N5841.28768	W13620.95552	22:01:33	14.03	210.1	2.7
N5841.25582	W13620.92977	22:02:19	14.04	860.2	11.1
N5841.11677	W13620.87956	22:03:05	14.05	937.6	12.3
N5840.97612	W13621.00122	22:03:50	14.06	769.5	9.9
N5840.85703	W13621.08362	22:04:36	14.08	1297.5	17.1
N5840.75403	W13620.72409	22:05:21	14.09	1962.6	25.3
N5840.70414	W13620.11062	22:06:07	14.10	1978.4	25.5
N5840.67356	W13619.48749	22:06:53	14.11	1982.9	25.5
N5840.64588	W13618.86243	22:07:39	14.13	1994.4	25.7
N5840.60372	W13618.23672	22:08:25	14.14	2002.2	25.8
N5840.56188	W13617.60844	22:09:11	14.15	1956.4	25.8
N5840.52325	W13616.99400	22:09:56	14.17	2021.0	26.0
N5840.49107	W13616.35767	22:10:42	14.18	2008.2	25.9
N5840.46178	W13615.72489	22:11:28	14.19	1934.7	25.5
N5840.41414	W13615.11978	22:12:13	14.20	1204.5	15.9
N5840.37069	W13614.74803	22:12:58	14.22	430.5	5.5
N5840.36554	W13614.61220	22:13:44	14.23	376.5	4.8
N5840.39451	W13614.50695	22:14:30	14.24	389.7	5.0
N5840.44697	W13614.43614	22:15:16	14.25	650.4	8.4
N5840.54771	W13614.36694	22:16:02	14.27	1546.5	20.4
N5840.74824	W13614.06599	22:16:47	14.28	1963.2	25.3
N5840.80746	W13613.45542	22:17:33	14.29	2014.4	25.9
N5840.66198	W13612.88282	22:18:19	14.31	1999.2	26.3
N5840.43699	W13612.42158	22:19:04	14.32	2037.2	26.2
N5840.18433	W13611.99833	22:19:50	14.33	1988.3	26.2
N5839.93134	W13611.59986	22:20:35	14.34	2019.9	26.0
N5839.68222	W13611.17725	22:21:21	14.36	1951.4	25.7
N5839.43631	W13610.78072	22:22:06	14.37	1968.3	25.9
N5839.20007	W13610.35521	22:22:51	14.38	1922.8	25.3
N5839.00662	W13609.87434	22:23:36	14.39	1963.6	25.3
N5838.81447	W13609.37545	22:24:22	14.41	1979.1	25.5
N5838.59045	W13608.92162	22:25:08	14.42	1985.1	25.6
N5838.34584	W13608.50610	22:25:54	14.43	1941.3	25.6
N5838.10926	W13608.09411	22:26:39	14.44	1922.9	25.3

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

LATITUDE	LONGITUDE	GMT	DEC TIME local	DISTANCE feet	SPEED * knots
N5837.87302	W13607.69017	22:27:24	14.46	1988.8	25.6
N5837.61971	W13607.29266	22:28:10	14.47	1989.3	25.6
N5837.36189	W13606.90578	22:28:56	14.48	1964.4	25.9
N5837.10601	W13606.52695	22:29:41	14.49	2025.6	26.1
N5836.83918	W13606.14393	22:30:27	14.51	2015.8	26.0
N5836.57139	W13605.76863	22:31:13	14.52	2001.7	26.4
N5836.30167	W13605.40621	22:31:58	14.53	2020.2	26.0
N5836.02519	W13605.05248	22:32:44	14.55	2046.6	26.4
N5835.73905	W13604.71227	22:33:30	14.56	1078.7	26.6
N5835.58649	W13604.53846	22:33:54	14.57	4898.9	24.8
N5834.92505	W13603.65559	22:35:51	14.60	1809.1	23.8
N5834.66917	W13603.36430	22:36:36	14.61	1796.5	23.7
N5834.39398	W13603.15799	22:37:21	14.62	1860.7	24.0
N5834.09271	W13603.05499	22:38:07	14.64	1884.6	24.3
N5833.78275	W13603.05692	22:38:53	14.65	1775.7	23.4
N5833.49147	W13603.09747	22:39:38	14.66	1144.9	15.1
N5833.30317	W13603.09780	22:40:23	14.67	1104.8	14.5
N5833.12164	W13603.11325	22:41:08	14.69	1112.1	14.3
N5832.93947	W13603.14447	22:41:54	14.70	1074.4	14.1
N5832.76534	W13603.20208	22:42:39	14.71	1095.6	14.1
N5832.59057	W13603.28609	22:43:25	14.72	1043.5	13.7
N5832.42320	W13603.35883	22:44:10	14.74	1029.6	13.3
N5832.25615	W13603.41194	22:44:56	14.75	1156.0	14.9
N5832.06979	W13603.48403	22:45:42	14.76	1479.7	19.1
N5831.82968	W13603.55999	22:46:28	14.77	1459.8	18.8
N5831.59278	W13603.63467	22:47:14	14.79	1435.0	18.9
N5831.35686	W13603.64690	22:47:59	14.80	1450.4	18.7
N5831.11835	W13603.63885	22:48:45	14.81	1361.9	17.9
N5830.89595	W13603.68971	22:49:30	14.83	1351.2	17.8
N5830.67386	W13603.70451	22:50:15	14.84	1327.4	17.5
N5830.45885	W13603.63209	22:51:00	14.85	1371.9	17.7
N5830.24256	W13603.50914	22:51:46	14.86	1388.8	17.9
N5830.02240	W13603.39263	22:52:32	14.88	1409.7	18.2
N5829.79806	W13603.28062	22:53:18	14.89	1433.3	18.5
N5829.57533	W13603.13288	22:54:04	14.90	1429.4	18.8
N5829.35679	W13602.96712	22:54:49	14.91	1422.8	18.7
N5829.14178	W13602.79042	22:55:34	14.93	1451.8	18.7
N5828.91229	W13602.66424	22:56:20	14.94	1405.5	18.5
N5828.70083	W13602.48561	22:57:05	14.95	1438.1	18.5
N5828.47359	W13602.36008	22:57:51	14.96	1439.6	19.0
N5828.25054	W13602.20816	22:58:36	14.98	1480.2	19.1
N5828.02330	W13602.04111	22:59:22	14.99	1443.3	19.0
N5827.80347	W13601.86988	23:00:07	15.00	1459.3	19.2
N5827.62837	W13601.55606	23:00:52	15.01	1469.7	19.4
N5827.46969	W13601.20748	23:01:37	15.03	1493.8	19.2
N5827.29685	W13600.87371	23:02:23	15.04	1513.4	19.5
N5827.11403	W13600.55088	23:03:09	15.05	1491.6	19.6
N5826.94666	W13600.20809	23:03:54	15.07	1522.7	19.6
N5826.79764	W13559.82346	23:04:40	15.08	1492.9	19.7

GPS Way Point Log
Cruise of Spirit of Adventure - 6-12-02

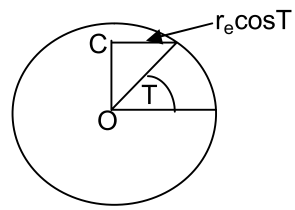
LATITUDE	**LONGITUDE**	**GMT**	**DEC TIME** local	**DISTANCE** feet	**SPEED *** knots
N5826.67018	W13559.42242	23:05:25	15.09	1516.3	19.5
N5826.55463	W13559.00013	23:06:11	15.10	1510.6	19.9
N5826.42975	W13558.58975	23:06:56	15.12	1556.4	20.0
N5826.31227	W13558.15524	23:07:42	15.13	1544.7	20.3
N5826.20573	W13557.71460	23:08:27	15.14	1618.0	20.8
N5826.11013	W13557.24017	23:09:13	15.15	1604.9	20.7
N5825.99973	W13556.78216	23:09:59	15.17	1519.6	20.0
N5825.97495	W13556.30709	23:10:44	15.18	1699.2	21.9
N5826.17419	W13555.93276	23:11:30	15.19	1693.4	22.3
N5826.40432	W13555.63310	23:12:15	15.20	1684.6	21.7
N5826.63156	W13555.33023	23:13:01	15.22	1613.8	21.2
N5826.85429	W13555.05439	23:13:46	15.23	1635.2	21.5
N5827.08989	W13554.80655	23:14:31	15.24	1567.0	20.2
N5827.27593	W13554.46570	23:15:17	15.25	1053.6	13.9
N5827.34449	W13554.16153	23:16:02	15.27	957.5	12.3
N5827.40596	W13553.88441	23:16:48	15.28	647.3	8.5
N5827.44716	W13553.69676	23:17:33	15.29	455.2	5.9
N5827.47613	W13553.56480	23:18:19	15.31	295.3	3.9
N5827.46519	W13553.47435	23:19:04	15.32	363.1	4.7
N5827.41465	W13553.41352	23:19:50	15.33	322.4	4.2
N5827.36991	W13553.35912	23:20:36	15.34	284.8	3.7
N5827.33258	W13553.30505	23:21:21	15.36	134.9	1.8
N5827.31874	W13553.27190	23:22:06	15.37	45.1	0.6
N5827.31842	W13553.25774	23:22:52	15.38	41.1	0.5
N5827.32002	W13553.24518	23:23:38	15.39	2.8	0.0
N5827.31970	W13553.24454	23:24:24	15.41	3.1	0.0
N5827.31970	W13553.24358	23:25:09	15.42	15.5	0.2
N5827.32002	W13553.24840	23:25:51	15.43	26865009.7	-286.5

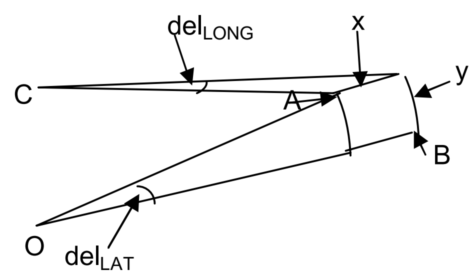
Approximate Distance given Latitude, Longitude - example calculation

Point A Nome Municipl Airport
Point B NOAA buoy in Norton sound

decimal latitude of A =	64.517			
decimal longitude of A =	165.45	$x=(Pi/180)del_{LONG} * CosT * r_e$	654.41	miles
		$y=(Pi/180)del_{LAT} * r_e$	513.59	miles
decimal latitude of B =	57.083	distance= $(x^2 + y^2)^{0.5}$	831.88	miles
decimal longitude of B =	177.73			

$r_e =$ 3958.76 miles
T = 59 deg





Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907) 561-1011 Fax (907) 563-4220

Memorandum

To: File Project No.: 02056.02

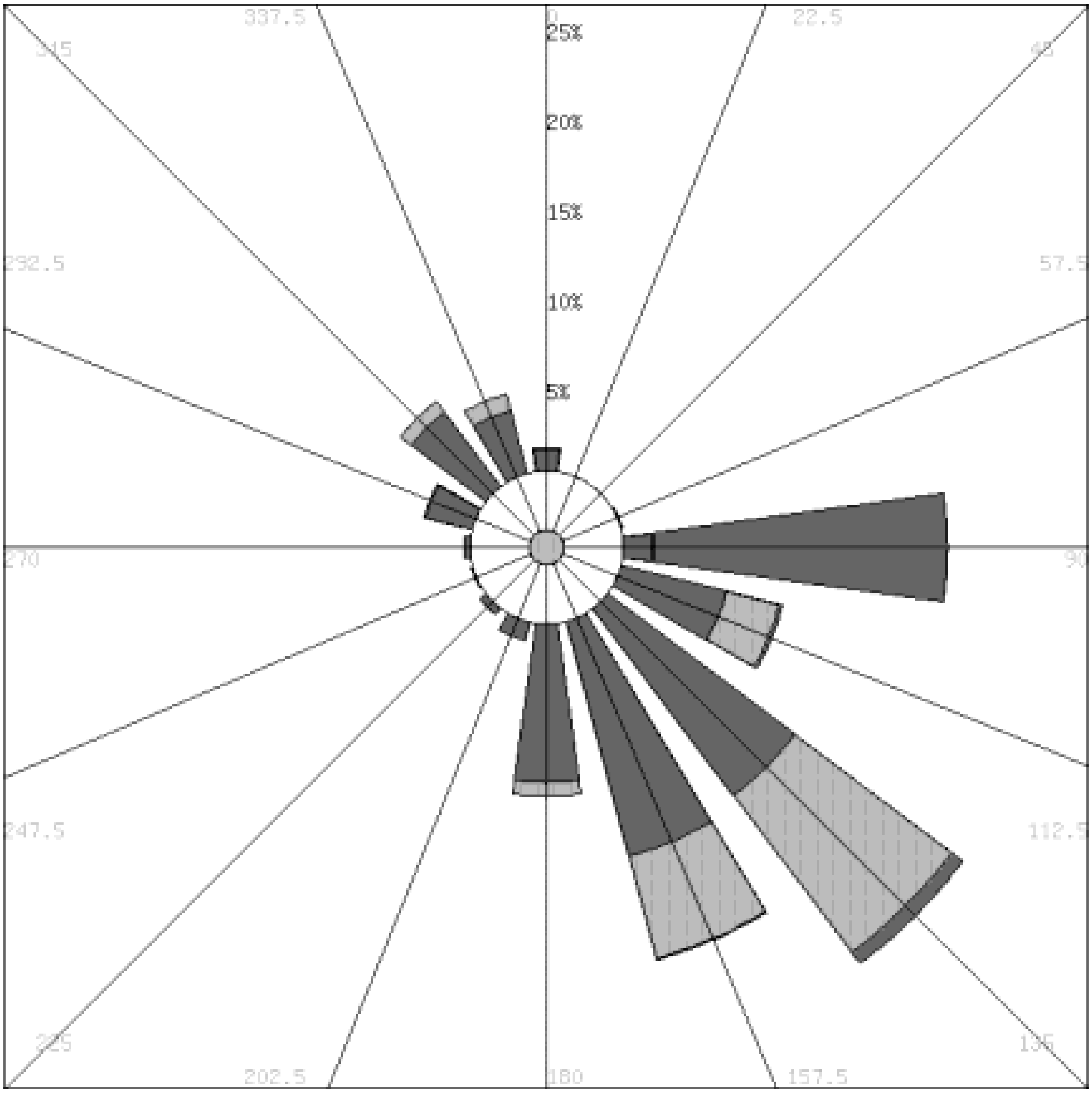
From: Jennifer Wilson Date: October 3, 2002

Re: *Wind Summaries for Sitka, Ketchikan, Juneau, and Cordova (1987-1999)*

Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum

---

The attached document, *Wind Summaries for Sitka, Ketchikan, Juneau, and Cordova (1987-1999)*, provides the data used to calculate the wind climatology in Glacier Bay proper. The document includes wind roses showing the speed and direction of wind events from 1987 through 1999.



Ketchikan (radial bands indicate 10 knot increments of wind speed acting toward center of the wind rose)

Database: TDF14, TD3280 - Hourly Observations
Stations: Kethcikan Ap
Years: 1987-1999
Months: January-December
Days: 1-31
Hours: 12 am-11 pm

Note: Radial Bands indicate 10 knot increments of wind speed acting toward the center of the wind rose

Speed	**0°**	**22.5°**	**45°**	**67.5°**	**90°**	**112.5°**	**135°**	**157.5°**	**180°**	**202.5°**	**225°**	**247.5°**	**270°**	**292.5°**	**315°**	**337.5°**	**Calm**
0-9 knots	1.27% (93)	0.04% (3)	0.05% (4)	0.10% (7)	1.65% (121)	6.06% (444)	13.10% (960)	13.56% (994)	8.87% (650)	1.10% (81)	0.46% (34)	0.10% (7)	0.38% (28)	2.70% (198)	5.25% (385)	3.67% (269)	18.09% (1326)
10-19 knots	0.11% (8)				0.10% (7)	3.04% (223)	10.93% (801)	5.85% (429)	0.74% (54)	0.01% (1)				0.11% (8)	0.75% (55)	0.91% (67)	
20-29 knots						0.14% (10)	0.74% (54)	0.14% (10)									
Unknown	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	

* Values in the table report the percentage and quantity for a given speed and direction.
* 'Calm' values are not graphed on the wind rose, but percentages and quantities are reported in the table.
* Unknown values are not included in percentages, only quantity is reported.

Please Read
Invalid Values are **NOT** included in the above calculations. The following information is presented to show the completeness of the database for your query. Please use this information to determine the validity and accuracy of the query results.

Your query returned 306 records.

A complete query should have returned at least 4748 records (1 for each hour (1945-83), 1 for each day (1984-99)).
7331 valid data cells were analyzed for your query.
A complete query should have analyzed 113952 data cells.
13 data cells were found to be invalid.
Possible reasons for an incomplete dataset are:

- One or more stations are not valid for the dates selected.
- Data is missing for a portion of the dates selected.

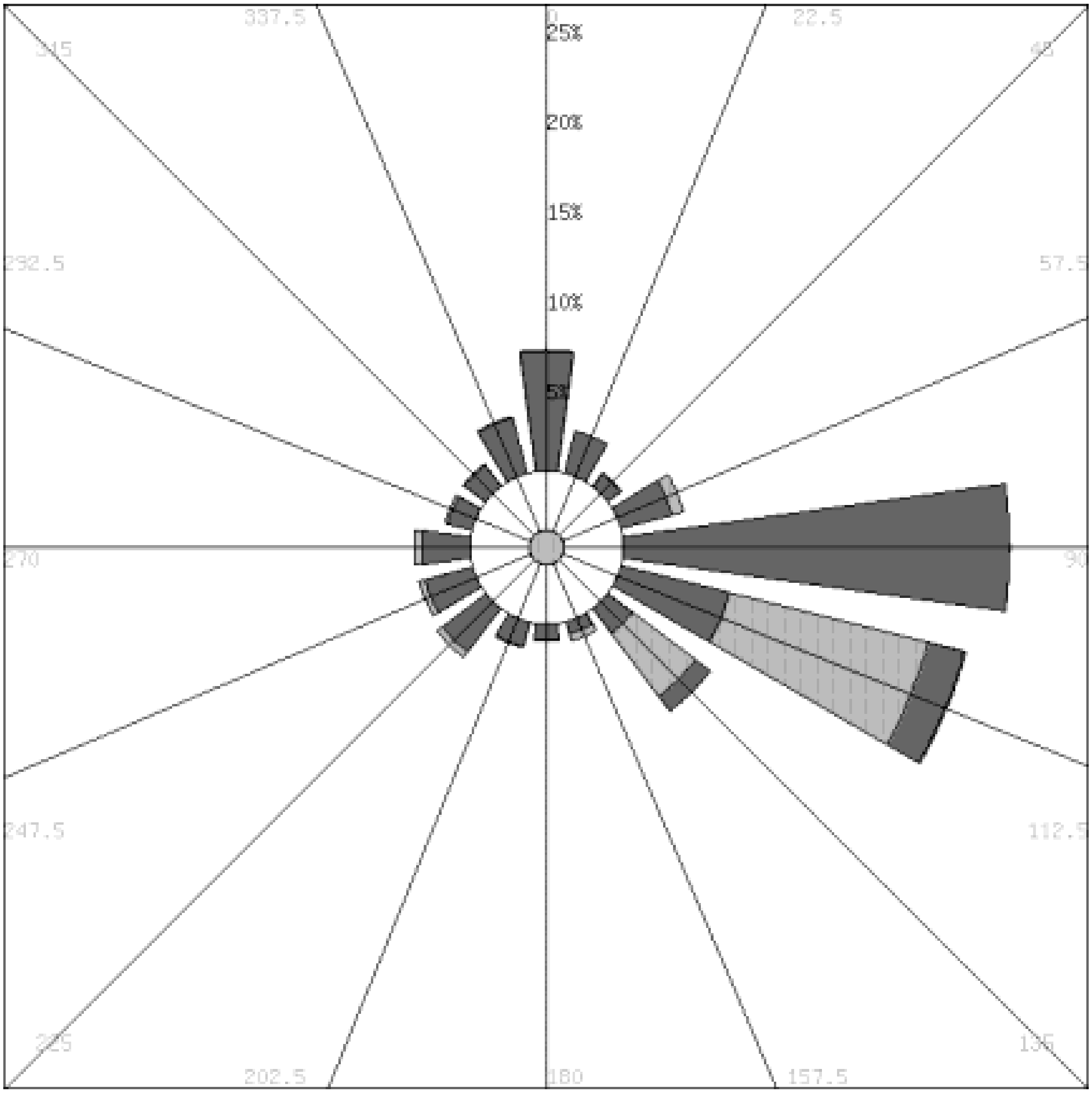
The dates found in the query are indicated below.

Station - KETHCIKAN AP (25325)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1999			1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31

The dates where invalid values were found are indicated below.

Station - KETHCIKAN AP (25325)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1999			1, 8-9, 29								28	

Change your search criteria by clicking here or by pressing the 'BACK' button on your browser.



Juneau (radial bands indicate 10 knot increments of wind speed acting
toward the center of the wind rose

Database: TDF14, TD3280 - Hourly Observations
Stations: Juneau Ap
Years: 1987-1999
Months: January-December
Days: 1-31
Hours: 12 am-11 pm

Note: Radial Bands indicate 10 knot increments of wind speed acting toward the center of the wind rose

Speed	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°	Calm	Unknown
0-9 knots	6.70% (7615)	2.44% (2779)	0.93% (1061)	2.94% (3349)	10.45% (11881)	6.22% (7073)	1.75% (1990)	0.71% (811)	0.89% (1017)	1.41% (1603)	3.09% (3509)	2.78% (3163)	2.73% (3100)	1.44% (1640)	1.54% (1753)	3.27% (3724)	21.52% (24474)	(3)
10-19 knots	0.08% (94)	0.04% (41)	0.08% (88)	0.71% (811)	6.74% (7666)	11.44% (13010)	4.40% (5006)	0.43% (487)	0.12% (136)	0.13% (152)	0.38% (434)	0.39% (441)	0.42% (476)	0.12% (136)	0.04% (46)	0.04% (49)		(0)
20-29 knots	0.00% (2)	0.00% (2)	0.00% (3)	0.01% (17)	0.28% (320)	2.07% (2352)	1.04% (1188)	0.05% (52)	0.01% (8)	0.00% (4)	0.00% (1)							(0)
30-39 knots					0.00% (1)	0.10% (112)	0.04% (50)											(0)
40-49 knots					0.00% (1)	0.00% (1)												(0)
Unknown	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)		(0)

* Values in the table report the percentage and quantity for a given speed and direction.
* 'Calm' values are not graphed on the wind rose, but percentages and quantities are reported in the table.
* Unknown values are not included in percentages, only quantity is reported.

Please Read
Invalid Values are **NOT** included in the above calculations. The following information is presented to show the completeness of the database for your query. Please use this information to determine the validity and accuracy of the query results.

Your query returned 4748 records.
A complete query should have returned at least 4748 records (1 for each hour (1945-83), 1 for each day (1984-99)).
113732 valid data cells were analyzed for your query.
A complete query should have analyzed 113952 data cells.
220 data cells were found to be invalid.
Possible reasons for an incomplete dataset are:

- One or more stations are not valid for the dates selected.
- Data is missing for a portion of the dates selected.

The dates found in the query are indicated below.

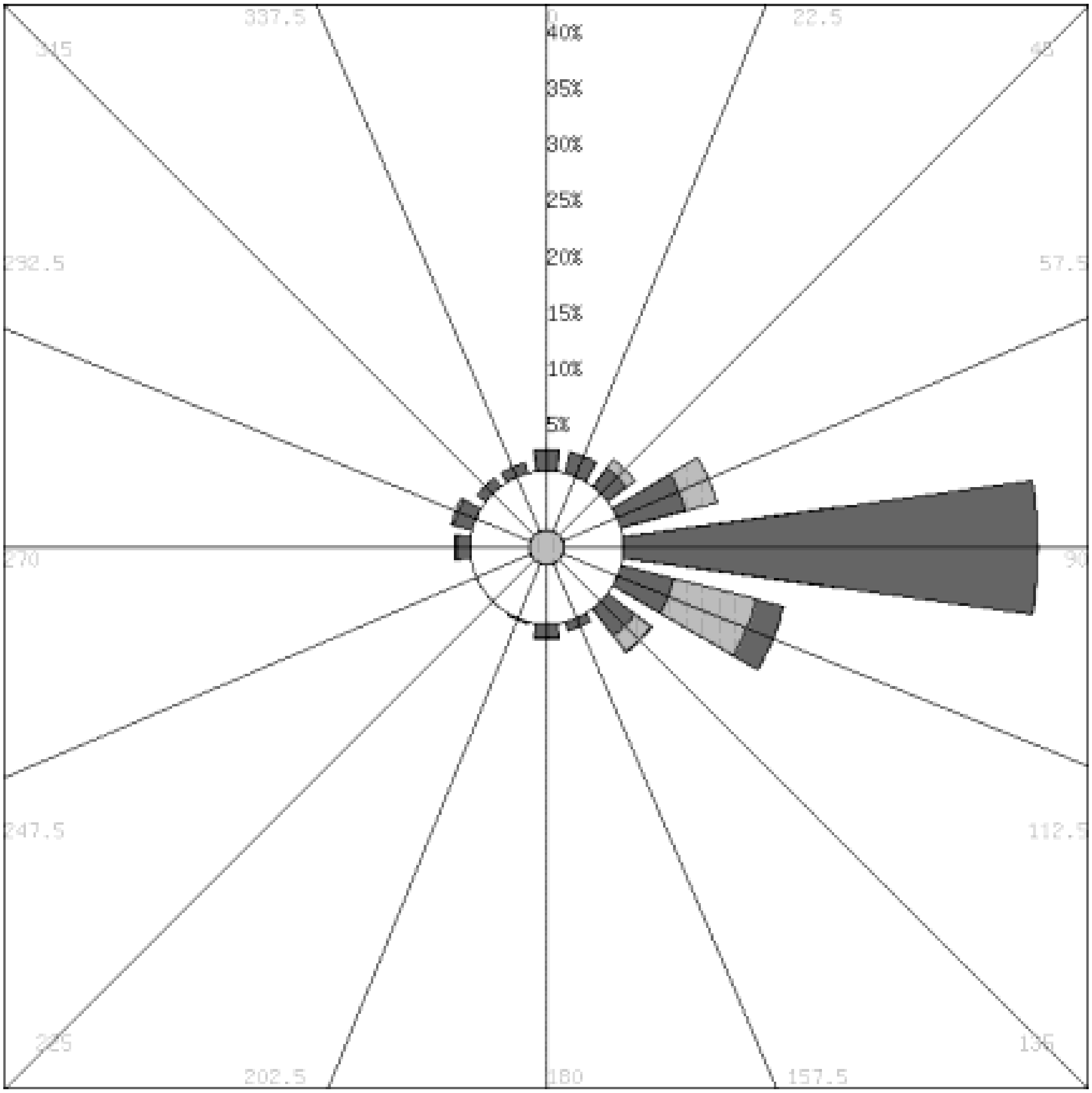
Station - JUNEAU AP (25309)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1987	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1988	1-31	1-29	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1989	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1990	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-18, 20-31
1991	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1992	1-31	1-29	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1993	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1994	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1995	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1996	1-31	1-29	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1997	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31
1998	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31

1999	1-31	1-28	1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31

The dates where invalid values were found are indicated below.

Station - JUNEAU AP (25309)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1987			1									
1988								19, 22-23	14			
1989											25-26, 29	6, 28
1990						28		2, 4-5, 7	18			12, 18, 20
1991			3					27				
1992									7			
1993					13-14	20					7, 15, 30	
1994		7			8				20-21, 24			
1995			6, 14, 18, 28, 30	3, 24			3, 9			2		20
1996	2, 11, 24, 29			2, 7, 9		15, 25	12, 20, 26	12, 18, 22-23, 27, 31	1, 13, 15, 17, 20, 25	2, 16-18, 31	1-2, 7, 19	1, 16
1997	16, 31	10, 21, 27	15	8, 14	4, 9	13, 26-27		6	6	11, 27		
1998	4, 29	2							18	5, 22		17
1999	3, 8, 10		28	18	3, 13							24-25

Change your search criteria by clicking here or by pressing the 'BACK' button on your browser.



Cordova (radial bands indicate 10 knot increments of wind speed acting toward the center of the wind rose

Database: TDF14, TD3280 - Hourly Observations
Stations: Cordova Ap
Years: 1987-1999
Months: January-December
Days: 1-31
Hours: 12 am-11 pm

Note: Radial Bands indicate 10 knot increments of wind speed acting toward the center of the wind rose

Speed	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°	Calm	Unknown
0-9 knots	2.03% (14)	2.03% (14)	2.17% (15)	5.93% (41)	10.71% (74)	4.92% (34)	3.04% (21)	0.87% (6)	1.30% (9)	0.14% (1)			1.30% (9)	1.74% (12)	1.01% (7)	1.01% (7)	36.90% (255)	(0)
10-19 knots			0.87% (6)	2.89% (20)	7.38% (51)	7.53% (52)	1.88% (13)		0.14% (1)				0.14% (1)	0.29% (2)				(0)
20-29 knots					1.16% (8)	2.46% (17)												(0)
30-39 knots							0.14% (1)											(0)
Unknown	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)		(0)

* Values in the table report the percentage and quantity for a given speed and direction.
* 'Calm' values are not graphed on the wind rose, but percentages and quantities are reported in the table.
* Unknown values are not included in percentages, only quantity is reported.

Please Read
Invalid Values are **NOT** included in the above calculations.

The following information is presented to show the completeness of the database for your query.

Please use this information to determine the validity and accuracy of the query results.

Your query returned 30 records.
A complete query should have returned at least 4748 records (1 for each hour (1945-83), 1 for each day (1984-99)).
691 valid data cells were analyzed for your query.
A complete query should have analyzed 113952 data cells.
29 data cells were found to be invalid.
Possible reasons for an incomplete dataset are:

- One or more stations are not valid for the dates selected.
- Data is missing for a portion of the dates selected.

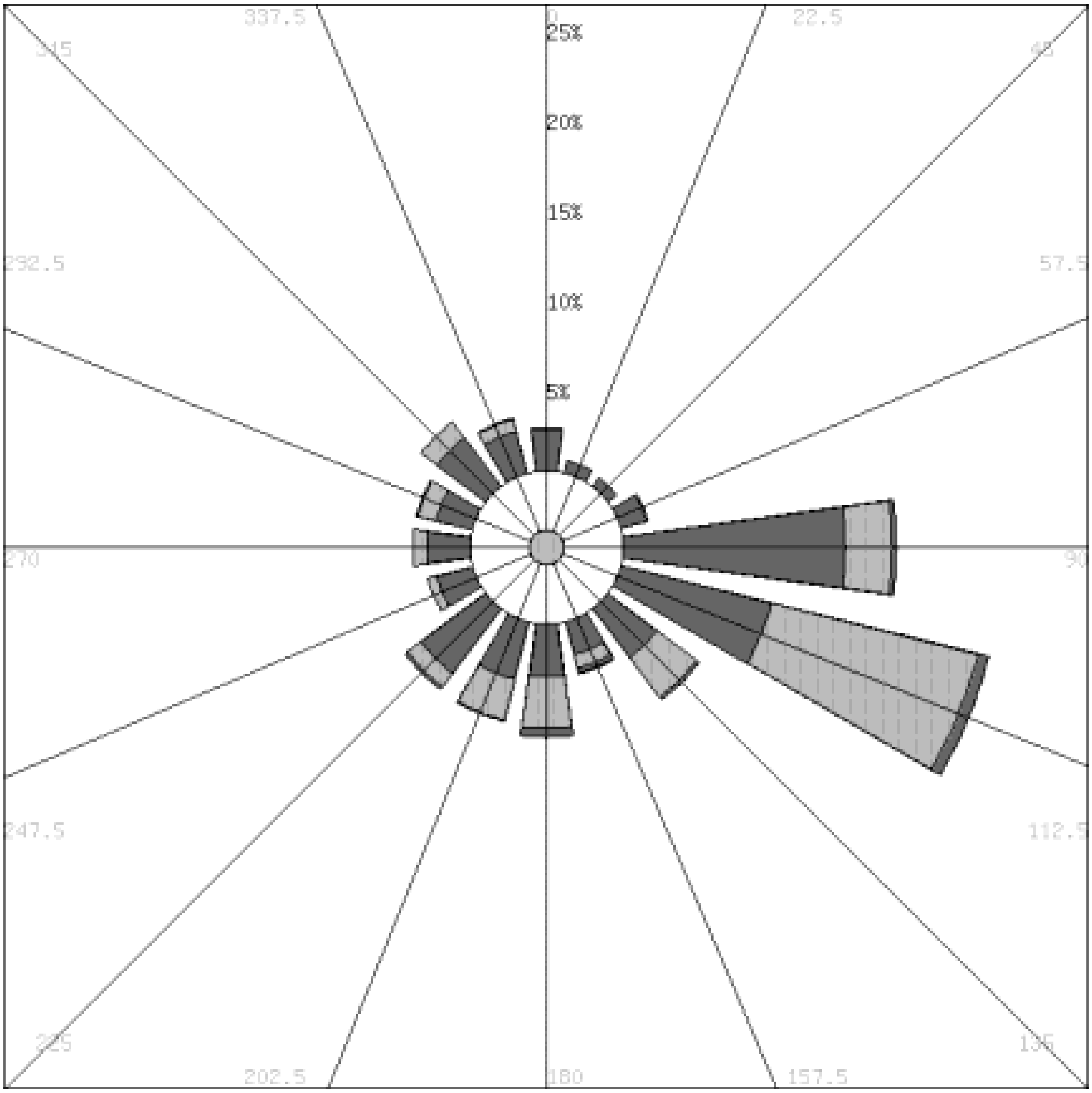
The dates found in the query are indicated below.

Station - CORDOVA AP (26410)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1999												1-30

The dates where invalid values were found are indicated below.

Station - CORDOVA AP (26410)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1999												1, 8, 13, 18, 30

Change your search criteria by clicking here or by pressing the 'BACK' button on your browser.



Sitka (radial bands indicate 10 knot increments of wind speed acting
toward the center of the wind rose

Database: TDF14, TD3280 - Hourly Observations
Stations: Sitka Ap
Years: 1987-1999
Months: January-December
Days: 1-31
Hours: 12 am-11 pm

Note: Radial Bands indicate 10 knot increments of wind speed acting toward the center of the wind rose

Speed	0°	22.5°	45°	67.5°	90°	112.5°	135°	157.5°	180°	202.5°	225°	247.5°	270°	292.5°	315°	337.5°	Calm	Unknown
0-9 knots	2.35% (172)	0.70% (51)	0.61% (45)	1.54% (113)	12.38% (907)	8.69% (637)	3.49% (256)	1.92% (141)	2.95% (216)	3.30% (242)	4.50% (330)	2.10% (154)	2.48% (182)	2.09% (153)	3.37% (247)	2.43% (178)	14.32% (1049)	(0)
10-19 knots	0.10% (7)			0.04% (3)	2.61% (191)	11.79% (864)	2.76% (202)	0.82% (60)	2.89% (212)	2.36% (173)	1.01% (74)	0.53% (39)	0.74% (54)	1.09% (80)	1.15% (84)	0.75% (55)		(0)
20-29 knots					0.25% (18)	0.59% (43)	0.19% (14)	0.26% (19)	0.52% (38)	0.08% (6)	0.11% (8)		0.05% (4)	0.03% (2)		0.01% (1)		(0)
30-39 knots								0.03% (2)	0.01% (1)									(0)
Unknown	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)		(0)

* Values in the table report the percentage and quantity for a given speed and direction.
* 'Calm' values are not graphed on the wind rose, but percentages and quantities are reported in the table.
* Unknown values are not included in percentages, only quantity is reported.

Please Read
Invalid Values are **NOT** included in the above calculations.

The following information is presented to show the completeness of the database for your query.

Please use this information to determine the validity and accuracy of the query results.

Your query returned 306 records.
A complete query should have returned at least 4748 records (1 for each hour (1945-83), 1 for each day (1984-99)).
7327 valid data cells were analyzed for your query.
A complete query should have analyzed 113952 data cells.
17 data cells were found to be invalid.
Possible reasons for an incomplete dataset are:

- One or more stations are not valid for the dates selected.
- Data is missing for a portion of the dates selected.

The dates found in the query are indicated below.

Station - SITKA AP (25333)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1999			1-31	1-30	1-31	1-30	1-31	1-31	1-30	1-31	1-30	1-31

The dates where invalid values were found are indicated below.

Station - SITKA AP (25333)												
Year	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**
1999			1, 3-5, 7, 30								23	

Change your search criteria by clicking here or by pressing the 'BACK' button on your browser.

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907) 561-1011 Fax (907) 563-4220

Memorandum

To: File Project No.: 02056.02

From: Jennifer Wilson Date: October 3, 2002

Re: *Technical References*

Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum

---

The attached document, *Technical References*, provides several technical documents used as the basis for the model at Glacier Bay proper. The theory behind these references was critical for deriving a model for identifying locations in Glacier Bay proper for site specific study and to conduct the study.

The technical references include:

Windspeed adjustment and wave growth, ACES Technical Reference
Coastal Engineering Manual III-1-8, II-1-74, and II-7-57 through -61
Chance of exceedance chart
Juneau extreme prediction chart

Windspeed Adjustment and Wave Growth

Description

The methodologies represented in this ACES application provide quick and simple estimates for wave growth over open-water and restricted fetches in deep and shallow water. Also, improved methods (over those given in the *Shore Protection Manual* (SPM), 1984) are included for adjusting the observed winds to those required by wave growth formulas.

Introduction

Wind-generated wave growth is a complex process of considerable practical interest. Although the process is only partially understood, substantial demand remains for quick estimates required for design and analysis procedures. The most accurate estimates available are those provided by sophisticated numerical models such as those presented in Cardone et al. (1976), Hasselmann et al. (1976), Resio (1981), and Resio (1987). Yet many studies, especially at the preliminary level, attempt to describe wind-generated wave growth without the benefit of intensive large-scale modeling efforts. The prediction methods that follow present a first-order estimate for the process, but their simplification of the more complex physics should always be considered.

Methods are included for adjusting observed winds of varying character and location to the conditions required by wave growth formulas. A model depicting an idealized atmospheric boundary layer over the water surface is employed to estimate the low-level winds above the water surface. Stability effects (air-sea temperature gradient) are included, but barotropic effects (horizontal temperature gradient) are ignored. The numerical descriptions of the planetary boundary layer model are based upon similitude theory. Additional corrections are provided for the observed bias of ship-based wind observations as well as short fetches. Formulas for estimating winds of alternate durations are also included. The methodology for this portion of the application is largely taken from Resio, Vincent, and Corson (1982).

The simplified wave growth formulas predict deepwater wave growth according to fetch- and duration-limited criteria and are bounded (at the upper limit) by the estimates for a fully developed spectrum. The shallow-water formulations are based partly upon the fetch-limited deepwater forms and do not encompass duration effects. The methods described are essentially those in Vincent (1984), the SPM (1984), and Smith (1991).

Unless otherwise annotated, metric units are assumed for the following discussion.

General Assumptions and Limitations

The deep- and shallow-water wave growth curves are based on limited field data that have been generalized and extended on the basis of dimensionless analysis. The wind estimation procedures are based on a combination of boundary layer theory and limited field data largely from the Great Lakes. Wind transformation from land to water tends to be highly site and condition specific. The derivation of an individual site from these generalized conditions can create significant errors. Collection of site-specific field data to calibrate the techniques is suggested.

WIND ADJUSTMENT

The methodology for preparing wind observations for use in the wave growth formulas is based upon an idealized model of the planetary boundary layer depicted in Figure 1-1-1. For typical mid-latitude conditions, this planetary boundary layer exists in the lowest kilometer of the atmosphere and contains about 10 percent of the atmospheric mass (Holton, 1979).

Low-level winds directly over the water surface are considered to exist in a region characterized as having relatively constant stress at the air-sea interface. This surface layer will be designated the constant stress region for the remainder of this discussion.

Above the constant stress region is the Ekman layer, where the additional forces of Coriolis force, pressure gradient force, viscous stress, and convectively driven mixing are considered important.

Finally, above the Ekman region, geostrophic winds are considered to exist which result from considering the balance between pressure gradient forces and Coriolis force for synoptic scale systems.

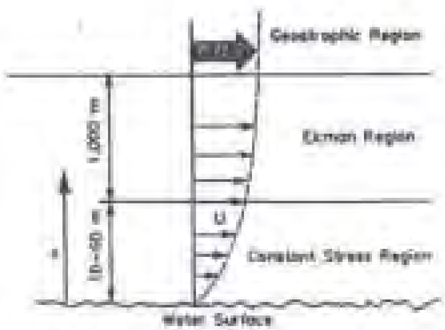


Figure 1-1-1. Idealized Atmospheric Boundary Layer over Water

Observed winds for use in the wave growth equations are considered to be characterized by six categories summarized in Table 1-1-1.

Table 1-1-1
Character and Action for Wind Observations

Observation type	Initial Action	Solution Domain
Over water (non-ship obs)	-------	Constant stress layer
Over water (ship obs)	Adjusted	Constant stress layer
At shoreline (onshore winds)	-------	Constant stress layer
At shoreline (offshore winds)	Geostrophic wind estimated	Full PBL* model
Over land	Geostrophic wind estimated	Full PBL model
Geostrophic wind	-------	Full PBL model

* PBL = Planetary Boundary Layer

Although the above six wind observation categories are presented for user convenience, only two separate cases are ultimately considered by the methodology: low-level winds observed within the constant stress region and known or estimated geostrophic winds. In the ACES application, adjustments for ship-based observations are made before proceeding with a solution in the constant stress region, and geostrophic winds are estimated for cases where low-level observed winds are predominantly over land masses. The case of observed winds blowing onshore and measured at the shoreline is considered to be effectively identical to the case of winds observed over water. Similarly, winds observed at the shoreline but blowing from the land mass in an offshore direction are considered effectively equivalent to winds observed at a more inland location. Complex wind patterns caused by local frictional characteristics or topography are obviously not considered by these simplifications.

Initial Adjustments and Estimates

Wind observations over water are typically the most desirable choice of available data sources for wave prediction. Observers on ships at sea frequently record such data and make qualitative estimates. Cardone (1969) reviewed the bias of ship-based observations and suggested the following adjustment:

$$U = 1.864\,U_{obs}^{\frac{7}{9}} \qquad (mps) \tag{1}$$

where

U = adjusted ship-based wind speed

U_{obs} = ship-based observations

For cases where the observed winds are predominantly over land surfaces, similar models of the boundary layer are sometimes employed for other prediction purposes. However, in this application, the following simple estimate for geostrophic winds is made from low-level wind observations (cgs units):

$$V_g = \frac{U_*}{\sqrt{C_{D\,land}}} \tag{2}$$

where

U_* = friction velocity

$$= \frac{k\,U_{obs}}{\ln\left(\frac{z_{obs}}{z_0}\right)} \tag{3}$$

k = von Karman constant (k=0.4)

z_{obs} = elevation of wind observation

z_0 = surface roughness length (assumed = 30 cm)

$C_{D\,land}$ = drag coefficient over land

$$C_{D\,land} = 0.00255\,z_0^{0.1627} \tag{4}$$

Constant Stress Region

The major features of the constant stress region can be summarized as follows:

- The constant stress region is confined to the lowest few meters of the boundary layer.
- Wind flow is assumed parallel to the water surface.
- The wind velocity is adjusted so that the horizontal frictional stress is nearly independent of height.
- The stress remains constant within the layer and is characterized by the friction velocity U_* .

Stability (air-sea temperature gradient) has an important effect on wave growth. The wind profile within this region is described by the following modified logarithmic form:

$$U_z = \frac{U_*}{k}\left[\ln\left(\frac{z}{z_0}\right) - \Psi\left(\frac{z}{L}\right)\right] \tag{5}$$

where

U_z = wind velocity at elevation z

z_0 = surface roughness length

$$= \frac{C_1}{U_*} + C_2 U_*^2 + C_3 \tag{6}$$

$$\left(C_1 = 0.1525 \;\;,\;\; C_2 = \frac{0.019}{980} \;\;,\;\; C_3 = -0.00371\right) \tag{7}$$

Ψ = universal similarity function
KEYPS formula (Lumley and Panofsky, 1964)

L = Obukov stability length

$$= 1.79\frac{U_*^2}{\Delta T}\left[\ln\left(\frac{z}{z_0}\right) - \Psi\left(\frac{z}{L}\right)\right] \tag{8}$$

ΔT = air-sea temperature gradient

$$\left.\begin{array}{ll} \Psi = 0 & \mid \Delta T = 0 \\ \Psi = C\dfrac{z}{L} & \mid \dfrac{z}{L} > 0 \\ \Psi = 1 - \phi_u - 3\ln\phi_u + 2\ln\left(\dfrac{1+\phi_u}{2}\right) + 2\tan^{-1}\phi_u - \dfrac{\pi}{2} + \ln\left(\dfrac{1+\phi_u^2}{2}\right) & \mid \dfrac{z}{L} \le 0 \end{array}\right\} \tag{9}$$

$$\phi_u = \frac{1}{1 - 18R_i^{1/4}} \tag{10}$$

$$R_i = \frac{z}{L}(1 - 18R_i)^{1/4} \tag{11}$$

The solution of the above equations is an iterative process that converges very rapidly. The convergence criterion (ϵ) for U_* and L' are given below:

$$\epsilon_{U_*} \rightarrow 0.1\,(cm/sec) \qquad \text{and} \qquad \epsilon_{L'} \rightarrow 1\,(cm) \tag{12}$$

The wave growth equations discussed later require the equivalent wind speed at a 10-m elevation under conditions of neutral stability ($\Delta T = 0$). Having solved the equations in the constant stress region for U_*, the required equivalent neutral wind speed U_e may be easily obtained from Equation 5 using (U_*, $z = 10\,m$, $\Delta T = 0$):

$$U_{e_{1000}} = \frac{U_*}{k}\left[\ln\left(\frac{1000}{z_0}\right) - 0\right] \tag{13}$$

Full Boundary Layer

For cases where the geostrophic winds are known or have been estimated, the similitude equations describing the entire planetary boundary layer are solved. In addition to the relations described above for the constant stress region, the following relationships describe the model from water surface level to the geostrophic level:

$$\ln\frac{|\overline{V}_g|}{f z_0} = A - \ln\frac{U_*}{|\overline{V}_g|} + \sqrt{\frac{k^2|\overline{V}_g|^2}{U_*^2} - B^2} \tag{14}$$

$$\sin\theta = \frac{BU_*}{k|\overline{V}_g|} \tag{15}$$

where

$\overline{V}_g$ = geostrophic wind

f = Coriolis acceleration

A, B = nondimensional functions of stability

$$\left.\begin{aligned} A &= A_0[1 - e^{(0.015\mu)}] \\ B &= B_0 - B_1[1 - e^{(0.03\mu)}] \end{aligned}\right|\quad \mu \le 0 \tag{16}$$

$$\left.\begin{aligned} A &= A_0 - 0.96\sqrt{\mu} + \ln(\mu + 1) \\ B &= B_0 + 0.7\sqrt{\mu} \end{aligned}\right|\quad \mu > 0 \tag{17}$$

μ = dimensionless stability parameter

$$= \frac{kU_*}{fL} \tag{18}$$

A_0, B_0, B_1 = constants

θ = angle between $\overline{V}_g$ and the surface stress

Equations *14-18* are solved simultaneously together with Equations *5-11* until the convergence of U_*, L', and A is obtained. A slightly different value of $(C_2 = 0.0144/980)$ in Equation *7* is used (Dr. C. Linwood Vincent, CERC, personal communication, September 1989). The convergence criteria for the iterative solution to the equations are as follows:

$$\epsilon_{U_*} \rightarrow 0.1\,(cm/\sec) \quad \text{and} \quad \epsilon_L \rightarrow 1\,(cm) \quad \text{and} \quad \epsilon_A \rightarrow 0.1 \qquad (19)$$

The solution procedure converges very rapidly. As before, Equation *13* is then used to determine the equivalent neutral wind speed at the 10-m elevation using $(U_*,\ z = 10\ m,\ \Delta t = 0)$.

Final Adjustments

An additional adjustment is made for situations having relatively short fetch lengths before application of the wave growth equations. For fetch lengths shorter than 16 km, the following reduction is applied:

$$U_a = 0.9\,U_a \qquad (20)$$

Finally, it is necessary to evaluate the effects of winds of varying duration, t_t, on the wave growth equations. The following expressions are used to adjust the wind speed to a duration of interest:

$$\frac{U_t}{U_{3600}} = 1.277 + 0.296\tanh\left(0.9\log\frac{45}{t_t}\right) \quad \Big| \quad (1 < t_t < 3600\ \text{sec}) \qquad (21)$$

$$\frac{U_t}{U_{3600}} = -0.15\log t_t + 1.5334 \quad \Big| \quad (3600 < t_t < 36000\ \text{sec}) \qquad (22)$$

The 1-hr wind speed U_{3600} is first determined (using $t_t = t_{obs}$). The wind speed U_t at the desired duration of interest is then determined by selecting the desired t_t and using the appropriate equation.

Wave Growth

Having estimated the winds above the water surface at a duration of interest, the objective is to provide an estimate of the wave growth caused by the winds. The simple wave growth formulas that follow provide quick estimates for wind-wave growth in deep and shallow water. The open-water expressions correspond to those listed in the SPM (1984) and Vincent (1984). The restricted fetch deepwater expressions can be found in Smith (1991). It should be noted that the drag law (Garratt, 1977) employed differs from that in the SPM. The major assumptions regarding the use of the simplified wave growth expressions include:

* Energy from the presence of other existing wave trains is neglected.
* Relatively short fetch geometries ($F \leq 75\,\mathrm{mi}$).
* Relatively constant wind speed ($\Delta U \leq 5\,\mathrm{kts}$) and direction ($\Delta\alpha \leq 15°$).
* Winds prescribed at the *10-m* elevation ($z = 10\,\mathrm{m}$).
* Neutral stability conditions.
* Fixed value of drag coefficient ($C_D = 0.001$).

The wind adjustment methodology described earlier in this report adjusts the observed wind, U_{obs}, to the 10-m elevation under neutrally stable conditions U_e. Vincent (1984) maintains the wind speed should be adjusted to consider the nonlinear effect on the wind stress creating the waves. The drag law reported by Garratt (1977) is used:

$$\tau = \rho_a C_D U^2 \tag{23}$$

where

ρ = air density

$$C_D = 0.001\,(0.75 + 0.067\,U) \tag{24}$$

The equivalent neutral wind speed, then, is adjusted (or linearized) to a constant drag coefficient ($C_D = 0.001$) before application in the wave growth formulas:

$$U_a = U_e \sqrt{\frac{C_D}{0.001}} \tag{25}$$

Fetch Considerations

The wave growth formulations which follow are segregated into four categories: deep and shallow-water forms for both simple open-water fetches and for more complex, limiting geometries (designated "restricted fetch"). A brief discussion of fetch delineation is useful.

Open-Water Fetches

In open water, wave generation is limited by the dimensions of the subject meteorological event, and fetch widths are of the same order of magnitude as the fetch length. The simplified estimates for wave growth in open water attribute significance to the fetch length (but not width or shape). The wave growth is assumed to occur along the fetch in the direction of the wind.

Restricted Fetches

The more limiting or complex geometries of water bodies such as lakes, rivers, bays, and reservoirs have an impact on wind-wave generation. This restricted fetch methodology applies the concept of wave development in off-wind directions and considers the shape of the basin. The details of the method are reported by Smith (1991), and are based upon a concept reported by Donelan (1980) whereby the wave period (as a function of fetch lengths at off-wind directions) is maximized. For this approach, the radial fetch lengths (as measured from various points along the shoreline of the basin to the point of interest) are used to describe the geometry of the basin. In addition, the wind direction must be specified. Figure 1-1-2 illustrates the relevant geometric data required for the restricted fetch approach.

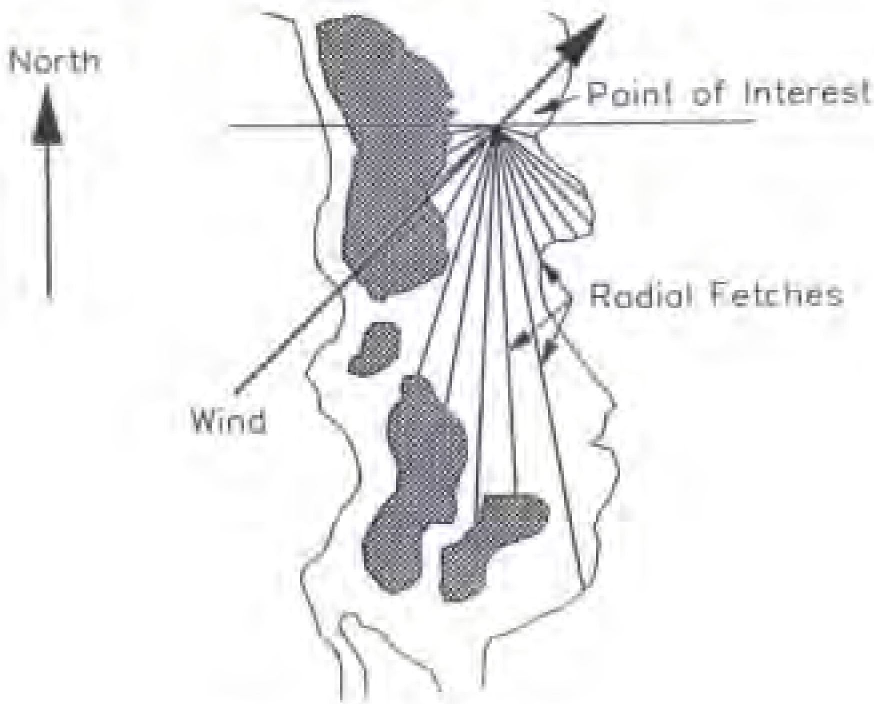


Figure 1-1-2 Restricted Fetch Geometry Data

The conventions used for specifying wind direction and fetch geometry are illustrated in Figure 1-1-3. The approach wind direction (α) as well as the radial fetch angles (β_i), and ($\Delta\beta$) should be specified in a clockwise direction from north from the point of interest where wave growth prediction is required.

From the specified radial fetch data, intermediate values are interpolated at 1-deg increments around the entire 360-deg compass. These interpolated fetches are subsequently averaged over 15-deg arcs centered at each whole 1-deg value.

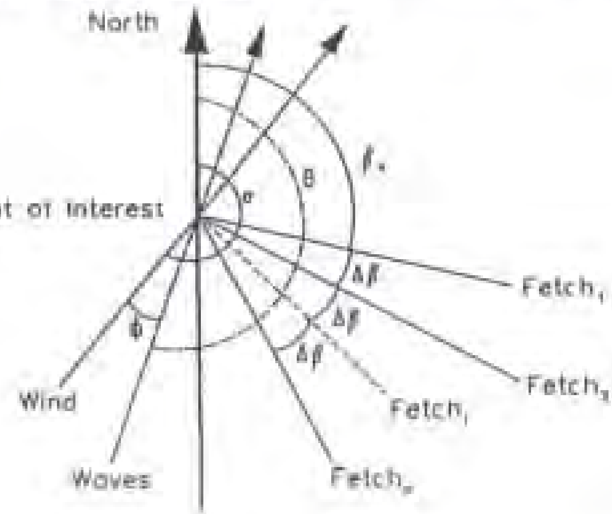


Figure 1-1-3. Restricted Fetch Conventions

The direction of wave development (θ) is solved by maximizing the product

$$F_{\theta}^{0.28} \cdot (\cos\phi)^{0.44} \tag{26}$$

This procedure maximizes the relevant terms in the expression for wave period (T_p) (Equation *36*). The angle (ϕ) is defined as the off-wind direction angle associated with the interpolated averaged fetch length value (F_{θ}). Product results (Equation *26*) are evaluated from ($\phi = 0 \pm 90°$) at 1-deg increments. When the product (Equation *26*) is maximized, (ϕ) represents the angle between the wind and waves, and (θ) represents the compass direction from which wave development occurs along (F_{θ}). For a specified wind direction, there will be a corresponding wave development direction where (T_p) is maximized by Equation *26*.

Deepwater Wave Growth

The formulas for wave growth in deep water encompass the effects of fetch and duration. The open-water formulas for fetch- and duration-limited wave growth are taken from Vincent (1984) and are based upon the spectrally based results given in Hasselmann et al. (1973, 1976). The fetch-limited and fully developed forms are also tabulated in the SPM (1984). The expressions for restricted fetch wave growth in deep water are from Smith (1991). In all cases, the wave growth estimates are bounded by the expressions for a fully developed equilibrium spectrum. The procedure is outlined as follows:

* Determine the minimum duration, t_{fetch}, required for a wave field to become fetch-limited:

Open Water

$$t_{fetch} = 68.8 \frac{F^{2/3}}{g^{1/3} U_a^{1/3}} \qquad (27)$$

Restricted Fetch

$$t_{fetch} = 51.09 \frac{F^{0.72}}{g^{0.28} \bar{U}_a^{0.44}} \qquad (28)$$

* Determine the character of the wave growth (duration-limited or fetch-limited):

Duration Limited $(t_l < t_{fetch})$

Open Water

$$H = 0.0000851 \left(\frac{U_a^2}{g}\right)\left(\frac{g t_l}{U_a}\right)^{5/7} \qquad (29)$$

$$T = 0.0702 \left(\frac{U_a}{g}\right)\left(\frac{g t_l}{U_a}\right)^{0.411} \qquad (31)$$

Restricted Fetch

$$H = 0.000103 \left(\frac{\bar{U}_a^2}{g}\right)\left(\frac{g t_l}{\bar{U}_a}\right)^{0.69} \qquad (30)$$

$$T = 0.082 \left(\frac{\bar{U}_a}{g}\right)\left(\frac{g t_l}{\bar{U}_a}\right)^{0.39} \qquad (32)$$

--- or ---

Fetch Limited $(t_l \geq t_{fetch})$

Open Water

$$H = 0.0016 \left(\frac{U_a^2}{g}\right)\left(\frac{g F}{U_a^2}\right)^{1/2} \qquad (33)$$

$$T = 0.2857 \left(\frac{U_a}{g}\right)\left(\frac{g F}{U_a^2}\right)^{1/3} \qquad (35)$$

Restricted Fetch

$$H = 0.0015 \left(\frac{\bar{U}_a^2}{g}\right)\left(\frac{g F}{\bar{U}_a^2}\right)^{1/2} \qquad (34)$$

$$T = 0.3704 \left(\frac{\bar{U}_a}{g}\right)\left(\frac{g F}{\bar{U}_a^2}\right)^{0.28} \qquad (36)$$

* Determine the "fully developed" condition:

Fully Developed

Open Water

$$H_{fd} = 0.2433 \left(\frac{U_a^2}{g}\right) \qquad (37)$$

$$T_{fd} = 8.134 \left(\frac{U_a}{g}\right) \qquad (39)$$

Restricted Fetch

$$H_{fd} = 0.2433 \left(\frac{\bar{U}_a^2}{g}\right) \qquad (38)$$

$$T_{fd} = 8.134 \left(\frac{\bar{U}_a}{g}\right) \qquad (40)$$

* Ensure that the "fully developed" condition is not exceeded:

$$H_{m0} = \min(H, H_{fd}) \qquad (41)$$

$$T_p = \min(T, T_{fd}) \qquad (42)$$

where

g = acceleration due to gravity

t_1 = wind duration used in duration-limited expressions

F = fetch length used in fetch-limited expressions

$\bar{U}_a = U_a\cos(\phi)$ = fetch-parallel component of U_a for restricted fetch approach

$\bar{U}_* = U_*\cos(\phi)$ = fetch-parallel component of U_* for restricted fetch approach

H = wave height determined by duration-limited or fetch-limited expressions

T = wave period determined by duration-limited or fetch-limited expressions

H_{fd} = wave height limited by fully developed spectrum criteria

T_{fd} = wave period limited by fully developed spectrum criteria

H_{m0} = final wave height determined from spectrally based methods

T_p = final wave period determined from spectrally based methods

Shallow-Water Wave Growth

Estimates for wave growth in shallow water are based upon the fetch-limited deepwater formulas, but modified to include the effects of bottom friction and percolation (Bretschneider and Reid, 1954). Water depth is assumed to be constant over the fetch. Duration-limited effects are not embodied by these formulas. The relationships have not been verified and may (or may not) be appropriate for the conditions and assumptions of the original Bretschneider-Reid work. **The expressions represent an interim method pending results of further research.** The open-water forms are also presented in the SPM (1984).

Open-Water Forms:

$$H_{m0} = \frac{U_a^2}{g} 0.283 \tanh\left[0.530\left(\frac{gd}{U_a^2}\right)^{0.75}\right] \tanh\left\{\frac{\frac{0.0016}{0.283}\left(\frac{gF}{U_a^2}\right)^{0.5}}{\tanh\left[0.530\left(\frac{gd}{U_a^2}\right)^{0.75}\right]}\right\} \qquad (43)$$

$$T_p = \frac{U_a}{g} 7.54 \tanh\left[0.833\left(\frac{gd}{U_a^2}\right)^{0.375}\right] \tanh\left\{\frac{\frac{0.2857}{7.54}\left(\frac{gF}{U_a^2}\right)^{0.333}}{\tanh\left[0.833\left(\frac{gd}{U_a^2}\right)^{0.375}\right]}\right\} \qquad (44)$$

Restricted Fetch Forms:

$$H_{m0} = \frac{U_a^2}{g} 0.283 \tanh\left[0.530\left(\frac{gd}{U_a^2}\right)^{0.75}\right] \tanh\left\{\frac{\frac{0.0015}{0.283}\left(\frac{gF}{U_a^2}\right)^{0.5}}{\tanh\left[0.530\left(\frac{gd}{U_a^2}\right)^{0.75}\right]}\right\} \tag{45}$$

$$T_p = \frac{U_a}{g} 7.54 \tanh\left[0.833\left(\frac{gd}{U_a^2}\right)^{0.375}\right] \tanh\left\{\frac{\frac{0.3704}{7.54}\left(\frac{gF}{U_a^2}\right)^{0.28}}{\tanh\left[0.833\left(\frac{gd}{U_a^2}\right)^{0.375}\right]}\right\} \tag{46}$$

REFERENCES AND BIBLIOGRAPHY

Bretschneider, C. L., and Reid, R. O. 1954. "Modification of Wave Height Due to Bottom Friction, Perlocation and Refraction," Technical Report 50-1, The Agricultural and Mechanical College of Texas, College Station, TX.

Cardone, V. J. 1969. "Specification of the Wind Distribution in the Marine Boundary Layer for Wave Forecasting," TR-69-1, Geophysical Sciences Laboratory, Department of Meteorology and Oceanography, School of Engineering and Science, New York University, New York.

Cardone, V. J., et al. 1976 "Hindcasting the Directional Spectra of Hurricane-Generated Waves," *Journal of Petroleum Technology*, American Institute of Mining and Metallurgical Engineers, No. 261, pp. 385-394.

Donelan, M.A. 1980. "Similarity Theory Applied to the Forecasting of Wave Heights, Periods, and Directions," *Proceedings of the Canadian Coastal Conference*, National Research Council, Canada, pp. 46-61.

Garratt, J. R., Jr. 1977. "Review of Drag Coefficients over Oceans and Continents," *Monthly Weather Review*, Vol. 105, pp. 915-929.

Hasselmann, K., Barnett, T. P., Bonws, E., Carlson H., Cartwright, D. C., Enke, K., Ewing, J., Gienapp, H., Hasselmann, D. E., Kruseman, P., Meerburg, A., Muller, P., Olbers, D. J., Richter, K., Sell, W., and Walden, H. 1973. "Measurements of Wind-Wave Growth and Swell Decay During the Joint North Sea Wave Project (JONSWAP)," Deutches Hydrographisches Institut, Hamburg, 95 pp.

Hasselmann, K., Ross, D. B., Muller, P., and Sell, W. 1976. "A Parametric Prediction Model," *Journal of Physical Oceanography*, Vol. 6, pp. 200-228.

Holton, J. R. 1979. *An Introduction to Dynamic Meteorology*, Academic Press, Inc., New York, pp. 102-118.

Lumley, J. L., and Panofsky, H. A. 1964. *The Structure of Atmospheric Turbulence*, Wiley, New York.

Mitsuyasu, H. 1968. "On the Growth of the Spectrum of Wind-Generated Waves (I)," Reports of the Research Institute of Applied Mechanics, Kyushu University, Fukuoka, Japan, Vol. 16, No. 55, pp. 459-482.

Resio, D. T. 1981. "The Estimation of Wind Wave Generation in a Discrete Model," *Journal of Physical Oceanography*, Vol. 11, pp. 510-525.

Resio, D. T. 1987. "Shallow Water Waves. I: Theory," *Journal of Waterway, Port, Coastal and Ocean Engineering*, American Society of Civil Engineers, Vol. 113, No. 3, pp. 264-281.

Resio, D. T., Vincent, C. L., and Corson, W. D. 1982. "Objective Specification of Atlantic Ocean Wind Fields from Historical Data," Wave Information Study Report No. 4, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Shore Protection Manual. 1984. 4th ed., 2 Vols., US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center, US Government Printing Office, Washington, DC, Chapter 3, pp. 24-66.

Smith, J.M. 1991. Wind-Wave Generation on Restricted Fetches," Miscellaneous Paper CERC-91-2, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Vincent, C. L. 1984. "Deepwater Wind Wave Growth with Fetch and Duration," Miscellaneous Paper CERC-84-13, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Table III-1-2
Sediment Particle Sizes

ASTM (Unified) Classification[1]	U.S. Std. Sieve[2]	Size in mm	Phi Size	Wentworth Classification[3]
Boulder		4096.	-12.0	
		1024.	-10.0	Boulder
	12 in. (300 mm)	256.	-8.0	Large Cobble
		128.	-7.0	
Cobble		107.64	-6.75	
		90.51	-6.5	Small Cobble
	3 in. (75 mm)	76.11	-6.25	
		64.00	-6.0	
		53.82	-5.75	
		45.25	-5.5	Very Large Pebble
Coarse Gravel		38.05	-5.25	
		32.00	-5.0	
		26.91	-4.75	
		22.63	-4.5	Large Pebble
	3/4 in. (19 mm)	19.03	-4.25	
		16.00	-4.0	
		13.45	-3.75	
		11.31	-3.5	Medium Pebble
		9.51	-3.25	
Fine Gravel	2.5	8.00	-3.0	
	3	6.73	-2.75	
	3.5	5.66	-2.5	Small Pebble
	4 (4.75 mm)	4.76	-2.25	
	5	4.00	-2.0	
Coarse Sand	6	3.36	-1.75	
	7	2.83	-1.5	Granule
	8	2.38	-1.25	
	10 (2.0 mm)	2.00	-1.0	
	12	1.68	-0.75	
	14	1.41	-0.5	Very Coarse Sand
	16	1.19	-0.25	
	18	1.00	0.0	
Medium Sand	20	0.84	0.25	
	25	0.71	0.5	Coarse Sand
	30	0.59	0.75	
	35	0.50	1.0	
	40 (0.425 mm)	0.420	1.25	
	45	0.354	1.5	Medium Sand
	50	0.297	1.75	
	60	0.250	2.0	
	70	0.210	2.25	
Fine Sand	80	0.177	2.5	Fine Sand
	100	0.149	2.75	
	120	0.125	3.0	
	140	0.105	3.25	
	170	0.088	3.5	Very Fine Sand
	200 (0.075 mm)	0.074	3.75	
Fine-grained Soil:	230	0.0625	4.0	
	270	0.0526	4.25	
Clay if PI $\geq$ 4 and plot of PI vs. LL is on or above "A" line and the presence of organic matter does not influence LL.	325	0.0442	4.5	Coarse Silt
	400	0.0372	4.75	
		0.0312	5.0	Medium Silt
		0.0156	6.0	Fine Silt
		0.0078	7.0	Very Fine Silt
Silt if PI < 4 and plot of PI vs. LL is below "A" line and the presence of organic matter does not influence LL.		0.0039	8.0	Coarse Clay
		0.00195	9.0	Medium Clay
		0.00098	10.0	Fine Clay
		0.00049	11.0	
(PI = plasticity limit; LL = liquid limit)		0.00024	12.0	
		0.00012	13.0	
		0.000061	14.0	

[1] ASTM Standard D 2487-92. This is the ASTM version of the Unified Soil Classification System. Both systems are similar (from ASTM (1994)).
[2] Note that British Standard, French, and German DIN mesh sizes and classifications are different.
[3] Wentworth sizes (in inches) cited in Krumbein and Sloss (1963).

(7) Wave height distribution.

(a) The heights of individual waves may be regarded as a stochastic variable represented by a probability distribution function. From an observed wave record, such a function can be obtained from a histogram of wave heights normalized with the mean heights in several wave records measured at a point (Figure II-1-30). Thompson (1977) indicated how well coastal wave records follow the Rayleigh distribution. If wave energy is concentrated in a very narrow range of wave period, the maxima of the wave profile will coincide with the wave crests and the minima with the troughs. This is termed a *narrow-band condition*. Under the narrow-band condition, wave heights are represented by the following Rayleigh distribution (Longuet-Higgins 1952, 1975b, 1983)

$$p(H) = \frac{2H}{H_{rms}^2} \exp\left[-\frac{H^2}{H_{rms}^2}\right]$$

$$P(H) = 1 - \exp\left[-\frac{H^2}{H_{rms}^2}\right] \qquad \text{(II-1-130)}$$

(b) The significant wave height $H_{1/3}$ is the centroid of the area for $H > H_*$ under the density function where $H > H_*$ corresponds to waves in the highest one-third range as shown in Figure II-1-29, that is

$$P(H_*) = 1 - \frac{1}{3} = 1 - e^{\left(-\frac{H_*^2}{H_{rms}^2}\right)} \qquad \text{(II-1-131)}$$

from which we find $H_* = 1.05H_{rms}$. Various estimates of wave heights may then be obtained upon integration of the above equations using certain mathematical properties of the Error function (Abramowitz and Stegun 1965). We find

$$\begin{aligned} H_{1/3} &= 4.00\sqrt{m_0} = 1.416\,H_{rms} \\ H_{1/10} &= 1.27\,H_{1/3} = 1.800\,H_{rms} = 5.091\sqrt{m_0} \\ H_{1/100} &= 1.67\,H_{1/3} = 2.36\,H_{rms} = 6.672\sqrt{m_0} \\ H_{max} &= 1.86\,H_{1/3} \quad \textit{(for 1000 wave cycles in the record)} \end{aligned} \qquad \text{(II-1-132)}$$

(c) The *most probable maximum wave height* in a record containing N waves is related to the rms wave height (Longuet-Higgins 1952) by

$$H_{max} = \left[\sqrt{\log N} + \frac{0.2886}{\sqrt{\log N}} - \frac{0.247}{(\log N)^{3/2}}\right] H_{rms} \qquad \text{(II-1-133)}$$

To: Johnny [illegible] [illegible]
from: Orson Smith 7/18/02

remedial efforts that may be necessary. Or the model may then be run to evaluate proposed modifications of the harbor.

An alternative is to run more extensive field studies as the sole effort to evaluate conditions at a harbor. This would generally be more costly than the hybrid field-model approach, but it may provide some detail that can not be achieved from model studies alone.

Also, field studies have been done to support the general development of physical and numerical modelling techniques for the study of harbor flushing and circulation.

Field measurements include those that define the hydrodynamics of a harbor and supplementary measurements to quantify harbor flushing. The former include measurements of tide levels inside and outside of the harbor, current velocity measurements at the entrance to quantify flow rates into and out of the harbor, and flow velocity measurements throughout the harbor and/or drogue studies to define circulation patterns in the harbor. If tidal flushing is the primary concern, these measurements would be conducted on days when the wind velocity is low. Otherwise, a directional anemometer would also be used to measure the wind speed and direction.

To determine exchange coefficients throughout the harbor and the harbor's flushing efficiency, the harbor would be uniformly seeded with a harmless detectable solute such as a fluorescent dye and then sampled periodically at several points in the harbor for a period of several tidal cycles. The initial and subsequent dye concentrations (see Eq. II-7-20) can be measured in situ by a standard fluorometer. The dye Rhodamine WT has been used in a number of harbor flushing studies. (see Callaway 1981; Schwartz and Imberger 1988).

II-7-7. Vessel Interactions

a. Vessel-Generated Waves. As a vessel travels across the water surface a variable pressure distribution develops along the vessel hull. The pressure rises at the bow and stern and drops along the midsection. These pressure gradients, in turn, generate a set of waves that propagate out from the vessel bow and another generally lower set of waves that propagate out from the vessel stern. The heights of the resulting waves depend on the vessel speed, the bow and stern geometry, and the amount of clearance between the vessel hull and channel bottom and sides. The period and direction of the resulting waves depend only on the vessel speed and the water depth. For a detailed discussion of the vessel wave generating process and the resulting wave characteristics see Robb (1952), Sorensen (1973a, 1973b), and Newman (1978).

The pattern of wave crests generated at the bow of a vessel that is moving at a constant speed over deep water is depicted in Figure II-7-40. There are symmetrical sets of *diverging* waves that move obliquely out from the vessel's sailing line and a set of *transverse* waves that propagate along the sailing line. The *transverse* and *diverging* waves meet along the cusp locus lines that form an angle of 19°28' with the sailing line. The largest wave heights are found where the *transverse* and *diverging* waves meet. If the speed of the vessel is increased, this wave crest pattern retains the same geometric form but expands in size as the individual wave lengths (and periods) increase.

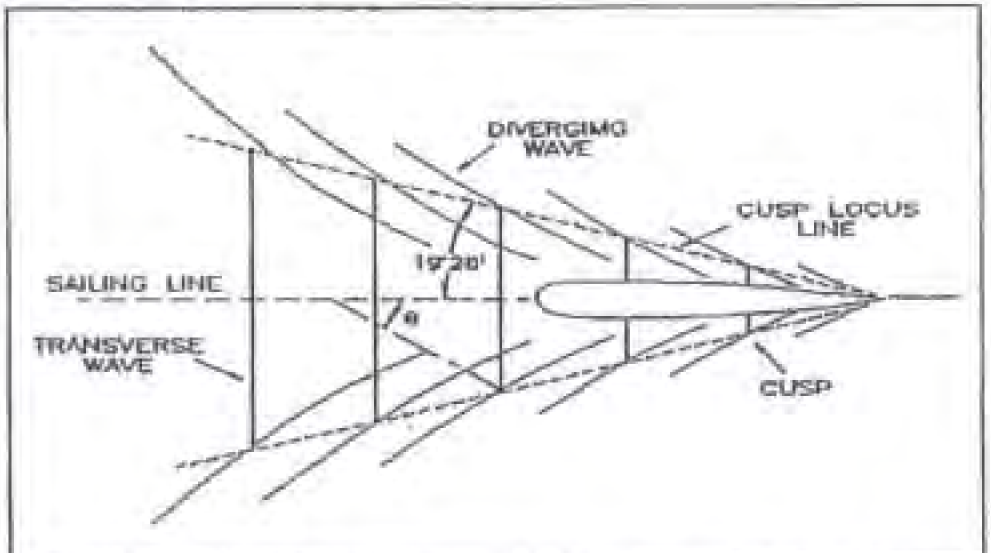


Figure II-7-40. Wave crest pattern generated at a vessel bow moving over deep water

The fixed pattern of wave crests requires that the individual wave celerities C be related to the vessel speed V_s by

$$C = V_s \cos\theta \tag{II-7-21}$$

where θ is the angle between the sailing line and the direction of wave propagation (Figure II-7-40). Thus, the *transverse* waves travel at the same speed as the vessel and, in deep water, θ has a value of 35°16′ for the *diverging* waves.

The increasing distances from the vessel, diffraction causes the wave crest lengths to continually increase and the resulting wave heights to continually decrease. It can be shown (Havelock 1908) that the wave heights at the cusp points decrease at a rate that is inversely proportional to the cube root of the distance from the vessel's bow (or stern). The *transverse* wave heights at the sailing line decrease at a rate proportional to the square root of the distance aft of the bow (or stern). Consequently, the *diverging* waves become more pronounced with distance from the vessel.

The above discussion applies to deep water, i.e. water depths where the particle motion in the vessel-generated waves does not reach to the bottom. This condition holds for a Froude number less than approximately 0.7, where the Froude number F is defined by

$$F = \frac{V_s}{\sqrt{gd}} \tag{II-7-22}$$

As the Froude number increases from 0.7 to 1.0, wave motion is affected by the water depth and the wave crest pattern changes. The cusp locus line angle increases from 19°28' to 90° at a Froude number of one. The *diverging* wave heights increase more slowly than do the *transverse* wave heights, so the latter become more prominent as the Froude number approaches unity. At a Froude number of one, the *transverse* and *diverging* waves have coalesced and are oriented with their crest perpendicular to the sailing line. Most of the wave energy is concentrated in a single large wave at the bow. Owing to propulsion limits (Schofield 1974) most self-propelled vessels can only operate at maximum Froude numbers of about 0.9. Also, as a vessel's speed increases, if the vessel is sufficiently light (i.e. has a shallow draft), hydrodynamic lift may cause the vessel to plane so that there is no significant increase in the height of generated waves for vessel speeds in excess of the speed when planing commences.

For harbor design purposes, one would like to know the direction, period and height of the waves generated by a design vessel moving at the design speed. For Froude numbers up to unity, Weggel and Sorensen (1986) show that the direction of wave propagation θ(in degrees) is given by

$$\theta = 35.27\left(1 - e^{12(F-1)}\right) \tag{II-7-23}$$

Then, from Eq. II-7-21 the *diverging* wave celerity can be calculated, and the wave period can be determined from the linear wave theory dispersion equation.

EXAMPLE PROBLEM II-7-6

FIND:

The period of the *diverging* waves generated by the vessel.

GIVEN:

A vessel is moving at a speed of 10 knots (5.157 meters/second) over water 5 meters deep.

SOLUTION:

The vessel Froude number is

$$F = \frac{5.157}{\sqrt{9.81\,(5)}} = 0.73$$

so Eq. II-7-23 gives a direction of propagation

$$\theta = 35.27\,[1 - e^{12(0.73-1)}] = 33.88°$$

and Eq. II-7-21 gives a wave celerity

$$C = 5.157\cos(33.88°) = 4.28\,m/s$$

The linear wave dispersion equation can be written

$$C = \frac{gT}{2\pi}\tanh\frac{2\pi d}{CT}$$

Inserting known values for C,g and d into the dispersion equation leads to a trial solution for T which is found to be 2.8 seconds. This is a typical period for vessel-generated waves and demonstrates why floating breakwaters are usually effective in protecting against vessel waves.

The typical wave record produced by a moving vessel is shown in Figure II-7-41. Most field and laboratory investigations of vessel-generated waves (Sorensen and Weggel 1984; Weggel and Sorensen 1986) report the maximum wave height (H_m see Figure II-7-41) as a function of vessel speed and type, water depth, and distance from the sailing line to where the wave measurement was made. Table II-7-5 (from Sorensen 1973b) provides a tabulation of selected H_m values for a range of vessel characteristics and speeds at different distances from the sailing line. These data are given to indicate the range of typical wave heights that might occur for common vessels and that vessel speed is more important than vessel dimensions in determining the height of the wave generated.

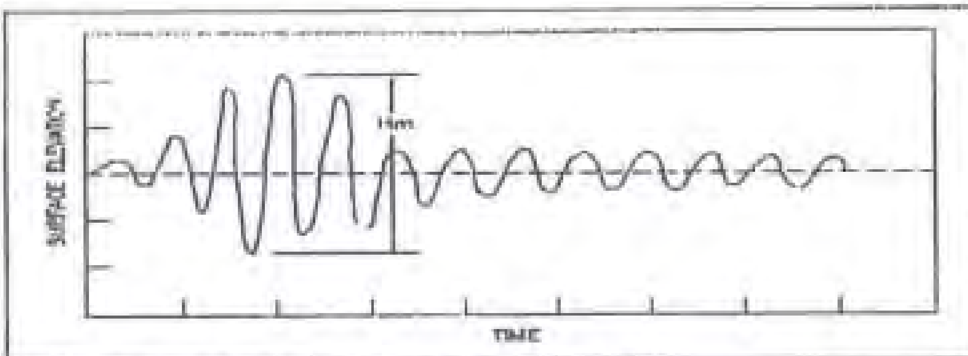


Figure II-7-41. Typical vessel-generated wave record

Table II-7-5
Selected Vessel-Generated Wave Heights (Sorensen 1973b)

Vessel	Speed (m/s)	H_m(m) @30m	H_m(m) @150m
Cabin Cruiser length-7.6m beam-2.5m draft-0.5m	3.1 5.1	0.2 0.4	0.1 0.2
Coast Guard Cutter length-12.2m beam-3.0m draft-1.1m	3.1 5.1 7.2*	0.2 0.5 0.7	0.3
Tugboat length-13.7m beam-4.0m draft-1.8m	3.1 5.1	0.3 0.5	0.1 0.3
Air-Sea Rescue Vessel length-19.5m beam-3.9m draft-0.9m	3.1 5.1 7.2*	0.1 0.4 0.6	0.2 0.3
Fireboat length-30.5m beam-8.5m draft-3.4m	3.1 5.1 7.2	0.1 0.5 0.9	0.1 0.3 0.8
Tanker length-153.6m beam-20.1m draft-8.5m	7.2 9.3		0.5 1.6

Note: The above data are from tests conducted at water depths ranging from 11.9 to 12.8 meters.
* denotes that the vessel was starting to plane.

A number of quasi-empirical procedures for predicting vessel-generated wave heights have been published (Sorensen 1986; Sorensen 1989 for a summary). Most procedures are restricted to a certain class or classes of vessels and specific channel conditions. A comparison (Sorensen 1989) of predicted H_m values for selected vessel speeds and water depths showed a significant variation among the results predicted by the various procedures. The best approach for design analyses appears to be to review the published vessel wave measurement data to compare with the vessel, vessel speed and channel conditions that most closely approach the design condition and select a conservative value of H_m from these data. If this is not possible, then the values in Table II-7-5 can be used as a rough estimate for the different types of vessels.

b. Vessel motions.

(1) Response to waves. Wave action will excite a floating vessel to oscillate in one or more of six components of motion or degrees of freedom. These are translation in the three coordinate directions (surge, sway and heave) and rotation around the three principal axes (roll, pitch and yaw). Which of these motion components is excited and to what extent depends primarily on the direction of wave incidence relative to the primary vessel axes and on the incident wave frequency spectrum compared to the resonant frequencies of the six motion components (Wehausen 1971). If the vessel is moored, the arrangement of the mooring lines and their taughtness will influence the resonant periods and the response amplitudes of the vessel motions. If the vessel is moving, the effective or encounter period of wave agitation is the wave period relative to the ship rather than to a fixed observation point. Wave mass transport will also cause a slow drift of the vessel in the direction of wave propagation.

Small vessels, such as the recreational vessels found in marinas, will commonly respond to shorter wind-wave periods. An analytical study coupled with some field measurements for seven small boats (Raichlen 1968) indicated that the periods of free oscillation were less than ten seconds. Larger sea-going deep-draft vessels, depending on the oscillation mode being excited, will respond to the entire range of wind-wave periods. Field measurements by van Wyk (1982) on ships having lengths around 250 to 300 m and beams around 40 m found maximum roll and pitch responses at encounter periods between 10 and 12 seconds. By proper design of the mooring system, the periods and amplitudes of vessel motion can be significantly modified.

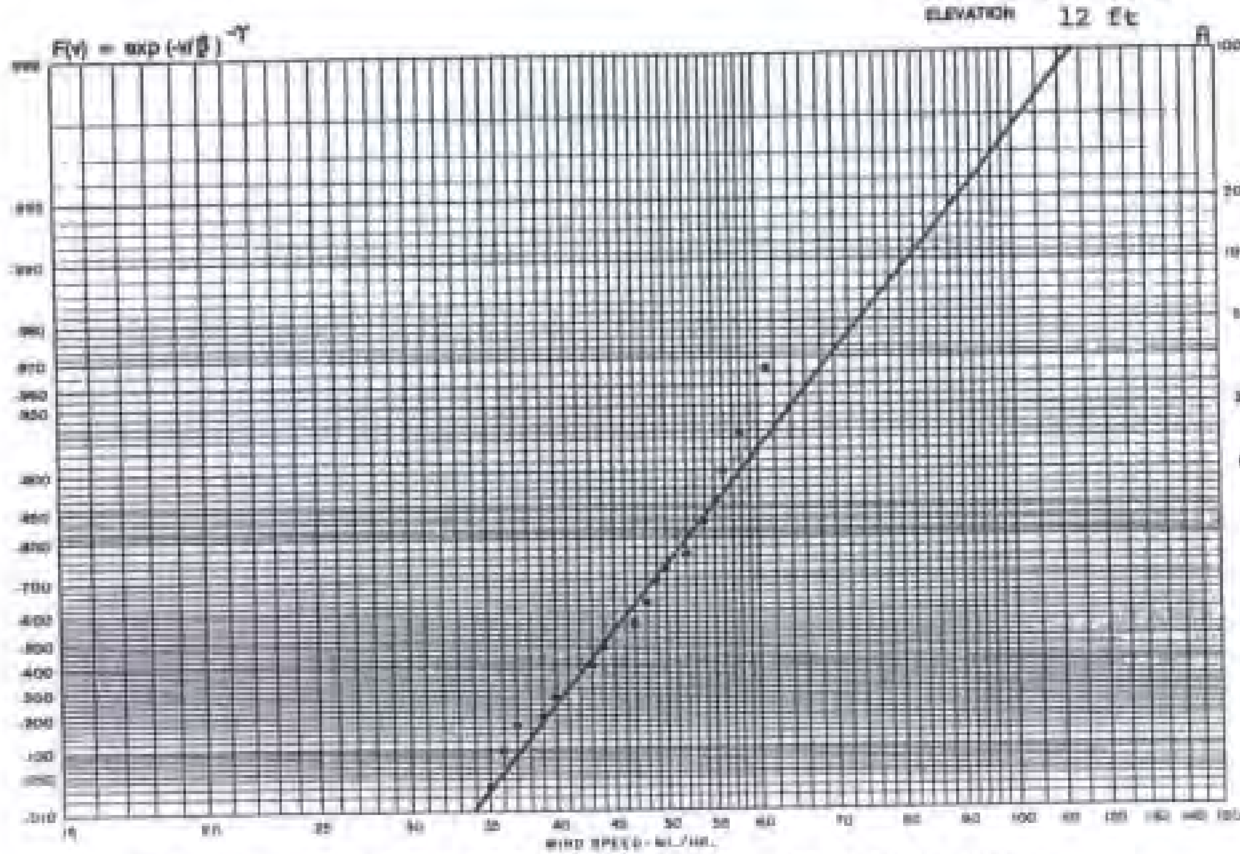
The wave-induced lateral and vertical motions of the design vessel will affect the required channel horizontal and depth dimensions respectively. The problem of wave-induced vessel oscillations has been addressed by analytical/numerical means (Anderson 1979; Madsen, et al. 1980, and Isaacson and Mercer 1982). These efforts usually employ small amplitude monochromatic waves and some limitations on vessel geometry and the incident wave directions relative to the vessel.

Some field measurement programs have been made that yield valuable design information. Wang and Noble (1982) describe an investigation of vessels entering the Columbia River

FIGURE 9

J U N E A U

LATITUDE 58 22'N
LONGITUDE 134 35'W
ELEVATION 12 ft



MAXIMUM VALUE PROBABILITY PAPER, FISHER-TIPPET TYPE II DISTRIBUTION

$\bar{v}$ = 46.4 σ^2 = 63.2 σ = 8.0

μ = 36 β = 42 γ = 6.9

PERIOD OF RECORD: 1949-1978

EXTREME VALUE PREDICTIONS IN MILES PER HOUR

	RETURN PERIOD IN YEARS					
	25	50	100	250	500	1000
WIND ESTIMATE	66.8	73.9	81.8	93.5	103.4	114.3

"Extreme Wind Prediction for First Order Weather stations in AK"
Arctic Environment Information and Data Center, UAF,
Alaska Climate Series Technical Note #1 1984

Chance of exceedance

Return Period	Probability	Chance of happening during a given number of years									
		1	2	5	10	20	25	50	100	200	500
2	50%	50%	75%	97%	100%	100%	100%	100%	100%	100%	100%
3	33%	33%	56%	87%	98%	100%	100%	100%	100%	100%	100%
4	25%	25%	44%	76%	94%	100%	100%	100%	100%	100%	100%
5	20%	20%	36%	67%	89%	99%	100%	100%	100%	100%	100%
6	17%	17%	31%	60%	84%	97%	99%	100%	100%	100%	100%
7	14%	14%	27%	54%	79%	95%	98%	100%	100%	100%	100%
8	13%	13%	23%	49%	74%	93%	96%	100%	100%	100%	100%
9	11%	11%	21%	45%	69%	91%	95%	100%	100%	100%	100%
10	10%	10%	19%	41%	65%	88%	93%	99%	100%	100%	100%
20	5%	5%	10%	23%	40%	64%	72%	92%	99%	100%	100%
25	4%	4%	8%	18%	34%	56%	64%	87%	98%	100%	100%
50	2.0%	2.0%	4.0%	10%	18%	33%	40%	64%	87%	98%	100%
100	1.0%	1.0%	2.0%	4.9%	10%	18%	22%	39%	63%	87%	99%
200	0.5%	0.5%	1.0%	2.5%	4.9%	10%	12%	22%	39%	63%	92%
500	0.2%	0.2%	0.4%	1.0%	2.0%	3.9%	4.9%	10%	18%	33%	63%
1,000	0.1%	0.1%	0.2%	0.5%	1.0%	2.0%	2.5%	4.9%	10%	18%	39%
10,000	0.01%	0.01%	0.02%	0.05%	0.1%	0.2%	0.2%	0.5%	1.0%	2.0%	4.9%
100,000	0.001%	0.001%	0.002%	0.005%	0.01%	0.02%	0.02%	0.05%	0.1%	0.2%	0.5%
1,000,000	0.0001%	0.0001%	0.0002%	0.0005%	0.001%	0.002%	0.002%	0.005%	0.01%	0.02%	0.05%

$$J = 1 - (1-p)^n$$

where J = probability of occurence in period
P = probability of occurence in a given year
N = Number of years in a period

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907) 561-1011 Fax (907) 563-4220

Memorandum

To: File

Project No.: 02056.02

From: Jennifer Wilson

Date: October 3, 2002

Re: *Areas Identified for Detailed Study*

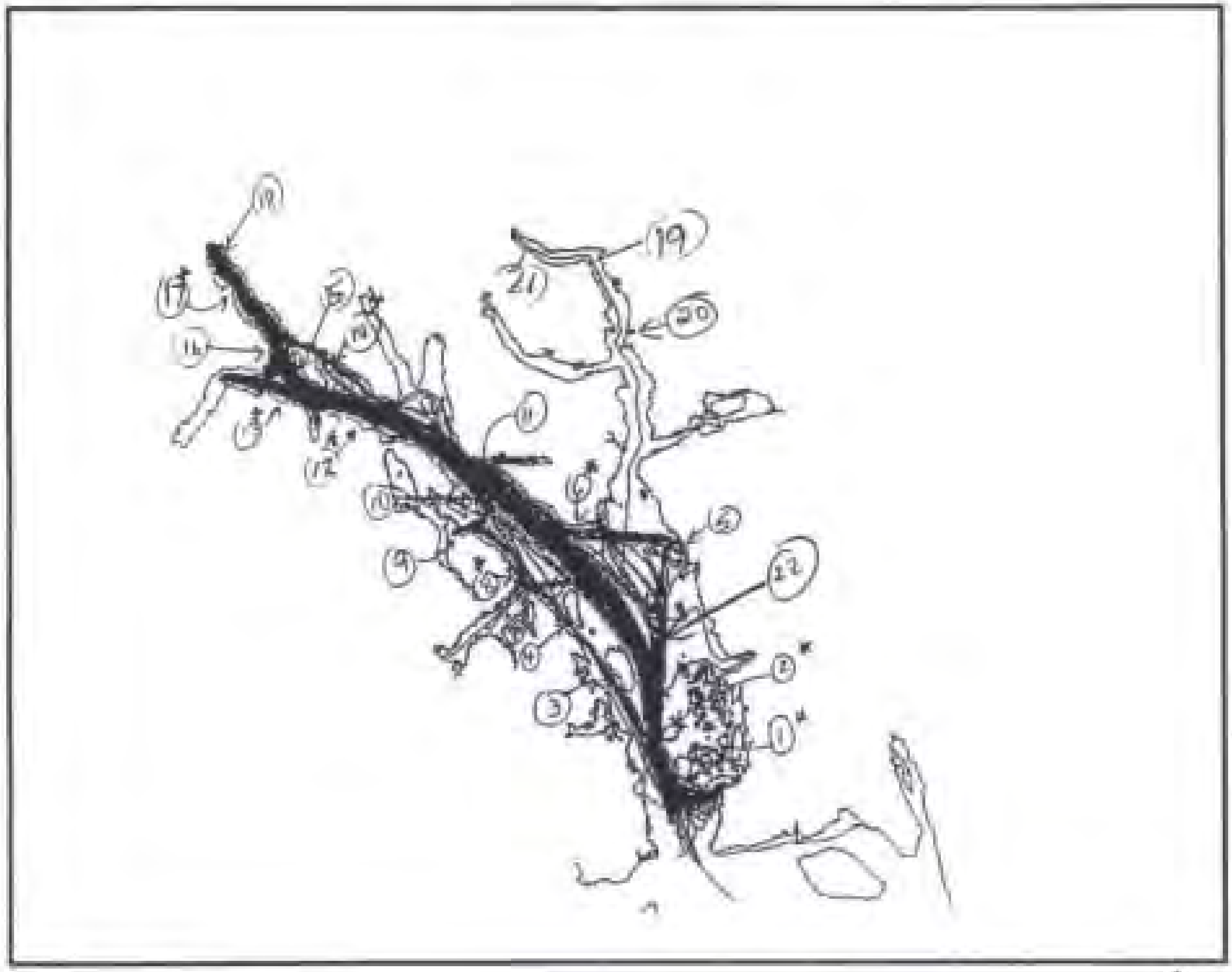
Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum

---

The attached document, *Areas Identified for Detailed Study*, provides the maps and data used to determine the sites where vessel traffic was within 2,000 feet of shore. This may be due to channel constriction or operation decisions. The attachment includes several maps with vessel track information.

ESRI ArcExplorer 2.0

Vessel Traffic



bt.dwg
oceanog_line_utm
NOAA_C~2

N

Friday, Jul 12 2002

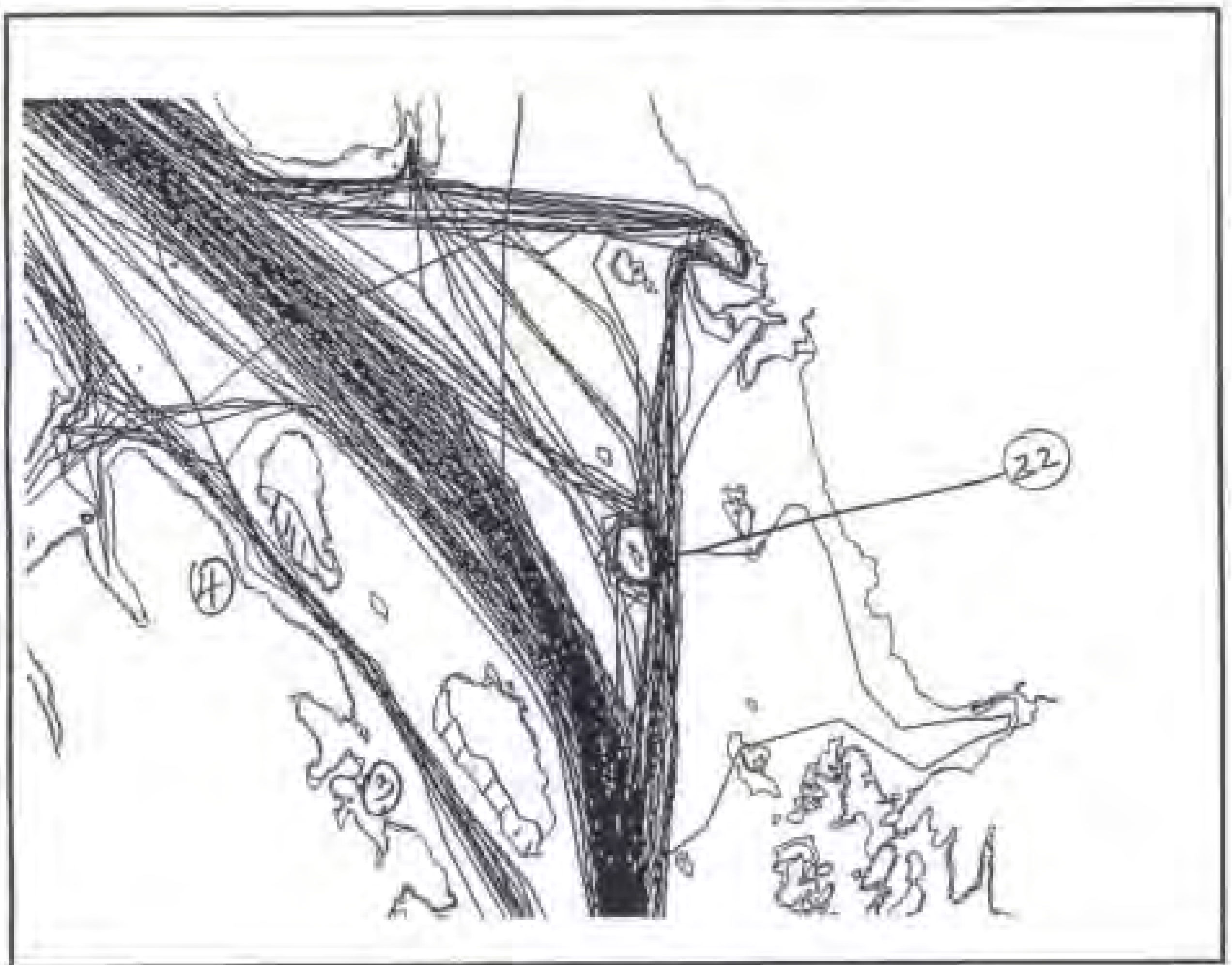
ESRI ArcExplorer 2.0

Sitadaday Narrows

Friday, Jul 12 2002

ESRI ArcExplorer 2.0

Whidbey Passage



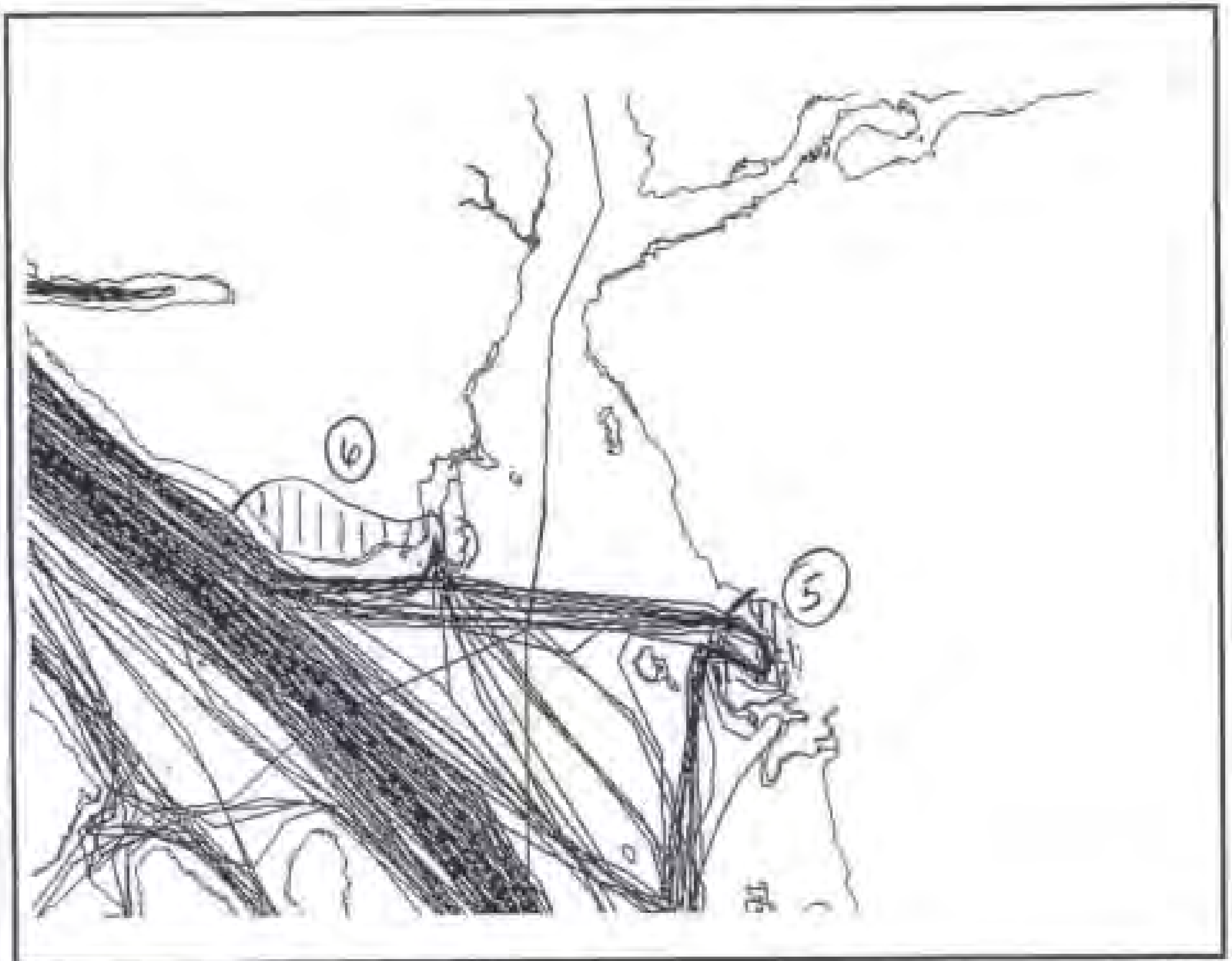
bt.dwg
oceanog_line_utm
NOAA_C-2

N

Friday, Jul 12 2002

ESRI ArcExplorer 2.0

Lower Muir Inlet



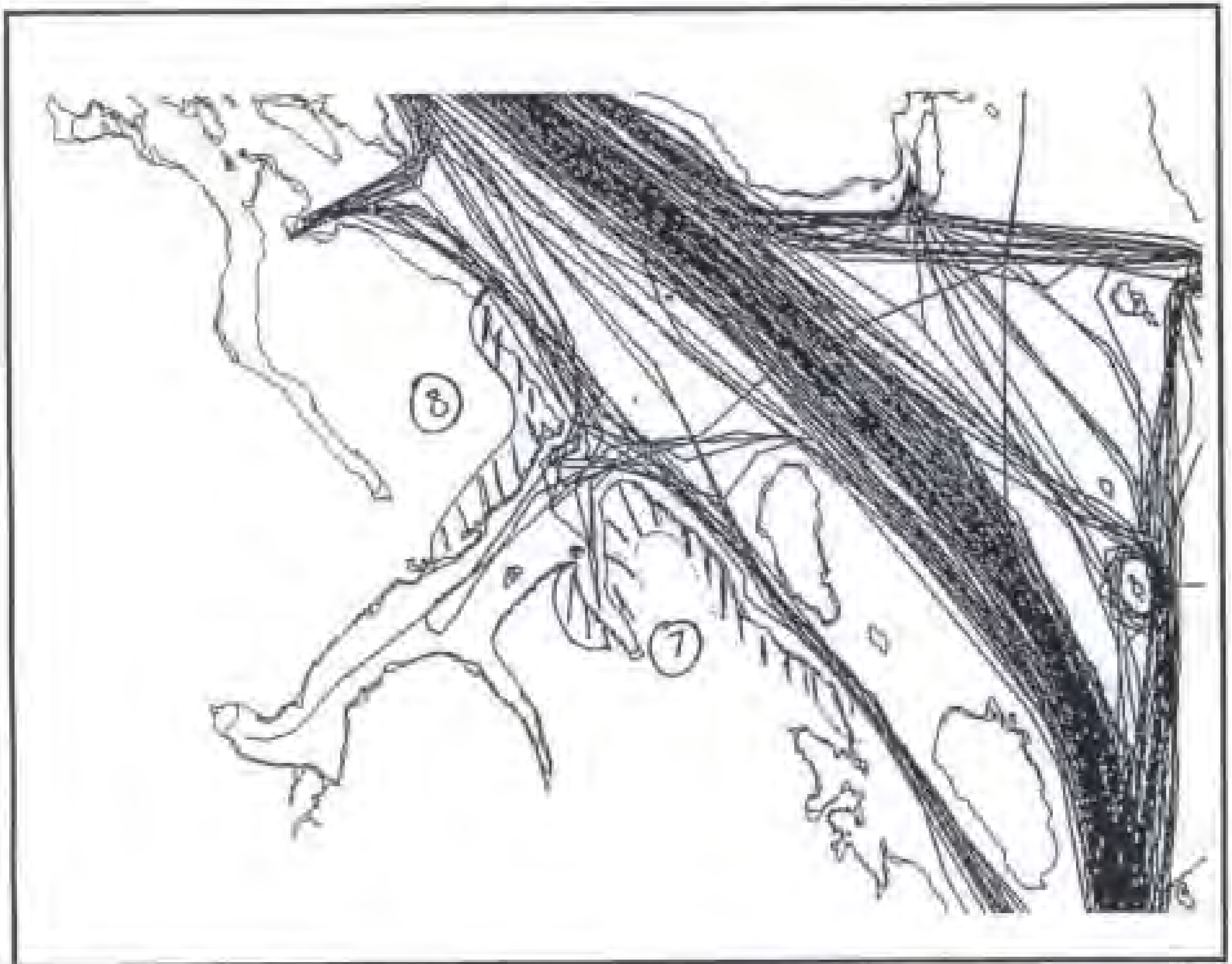
bt.dwg
oceanog_line_utm
NOAA_C-2

N

Friday, Jul 12 2002

ESRI ArcExplorer 2.0

Geikie Inlet



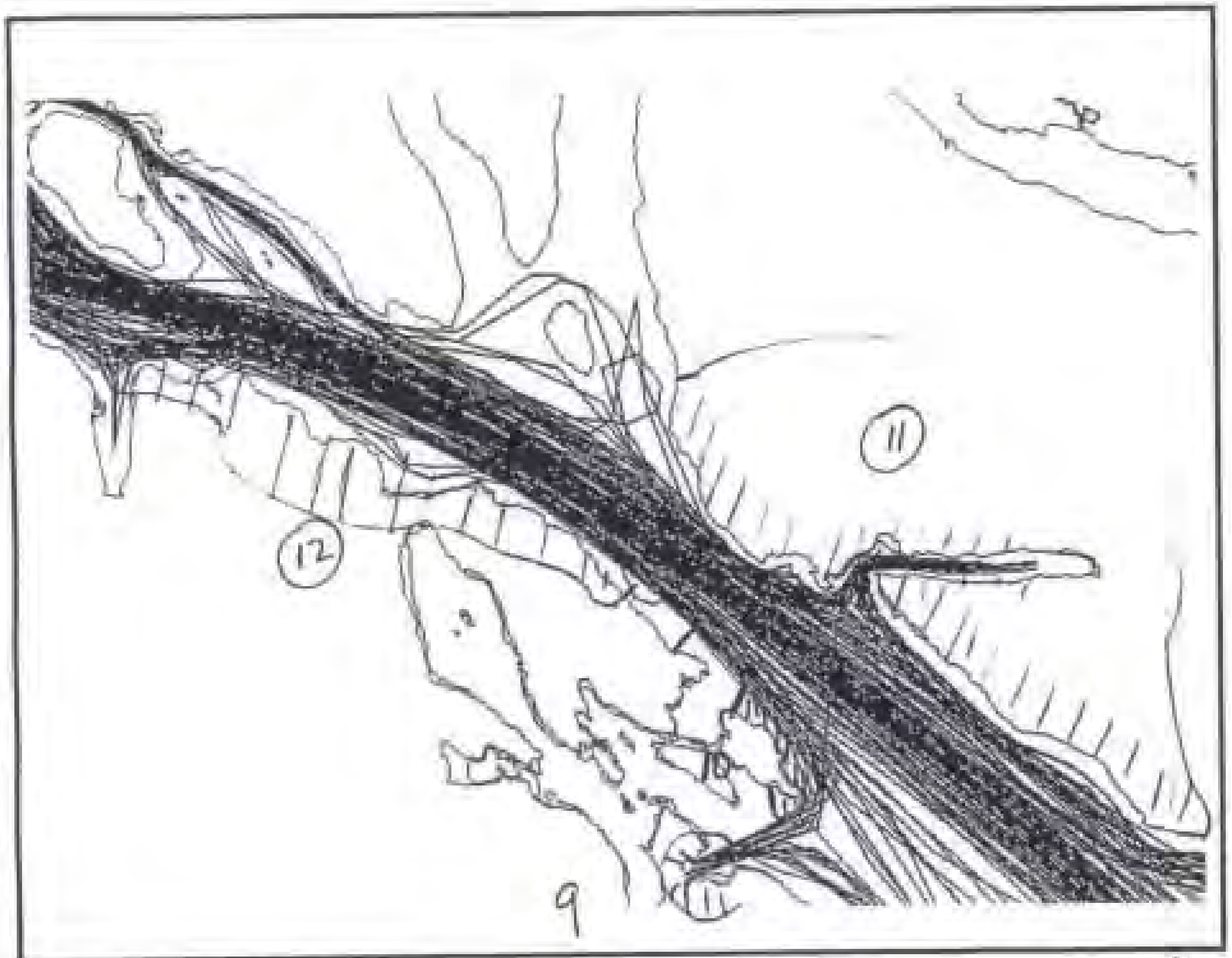
bt.dwg
oceanog_line_utm
NOAA_C-2

N

Friday, Jul 12 2002

ESRI ArcExplorer 2.0

Tidal Inlet



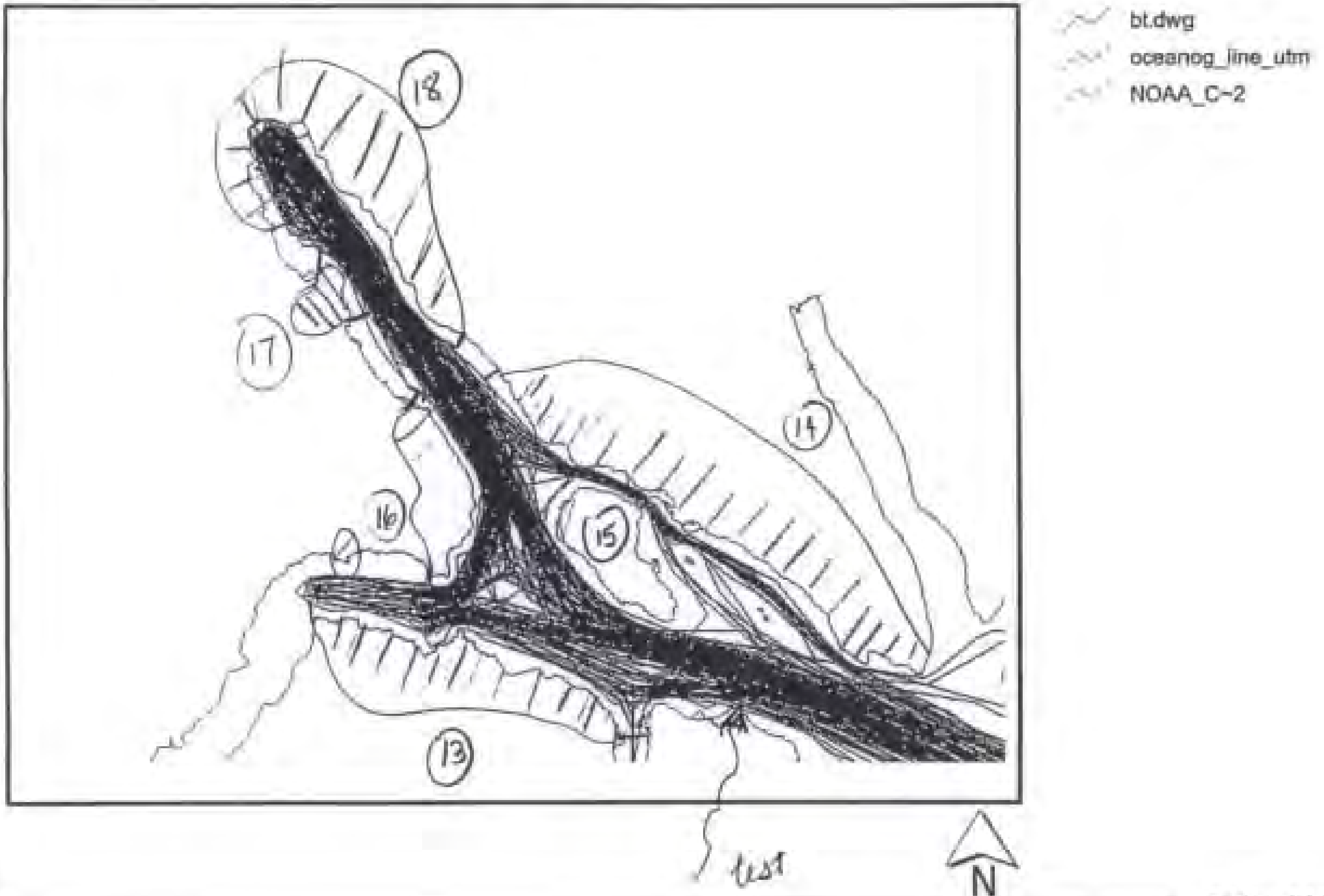
bt.dwg
oceanog_line_utm
NOAA_C~2

N

Friday, Jul 12 2002

ESRI ArcExplorer 2.0

Tarr Inlet



Friday, Jul 12 2002

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907) 561-1011 Fax (907) 563-4220

Memorandum

To: File
Project No.: 02056.02

From: Jennifer Wilson
Date: October 3, 2002

Re: *Example Calculations*

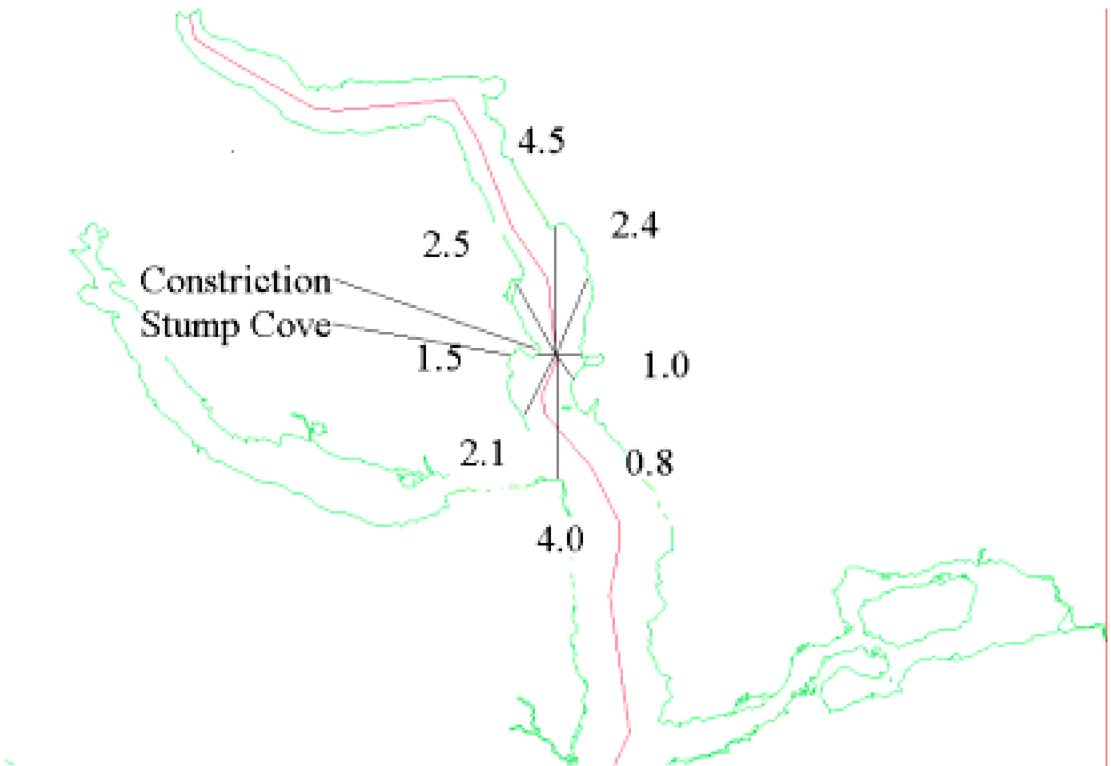
Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum

---

The attached document, *Example Calculations*, provides example calculations on vessel wake energy for Site 11 and Site 20 in Glacier Bay proper. These calculations use the 1996 vessel use-days under Alternative 1 (No Action Alternative).

Example Calculation 1. Upper Muir Inlet

Winds from 50 degrees



Site 20. Stump Cove near Muir Inlet, fetch distances in miles.

From the wind analysis, there are three categories of wind with values for direction 50 degrees, and the following probablilities of occurence in each category.

Category 1: 1 to 9.999 knots with probability of occurence of 5.6%
Category 2: 10 to 19.999 knots with probability of occurence of 0.34%
Category 3: 20 to 29.999 knots with probability of occurence of 0.0034%

$P_1 := 0.056237$

$P_2 := 0.003371$

$P_3 := 0.000034$

For the fetch shown in the drawing above, using CEDAS for restricted open water fetches, the wind direction of 50 degrees, a duration of 1 hour, the average wind velocity of 5 knots, we find that a significant wave of height 0.13 foot will be generated with a significant period of 0.8 sec.

With the average wind velocity of 15 knots, we find that a significant wave height of 0.68 feet with the significant wave period of 1.7 sec will be generated.

With the average wind velocity of 25 knots, we find that a significant wave height of 1.33 feet with the significant wave period of 2.27 sec will be generated.

The general direction of the waves are 52 degrees in both instances and the shorelines affected will be oriented perpendicular to this direction.

$H_{MO1} := 0.13 \qquad T_{P1} := 0.8s$

$H_{MO2} := 0.68 \qquad T_{P2} := 1.7s$

$H_{MO3} := 1.33 \qquad T_{P3} := 2.27s$

The expected number of waves in an hourly wind event:

$$E_1 := \frac{1}{T_{P1}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_1 = 4.5 \times 10^3\, hr^{-1}$$

$$E_2 := \frac{1}{T_{P2}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_2 = 2.118 \times 10^3\, hr^{-1}$$

$$E_3 := \frac{1}{T_{P3}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_3 = 1.586 \times 10^3\, hr^{-1}$$

Two shores most directly affected by the wind from 50 degrees are labeled as Beach A and Beach B in the figure below.

If Beach A were directly perpendicular to the direction of the waves generated by the 50 degree wind in this fetch, the energy from the 50 degree winds can be seen to be proportional to n_1 + n_2 where:

$$n_1 := H_{MO1}{}^2 \cdot P_1 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_1 \qquad n_1 = 3.746 \times 10^4\, yr^{-1}$$

$$n_2 := H_{MO2}{}^2 \cdot P_2 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_2 \qquad n_2 = 2.892 \times 10^4\, yr^{-1}$$

$$n_3 := H_{MO3}{}^2 \cdot P_3 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_3 \qquad n_3 = 835.532\, yr^{-1}$$

Where the term (P_1(24) 365 hr/yr)E_1 represents the expected value of the number of hourly wind events per year. The n_i's represent the energy from the waves generated by wind in this one direction predicted by linear wave theory.

Beach A will be affected only by winds from 50 degrees and from 340 degrees, as the following analysis shows. Furthermore, wave energies directly perpendicular to shore must be calculated.

Since Beach A is not directly perpendicular to the direction of the waves, the values n_1, n_2 and n_3 must be multiplied by the sin of the angle between the beach and the wave ray to get the component or part of the energy which is directed perpendicular to the beach. The energy directed parallel to shore is not added into the calculation. Wind wave energy parallel to shore adds to the longshore sediment transport, as does tidal energy.

The approximate azimuth of Beach A is 329 degrees. The waves generated by 50 degree winds in this particular fetch will have a propagation direction of 52 degrees. The angle between the beach face and the wave ray is thus 360-329+52 or 83 degrees.

The energy perpendicular to shore from these waves is thus found from:

$\theta := 83deg$

$$n_1 := H_{MO1}{}^2 \cdot P_1 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_1 \cdot \sin(\theta) \qquad n_1 = 3.719 \times 10^4\, yr^{-1}$$

$$n_2 := H_{MO2}{}^2 \cdot P_2 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_2 \cdot \sin((\theta)) \qquad n_2 = 2.87 \times 10^4\, yr^{-1}$$

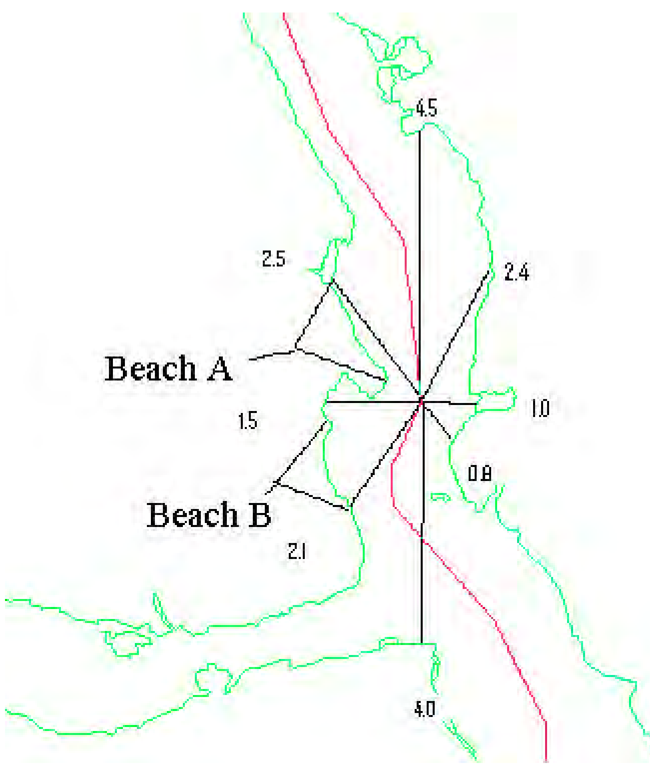
$$n_3 := H_{MO3}{}^2 \cdot P_3 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_3 \cdot \sin((\theta)) \qquad n_3 = 829.304\, yr^{-1}$$

Let the total energy per year perpendicular to Shore A due to waves from winds coming from 50 degrees be

$$E_{50} := n_1 + n_2 + n_3 \qquad E_{50} = 6.672 \times 10^4\, yr^{-1}$$

To complete the analysis, this process is repeated for the other wind directions.

Winds from 130 deg



Beaches in Site 20. Two of the Beaches Analyzed in Site 20.

Beach A, may be affected by winds from 130 degrees, with the same limited fetch. It is necessary to use ACES to determine the direction of the waves that winds from 130 degrees will produce in this fetch. In general, a fetch modifies the wave direction.

The direction of the waves according to ACES is 170 degrees. Since θ=360-329+170=201. These waves will not be incident on Beach A.

Winds from 200, 260 and 340 deg

Wind directions 200, 260 and 340 produce waves in this fetch of incident angles 185, 245 and 353, according to ACES with the fetch in Upper Muir Inlet near Stump Cove. Of these, only the last wind direction will affect Beach A and

$\theta := (353 - 329)\text{deg}$ $\qquad\qquad$ $\theta = 24\,\text{deg}$

Site 20 Beach A is sheltered by the topography and coastal features of the site from wave attack in the other directions.

From the wind analysis, there are three categories of wind with values for direction 340 degrees, and the following probablilities of occurence in each category.

Category 1: 1 to 9.999 knots with probability of occurence of 18.07% $\quad P_1 := .180695$

Category 2: 10 to 19.999 knots with probability of occurence of .9195% $\quad P_2 := .009195$

Category 3: 20 to 29.999 knots with probability of occurence of 0.009% $\quad P_3 := 0.000009$

For the fetch shown in the drawings above, using CEDAS for restricted open water fetches, the wind direction of 340 degrees, a duration of 1 hour, the average wind velocity of 5 knots, we find that a significant wave of height 0.13 foot will be generated with a significant period of 0.79 sec.

With the average wind velocity of 15 knots, we find that a significant wave height of .66 feet with the significant wave period of 1.69 sec will be generated.

With the average wind velocity of 25 knots, we find that a significant wave height of 1.49 feet with a significant wave period of 2.47 sec will be generated.

The general direction of the waves are 353 degrees. θ=24 deg

$H_{MO1} := 0.13$ $\qquad\qquad$ $T_{P1} := 0.79\text{s}$

$H_{MO2} := 0.66$ $\qquad\qquad$ $T_{P2} := 1.69\text{s}$

$H_{MO3} := 1.49$ $\qquad\qquad$ $T_{P3} := 2.47\text{s}$

The expected number of waves in an hourly wind event:

$$E_1 := \frac{1}{T_{P1}} \cdot 60\,\frac{\text{sec}}{\text{min}} \cdot 60\,\frac{\text{min}}{\text{hr}} \qquad E_1 = 4.557 \times 10^3\,\text{hr}^{-1}$$

$$E_2 := \frac{1}{T_{P2}} \cdot 60\,\frac{\text{sec}}{\text{min}} \cdot 60\,\frac{\text{min}}{\text{hr}} \qquad E_2 = 2.13 \times 10^3\,\text{hr}^{-1}$$

$$E_3 := \frac{1}{T_{P3}} \cdot 60\,\frac{\text{sec}}{\text{min}} \cdot 60\,\frac{\text{min}}{\text{hr}} \qquad E_3 = 1.457 \times 10^3\,\text{hr}^{-1}$$

$\theta := 24\text{deg}$

$$m_1 := {H_{MO1}}^2 \cdot P_1 \cdot 24 \cdot 365\,\frac{\text{hr}}{\text{yr}} \cdot E_1 \cdot \sin(\theta) \qquad m_1 = 4.958 \times 10^4\,\text{yr}^{-1}$$

$$m_2 := H_{MO2}^{\,2} \cdot P_2 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_2 \cdot \sin(\theta) \qquad m_2 = 3.04 \times 10^4 \, yr^{-1}$$

$$m_3 := H_{MO3}^{\,2} \cdot P_3 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_3 \cdot \sin(\theta) \qquad m_3 = 103.762 \, yr^{-1}$$

Let the total energy per year perpendicular to Beach A due to waves from winds coming from 340 degrees be

$$E_{340} := m_1 + m_2 + m_3$$

Calculation of N

A conversion value to convert the maximum wave height of a wave state to the moment magnitude wave height is 1.8, hence let

$H_{max} := 1$ The design vessel wave height

$$H_{MOV} := \frac{H_{max}}{1.8} \qquad H_{MOV} = 0.556$$

Define V to be the number of vessels "use days" in Glacier Bay per season.

Not every vessel entering Glacier Bay will cause a wake which is incident on Beach A in the above example. Of the 241 total vessel tracks, 2 were counted within 2000 feet of Site 20, Beach A.

$$V := \frac{2908}{yr}$$

This is the current number of "use days" for permitted vessel entries into Glacier Bay. (refered to as Alternative 1)

$$A := V \cdot \frac{2}{241} \qquad A = 24.133 \, yr^{-1}$$

once every .3 days during the 3 month season.

Using this calculation as the basis for the vessel waves which affect each site assumes that the 241 vessel tracks provided by Glacier Bay National Park represent a statistically significant sampling of all vessels which enter the Bay. In fact, we know this is not the case, since the tracks provided include only tour vessels, charter vessels and cruise ships. However the assumption is conservative, because the sampling includes the largest vessels, which are also the vessels which produce the largest wakes.

The value of N for the site would then be:

$$N := \frac{H_{MOV}^{\,2} \cdot 15 \cdot A}{E_{50} + E_{340}}$$

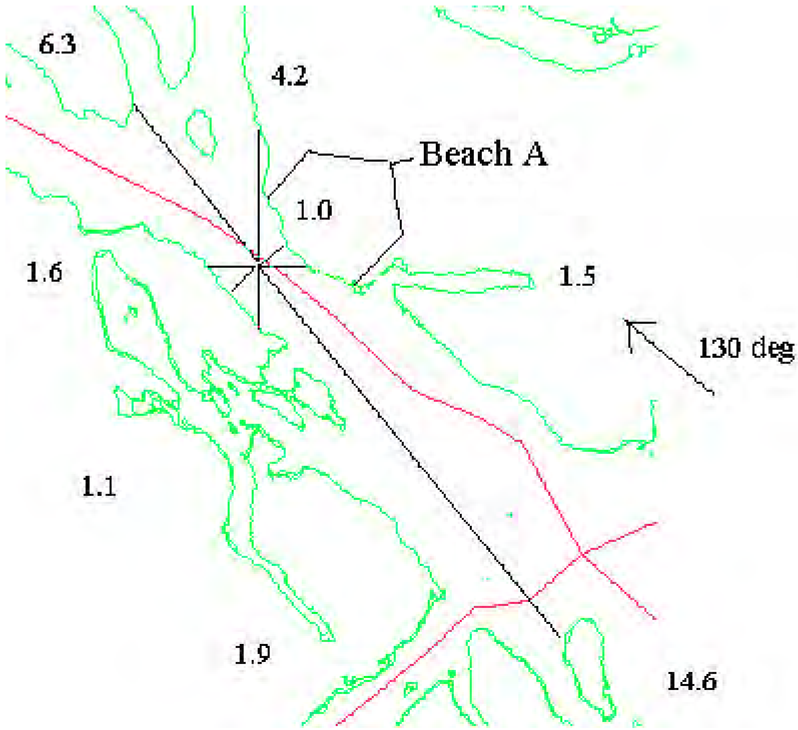
where the value of 15 represents the number of waves per vessel wake.

$$N = 7.611 \times 10^{-4}$$

This is a negligible vessel wake potential.

Example 2

Wave analysis of site 11



Site 11, Beach A, Lower West Arm near Tidal Inlet, fetch distances in miles.

Beach A will not be affected by 50 degree winds.

Beach A has a beach face oriented at azimuth angle of 309 degrees. Wave directions which will be incident on Beach A will be in the range of 129 to 309 degrees.

Using ACES with the fetch shown in the figure above, wave directions given wind directions are

130 degrees - waves at 134 degrees (include)
200 degrees - waves at 153 degrees (include)
260 degrees - waves at 299 degrees (include)
340 degrees - waves at 324 degrees (no effect)

Winds from 130 degrees

From the wind analysis, there are two categories of wind with values for direction 130 degrees, and the following probablilities of occurence in each category.

Category 1: 1 to 9.999 knots with probability of occurence of 20.8%
Category 2: 10 to 19.999 knots with probability of occurence of 4.51%
Category 3: 20 to 29.999 knots with probability of occurence of 0.28%

$P_1 := .208013$

$P_2 := 0.0454$

$P_3 := 0.002845$

For the fetch shown in the drawing above, using CEDAS for restricted open water fetches, the wind direction of 50 degrees, a duration of 1 hour, the average wind velocity of 5 knots, we find that a significant wave of height 0.15 foot will be generated with a significant period of 0.86 sec.

With the average wind velocity of 15 knots, we find that a significant wave height of 0.80 feet with the significant wave period of 1.85 sec will be generated.

With the average wind velocity of 25 knots, we find that a significant wave height of 1.83 feet with a significant wave period of 2.72 sec will be generated.

$H_{MO1} := 0.15 \qquad T_{P1} := 0.86s$

$H_{MO2} := 0.8 \qquad T_{P2} := 1.85s$

$H_{MO3} := 1.83 \qquad T_{P3} := 2.72s$

The expected number of waves in an hourly wind event:

$$E_1 := \frac{1}{T_{P1}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_1 = 4.186 \times 10^3\, hr^{-1}$$

$$E_2 := \frac{1}{T_{P2}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_2 = 1.946 \times 10^3\, hr^{-1}$$

$$E_3 := \frac{1}{T_{P3}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_3 = 1.324 \times 10^3\, hr^{-1}$$

The general direction of the waves are 134 degrees in all instances and the shoreline A is oriented at an angle of 309 degrees.

$\theta := [134 - (309 - 180)]deg \quad \theta = 5\, deg$

$\sin(\theta) = 0.087$

$$m_1 := H_{MO1}{}^2 \cdot P_1 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_1 \cdot \sin(\theta) \qquad m_1 = 1.496 \times 10^4\, yr^{-1}$$

$$m_2 := H_{MO2}{}^2 \cdot P_2 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_2 \cdot \sin(\theta) \qquad m_2 = 4.317 \times 10^4\, yr^{-1}$$

$$m_3 := H_{MO3}{}^2 \cdot P_3 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_3 \cdot \sin(\theta) \qquad m_3 = 9.628 \times 10^3\, yr^{-1}$$

$$E_{130} := m_1 + m_2 + m_3$$

Winds from 200 degrees

From the wind analysis, there are three categories of wind with values for direction 200 degrees, and the following probablilities of occurence in each category.

Category 1: 1 to 9.999 knots with probability of occurence of 11.55%
Category 2: 10 to 19.999 knots with probability of occurence of .70%
Category 3: 20 to 29.999 knots with probability of occurence of .0168%

$$P_1 := .115498$$

$$P_2 := 0.006978$$

$$P_3 := 0.000168$$

For the fetch shown in the drawing above, using CEDAS for restricted open water fetches, the wind direction of 200 degrees, a duration of 1 hour, the average wind velocity of 5 knots, we find that a significant wave of height 0.08 foot will be generated with a significant period of 0.63 sec.

With the average wind velocity of 15 knots, we find that a significant wave height of 0.41 feet with the significant wave period of 1.36 sec will be generated.

With the average wind velocity of 25 knots, we find that a significant wave height of .93 feet with a significant wave period of 1.99 sec will be generated.

$$H_{MO1} := 0.08 \qquad T_{P1} := 0.63s$$

$$H_{MO2} := 0.41 \qquad T_{P2} := 1.36s$$

$$H_{MO3} := .93 \qquad T_{P3} := 1.99s$$

The expected number of waves in an hourly wind event:

$$E_1 := \frac{1}{T_{P1}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_1 = 5.714 \times 10^3 \, hr^{-1}$$

$$E_2 := \frac{1}{T_{P2}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_2 = 2.647 \times 10^3 \, hr^{-1}$$

$$E_3 := \frac{1}{T_{P3}} \cdot 60 \frac{sec}{min} \cdot 60 \frac{min}{hr} \qquad E_3 = 1.809 \times 10^3 \, hr^{-1}$$

The general direction of the waves are 153 degrees in all instances and the since shoreline A is oriented at an angle of 309 degrees degrees.

$$\theta := [153 - (309 - 180)]deg$$

$$\theta = 24\,deg \qquad \sin(\theta) = 0.407$$

$$m_1 := H_{MO1}{}^2 \cdot P_1 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_1 \cdot \sin(\theta) \qquad m_1 = 1.505 \times 10^4 \, yr^{-1}$$

$$m_2 := H_{MO2}{}^2 \cdot P_2 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_2 \cdot \sin(\theta) \qquad m_2 = 1.106 \times 10^4 \, yr^{-1}$$

$$m_3 := H_{MO3}{}^2 \cdot P_3 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_3 \cdot \sin(\theta) \qquad m_3 = 936.574 \, yr^{-1}$$

$$E_{200} := (m_1 + m_2 + m_3)$$

$$E_{200} = 2.705 \times 10^4\,\mathrm{yr}^{-1}$$

Winds from 260 degrees

From the wind analysis, there are two categories of wind with values for direction 260 degrees, and the following probablilities of occurence in each category.

Category 1: 1 to 9.999 knots with probability of occurence of 6.05% $P_1 := 0.060527$

Category 2: 10 to 19.999 knots with probability of occurence of 1.07% $P_2 := 0.010674$

Category 3: 20 to 29.999 knots with probability of occurence of .0034% $P_3 := .000034$

For the fetch shown in the drawing above, using CEDAS for restricted open water fetches, the wind direction of 250 degrees, a duration of 1 hour, the average wind velocity of 5 knots, we find that a significant wave of height 0.09 foot will be generated with a significant period of 0.69 sec.

With the average wind velocity of 15 knots, we find that a significant wave height of 0.49 feet with the significant wave period of 1.47 sec will be generated.

With the average wind velocity of 25 knots, we find that a significant wave height of 1.11 feet with the significant wave period of 2.15 sec will be generated.

$H_{MO1} := 0.09$ $T_{P1} := 0.69\mathrm{s}$

$H_{MO2} := 0.49$ $T_{P2} := 1.47\mathrm{s}$

$H_{M03} := 1.11$ $T_{P3} := 2.15\mathrm{s}$

The expected number of waves in an hourly wind event:

$$E_1 := \frac{1}{T_{P1}} \cdot 60\,\frac{\mathrm{sec}}{\mathrm{min}} \cdot 60\,\frac{\mathrm{min}}{\mathrm{hr}} \qquad E_1 = 5.217 \times 10^3\,\mathrm{hr}^{-1}$$

$$E_2 := \frac{1}{T_{P2}} \cdot 60\,\frac{\mathrm{sec}}{\mathrm{min}} \cdot 60\,\frac{\mathrm{min}}{\mathrm{hr}} \qquad E_2 = 2.449 \times 10^3\,\mathrm{hr}^{-1}$$

$$E_3 := \frac{1}{T_{P3}} \cdot 60\,\frac{\mathrm{sec}}{\mathrm{min}} \cdot 60\,\frac{\mathrm{min}}{\mathrm{hr}} \qquad E_3 = 1.674 \times 10^3\,\mathrm{hr}^{-1}$$

The general direction of the waves are 299 degrees in both instances and the shorelines most affected will be oriented perpendicular to this direction

$$\theta := [299 - (309 - 180)]\mathrm{deg}$$

$$\theta = 170\,\mathrm{deg} \qquad \sin(\theta) = 0.174$$

$$m_1 := {H_{MO1}}^2 \cdot P_1 \cdot 24 \cdot 365\,\frac{\mathrm{hr}}{\mathrm{yr}} \cdot E_1 \cdot \sin(\theta) \qquad m_1 = 3.891 \times 10^3\,\mathrm{yr}^{-1}$$

$$m_2 := H_{MO2}^{\,2} \cdot P_2 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_2 \cdot \sin(\theta) \qquad m_2 = 9.547 \times 10^3\, yr^{-1}$$

$$m_3 := H_{MO3}^{\,2} \cdot P_3 \cdot 24 \cdot 365 \frac{hr}{yr} \cdot E_3 \cdot \sin(\theta) \qquad m_3 = 74.9\, yr^{-1}$$

$$E_{260} := m_1 + m_2 + m_3 \qquad E_{260} = 1.351 \times 10^4\, yr^{-1}$$

Calculation of N

A conversion value to convert the max wave height of a wave state to the moment magnitude wave height is 1.8, hence let

$H_{max} := 1$ The design vessel wave height

$$H_{MOV} := \frac{H_{max}}{1.8} \qquad H_{MOV} = 0.556$$

Define V to be the number of vessels "use days" in Glacier Bay per season.

Not every vessel entering Glacier Bay will cause a wake which is incident on Beach A in the above example. Of the 241 total vessel tracks, 36 were counted within 2000 feet of Site 11, Beach A.

$V := \frac{2908}{yr}$ This is the current number of "use days" for permitted vessel entries into Glacier Bay. (refered to as Alternative 1)

$$A := V \cdot \frac{36}{241} \qquad A = 434.39\, yr^{-1} \qquad 15 \cdot A = 6.516 \times 10^3\, yr^{-1}$$

or once every 5 days during the 3 month season.

Using this calculation as the basis for the vessel waves which affect each site assumes that the 241 vessel tracks provided by Glacier Bay National Park represent a statistically significant sampling of all vessels which enter the Bay. In fact, we know this is not the case, since the tracks provided include only tour vessels, charter vessels and cruise ships.

The value of N for the site would then be:

$$N := \frac{H_{MOV}^{\,2} \cdot 15 \cdot A}{E_{130} + E_{200} + E_{260}}$$

where the value of 15 represents the number of waves per vessel wake.

$$N = 0.019$$

This is a moderate level of significance for vessel wake potential.

Peratrovich, Nottingham & Drage, Inc.
Engineering Consultants
1506 West 36th Avenue Anchorage, Alaska 99503 (907) 561-1011 Fax (907) 563-4220

Memorandum

To: File Project No.: 02056.02

From: Jennifer Wilson Date: October 3, 2002

Re: *CoastWalkers Polygon Table*

Project: Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement, Appendix F Technical Memorandum

The attached document, *CoastWalkers Polygon Table*, provides a detailed list of the polygons that make up each site as provided in this database. The purpose of this list is to provide an exact location of the beaches studied for the EIS.

CoastWalkers Polygon Table
Listed by Site

Site	CoastWalker Polygons
1	H008
	H009
	H010
	H011
	H012
	H013
	H014
	H015
	H016
	H017
	H018
	H019
	H048
	H049
	H050
	H051
	H052
	H053
	H054
	H055
	H056
2	H096
	H097
	H098
	H099
	H100
3	N120
	Y003
	Y004
	Y005
	Y006
	Y007
	Y008
	Y009
	Y010
	Y011
	Y012
	Y013
	Y014
	Y015
	Y016
	Y017
	Y018
	Y019
	Y020
	Y021

Site	CoastWalker Polygons
	Y022
	Y023
	Y024
	Y025
	Y026
	Y027
	Y028
4	N083
	N084
	N085
	N086
	N087
	N088
	N018
	N019
	N020
	N021
	N022
	N023
	N024
	N025
	N002
	N003
	N004
	N005
	N006
	N007
	N008
5	W001
	W002
	W003
	W004
	W005
	W006
	W007
	W015
	W016
	S083
	S084
	W019
	W020
	W021
	W022
	W023
	W034
	W035

Site	CoastWalker Polygons
	W036
	WO41
	WO42
	WO43
	WO44
	W055
	W056
6	II044
	II045
	II046
	II047
	II048
	II049
	II050
	II051
	II052
	II038
	HH054
	HH055
	HH056
	HH057
	HH058
	HH059
	HH060
	HH061
	HH062
	HH063
	HH049
	HH050
	HH051
	HH052
7	D013
	D014
	D015
	D016
	D017
	D018
	D019
	D020
	D021
	D022
	D023
	D024
	D025
	D026
	D027

CoastWalkers Polygon Table
Listed by Site

Site	CoastWalker Polygons
	D028
	D029
	D030
	D031
	D032
	D033
	D034
	D038
	D039
	D040
	D041
	D042
	D043
	D044
	D045
	D046
	D047
	D048
	D049
	D050
	D051
8	X013
	X014
	X015
	X016
	X017
	X018
	X019
	X020
	X021
	X022
	X023
	X070
	X071
	X072
	X073
	X074
	X075
	X076
	X077
	X078
	X079
	X080
	X081
	X082
	X083

Site	CoastWalker Polygons
	X084
	X085
	X086
	X087
	X088
	X089
	X090
	X091
	X092
	X093
	Z094
	Z095
	Z096
	Z097
	Z098
	Z099
	Z100
	Z101
	Z102
	Z103
	Z104
	Z105
	Z106
	Z107
	Z108
	Z109
	Z110
	Z111
	Z112
	Z113
	Z114
	Z115
	Z116
	Z117
	Z118
	Z119
	Z120
	Z121
	Z122
	Z123
	Z124
	Z125
	Z126
	Z127
	Z128
	Z129

Site	CoastWalker Polygons
	Z130
	Z131
	Z132
	Z133
9	X008
	X009
	X010
	X011
	X012
	X032
	X033
	X034
	X035
	X036
	X037
	X038
	X039
	X040
	X041
	X053
	X054
	X055
	X056
	X057
	X058
	X059
	X060
	X061
10	V038
	V039
	V040
	V041
	V093
	V094
	V095
	V096
	V097
	V098
	V099
	V100
	V101
	V102
	V103
	V104
	V105
11	FF004

CoastWalkers Polygon Table
Listed by Site

Site	CoastWalker Polygons
	FF005
	FF006
	FF007
	FF008
	FF009
	FF053
	FF054
	FF055
	FF056
	FF057
	FF058
	FF059
	FF060
	FF061
	FF062
	FF063
	FF064
	FF065
	FF066
	FF067
	GG001
	GG002
	GG003
	GG004
	GG005
	GG006
	GG007
	GG008
	GG009
	GG010
	GG011
	GG012
	GG013
	GG014
	GG015
	GG016
	GG017
	GG018
	GG019
	GG020
	GG021
	GG022
	GG023
	GG024
	GG025
	GG026

Site	CoastWalker Polygons
	HH001
	HH002
	HH003
	HH004
	HH005
	HH006
	HH007
	HH008
	HH009
	HH010
	HH011
	HH012
	HH013
	HH014
	HH015
	HH016
	HH017
	HH018
	HH019
	HH020
	HH021
	HH022
	HH023
	HH024
	HH025
	HH026
	HH027
12	AA001
	AA002
	AA003
	AA004
	AA005
	AA006
	AA007
	AA008
	AA009
	AA010
	AA011
	AA012
	AA013
	AA014
	AA015
	AA016
	AA017
	AA018
	AA019

Site	CoastWalker Polygons
	AA020
	AA021
	AA022
	AA023
	AA024
	AA025
	AA026
	AA027
	AA028
	AA029
	AA030
	AA031
	AA032
	AA033
	AA034
	AA035
	AA036
	AA037
	AA038
	AA039
	AA040
	AA041
	AA042
	DD001
	DD002
	DD003
	DD004
	DD005
	DD006
	DD007
	V011
13	AA083
	AA084
	AA085
	AA086
	AA087
	AA088
	AA089
	AA090
	AA091
	AA092
	AA093
	AA094
	AA095
	AA096
	AA097

CoastWalkers Polygon Table
Listed by Site

Site	CoastWalker Polygons
	AA098
	AA099
	AA100
	AA101
	AA102
	AA103
	AA104
	AA109
	AA110
	CC146
14	CC078
	CC079
	CC080
	CC081
	CC082
	CC083
	CC084
	CC085
	CC086
	CC087
	CC088
	CC089
	CC090
	CC091
	CC092
	CC093
	CC094
	CC095
	CC073
	DD073
	DD074
	DD075
	DD076
	DD077
	DD078
	DD079
	DD080
15	CC117
	CC118
	CC119
	CC120
	CC121
	CC122
	CC123
	CC124
	CC125

Site	CoastWalker Polygons
	CC126
	CC127
	CC128
	CC129
	CC130
16	AA149
	AA150
	AA151
	AA152
	AA153
	AA154
	AA155
	AA160
	AA161
	AA162
	AA163
	BB068
	BB069
	BB070
	BB071
	BB072
	BB073
17	BB082
	BB083
	BB084
	BB085
	BB086
18	BB091
	BB092
	BB093
	BB094
	BB095
	BB096
	BB097
	BB098
	BB099
	BB100
	BB103
	BB104
	BB105
	BB106
	BB107
	BB108
	BB109
	BB110
	BB111

Site	CoastWalker Polygons
	BB112
	BB113
	BB114
	BB115
	BB116
	BB117
	BB118
	BB119
	BB120
	BB121
	BB122
	BB123
	BB124
	BB125
	BB126
	BB127
	BB128
	BB129
	BB130
	BB131
	BB132
	BB133
	BB134
	BB135
	BB136
	BB137
	BB138
	BB139
	BB140
	BB141
	BB142
	BB143
	BB144
	BB145
	BB146
	BB147
	BB148
19	NO POLYGONS - Upper Muir Inlet north of McConnel Ridge
20	NN073
	NN074
	OO67

CoastWalkers Polygon Table
Listed by Site

Site	CoastWalker Polygons
	OO68
	OO69
	OO70
	OO71
	OO72
	OO73
	OO74
	OO75
	OO76
	OO77
	OO78
	OO79
	OO80
	OO83
	OO84
	OO085
	OO086
	OO087
	OO088
	OO089
	OO090
	OO091
	OO092
	OO093
	OO094
	OO095
21	NO POLYGONS - Upper end of Muir Inlet
22	NO POLYGONS - South Marble Island

APPENDIX H

Coastal Geomorphology Effects Tables

TABLE 1: ALTERNATIVE 1 – POTENTIAL EFFECTS ON THE PHYSICAL COASTLINE AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE

Site	Substrate[a]	Erodability	Vessel Wake Potential Index[b]	Erosion Potential
1	Course Sand and Granule	Moderate	Minor	Minor
2	Pebble	Minor	Minor	Minor
3	Cobble	Minor	Negligible	Negligible
4	Cobbles with boulders	Minor	Minor	Minor
5	Pebble	Minor	Minor	Minor
6	Pebble with cobble	Minor	Negligible	Negligible
7	Boulder with cobble	Minor	Minor	Minor
8	Cobble	Minor	Minor	Minor
9	Granular with pebbles	Moderate to minor	Minor	Minor
10	Boulder with cobbles	Minor	Negligible	Negligible
11	Cobble	Minor	Minor	Minor
12	Cobble	Minor	Moderate	Minor
13	Cobble	Minor	Minor	Minor
14	Granular with pebbles and cobbles	Moderate to minor	Minor	Minor
15	Cobbles	Minor	Moderate	Minor
16	Boulder	Minor	High	Minor
17	Boulder	Minor	Moderate	Minor
18	Pebble	Moderate to minor	Moderate	Moderate
19[c]	Boulder	Minor	Minor	Negligible
20	Granular	Moderate	Negligible	Negligible
21[c]	Boulder	Minor	Minor	Negligible
22[c]	Bedrock	Negligible	Moderate	Negligible

Notes:

[a] Synthesized from NPS Coast Walkers database.

[b] Based on the 1996 vessel use-days. Reflects potential vessel wake affect from May through September.

c The physical attribute information is not available for Sites 19, 21, and 22 so an overall potential affect cannot be assigned.

TABLE 1B: NO ACTION ALTERNATIVE VESSEL WAKE POTENTIAL BREAKDOWN. NO ACTION ALTERNATIVE

Site	Vessel Wake Potential Affect[1] June-August	May & September[2]	Combined
1	Negligible	Negligible	Minor
2	Minor	Minor	Minor
3	Negligible	Negligible	Negligible
4	Minor	Minor	Minor
5	Minor	Minor	Minor
6	Negligible	Negligible	Negligible
7	Negligible	Minor	Minor
8	Negligible	Negligible	Minor
9	Minor	Minor	Minor
10	Negligible	Negligible	Negligible
11	Minor	Minor	Minor
12	Minor	Minor	Moderate
13	Negligible	Minor	Minor
14	Minor	Minor	Minor
15	Minor	Minor	Moderate
16	Moderate	Moderate	High
17	Minor	Minor	Moderate
18	Minor	Minor	Moderate
19	Negligible	Negligible	Minor
20	Negligible	Negligible	Negligible
21	Negligible	Negligible	Minor
22	Minor	Moderate	Moderate

[1] Based on the 1996 vessel use-days.
[2] Assumes the maximum allowable vessel traffic is realized, which is a grossly conservative assumption.

TABLE 2: ALTERNATIVE 2 – POTENTIAL EFFECTS ON THE PHYSICAL COASTLINE AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE

Site	Substrate[a]	Erodability	Vessel Wake Potential Index[b]	Erosion Potential
1	Course Sand and Granule	Moderate	Minor	Minor
2	Pebble	Minor	Minor	Minor
3	Cobble	Minor	Negligible	Negligible
4	Cobbles with boulders	Minor	Minor	Minor
5	Pebble	Minor	Minor	Minor
6	Pebble with cobble	Minor	Negligible	Negligible
7	Boulder with cobble	Minor	Minor	Minor
8	Cobble	Minor	Minor	Minor
9	Granular with pebbles	Moderate to minor	Minor	Minor
10	Boulder with cobbles	Minor	Negligible	Negligible
11	Cobble	Minor	Minor	Minor
12	Cobble	Minor	Minor	Minor
13	Cobble	Minor	Minor	Minor
14	Granular with pebbles and cobbles	Moderate to minor	Minor	Minor
15	Cobbles	Minor	Moderate	Minor
16	Boulder	Minor	High	Minor
17	Boulder	Minor	Moderate	Minor
18	Pebble	Moderate to minor	Moderate	Moderate
19[c]	Boulder	Minor	Minor	Negligible
20	Granular	Moderate	Negligible	Negligible
21[c]	Boulder	Minor	Minor	Negligible
22[c]	Bedrock	Negligible	Moderate	Negligible

Notes:

a Synthesized from NPS Coast Walkers database.

b Based on 1995 vessel use-days and current regulations. Reflects potential vessel wake affect from May through September.

c The physical attribute information is not available for Sites 19, 21, and 22 so an overall potential affect cannot be assigned.

TABLE 2B: ALTERNATIVE 2 VESSEL WAKE POTENTIAL BREAKDOWN

Site	Vessel Wake Potential Affect[3]		Combined
	June-August	May & September[4]	
1	Negligible	Negligible	Minor
2	Minor	Minor	Minor
3	Negligible	Negligible	Negligible
4	Minor	Minor	Minor
5	Minor	Minor	Minor
6	Negligible	Negligible	Negligible
7	Negligible	Minor	Minor
8	Negligible	Negligible	Minor
9	Minor	Minor	Minor
10	Negligible	Negligible	Negligible
11	Minor	Minor	Minor
12	Minor	Minor	Minor
13	Negligible	Minor	Minor
14	Minor	Minor	Minor
15	Minor	Minor	Moderate
16	Moderate	Moderate	High
17	Minor	Minor	Moderate
18	Minor	Minor	Moderate
19	Negligible	Negligible	Minor
20	Negligible	Negligible	Negligible
21	Negligible	Negligible	Minor
22	Minor	Moderate	Moderate

[3] Based on the 1995 vessel use-days and current regulations.
[4] Assumes the maximum allowable vessel traffic is realized, which is a grossly conservative assumption.

TABLE 3: ALTERNATIVE 3 – POTENTIAL EFFECTS ON THE PHYSICAL COASTLINE AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE

Site	Substrate[a]	Erodability	Vessel Wake Potential Index[b]	Erosion Potential
1	Course Sand and Granule	Moderate	Minor	Minor
2	Pebble	Minor	Minor	Minor
3	Cobble	Minor	Negligible	Negligible
4	Cobbles with boulders	Minor	Minor	Minor
5	Pebble	Minor	Minor	Minor
6	Pebble with cobble	Minor	Negligible	Negligible
7	Boulder with cobble	Minor	Minor	Minor
8	Cobble	Minor	Minor	Minor
9	Granular with pebbles	Moderate to minor	Minor	Minor
10	Boulder with cobbles	Minor	Negligible	Negligible
11	Cobble	Minor	Minor	Minor
12	Cobble	Minor	Moderate	Minor
13	Cobble	Minor	Minor	Minor
14	Granular with pebbles and cobbles	Moderate to minor	Minor	Minor
15	Cobbles	Minor	Moderate	Minor
16	Boulder	Minor	High	Minor
17	Boulder	Minor	Moderate	Minor
18	Pebble	Moderate to minor	Moderate	Moderate
19[c]	Boulder	Minor	Minor	Negligible
20	Granular	Moderate	Negligible	Negligible
21[c]	Boulder	Minor	Minor	Negligible
22[c]	Bedrock	Negligible	Moderate	Negligible

Notes:

a Synthesized from NPS Coast Walkers database.

b Based on the maximum allowable vessel use-days in the 1996 Finding of No Significant Impact. Reflects potential vessel wake affect from May through September.

c The physical attribute information is not available for Sites 19, 21, and 22 so an overall potential affect cannot be assigned.

TABLE 3B: ALTERNATIVE 3 VESSEL WAKE POTENTIAL BREAKDOWN			
Site	Vessel Wake Potential Affect[5]		Combined
	June-August	May & September[6]	
1	Negligible	Negligible	Minor
2	Minor	Minor	Minor
3	Negligible	Negligible	Negligible
4	Minor	Minor	Minor
5	Minor	Minor	Minor
6	Negligible	Negligible	Negligible
7	Negligible	Minor	Minor
8	Negligible	Negligible	Minor
9	Minor	Minor	Minor
10	Negligible	Negligible	Negligible
11	Minor	Minor	Minor
12	Minor	Minor	Moderate
13	Negligible	Minor	Minor
14	Minor	Minor	Minor
15	Minor	Minor	Moderate
16	Moderate	Moderate	High
17	Minor	Minor	Moderate
18	Minor	Minor	Moderate
19	Negligible	Negligible	Minor
20	Negligible	Negligible	Negligible
21	Negligible	Negligible	Minor
22	Moderate	Minor	Moderate

[5] Based on the maximum allowable vessel use-days in the 1996 FONSI.
[6] Assumes the maximum allowable vessel traffic is realized, which is a grossly conservative assumption.

TABLE 4: ALTERNATIVE 4 – POTENTIAL EFFECTS ON THE PHYSICAL COASTLINE AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE

Site	Substrate[a]	Erodability	Vessel Wake Potential Index[b]	Erosion Potential
1	Course Sand and Granule	Moderate	Negligible	Negligible
2	Pebble	Minor	Minor	Minor
3	Cobble	Minor	Negligible	Negligible
4	Cobbles with boulders	Minor	Minor	Minor
5	Pebble	Minor	Minor	Minor
6	Pebble with cobble	Minor	Negligible	Negligible
7	Boulder with cobble	Minor	Minor	Minor
8	Cobble	Minor	Negligible	Negligible
9	Granular with pebbles	Moderate to minor	Minor	Minor
10	Boulder with cobbles	Minor	Negligible	Negligible
11	Cobble	Minor	Minor	Minor
12	Cobble	Minor	Minor	Minor
13	Cobble	Minor	Minor	Minor
14	Granular with pebbles and cobbles	Moderate to minor	Minor	Minor
15	Cobbles	Minor	Minor	Minor
16	Boulder	Minor	Moderate	Minor
17	Boulder	Minor	Minor	Minor
18	Pebble	Moderate to minor	Minor	Minor
19a	Boulder	Minor	Negligible	Negligible
20	Granular	Moderate	Negligible	Negligible
21a	Boulder	Minor	Negligible	Negligible
22a	Bedrock	Negligible	Moderate	Negligible

Notes:

a Synthesized from NPS CoastWalkers database.

b Based on the pre-1985 entry levels with an extended vessel entry period. Reflects potential vessel wake affect from May through September.

c The physical attribute information is not available for Sites 19, 21, and 22 so an overall potential affect cannot be assigned.

TABLE 4B: ALTERNATIVE 4 VESSEL WAKE POTENTIAL BREAKDOWN			
Site	**Vessel Wake Potential Affect**[7]		**Combined**
	June-August	**May & September**[8]	
1	Negligible	Negligible	Negligible
2	Minor	Negligible	Minor
3	Negligible	Negligible	Negligible
4	Minor	Minor	Minor
5	Minor	Minor	Minor
6	Negligible	Negligible	Negligible
7	Negligible	Negligible	Minor
8	Negligible	Negligible	Negligible
9	Minor	Minor	Minor
10	Negligible	Negligible	Negligible
11	Minor	Minor	Minor
12	Minor	Minor	Minor
13	Negligible	Negligible	Minor
14	Minor	Minor	Minor
15	Minor	Minor	Minor
16	Moderate	Moderate	Moderate
17	Minor	Minor	Minor
18	Minor	Minor	Minor
19	Negligible	Negligible	Negligible
20	Negligible	Negligible	Negligible
21	Negligible	Negligible	Negligible
22	Minor	Minor	Moderate

[7] Based on the pre-1985 entry levels with an extended vessel entry period.
[8] Assumes the maximum allowable vessel traffic is realized, which is a grossly conservative assumption.

TABLE 5: ALTERNATIVE 5 – POTENTIAL EFFECTS ON THE PHYSICAL COASTLINE AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE

Site	Substrate[a]	Erodability	Vessel Wake Potential Index[b]	Erosion Potential
1	Course Sand and Granule	Moderate	Minor	Minor
2	Pebble	Minor	Minor	Minor
3	Cobble	Minor	Negligible	Negligible
4	Cobbles with boulders	Minor	Minor	Minor
5	Pebble	Minor	Minor	Minor
6	Pebble with cobble	Minor	Negligible	Negligible
7	Boulder with cobble	Minor	Minor	Minor
8	Cobble	Minor	Minor	Minor
9	Granular with pebbles	Moderate to minor	Minor	Minor
10	Boulder with cobbles	Minor	Negligible	Negligible
11	Cobble	Minor	Minor	Minor
12	Cobble	Minor	Moderate	Minor
13	Cobble	Minor	Minor	Minor
14	Granular with pebbles and cobbles	Moderate to minor	Minor	Minor
15	Cobbles	Minor	Moderate	Minor
16	Boulder	Minor	High	Minor
17	Boulder	Minor	Moderate	Minor
18	Pebble	Moderate to minor	Moderate	Moderate
19[c]	Boulder	Minor	Minor	Negligible
20	Granular	Moderate	Negligible	Negligible
21[c]	Boulder	Minor	Minor	Negligible
22[c]	Bedrock	Negligible	Moderate	Negligible

Notes:

a Synthesized from NPS Coast Walkers database.

b Based on current entry levels, uses the current operating regulations, and includes an extended operating period. Reflects potential vessel wake affect from May through September.

c The physical attribute information is not available for Sites 19, 21, and 22 so an overall potential affect cannot be assigned.

TABLE 5B ALTERNATIVE 5 VESSEL WAKE POTENTIAL BREAKDOWN			
Site	**Vessel Wake Potential Affect**[9]		**Combined**
	June-August	**May & September**[10]	
1	Negligible	Negligible	Minor
2	Minor	Minor	Minor
3	Negligible	Negligible	Negligible
4	Minor	Minor	Minor
5	Minor	Minor	Minor
6	Negligible	Negligible	Negligible
7	Minor	Minor	Minor
8	Negligible	Negligible	Minor
9	Minor	Minor	Minor
10	Negligible	Negligible	Negligible
11	Minor	Minor	Minor
12	Minor	Minor	Moderate
13	Negligible	Minor	Minor
14	Minor	Minor	Minor
15	Minor	Minor	Moderate
16	Moderate	Moderate	High
17	Minor	Minor	Moderate
18	Minor	Minor	Moderate
19	Negligible	Negligible	Minor
20	Negligible	Negligible	Negligible
21	Negligible	Negligible	Minor
22	Minor	Minor	Moderate

[9] Based on current entry levels, uses the current operating regulations, and includes an extended operating period.
[10] Assumes the maximum allowable vessel traffic is realized, which is a grossly conservative assumption.

TABLE 6: ALTERNATIVE 6 – POTENTIAL EFFECTS ON THE PHYSICAL COASTLINE AT 22 SITES IN GLACIER BAY NATIONAL PARK AND PRESERVE

Site	Substrate[a]	Erodability	Vessel Wake Potential Index[b]	Erosion Potential
1	Course Sand and Granule	Moderate	Minor	Minor
2	Pebble	Minor	Minor	Minor
3	Cobble	Minor	Negligible	Negligible
4	Cobbles with boulders	Minor	Minor	Minor
5	Pebble	Minor	Minor	Minor
6	Pebble with cobble	Minor	Negligible	Negligible
7	Boulder with cobble	Minor	Minor	Minor
8	Cobble	Minor	Minor	Minor
9	Granular with pebbles	Moderate to minor	Minor	Minor
10	Boulder with cobbles	Minor	Negligible	Negligible
11	Cobble	Minor	Minor	Minor
12	Cobble	Minor	Moderate	Minor
13	Cobble	Minor	Minor	Minor
14	Granular with pebbles and cobbles	Moderate to minor	Minor	Minor
15	Cobbles	Minor	Moderate	Minor
16	Boulder	Minor	High	Minor
17	Boulder	Minor	Moderate	Minor
18	Pebble	Moderate to minor	Moderate	Moderate
19[c]	Boulder	Minor	Minor	Negligible
20	Granular	Moderate	Negligible	Negligible
21[c]	Boulder	Minor	Minor	Negligible
22[c]	Bedrock	Negligible	Moderate	Negligible

Notes:

a Synthesized from NPS Coast Walkers database.

b Based on current entry levels, uses the current operating regulations, and includes an extended operating period. Reflects potential vessel wake affect from May through September.

c The physical attribute information is not available for Sites 19, 21, and 22 so an overall potential affect cannot be assigned.

TABLE 6B ALTERNATIVE 6 VESSEL WAKE POTENTIAL BREAKDOWN			
Site	**Vessel Wake Potential Affect[9]**		**Combined**
	June-August	**May & September[10]**	
1	Negligible	Negligible	Minor
2	Minor	Minor	Minor
3	Negligible	Negligible	Negligible
4	Minor	Minor	Minor
5	Minor	Minor	Minor
6	Negligible	Negligible	Negligible
7	Minor	Minor	Minor
8	Negligible	Negligible	Minor
9	Minor	Minor	Minor
10	Negligible	Negligible	Negligible
11	Minor	Minor	Minor
12	Minor	Minor	Moderate
13	Negligible	Minor	Minor
14	Minor	Minor	Minor
15	Minor	Minor	Moderate
16	Moderate	Moderate	High
17	Minor	Minor	Moderate
18	Minor	Minor	Moderate
19	Negligible	Negligible	Minor
20	Negligible	Negligible	Negligible
21	Negligible	Negligible	Minor
22	Minor	Minor	Moderate

[9] Based on current entry levels, uses the current operating regulations, and includes an extended operating period.
[10] Assumes the maximum allowable vessel traffic is realized, which is a grossly conservative assumption.

APPENDIX I

43 Code of Federal Regulations 36.11
Transportation and Utility Systems In and Across, and Access Into, Conservation System Units in Alaska—Special Access

[Code of Federal Regulations]
[Title 43, Volume 1, Parts 1 to 999]
[Revised as of October 1, 1999]
From the U.S. Government Printing Office via GPO Access
[**CITE**: **43CFR36**.**11**]

[Page 513-515]

TITLE 43--PUBLIC LANDS: INTERIOR

PART 36--TRANSPORTATION AND UTILITY SYSTEMS IN AND ACROSS, AND ACCESS INTO, CONSERVATION SYSTEM UNITS IN ALASKA--Table of Contents

Sec. 36.**11** Special access.

(a) This section implements the provisions of section 1110(a) of ANILCA regarding use of snowmachines, motorboats, nonmotorized surface transportation, aircraft, as well as off-road vehicle use.

As used in this section, the term:

(1) Area also includes public lands administered by the BLM and designated as wilderness study areas.

(2) Adequate snow cover shall mean snow of sufficient depth, generally 6-12 inches or more, or a combination of snow and frost depth sufficient to protect the underlying vegetation and soil.

(b) Nothing in this section affects the use of snowmobiles, motorboats and nonmotorized means of surface transportation traditionally used by rural residents engaged in subsistence activities, as defined in Tile VIII of ANILCA.

(c) The use of snowmachines (during periods of adquate snow cover and frozen river conditions) for traditional activities (where such activities are permitted by ANILCA or other law) and for travel to and from villages and homesites and other valid occupancies is permitted within the areas, except where such use is prohibited or otherwise restricted by the appropriate Federal agency in accordance with the procedures of paragraph (h) of this section.

(d) Motorboats may be operated on all area waters, except where such use is prohibited or otherwise restricted by the appropriate Federal agency in accordance with the procedures of paragraph (h) of this section.

(e) The use of nonmotorized surface transportation such as domestic dogs, horses and other pack or saddle animals is permitted in areas except

where such use is prohibited or otherwise restricted by the appropriate Federal agency in accordance with the procedures of paragraph (h) of this section.

(f) Aircraft. (1) Fixed-wing aircraft may be landed and operated on lands and waters within areas, except where such use is prohibited or otherwise restricted by the appropriate Federal agency, including closures or restrictions pursuant to the closures of paragraph (h) of this section. The use of aircraft for access to or from lands and waters within a national park or monument for purposes of taking fish and wildlife for subsistence uses therein is prohibited, except as provided in 36 CFR 13.45. The operation of aircraft resulting in the harassment of wildlife is prohibited.

(2) In imposing any prohibitions or restrictions on fixed-wing aircraft use the appropriate Federal agency shall:

(i) Publish notice of prohibition or restrictions in ``Notices to Airmen'' issued by the Department of Transportation; and

(ii) Publish permanent prohibitions or restrictions as a regulatory notice in the United States Flight Information Service ``Supplement Alaska.''

(3) Except as provided in paragraph (f)(3)(i) of this section, the owners of any aircraft downed after December 2, 1980, shall remove the aircraft and all component parts thereof in accordance with procedures established by the appropriate Federal agency. In establishing a removal procedure, the appropriate Federal agency is authorized to establish a

reasonable date by which aircraft removal operations must be complete and determine times and means of access to and from the downed aircraft.

(i) The appropriate Federal agency may waive the requirements of this paragraph upon a determination that the removal of downed aircraft would constitute an unacceptable risk to human life, or the removal of a downed aircraft would result in extensive resource damage, or the removal of a downed aircraft is otherwise impracticable or impossible.

(ii) Salvaging, removing, possessing or attempting to salvage, remove or possess any downed aircraft or component parts thereof is prohibited, except in accordance with a removal procedure established under this paragraph and as may be controlled by the other laws and regulations.

(4) The use of a helicopter in any area other than at designated landing areas pursuant to the terms and conditions of a permit issued by the appropriate Federal agency, or pursuant to a memorandum of understanding between the appropriate Federal agency and another party, or involved in emergency or search and rescue operations is prohibited.

(g) Off-road vehicles. (1) The use of off-road vehicles (ORV) in locations other than established roads and parking areas is prohibited, except on routes or in areas designated by the appropriate Federal agency in accordance with Executive Order 11644, as amended or pursuant to a valid permit as prescribed in paragraph (g)(2) of this section or in Sec. 36.10 or Sec. 36.12.

(2) The appropriate Federal agency is authorized to issue permits for the use of ORVs on existing ORV trails located in areas (other than in areas designated as part of the National Wilderness Preservation System) upon a finding that such ORV use would be compatible with the purposes and values for which the area was established. The appropriate Federal agency shall include in any permit such stipulations and conditions as are necessary for the protection of those purposes and values.

(h) Closure procedures. (1) The appropriate Federal agency may close an area on a temporary or permanent basis to use of aircraft, snowmachines, motorboats or nonmotorized surface transportation only upon a finding by the agency that such use would be detrimental to the resource values of the area.

(2) Temporary closures. (i) Temporary closures shall not be effective prior to notice and hearing in the vicinity of the area(s) directly affected by such closures and other locations as appropriate.

(ii) A temporary closure shall not exceed 12 months.

(3) Permanent closures shall be published by rulemaking in the Federal Register with a minimum public comment period of 60 days and shall not be

effective until after a public hearing(s) is held in the affected vicinity and other locations as deemed appropriate by the appropriate Federal agency.

(4) Temporary and permanent closures shall be: (i) Published at least once in a newspaper of general circulation in Alaska and in a local newspaper, if available; posted at community post offices within the vicinity affected; made available for broadcast on local radio stations in a manner reasonably calculated to inform residents in the affected vicinity; and designated on a map which shall be available for public inspection at the office of the appropriate Federal agency and other places convenient to the public; or

(ii) Designated by posting the area with appropriate signs; or

(iii) Both.

(5) In determining whether to open an area that has previously been closed pursuant to the provisions of this section, the appropriate Federal agency shall provide notice in the Federal Register and shall, upon request, hold a hearing in the affected vicinity and other locations as appropriate prior to making a final determination.

(6) Nothing in this section shall limit the authority of the appropriate Federal agency to restrict or limit uses of an area under other statutory authority.

(i) Except as otherwise specifically permitted under the provisions of this section, entry into closed areas or failure to abide by restrictions established under this section is prohibited.

(j) Any person convicted of violating any provision of the regulations contained in this section, or as the same may be amended or supplemented, may be punished by a fine or by imprisonment in accordance with the penalty provisions applicable to the area.

[51 FR 31629, Sept. 4, 1986; 51 FR 36011, Oct. 8, 1986]

APPENDIX J

Consultation Correspondence

United States Department of the Interior

NATIONAL PARK SERVICE
Glacier Bay National Park and Preserve
P.O. Box 140
Gustavus, Alaska 99826-0140

Tel: 907-697-2230
Fax: 907-697-2654

IN REPLY REFER TO:
N1621

March 17, 2003

Michael Payne
Assistant Regional Administrator for Protected Resources
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99801-1668

Dear Mr. Payne:

The National Park Service (NPS) has completed a draft environmental impact statement (EIS) on Vessel Quotas and Operating Requirements for Glacier Bay National Park and Preserve (enclosed). This draft EIS is out for public review through May 14. With this letter, we formally request consultation for threatened and endangered species, in compliance with Section 7 of the Endangered Species Act. As we agreed in a letter dated February 26, 2003, in which you concurred on March 6, the draft EIS is serving as the biological assessment for Section 7 consultation.

The National Park Service (NPS) proposes to establish new or keep existing quotas and operating requirements for four types of motorized watercraft – cruise ships and tour, charter, and private vessels – in Glacier Bay proper and Dundas Bay in Glacier Bay National Park and Preserve. The purpose of the actions considered in the draft EIS is to address the continuing demand for vessel access into Glacier Bay National Park and Preserve in a manner that assures continuing protection of park resources and values while providing for a range of high-quality recreational opportunities for visitors. The need for action stems from federal legislation passed in November 2001, wherein Congress directed the NPS to identify and analyze in an EIS the possible effects of the 1996 increases in the number of vessel entries issued for Glacier Bay National Park and Preserve and to set the maximum level of vessel entries based on the analysis in this EIS. Listed species potentially affected by the actions in this plan are the humpback whale and Steller sea lion.

Chapter 1 of the draft EIS describes the purpose and need for the actions being considered in this EIS. Chapter 2 describes the five alternatives evaluated in the EIS, including a no action alternative (alternative 1), the National Park Service's preferred alternative (alternative 3) and the environmentally preferred alternative (alternative 4). Chapter 2 also contains useful tables that summarize the elements and effects of each alternative and provides a comparative summary of alternatives. Chapter 3 describes the affected environment (section 3.3.1 pertains to threatened and endangered species). Chapter 4 presents an analysis of the environmental consequences of each alternative. Section 4.1 discusses the methods and assumptions used; section 4.3.1 pertains to threatened and endangered species. Any of the alternatives considered in the EIS may adversely affect the humpback whale and Steller sea lion.

As you know, the NPS most recently modified its vessel management system for the park in 1996 based on a lengthy planning process and environmental assessment (EA). In addition, the park developed a research program based on recommendations from the National Marine Fisheries Service (NMFS). Vessel quotas and operating requirements have been in place for Glacier Bay since 1979. The 1996 actions increased the number of cruise ships, charter vessels and private vessels permitted in Glacier Bay proper during June, July and August.

A 1997 complaint filed in Federal District Court asserted that the NPS should have prepared a more comprehensive environmental impact statement rather than an environmental assessment. The U. S. Court of Appeals for the Ninth Circuit generally agreed with those assertions in a February 2001 decision, and returned traffic to pre-1996 levels pending preparation of an EIS. Congressional legislation in November 2001 required the NPS to prepare an EIS by January 1, 2004. The NPS is to set the maximum level of motorized vessel entries based on the analysis in the EIS. In the interim, Congress set the numbers of allowable vessel entries to the levels in effect in 2000. The court modified its previous action in accordance with this law. The current regulations (36 Code of Federal Regulations 13.65), promulgated in 1996, incorporated recommendations based on the NMFS 1993 biological opinion.

The Congressionally mandated time frame for completion of the EIS means that an internal draft final EIS must be completed by August 18, 2003, followed by publication of a final EIS by October 3. The Record of Decision is scheduled for approval by mid-November, with a Federal Register Notice issued by late November. When we met with Kaja Brix in January, it looked as though we would need to work very efficiently with you to ensure a biological opinion would be completed in time to meet this schedule.

I would like to schedule a meeting with you and Ms. Brix to discuss the details of the EIS and the biological opinion. I will be contacting your office within the next few days to confirm your availability to meet – hopefully no later than the week of April 21. We have tentatively set April 22 for an informational open house/public hearing in Juneau and thought that week might be a good one to meet with you as well, since our representatives from Ecology and Environment, Inc., our EIS consultant, will be with us then. I would be happy to meet with you anytime sooner, however, if that works better for your schedule.

Please do not hesitate to contact me with any questions you may have about this EIS or to convey any information about this consultation. I look forward to working with you further on this project.

Sincerely,

Nancy K. Swanton

Nancy K. Swanton
EIS Project Manager
Phone: (907) 257-2651

cc: Kaja Brix

United States Department of the Interior

NATIONAL PARK SERVICE
Glacier Bay National Park and Preserve
P.O. Box 140
Gustavus, Alaska 99826-0140

IN REPLY REFER TO:

Tel: 907-697-2230
Fax: 907-697-2654

N1621

February 26, 2003

Michael Payne
Assistant Regional Administrator for Protected Resources
National Marine Fisheries Service
P.O. Box 21668
Juneau, AK 99801-1668

Dear Mr. Payne:

As you are aware, the National Park Service (NPS) is preparing an Environmental Impact Statement (EIS) on vessel quotas and operating requirements in Glacier Bay National Park and Preserve. Specifically, the NPS proposes to establish new or keep existing quotas and operating requirements for four types of motorized watercraft – cruise ships and tour, charter and private vessels – within Glacier Bay proper and in Dundas Bay. The purpose for the action is to address the continuing demand for vessel access into Glacier Bay National Park and Preserve in a manner that assures continuing protection of park resources and values while providing for a range of high-quality recreational opportunities for visitors. The need for action stems from legislation enacted in 2001, wherein the U.S. Congress directed the NPS to identify and analyze in an EIS the possible effects of the 1996 increases in the number of vessel entries issued for Glacier Bay National Park and Preserve and to set the maximum level of vessel entries based on the analysis in this EIS. Congress further directed that the EIS be completed by January 2004. The draft EIS will be available for public review on March 14, 2003. The comment period will extend through May 14, 2003. The final EIS and Record of Decision will be completed by October 3 and November 21, 2003, respectively.

This EIS will build on an Environmental Assessment (EA) completed in 1995 and a Revised EA, Finding of No Significant Effect, and decision completed in 1996. The decision was supported by a 1993 biological opinion, prepared by the NMFS in accordance with Section 7 of the Endangered Species Act (ESA). The decision incorporated conservation recommendations included in the biological opinion.

Based on internal discussions and discussions with and comments from agencies, interest groups, businesses, and the public that occurred in 2002, the NPS has developed and will evaluate in a draft EIS four action alternatives, as well as a no action alternative. We discussed these with Kaja Brix by phone on January 28, 2003.

Listed below are mutual understandings based on our informal consultation with Ms. Brix on January 28. We request your concurrence with these understandings so we can assure we are on the right track with respect to Section 7 consultation for this project.

1. The species (and stocks) listed under the ESA that are present in the area potentially affected by this action are the humpback whale (endangered), the western stock of Steller sea lion (endangered), and the eastern stock of Steller sea lion (threatened).

2. We anticipate that any of the alternatives considered in the draft EIS may adversely affect species listed under the ESA or their critical habitat. Therefore, in accordance with Section 7 of the ESA, formal consultation between the NPS and the National Marine Fisheries Service is necessary and a biological assessment and biological opinion are required.

3. The draft EIS will serve as the biological assessment. A cover letter will be appended to the draft EIS mailed to NMFS; this letter will serve to initiate formal Section 7 consultation.

4. The NMFS will use the information and assessment in the draft EIS to develop the biological opinion.

5. Conservation recommendations identified in the 1993 biological opinion for vessel management in Glacier Bay should serve as a good starting point for developing any new measures that may be needed. The NMFS and NPS will work together to define reasonable mitigation for use in the biological opinion and the final EIS.

6. The draft EIS will include how current measures are working and include additional measures, as needed, to minimize or eliminate potentially adverse effects.

7. In recognition of the Congressionally mandated timeframe for this EIS, the NPS and NMFS will strive to complete formal consultation by the time the Record of Decision is completed in November 2003. Regular, ongoing communications should facilitate this.

8. The NPS and NMFS intend to meet in Juneau in April, near the time of the public hearing on the draft EIS.

The draft EIS will evaluate effects on marine mammals in addition to listed species. We anticipate that NMFS will review and comment on this portion of the EIS as well, based on your agency's authority under the Marine Mammal Protection Act and your expertise.

We appreciated meeting with you last May and have had productive conversations with Ms. Brix since that time. We look forward to meeting with you and Ms. Brix in mid-April in Juneau, sometime close to when our public hearing on the draft EIS occurs. I will contact Ms. Brix to arrange this meeting.

I would appreciate your concurrence with the understandings listed above. Please contact me with any questions or comments you may have (phone: (907) 257-2651; EMail: nancy_swanton@nps.gov)

Thank you.

Sincerely,

Nancy K. Swanton
EIS Project Manager

cc: Kaja Brix, NMFS

I concur: ______________________ Date: 3/6/03
Michael Payne ARA

I do not concur: ______________________ Date: ____________
Michael Payne ARA

United States Department of the Interior

NATIONAL PARK SERVICE
Glacier Bay National Park and Preserve
P.O. Box 140
Gustavus, AK 99826-0140

Tel: 907-697-2230
Fax: 907-697-2654

H4217

FILE COPY

FEB 21 2003

Ms. Judith E. Bittner, State Historic Preservation Officer
Alaska Office of History and Archaeology
500 West 7th Ave., Suite 1310
Anchorage, AK 99501-3565

Dear Ms. Bittner:

The National Park Service (NPS) is currently proposing changes in vessel management policies for Glacier Bay National Park and Preserve in Southeast Alaska. These changes are currently being reviewed under the National Environmental Policy Act (NEPA) and an Environmental Impact Statement is being coordinated with the Section 106 review. As this is a federal undertaking, this department is required to comply with Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR 800. NPS contracted with Environment and Ecology who subcontracted to Stephen R. Braund & Associates (SRB&A) to conduct the NEPA and Section 106 review. NPS is responsible for coordinating and conducting consultation with Alaska Native Tribes interested in the undertaking. As the proposed undertaking takes place entirely within the traditional homeland of the Huna Tlingit tribe, the Hoonah Indian Association, a federally recognized tribal government, is being consulted regarding this matter. SRB&A is working with Wayne Howell, cultural anthropologist, National Park Service, Glacier Bay National Park and Preserve to identify and determine eligibility for the National Register of Historic Places for cultural resources (e.g., archaeological resources, historic structural resources, ethnographic resources, and cultural landscapes) within the area of potential effect (APE). The APE includes the waters and coastlines of Glacier and Dundas bays and is located in Glacier Bay National Park and Preserve, Southeast Alaska (Juneau, Mt. Fairweather, and Skagway USGS Quadrangles, Copper River Meridian) and is within an area delineated in the northeast by T32S, R57E; in the southeast by T40S, R58E; in the northwest by T32S, R49E; and in the southwest by T42S, R54E. The enclosed topographic maps assist in delineating the APE [36 CFR 800.11 (e)(1.

NPS has conducted surveys and inventories for cultural resources (archaeological resources, historic structural resources, ethnographic resources, and cultural landscapes) in the APE. NPS has documented cultural resources and has established context within the APE. The enclosed report, "Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Environmental Impact Statement Section 106 Report, Literature Review and Recommendations," documents these findings and the agency's implementation of 36 CFR

800.4(b). NPS consulted [illegible] local tribes to establish cultural or re[illegible]ous significance to cultural resources in the APE. Oral histories from local residents added to the role and importance of these cultural resources. Local government comments were solicited and a town meeting was held to obtain public opinion. [36 CFR 800.11(e)(2)].

Based on the archaeological survey, in depth ethnographic research, literature review and consultation, we are seeking your concurrence on the finding of "no historic properties affected" by any of the alternatives outlined by this undertaking (36 CFR Part 800 Sec. 800.4 [d1]). NPS is dedicated to insuring that the vital associations of Huna Tlingit tribal members to their sacred sites within the park are maintained, and this undertaking is one step in that process.

If you have any questions, please contact Wayne Howell at (907) 697-2662 or email at <wayne_howell@nps.gov>.

Sincerely,

Tomie Patrick Lee

Tomie Patrick Lee
Superintendent

Enclosure

APPENDIX K

Endangered Species Act Section 7 Biological Opinion

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

August 5, 2003

RECEIVED
AUG 1 3 2003
BY: Klw

Robert Arnberger
Regional Director, Alaska Region
National Park Service
2525 Gambell St
Anchorage, AK 99503

Dear Mr. Arnberger:

This document transmits the National Marine Fisheries Service's (NOAA Fisheries) biological opinion based on our review of the proposed vessel quota and operating requirements in Glacier Bay National Park and Preserve, Alaska, in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.). Your request of March 17, 2003, for formal consultation under Section 7 of the Act initiated the consultation procedures that produced this biological opinion.

This biological opinion is based on information provided in the March 17, 2003, Environmental Impact Statement (EIS) that served as the Biological Assessment for section 7 consultation along with subsequent discussions with NPS staff regarding the new alternative that will be in the Final EIS. A complete administrative record of this consultation is on file at the Alaska Regional Office, NOAA Fisheries, Juneau, Alaska.

After reviewing the current status of both populations of Steller sea lions and the central North Pacific population of humpback whales, the environmental baseline for the action area, the preferred alternative, and the cumulative effects of other actions on listed species, it is NOAA Fisheries biological opinion that the proposed vessel quota increases and operating requirements in Glacier Bay, as proposed, are not likely to jeopardize the continued existence of listed species in the action area, or destroy or adversely modify designated critical habitat found in the action area. In formulating this opinion, NOAA Fisheries used the best available information, including information provided by the National Park Service.

Sincerely,

James W. Balsiger
Administrator, Alaska Region

Endangered Species Act
Section 7 Consultation - Biological Opinion

Agency:	Glacier Bay National Park and Preserve Department of the Interior National Park Service Alaska Region
Activities Considered:	Vessel Quotas and Operating Requirements for Glacier Bay National Park and Preserve
Consultation By:	National Marine Fisheries Service (NOAA Fisheries) Protected Resources Division Alaska Region
Date:	August 5, 2003

Endangered Species Act
Section 7 Consultation - Biological Opinion

Agency: Glacier Bay National Park and Preserve
Department of the Interior
National Park Service
Alaska Region

Activities Considered: Vessel Quotas and Operating Requirements for Glacier Bay National Park and Preserve

Consultation By: National Marine Fisheries Service (NOAA Fisheries)
Protected Resources Division
Alaska Region

Date Issued: August 5, 2003

Approved by: ______________________

James W. Balsiger
Administrator, Alaska Region
NOAA Fisheries

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The Glacier Bay National Park and Preserve, National Park Service (NPS) initiated consultation pursuant to section 7 of the Endangered Species Act (ESA) on March 17, 2003. NOAA Fisheries received a letter from NPS formally requesting consultation on the effects of possible increases in vessel traffic quotas in the Park on all threatened and endangered species under the authority of NOAA Fisheries in compliance with section 7(a)(2) of the ESA. Consultation was initiated by NPS due to Federal legislation passed in November 2001, wherein Congress directed the NPS to identify and analyze in an Environmental Impact Statement (EIS) the possible effects of increased vessel entries into the Park and to set a maximum level of vessel entries based on the analysis in the EIS. The purpose of the action was to address the continuing demand for vessel access into Glacier Bay National Park and Preserve (Park) and to evaluate new vessel quotas and operating requirements in the Park in a manner that provided continued protection of Park resources. The letter also indicated that new information on the status and occurrence of listed species in the action area has become available since the last biological opinion (NMFS 1993) further resulting in the need to consult on this action at this time. The letter was attached to a Draft Environmental Impact Statement (DEIS) completed by NPS on the Federal action.

The action area means "all areas to be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action" (50 CFR §402.02(d)). As such the action area for this Federal action includes all waters located inside the boundaries of Glacier Bay Park and Preserve, and those waters immediately adjacent to, and outside the entrance to, the Park boundaries where vessels will be funneled into the Park. Thus the action area would also include waters of Icy Strait between the Park entrance and Point Adolphus.

This document is the product of a consultation pursuant to Section 7(a)(2) of the ESA and implementing regulations found at 50 Code of Federal Regulations (CFR) Part 402. This consultation considers whether the effects of these actions are likely to jeopardize the continued existence of two Distinct Population Segments (DPSs) of Steller sea lions or cause the destruction or adverse modification of their designated critical habitat; and the North Pacific population of humpback whales with special emphasis on the North Central stock of this population. For all other listed species in the action area, or waters adjacent to the action area, under the authority of NOAA Fisheries, the NPS has determined that this action has "no effect" on those species. NOAA Fisheries concurs with that determination; therefore further consultation is not required for those species. The species of concern in this formal Section 7(a)(2) consultation are as follows:

(i) Western DPS of Steller Sea Lions (*Eumetopias jubatus*; listed as threatened on November 26, 1990 [55 FR 40204]; listed as endangered on May 5, 1997 [62 FR 30772]; critical habitat designated on August 27, 1993 [58 FR 45269])

(ii) Eastern DPS of Steller Sea Lions (*Eumetopias jubatus*; listed as threatened on November 26, 1990 [55 FR 40204]; critical habitat designated on August 27, 1993 [58 FR 45269])

(iii) North Pacific Humpback Whales (*Megaptera novaeangliae*) listed as endangered upon passage of the ESA of 1973 (16 U.S.C. 1531 *et seq.*)

The Preferred Alternative identified in NPS 2003 (Alternative 3, p. 2-11, NPS 2003) addresses motorized vessel use of Glacier Bay proper, including potential increases in cruise ship traffic, and Dundas Bay. This alternative would provide for potential cruise ship entries in Glacier Bay from 139 to 184 during the June 1-August 31 season. It would retain the daily quotas for tour, charter and private vessels; the seasonal quotas for tour, private and charter vessels; and the existing operating requirements for vessels.: Any increase in cruise ship numbers would be contingent upon the completion of studies that demonstrate the increases would be compatible with the protection of park purposes and values. The existing operating requirements would also remain the same as currently enforced. By October 1 of each year, the Park Superintendent would determine, with the Director's approval, the number of cruise ship entries for the following summer season (June 1-August 31). This determination would be based upon available scientific information; and other information, and applicable authorities.

As a result of public comments received and internal discussions within the NPS, the Preferred Alternative has changed somewhat from the DEIS (NPS 2003) to include parts of Alternative 3 and Alternative 5. The new alternative (Alternative 6) maintains the current daily vessel quotas for all vessel types in Glacier Bay (NPS 2003, Chap 2.7, pp 2-16). However, cruise ships would be limited to an average of 1.5 per day in May and September, rather than the average of 2 per day as in Alternative 3. The other vessel classes would maintain the June through August season. However, this alternative would increase private vessel use in Glacier Bay by allowing a maximum of 25 private vessels each day from June 1 through August 31 (for a total of 2300 seasonal use days) rather than the average of 21.5 vessels per day (for a total of 1971 seasonal use days) under Alternative 3. Operating requirements would be modified from Alternative 3 including limited closure of certain waters to cruise ships and tour vessels and decreased speed for large vessels throughout the Park rather than just in whale-waters.

Listed species within the action area may be affected by several direct and indirect factors as a result of implementing the Preferred Alternative: a potential increase in the number of collisions between cruise ships and whales or between other smaller vessels and whales; harassment or displacement of the whales and sea lions by vessels or disturbance of whale prey by vessels which may cause whales to redistribute; an increase in acoustic impacts from vessel noise which could impede communication or damage or interfere with hearing; disruption and alteration of normal feeding, resting and other critical behaviors; habitat modification including prey disruption; and ultimately, reduced fitness, leading potentially to reproductive effects or population level changes.

Regulations that implement section 7(a)(2) of the ESA require biological opinions to evaluate the direct and indirect effects of federal actions to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution. Section 7 (a)(4) of the ESA and its implementing regulations also require biological opinions to determine if federal actions would appreciably diminish the value of critical habitat for the survival and recovery of listed species.

Jeopardy analyses usually focus on the effects of an action on a species' population dynamics. A conclusion of "jeopardy" for an action means that the action could reasonably be expected to reduce appreciably the likelihood of both the survival and recovery of a population or species, not an individual.

There is no reason to believe that the Preferred Alternative would affect the western DPS of Steller sea lions in the action area. After reviewing the current status of the endangered western population of Steller sea lions, the environmental baseline for the action area, the proposed action(s), and the cumulative effects of other actions, it is NOAA Fisheries biological opinion that the Preferred Alternative may adversely affect but is not likely to jeopardize the continued existence of the western population of Steller sea lions.

Given that the eastern DPS of Steller sea lions is increasing and appears to be robust, it is unlikely that it would experience reductions in reproduction, numbers, and distribution in response to any of the proposed alternatives. After reviewing the current status of the threatened eastern DPS of Steller sea lions, the environmental baseline for the action area, and the cumulative effects of other actions on the eastern DPS of Steller sea lions, it is NOAA Fisheries biological opinion that the Preferred Alternative may adversely affect, but is not likely to jeopardize, the continued existence of the eastern population of Steller sea lions.

After reviewing the current status of the central North Pacific population of humpback whales, the environmental baseline for the Preferred Alternative, and the cumulative effects of other actions on the central North Pacific population of humpback whales, it is NOAA Fisheries biological opinion that individual whales within the action area may be adversely affected by the Preferred Alternative but that this alternative may adversely affect, but is not likely to jeopardize, the continued existence of the central North Pacific population of humpback whales.

Adverse modification analyses usually focus on the effects of an action on the physical, chemical, and biological resources that support a population. A conclusion of "adverse modification" means that the action could reasonably be expected to appreciably diminish the value of critical habitat for of a population or species. There are no areas designated as critical habitat for the western DPS of Steller sea lions or the central North Pacific population of humpback whales in the action area. After reviewing the current status of critical habitat that has been designated for the eastern population of Steller sea lions in the action area, the environmental baseline for the action area, the proposed alternatives, and the cumulative effects, it is NOAA Fisheries biological opinion that the Preferred Alternative is not likely to destroy or adversely modify designated critical habitat for the eastern DPS of Steller sea lions.

1.0 PURPOSE AND CONSULTATION HISTORY

1.1 Purpose

The Endangered Species Act (ESA or Act) (16 U.S.C. 1531-1544), amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat on which they depend. Section 7(a)(2) of the ESA, 16 U.S.C. § 1531 et seq., requires that each Federal agency shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a Federal agency may adversely affect a protected species, that agency (i.e., the "action" agency) is required to consult with either the National Marine Fisheries Service (NOAA Fisheries) or the U.S. Fish and Wildlife Service (FWS), depending upon the protected species that may be affected. For the actions described in this opinion, the action agency is the Glacier Bay National Park and Preserve, National Park Service (NPS); and the consulting agency is the Protected Resources Division, Alaska Region, NOAA Fisheries.

The NPS initiated consultation pursuant to section 7 of the Endangered Species Act (ESA) on March 17, 2003. NOAA Fisheries received a letter from NPS formally requesting consultation on the effects of possible changes in the management of motor vessels in Glacier Bay and Dundas Bay on all threatened and endangered species under the authority of NOAA Fisheries in compliance with section 7(a)(2) of the ESA. Consultation was initiated by NPS due to Federal legislation passed in November 2001, wherein Congress directed the NPS to identify and analyze in an Environmental Impact Statement (EIS) the possible effects of increased vessel entries into the Park and to set a maximum level of vessel entries based on the analysis in the EIS. The purpose of the action was to address the continuing demand for vessel access into Glacier Bay National Park and Preserve (Park) and to evaluate new vessel quotas and operating requirements in the Park in a manner that provided continued protection of Park resources. The letter also indicated that new information on the status and occurrence of listed species in the action area has become available since the last biological opinion (NOAA Fisheries 1993) further resulting in the need to consult on this action at this time. The letter was attached to a Draft Environmental Impact Statement (DEIS) completed by NPS on the Federal action (NPS 2003).

The NPS has jurisdiction over and manages the Park. Vessel traffic in Park boundaries is, therefore, under Federal control within the jurisdiction of the NPS. As a Federal action, changes to vessel management in the Park are subject to section 7 consultation for effects to species listed under the ESA. The March 17, 2003, letter indicated that any of the alternatives considered in the DEIS may adversely affect humpback whales and Steller sea lions. The purpose of this opinion, therefore, is to fulfill the section 7 requirements for consultation on vessel quotas and operating requirements for the National Park.

This document is the product of a consultation pursuant to Section 7(a)(2) of the ESA and implementing regulations found at 50 Code of Federal Regulations (CFR) Part 402. This consultation considers whether the effects of these actions are likely (1) to jeopardize the continued existence of two Distinct Population Segments (DPSs) of Steller sea lions; (2) to cause the destruction or adverse modification of designated critical habitat in the action area for the eastern DPS of Steller sea lions (critical habitat has not been designated in the action area for the western DPS of Steller sea lions or the North Pacific population of humpback whales); and (3) whether the actions are likely to jeopardize the continued existence of the North Pacific population of humpback whales with special emphasis on the central North Pacific stock of this population (as described in Angliss *et al.* 2002). For all other listed species in the action area, or waters adjacent to the action area, under the authority of NOAA, the NPS has determined that this action will have "no effect" or is "not likely to adversely affect." NOAA Fisheries concurs with this determination. Therefore, the species of concern in this formal Section 7(a)(2) consultation are as follows:

> Western DPS of Steller Sea Lions (*Eumetopias jubatus*; listed as threatened on November 26, 1990 [55 FR 40204]; listed as endangered on May 5, 1997 [62 FR 30772]; critical habitat designated on August 27, 1993 [58 FR 45269])
>
> Eastern DPS of Steller Sea Lions (*Eumetopias jubatus*; listed as threatened on November 26, 1990 [55 FR 40204]; critical habitat designated on August 27, 1993 [58 FR 45269])
>
> North Pacific Humpback Whales (*Megaptera novaeangliae*) listed as endangered upon passage of the ESA of 1973 (16 U.S.C. 1531 *et seq.*)

This opinion is based on an evaluation of both the direct and indirect effects of the action on these listed species and their critical habitat (Eastern DPS of Steller sea lions), together with the effects of other activities that are interrelated or interdependent with that action. These effects are considered in the context of an Environmental Baseline and Cumulative Effects. The Environmental Baseline includes the past and present impacts of other Federal, state, Tribal, or private actions and other human activities in the action area, or waters adjacent to the action area. There are no anticipated impacts from other proposed Federal projects in the action area that have already undergone Section 7 consultation, or from the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR §402.02). Cumulative Effects are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to affect these listed species either within the action area (50 CFR §402.02) or in waters adjacent to the action area.

This opinion also addresses authorization by NOAA Fisheries of the Preferred Alternative activities under section 101(a)(5) of the Marine Mammal Protection Act (MMPA) for the incidental, but not intentional, "taking" of marine mammals through harassment and disturbance. The term "take" means to harass, hunt, harm, pursue, capture, or kill, or attempt to harass, hunt, harm, pursue, capture, or kill any marine mammal. Such authorization may be accomplished through regulations and issuance of letters of authorization under those regulations, or through issuance of an incidental harassment authorization. These authorizations may be granted only if an activity would have no more than a negligible effect on species (or stock), would not have an unmitigable adverse impact on the availability of the marine mammal for subsistence uses, and that the permissible method of taking and requirements pertaining to the monitoring and reporting of such taking are set forth to ensure the activity will have the least practicable adverse effect on the species or stock and its habitat. These authorizations are often requested for activities in the Beaufort Sea which produce underwater noise at levels which harass marine mammals. Harassment is a form of taking otherwise prohibited by the MMPA and ESA.

1.2 Consultation History

The NPS first initiated consultation with NOAA Fisheries in 1979 due to the departure of humpback whales from Glacier Bay and the implication that this was due to an increase in vessel traffic in Glacier Bay at that time. The belief was that increased vessel traffic produced intolerable levels of noise and harassment which resulted in the near abandonment of the Park by humpback whales. At the request of the NPS, NOAA Fisheries issued a biological opinion (NMFS 1979) addressing the effects of the actions proposed by NPS to control vessel activity in Glacier Bay National Monument. NOAA Fisheries determined that the uncontrolled increase in vessel traffic at the time, particularly of pleasure craft, may have altered the behavior of humpback whales in Glacier Bay such that it resulted in their departure from the bay during 1978-1979. NOAA Fisheries concluded that a continued increase in the amount of vessel traffic, particularly charter/pleasure craft, in Glacier Bay was likely to jeopardize the continued existence of the humpback whales in southeast Alaska. Critical habitat has not been designated for humpback whales in the North Pacific; therefore adverse modification of critical habitat for this species under section 7 was not considered.

NOAA Fisheries developed a Reasonable and Prudent alternative (RPA) that was implemented by the NPS. The RPA required the following measures:

(1) a restriction of total vessel use of Glacier Bay to 1976 levels (i.e. 123 large vessels, 318 private boats and 856 fishing vessels);

(2) the implementation of regulations governing vessel routes and vessel maneuvering to minimize whale/vessel interactions; and a prohibition of the willful pursuit and disturbance of whales; and vessel operators needed to be informed of such regulations;

(3) the continuation of research programs to monitor the humpback population and whale/vessel interactions; and

(4) a requirement to develop new research programs to characterize the food and feeding behavior of humpback whales in Glacier Bay and other areas; to ascertain the acoustic characteristics of vessels within the Bay and in other areas with the aim of identifying equipment and/or modes of operation which are inimical to the whales; and to compare behavioral responses of the humpback whales to vessels in Glacier Bay with those observed in other areas of southeastern Alaska.

The NPS promulgated regulations implementing the first and second element of the RPA and has monitored the abundance of humpback whales in the Park since this opinion. A research program was undertaken in 1981 and 1982. The NPS reinitiated consultation in 1983 due to new scientific information from these studies and to address whether vessel numbers could be increased and to what extent without jeopardizing humpback whales.

A second biological opinion, issued in 1983, considered impacts to humpback whales from existing levels of vessel traffic and from the effects of proposed increases in the levels of vessel traffic in Glacier Bay. In 1981 and 1982 (June 1 to August 31) large ships (over 100 tons gross) were limited to two entries per day with a seasonal maximum of 89 entries for cruise ships. During the same period private/pleasure craft were limited to 21 entries per day with a seasonal maximum of 538 entries. The 1983 biological opinion concluded that this level of vessel use and operational management of vessels in Glacier Bay was not likely to jeopardize the continued existence of the southeast Alaska humpback whale stock. NOAA Fisheries also concluded that some increase in vessel traffic could occur in Glacier Bay without jeopardizing the southeast Alaska stock of humpback whales. This determination was based on the NPS's ability to monitor and control both the amount of vessel traffic, and the operation of vessels in the Park. NOAA Fisheries stated that no more than a 20% increase in the large ship and small vessel categories would be prudent. This allowed for two large ships per day with a maximum of 107 large vessel-use days during June 1 to August 31. NOAA Fisheries recommended that the effects of these increases should be monitored for at least two years before additional increases were proposed. The 1983 opinion noted, as did the 1979 opinion, that if the amount of vessel traffic in Glacier Bay were allowed to increase without limit or if existing restrictions on the operation of vessels within the Bay were removed, the associated disturbance would likely jeopardize the continued existence of the southeast Alaska humpback whale stock.

The 1983 biological opinion did not suggest a threshold limit at which vessel traffic and operational practices would jeopardize the continued existence or survival of humpback whales. NOAA Fisheries did recommend, however, that the number of vessel entries should not be increased unless the number of whales in the Bay remains equal to, or greater than, the number of whales present in 1982. The 1983 biological opinion also recommended research and monitoring requirements pertaining to whale biology and feeding ecology and to the interactions of vessel presence within the Park.

It is important to recognize that the 1979 and 1983 biological opinions analyzed the effects of the action on a "southeast stock of humpback whales" or a "stock of humpback whales in southeast Alaska". Humpback whales in Glacier Bay and southeast Alaska are currently considered part of a larger ESA unit or population that occurs throughout the North Pacific basin, or at a minimum the Central North Pacific Ocean (Angliss et al. 2002). While humpback whales in southeast Alaska do represent a feeding aggregation of whales somewhat discrete from other humpback whales throughout central and western Alaska (possibly a substock of the Central North Pacific stock), the ESA does not distinguish between humpback whales in southeast Alaska from humpback whales throughout the remaining North Pacific Ocean. For that reason, the next consultation between NPS and NOAA Fisheries on this action (the 1993 biological opinion) analyzed whether the effects of the proposed activity were likely to jeopardize the continued existence of the entire North Pacific population, and not just those whales located in southeast Alaska. When placed in the appropriate ESA context, it becomes apparent that activities in Glacier Bay may have effects on whales at that local scale without jeopardizing the species or population.

NMFS issued another biological opinion in 1993 that also addressed the effects of vessel traffic in Glacier Bay on humpback whales (NMFS 1993). However, this opinion also considered Steller sea lions and gray whales (Eschrichtius robustus) (NMFS 1993). Steller sea lions throughout their range were listed as threatened under the ESA on November 26, 1990 (55 FR 49204). Therefore, the effects of the action on Steller sea lions throughout their range were considered in ESA consultations between the two agencies for the first time.

The listing of Steller sea lions followed a decline in the U.S. population of about 64% over the three decades prior to the listing. The species was split into two separate Distinct Population Segments (DPSs) in 1997 on the basis of demographic and genetic dissimilarities (Bickham *et al.* 1996, Loughlin 1997); a western DPS whose status was changed to endangered, and an eastern DPS whose status was left unchanged (62 FR 30772). Therefore, this consultation evaluates the effects of the action on two DPSs of Steller sea lions. Gray whales were considered in the 1993 consultation due to sightings in the action area and adjacent waters between 1983 and 1993. However, gray whales were delisted from the ESA in 1994 and are not considered in this consultation. Other species listed under the ESA, and under the authority of NOAA, are not considered in this opinion because NPS has determined that the action has "no effect" on those species. NOAA Fisheries concurs with that determination; therefore further consultation is not required for those species.

The 1993 consultation was based on the Preferred Alternative as described in the September 25, 1992, Draft Vessel Management Plan and Environmental Assessment (NPS 1995). This management proposal allowed cruise ships into the Bay at the rate of 2 per day for a total of up to 184 cruise vessels during June, July and August. Tour vessels would be allowed in at the rate of 3 each day for a total of 276 tour vessels; charter vessels would be allowed in at the rate of 6 per day for a total of 552 charter vessels; and private vessels at a rate of 25 each day for a total of 1,971 vessels for the same time period of June through August. The 1993 biological opinion concluded that the Preferred Alternative was not likely to jeopardize the continued existence of Steller sea lions, gray whales or North Pacific humpback whales.

Conservation recommendations in the 1993 opinion suggested that the NPS maintain a minimum vessel approach restriction around Steller sea lion haulouts throughout the year. NMFS also recommended that the NPS implement a humpback whale feeding ecology research program and undertake studies "to determine how vessel presence alters the behavior and/or distribution of humpback whales" (presumably in the Park). NMFS also recommended that the NPS continue monitoring programs that "identify the number of humpback whales that feed in the National Park waters and their individual identity, age, reproductive status and length of stays". The Park has maintained an active monitoring program for humpback whales in, and adjacent to, Park waters since 1985.

1.3 Background on Jeopardy and Adverse Modification of Critical Habitat

In this section, we discuss the statutory requirements of ESA section 7(a)(2), and its implementing regulations, and their relation to the actions considered in this consultation. Whereas the statutory standards, and the regulations that interpret them, are the ultimate determinants for this biological opinion, it is necessary for NOAA Fisheries to develop a methodology for applying those standards that uses the best scientific and commercial data available. Both the FWS and NOAA Fisheries are currently revising regulations pertaining to jeopardy and adverse modification of critical habitat. However, they will not be available for this biological opinion.

Section 7(a)(2) of the ESA states:

> *"Each federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of any endangered species and threatened species or result in the destruction or adverse modification of habitat of such species which is determined by the Secretary, after consultation as appropriate with affected States, to be critical, unless such agency has been granted an exemption for such action by the Committee pursuant to subsection (h) of this chapter."*

Definitions of "jeopardize the continued existence of" and "adverse modification of habitat" are not defined further in the statute. However, these definitions were further refined in the June 3, 1986, regulations implementing the ESA in 50 CFR §402.02.

> ***Destruction or adverse modification*** means a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 CFR §402.02).
>
> ***Jeopardize the continued existence of*** means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species (50 CFR §402.02).

The consulting agency is required to consider both of these standards to insure that the proposed action does not result in jeopardy or adverse modification of critical habitat as intended by the Act. The jeopardy standard is intended to provide for the conservation of the species based on any impacts that might occur to that species no matter where they might occur, whereas the adverse modification standard is intended to look more closely at the effects to the core habitat essential for the species' long term survival.

Regulations that implement section 7(a)(2) of the ESA require biological opinions to evaluate the direct and indirect effects of federal actions to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (50 CFR §402.02). Biological opinions must also determine if federal actions would appreciably diminish the value of critical habitat of listed species (50 CFR §402.02).

The jeopardy analysis was approached using the following steps:

(i) First, we identify the possible direct and indirect effects of the action on the physical and biotic environment of the action area;

(ii) Given the environmental baseline, we determine if we would reasonably expect the western or eastern populations of Steller sea lions, and North Pacific population of humpback whales, to experience reductions in reproduction, numbers, or distribution in response to these effects, and the cumulative effects of future anticipated non-Federal actions; and

(iii) Third, we determine if any reductions in a species' reproduction, numbers, or distribution (identified in the second step of our analysis) can be expected to appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

The final step in our analysis — relating reductions in a species' reproduction, numbers, or distribution to reductions in the species' likelihood of surviving and recovering in the wild — is often the most difficult step because (a) the relationship is not linear; (b) to persist over geologic time, most species' have evolved to withstand some level of variation in their birth and death rates without a corresponding change in the species' likelihood of surviving and recovering in the wild; and (c) we have imperfect knowledge of the population dynamics of other species and their response to human perturbation. Nevertheless, our analysis must attempt to distinguish between anthropogenic reductions in a species' reproduction, numbers, and distribution that can reasonably be expected to affect the species' likelihood of survival and recovery in the wild and other (natural) declines, given the best scientific and commercial information available at the time of the analysis.

We will approach an analysis for the adverse modification of critical habitat through a more qualitative analysis using available scientific and commercial information.

1.4 Standards of Survival and Recovery

For both the determination of jeopardy and adverse modification of critical habitat NOAA Fisheries must make a determination on whether an action is likely to appreciably reduce the likelihood of survival and recovery of a species in the wild. The following are the definitions of survival and recovery from the ESA Section 7 Handbook:

> ***Survival*** is defined as the species' persistence, as a listed or recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for recovery from endangerment (ESA Handbook).

> ***Recovery*** is the process by which species' ecosystems are restored and/or threats to the species are removed so self-sustaining and self-regulating populations of listed species can be supported as persistent members of native biotic communities (ESA Handbook).

Recovery is also defined in the implementing regulations (however survival is not):

> ***Recovery*** means improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in section 4(a)(1) of the Act (50 CFR 402.02).

There is no uniform guidance either in regulation or through NMFS policy on the specific criteria to determine whether a species is likely to survive. In some cases, NMFS and FWS have attempted to project population trajectories into the future (such as 100 years) and account for some level of variability around that trend, such as environmental disturbance, threats of disease, and other unknown factors. Then, a probability of extinction has been calculated for some species. In some cases, this probability of extinction is related to a bright line definition of what risk is acceptable for that particular species. For this type of an analysis, considerable information on the life history of a species is needed in order to have confidence in the predictions of the model.

Since the listing of Steller sea lions in 1990, NMFS scientists have prepared a number of different Population Viability Analyses (PVA) (Merrick and York 1994, York 1994, and York *et al.* 1996). In a draft document prepared by Merrick and York (1994), they looked at a number of different models using both the 1985-94 and the 1989-94 population trends and determined that it was highly likely that the western population or DPS would reach extinction between 53 and 86 years respectively. These analyses were further refined in York (1994) and York *et. al.* (1996), however, they have relied heavily on using a population trend since the mid-1970s. At the current decline, Loughlin and York (2001) estimated that the western population would be reduced to only 11,430 animals by 2020. Neither the eastern DPS of Steller sea lions nor the North Pacific population of humpback whales are currently experiencing population declines. The potential for survival and recovery is likely for these two species.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND THE PREFERRED ALTERNATIVE

2.1 The Proposed Action

The NPS proposes to keep existing or establish new quotas and operating requirements for cruise ships and tour, charter and private motor vessels within Glacier Bay and Dundas Bay in Glacier Bay National Park and Preserve. Four action alternatives and a no action alternative are evaluated in a Draft Environmental Impact Statement (DEIS)(NPS 2003). The DEIS provides a reasonable range of alternatives and contains an analysis of the consequences of each of the alternatives on the human environment, including listed species, as required under the National Environmental Policy Act.

The existing regulations define a cruise ship as any motor vessel at or more than 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that carries passengers for hire (Table 2.1, pp 2-2, NPS 2003). A charter vessel is any motor vessel under 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that is rated to carry up to 49 passengers, and is available for hire on an unscheduled basis, except a charter vessel used to provide a scheduled camper or kayak drop-off service. A tour vessel is any motor vessel under 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that is rated to carry more than 49 passengers, or any smaller vessel that conducts tours or provides transportation at regularly scheduled times along a regularly scheduled route. A private vessel is any motor vessel used for recreation that is not engaged in commercial transport of passengers, commercial fishing or official government business.

The Preferred Alternative identified in the DEIS (Alternative 3, p. 2-11, NPS 2003) addressed motorized vessel use of Glacier Bay proper, including potential increases in cruise ship traffic. This alternative would provide for potential future increases in cruise ship entries in Glacier Bay from 139 to 184 during the June 1 through August 31 season. It would retain the daily quotas for tour, charter and private vessels; the seasonal quotas for tour, private and charter vessels; and the existing operating requirements for vessels. Any increase in cruise ship numbers would be contingent upon the completion of studies that demonstrate the increases would be compatible with the protection of park values and purposes. The existing operating requirements would remain the same as currently enforced. While regulations do not prohibit cruise ships from entering Dundas Bay, existing cruise ship operators have committed to an itinerary that does not include Dundas Bay. By October 1 of each year, the Park Superintendent would determine, with the Director's approval, the number of cruise ship entries for Glacier Bay the following summer season (June 1-August 31). This determination would be based upon available scientific information, and other information, and applicable authorities.

During the consultation process, the NPS informed NOAA Fisheries that, as a result of comments received on the DEIS and internal discussions within the NPS, the Preferred Alternative changed from Alternative 3 as described in the DEIS (NPS 2003) to an Alternative 6 (described in the following section). This alternative will be described in the Final EIS and is the NPS Preferred Alternative for this action.

2.2 Alternative 6 (Preferred Alternative)

Alternative 6 would simplify the present vessel operating requirements based on the Park's experience administering them for the past several years and based on evaluation of the results of studies obtained since the 1996 Vessel Management Plan was developed. Alternative 6 would set a maximum level of vessel entries, as mandated by Congress, while protecting resources and providing for a range of visitor opportunities within the Park. Like Alternative 3, seasonal use day quotas for cruise ships in Glacier Bay would be set at 139 and could be increased to 184. Like Alternative 3, the Superintendent would determine by October 1 of each year the number of cruise ship seasonal use days in Glacier Bay for the following summer season. The number would be subject to the maximum year-round daily limit of two vessel use days. The Superintendent would publish a document of any revision in seasonal use day quotas in the Federal Register with an opportunity for public comment. Differences between Alternative 6 (the Preferred Alternative) and Alternative 3 (the DEIS Preferred Alternative, in NPS 2003) that are important to this opinion are described in the following sections.

2.2.1 Definition of Terms

The following terms and definitions are applicable to Alternative 6 and may be different from Alternative 3 as identified in the DEIS (NPS 2003):

(i) Charter vessel: Modified from Alternative 3 to be more accurate. Like Alternative 3, under Alternative 6 charter vessel applies to any motor vessel of less than 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) engaged in transport of passengers for hire. Unlike Alternative 3, the definition of charter vessel under Alternative 6 specifies the number of passengers a charter vessel is rated to transport overnight (up to 12) and for day-time use (up to 49), clarifies its use as an administrative vessel, and provides for uninspected vessels of a certain gross tonnage and length to serve as charter vessels. Eliminated is the reference to being "available for hire on an unscheduled basis except as used to provide a scheduled camper or kayak drop-off service."

(2) Cruise ship: Modified from Alternative 3. Like Alternative 3, the definition for cruise ship under Alternative 6 applies to a vessel of at least 100 U.S. gross tons, engaged in transport of passengers for hire. Unlike Alternative 3, it specifies a number of passengers (more than 12), thereby making it more consistent with the way the other two commercial motor vessel classifications are defined. It also clarifies its use as an administrative vessel.

(iii) Tour vessel: Modified from Alternative 3 to be more accurate. Like Alternative 3, the definition for tour vessel under Alternative 6 applies to any motor vessel of less than 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) engaged in the transport of passengers for hire. Unlike Alternative 3, it specifies the number of passengers a tour vessel is rated to transport overnight (more than 12) and for daytime use (greater than 49) and clarifies its use as an administrative vessel.

(iv) Private vessel: The definition of this vessel category is the same as for Alternative 3.

(v) Entry: Not applicable

(vi) Vessel-use Day: This definition was adjusted, in consideration of the elimination of seasonal entry quotas, to be when a vessel is in Glacier Bay or Dundas Bay operating under its permit for that calendar day.

(vii) Seasonal-use Day: Defined (not defined in present regulations) as the number of vessel-use days allowed during a specific seasonal period.

(viii) Daily Vessel Quota: Defined (not defined in present regulations) as the number of vessel-use days allowed in an area on any one calendar day.

(ix) Administrative Use: Defined (not defined in present regulations) as a motor vessel engaged in official government business.

(x) Administrative Vessel: Defined (not defined in present regulations) as any vessel involved in administrative use.

(xi) Short-Notice Private Vessel Permits: Permits available to private vessels on a short notice basis – with a 48 hour advance reservation.

2.2.2 Vessel Seasons and Quotas

The quota season is the same for alternatives 3 and 6, except that under Alternative 6, for cruise ships, the seasonal use day quota is extended to cover May and September (the season is June-August for Alternative 3). Quotas apply to Glacier Bay Proper for Alternative 3 and for both Glacier Bay Proper and Dundas Bay for Alternative 6. Alternative 6 provides for the following daily and seasonal quotas for each of the following vessel categories and locations:

Glacier Bay Proper

Cruise Ships

Daily Quota	2 vessels per day year-round (same as Alternative 3)
Seasonal Entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Seasonal-Use Days	92 vessels for May and September with the potential increase of up to 122 (2 per day every day); 139 for cruise ships from June 1 through August 31 with a potential increase of up to 184 (2 per day every day -- same as Alternative 3)

Tour Vessels

Daily Quota	3 vessels per day year-round (same as Alternative 3)
Seasonal Entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Seasonal Use-days	183 seasonal use days permitted during May and September; 276 from June 1 through August 31 (same as Alternative 3)

Charter Vessels

Daily Quota	No limit in May and September; 6 per day from June 1 through August 31 (same as Alternative 3)
Seasonal Entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Seasonal-Use Days	No limit in May and September (no limit from September through May); 552 days from June 1 through August 31 (same as Alternative 3)

Private Vessels

Daily Quota	No limit in May and September; 25 per day from June 1 through August 31 (same as Alternative 3)

Seasonal Entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Seasonal Use-days	No limit in May and September (no limit from September - May); 2300 from June 1 through August 31

Dundas Bay

<u>Cruise Ships</u>	Not permitted year-round
<u>Tour Vessels</u>	
Daily Quota	Not permitted in wilderness waters year-round; 1 permitted per day in non-wilderness waters June 1 through August 31
Seasonal Use-days	Not permitted in wilderness waters year-round; 92 in non-wilderness waters June 1 through August 31
<u>Charter Vessels</u>	
Daily quota	No limit
Seasonal Use-days	276 from June 1 through August 31 (an average of 3 per day)

2.2.3 Operating Requirements

As with Alternative 3, and consistent with the existing regulations, Alternative 6 would not require a permit for the following types of vessels for entry into Glacier Bay: administrative vessels, which include vessels operated by the Hoonah Indian Association and research vessels; vessels granted safe harbor in Bartlett Cove by the Superintendent based on hazardous conditions, such as weather or mechanical problems; skiffs launched from a permitted motor vessel and operated while the permitted vessel remains at anchor; and commercial fishing vessels otherwise permitted and engaged in commercial fishing.

As for Alternative 3, and unchanged from the current regulations, Alternative 6 would prohibit operation of a vessel within one-quarter nautical mile of a whale, except for certain commercial fishing vessel operations as otherwise authorized by the Superintendent. Also, an operator of a vessel accidentally positioned within one-quarter nautical mile of a whale shall immediately slow the vessel to 10 knots or less, without shifting into reverse unless impact is likely. Then the operator must proceed on a steady course away from the whale until at least one-quarter nautical mile of separation is established. As for Alternative 3, and consistent with the current regulations, Alternative 6 would prohibit pursuing or attempting to pursue a whale.

As for Alternative 3, and unchanged from the current regulations, Alternative 6 would prohibit operating a vessel or otherwise approaching within 100 yards of a Steller sea lion hauled out on land or a rock. This 100 yard approach distance applies specifically to a number of islands and islets in Glacier Bay and on the outer coast of the park, including Graves Rocks, a sea lion haulout [see 36 CFR 13.65(b)(3)(vi)(A) for the list of specific locations].

In addition to the above, Alternative 6 provides for the following vessel-use requirements:

(i) <u>Speed Restrictions</u>: Alternative 6 would maintain a 20 knot (through the water) speed restriction in lower Glacier Bay whale waters from May 15 through September 30 for motor vessels less than 80 meters (262 feet) long. However, Alternative 6 would set a maximum speed restriction of 13 knots (through the water) year-round in Glacier Bay for motor vessels 262 feet or greater in length. It would set a 13 knot rather than a 10 knot (through the water) speed restriction from May 15 through September 30 when the Superintendent deems it necessary due to the presence of whales. This lowered speed restriction would also apply to Dundas Bay. Thus, as compared to Alternative 3, Alternative 6 would differentiate between vessel lengths in assigning speed limits in Glacier Bay, extend the vessel speed season through September in the lower Bay whale waters for vessels less than 80 meters long, and set a year-round 13-knot speed limit throughout Glacier Bay for large vessels (80 meters or greater in length). In addition, as compared to Alternative 3, Alternative 6 would increase (from 10 to 13 knots) the speed limit imposed in Glacier Bay when the Superintendent has designated a maximum speed due to the presence of whales, impose this limit in Dundas Bay and extend the through September the time-frame during which this speed limit could be imposed.

(ii) Whale Waters: As compared to Alternative 3, Alternative 6 would reduce the number of designated whale waters from four areas to one, keeping the designation for the lower bay only and extending the time during which the designation would be in effect from May 1 through September 30 (versus May 15 - August 31 under Alternative 3). It is important to note, however, that Alternative 6 retains the Superintendent's authority to impose temporary whale waters within the Park boundaries in response to identified and shifting whale aggregations, and to impose vessel speed restrictions in those "whale waters." The Park defines "whale waters" as any portion of Glacier Bay designated by the Superintendent as having a high probability of whale occupancy, based on recent sightings or past patterns of occurrence (at Table 2.1, pp 2-4, NPS 2003).

Vessel operating restrictions in designated whale-waters would be the same as for Alternative 3 (no change from the current regulations). In designated whale waters, all motor vessels more than 18 feet long are required to navigate a mid-channel course and, where possible, maintain a distance of at least 1 mile from the shoreline while in transit through whale-waters. All vessels are prohibited from operating within 0.25 nautical mile of a humpback whale or pursuing, or attempting to pursue, humpback whales within 0.5 nautical mile in marine waters within the boundary of the park and preserve.

(iii) Closures: In addition to the closures for Alternative 3, which are the same as those in the current regulations, Alternative 6 would close the following areas to cruise ships and/or tour vessels.

Non-motorized waters: closed for cruise ships: Alternative 6 adds Beardslee Entrance, extends the closure of Adams Inlet to the entrance of that inlet, and includes all of Dundas Bay.

Non-motorized waters: closed for tour vessels : Alternative 6 adds Beardslee Entrance, extends the closure of Adams Inlet to the entrance of that inlet, and includes the wilderness waters of Dundas Bay.

Vessel routes are not defined, although cruise ships generally follow the mid-channel of Glacier Bay. The permit exemption for private motor vessels 'based in Bartlett Cove' would be eliminated. Private vessels based in Bartlett Cove are currently (and under Alternative 3) allowed to transit between Bartlett Cove and waters outside Glacier Bay without a permit.

2.3 Research and Monitoring

The Park maintains a research and monitoring program that provides a tool to identify problems early and to provide a basis for making adaptive management decisions as needed to protect park resources. This research and monitoring program would be continued under the Preferred Alternative and would make a real-time contribution to 1) the identification of whale-waters, 2) to the research needed for evaluation of the potential effects of increased cruise ship quotas within the limits of the proposed action, and 3) to assess the effectiveness of and modify, as needed, measures implemented to mitigate the environmental effects of motor vessels in the park.

2.4 Action Area

The action area means "all areas to be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action" (50 CFR §402.02(d)). As such the action area for this Federal action includes all waters located inside the boundaries of Glacier Bay Park and Preserve, and those waters immediately adjacent to, and outside the entrance to, the Park boundaries where vessels will be funneled into the Park. Thus the action area would also include waters of Icy Strait between the Park entrance and Point Adolphus.

Chapter 3.2.1 (NPS 2003) provides a physical and oceanographic description of Glacier Bay National Park and Preserve.

3.0 STATUS OF SPECIES AND CRITICAL HABITAT

The following species summaries were abstracted and compiled from the information found in the Alaska Marine Mammal Stock Assessments, 2002 (Angliss et al. 2002); Chapter 3 - Affected Environment (NPS 2003); Chapter 3 - Status of Species and Critical Habitat, NOAA Fisheries (2001a); NOAA Fisheries (2001b); and scientific literature, reports and research summaries as identified in the literature cited.

3.1 Steller Sea Lions (*Eumetopias jubatus*)

The Steller sea lion (*Eumetopias jubatus*) is the only species of the genus *Eumetopias*, and is a member of the family Otariidae, order Pinnipedia. The closest relatives of the Steller sea lion appear to be the other sea lion genera, including *Zalophus*, *Otaria*, *Neophoca*, and *Phocarctos;* and fur seals of the genera *Callorhinus* (Northern fur seals) and *Arctocephalus*. Loughlin *et al.* (1987) provide a brief but informative summary of the fossil record for *Eumetopias*. Repenning (1976) suggests that a femur dated 3 to 4 million years old may have been from an ancient member of the *Eumetopias* genus, thereby indicating that the genus is at least that old. *Eumetopias jubatus* likely evolved in the North Pacific (Repenning 1976).

Steller sea lions range along the North Pacific Rim from northern Japan to California (Loughlin et al. 1984), with centers of abundance and distribution in the Gulf of Alaska (GOA), and the Bering Sea and Aleutian Islands (BSAI), respectively, and along the eastern shore of the Kamchatka Peninsula. The GOA and the Aleutian Islands are considered the geographic center of the sea lions' distribution (Kenyon and Rice 1961). The species is not known to migrate, but individuals disperse widely outside of the breeding season (late May-early July), thus potentially intermixing with animals from other areas. Despite the wide ranging movements of juveniles and adult males in particular, exchange between rookeries by breeding adult females and males (other than between adjoining rookeries) appears low (NMFS 1995).

The breeding range of the Steller sea lion covers virtually all of the North Pacific Rim from about 34° N to 60°N lat. Within this range, sea lions are found in hundreds of rookeries and haulouts. These rookery and haulout sites can be grouped in rookery/haulout clusters on the basis of politics, geography, demographic patterns, genetics, foraging patterns, or other reasons related to scientific study or management. Geographic distinctions are frequently made on the basis of variable habitat or ecosystem characteristics in differing parts of the range. For example, rookeries and haulouts in the Aleutian Islands are often separated from those in the GOA, and these two areas are again separated from southeastern Alaska and British Columbia. These distinctions may have demographic significance because of the important variability in ecosystem features such as prey resources.

Loughlin (1997) recommended reclassifying the one stock structure of Steller sea lions based on the phylogeographic approach of Dizon et al. (1992). This approach examined 1) distributional data: geographic distribution continuous, yet a high degree of natal site fidelity and low (<10%) exchange rate of breeding animals between rookeries; 2) population response data: substantial differences in population dynamics (York et al. 1996); 3) phenotypic data: unknown; and 4) genotypic data: substantial differences in mitochondrial DNA (Bickham et al. 1996). Based on available information information, two Distinct Population Segments (DPSs) of Steller sea lions are now recognized within U. S. waters: a western U. S. DPS which includes animals at, and west of, Cape Suckling , Alaska (144°W); and an eastern U. S. DPS which includes animals east of Cape Suckling, Alaska. Some of the western DPS of Steller sea lions move east of the management boundary separating the two populations and have been seen within the boundaries of Glacier Bay National

Park (Matthews 2003). For that reason, both DPSs are considered in this biological opinion.

On November 26, 1990, the Steller sea lion was listed as threatened under the ESA (55 FR 40204), and on August 27, 1993 (58 FR 45269) critical habitat was designated based on observed movement patterns. In 1997 the Steller sea lion population was split into two separate stocks (western and eastern stocks) based on demographic and genetic dissimilarities (Bickham *et al.* 1996, Loughlin 1997)(62 FR 30772). Due to the continued decline, the status of the western stock was changed to endangered, while the status of the increasing eastern stock was left as threatened. Since 1977 the western population has continued to decline while the eastern population has maintained steady increases and may be considered for de-listing over the next few years if the positive trend continues.

3.1.1 Western Distinct Population Segment (DPS)

The Western DPS of Steller sea lions includes all animals at, and west of, Cape Suckling, Alaska (144°W). Some of the western DPS of Steller sea lions move east of the management boundary separating the two populations and have been seen within the boundaries of Glacier Bay National Park (Matthews 2003). For that reason, both DPSs are considered in this biological opinion.

(i) **Abundance**: Assessments of Steller sea lions are based largely on (a) aerial counts of nonpups (juveniles and adults) on rookeries and haulouts, and (b) counts of pups on rookeries in late June and early July. Both kinds of counts are indices of abundance, as they do not necessarily include every site where animals haul out, and they do not include animals that are in the water at the time of the counts. Population size can be estimated by standardizing the indices (e.g., with respect to date, sites counted, and counting method), by making certain assumptions regarding the ratio of animals present versus absent from a given site at the time of the count, and by correcting for the portion of sites counted. Population estimates from the 1950s and 1960s (e.g., Kenyon and Rice 1961; see also Trites and Larkin 1992, 1996) are used with caution because counting methods and dates were not standardized, and the results contain inconsistencies that indicate the possibility of considerable measurement error at some sites in some years. Efforts to standardize methods began in the 1970s (Braham *et al.* 1980); as a result, counts conducted since the late 1970s are the most reliable index of population status and trends.

Recent comprehensive estimates (pups and non-pups) of Steller sea lion abundance in Alaska is based on aerial surveys and ground based pup counts in June and July 1998 from Southeast Alaska to the western Aleutian Islands (Sease and Loughlin 1999). Data from these surveys represent actual counts of pups and non-pups at all rookeries and major haulout sites in Alaska. During the 1998 survey, a total of 28,658 non-pups were counted; 12,299 in the GOA and 16,359 in the BSAI (Sease and Loughlin 1999). The 1998 counts for the GOA (12,299) were incomplete because only three of the 25 sites in the eastern GOA were surveyed during 1998. These three sites, however, are major rookeries and included a majority of the animals counted in the eastern Gulf subarea during the 1994 and 1996 surveys (52% and 60%, respectively). The 22 remaining sites were surveyed in 1999 and 757 animals were counted (NMFS, unpublished data). The pup counts were conducted at all known rookeries for this stock during 1998. There were 4,058 pups counted in the GOA and 5,315 pups counted in the BSAI for a total of 9,373 for the stock. Combining the pup count data from 1998 (9,373), non-pup count data from 1998 (28,658), and estimate for unsurveyed sites from 1999 (757) resulted in a 1998 minimum abundance estimate of 38,788 Steller sea lions in the western DPS.

All non-pup trend sites, haulout sites, and rookeries were surveyed during 2000 (Sease et al., 2001). During the 2000 survey, a total of 25,384 non-pups were counted: 11,738 in the GOA and 13,646 in the BSAI (Sease et al. 2001). The best available population estimate for the western DPS of Steller sea lions is the sum of the total number of non-pups counted in 2000 (25,384) and the number of pups counted in 1998 (9,211). Thus, the best available count in 2000 was 34,595, a decrease from the 1998 estimate of 38,788 animals.

(ii) Minimum Population Estimate (Nmin): The 2000 count of non-pups (25,384) plus the number of pups in 1998 (9,211) was 34,595 and is considered the minimum population estimate for the western DPS of Steller sea lions in 2000 (in Angliss et al. 2002).

(iii) Population Trend: The first reported trend counts (an index to examine population trends) of Steller sea lions in Alaska were made in 1956-60. Those counts indicated that there were at least 140,000 (no correction factors applied) sea lions in the GOA and Aleutian Islands (Merrick et al. 1987). Subsequent surveys indicated a major population decrease, first detected in the eastern Aleutian Islands in the mid-1970s (Braham et al. 1980). Braham *et al.* (1980) documented declines of at least 50% from 1957 to 1977 in the eastern Aleutian Islands, the heart of what now is the western DPS. Counts from 1976 to 1979 indicated about 110,000 sea lions (no correction factors applied). The decline appears to have spread eastward to the Kodiak Island area during the late 1970s and early 1980s, and then westward to the central and western Aleutian Islands during the early and mid-1980s (Merrick et al. 1987, Byrd 1989). The greatest declines since the 1970s occurred in the eastern Aleutian Islands and western GOA, but declines also occurred in the central GOA and central Aleutian Islands. Merrick *et al.* (1987) estimated a population decline of about 50% from the late 1950s to 1985 over a much larger geographical area, the central Gulf of Alaska through the central Aleutian Islands, although this still included a patchwork of regional counts and surveys. The population in the GOA and Aleutian Islands declined by about 50% again from 1985 to 1989, or an overall decline of about 70% from 1960 to 1989 (Loughlin *et al.*, 1992). During the late 1980s the population from the Kenai Peninsula to Kiska Island in the central

Table 3.1: Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the western U. S. June 21, 2003 DPS from the late 1970s through 1998

Area	late 1970s	1990	1991	1992	1994	1996	1998	2000
Gulf of Alaska	65,296	16,409	14,598	13,193	11,862	9,784	8,937	7,995
Bering Sea/Aleutians	44,584	14,116	14,807	14,106	12,274	12.426	11,501	10,330
Total	109,880	30,525	29,405	27,299	24,136	22,210	20,438	18,325

Aleutian Islands declined at about 15.6% per year (York *et al.*, 1996). More recently, counts of Steller sea lions at trend sites for the western U. S. DPS decreased 40% from 1990 to 2000 (Table 3.1). Counts at trend sites during 2000 indicate that the number of sea lions in the Bering Sea/Aleutian Islands region has declined 10.2% between 1998 and 2000.

From 1991-2000, an average annual decline of 5.4% in non-pup counts at trend sites was reported by Loughlin and York (2000). From 2000 to 2002, the population of the western DPS increased by 5.5%. This was the first region-wide increase observed during more than two decades of surveys. Despite this increase, however, the 2002 count was still down 5% from 1998 and 34% from 1991. The average, long-term trend was a decline of 4.2% per year from 1991 to 2002. Trends were similar in the Kenai-to-Kiska subarea (four regions from the central Gulf of Alaska through the central Aleutian Islands), another geographical region used as a population index. Counts at the 70 Kenai-to-Kiska trend sites increased by 4.8% from 2000 to 2002 but decreased by 26% from 1991 to 2002. The long-term trend across the Kenai-to-Kiska region represents a decline of 3.1% per year from 1991 to 2002 (Sease, 2002).

Population viability analyses have been conducted for the western population by Merrick and York (1994) and York *et al.* (1996). The results of these analyses indicated that the next 20 years (from the publication of the paper) would be crucial for the western population of Steller sea lions, if the rates of decline observed at that time were to continue. Within this time frame, they determined the possibility that the number of adult females in the Kenai-to-Kiska region could drop to less than 5000. Extinction rates for rookeries or clusters of rookeries could also increase sharply in 40 to 50 years, and extinction for the entire Kenai-to-Kiska region could occur within 100–120 years. In a recent paper by Loughlin and York (2001), they estimated that the population may decline to only about 11,430 animals in the year 2020, of that only about 6,325 would be counted in the bi-annual survey, about a third of the current numbers. At that low an abundance, current survey techniques would have much higher errors associated with it and research would be difficult to undertake with few pups or juveniles available for studies with an adequate sample size. Although the recent survey estimate is encouraging, it will be at least 6-8 years before we are sure we have detected a true reversal in the sea lion decline. However, for all areas except the western Aleutian Islands, this positive trend could be a signal that this population is recovering. For the western Aleutian Islands, continued sharp declines could lead to the extirpation of sea lions from this region - however recent modeling has not been done on this sub-population within the western DPS.

3.1.1.1 Occurrence of the Western DPS in the Action Area: Matthews (2003) documented the occurrence of Steller sea lions from the Western DPS at South Marble Island in Glacier Bay National Park. The observations occurred during a vessel-interaction study during 1994, 1995 and 1997, 1998. Six identifiable individuals (tagged animals) were observed during the 1994-1997 period. None of the individually identifiable animals from the western DPS were seen in the action area in more than one year. Two other sea lions observed in 1998 were possibly tagged in Russia given their tag numbers. Matthews estimated that these tagged animals represented 0.7-1.9% of the animals on South Marble Island. These numbers represent a minimum estimate of the number of animals in the Park from the Western DPS. Most of the animals were not tagged so it was impossible to determine their DPS origin, and the numbers do not include animals on Graves Rock, a haulout designated as critical habitat that occurs within the Park boundaries but outside the area of the study by Matthews.

3.1.2 Eastern Distinct Population Segment

The Eastern DPS of Steller sea lions includes all animals at, and east of Cape Suckling, Alaska (144°W), including most of the sea lions in the action area. Steller sea lions from this DPS are the most likely ones to be found in the action area inside Glacier Bay and along the Park's outer coastline. There are three designated rookeries in southeast Alaska; Hazy Island, White Sisters near Sitka and Forrester Island near Dixon Entrance. None of the designated rookeries are in the action area although one haulout has recently had pups on it during surveys, so a new rookery may have formed since critical habitat was designated for this species.

(i) Abundance: Steller sea lion abundance in Southeast Alaska was based on comprehensive aerial surveys performed in June 1996 (Sease et al. 1999, Sease and Loughlin 1999). Data from these surveys represent actual counts of pups and non-pups at all rookeries and major haulout sites in Southeast Alaska. In 1996 a total of 14,621 Steller sea lions were counted in Southeast Alaska, including 10,907 non-pups and 3,714 pups. Aerial surveys in 1998 and 2000 included the trend sites and other major sites. There were some differences between which major sites were surveyed in 1998 and 2000, so the total counts for each survey are not entirely comparable. The counts for 1998 and 2000 were 10,939 and 12,417, respectively (Sease and Loughlin 1999, Sease et al. 2001). Pup counts totaled 4,160 in 1997 and 4,257 in 1998 (Sease and Loughlin 1999). The total count for Southeast Alaska in 1998 is 15,196 (10,939 non-pups plus 4,257 pups); if we assume that the pup count is roughly stable, the total 2000 count for the eastern DPS would be 16,674 (12,417 non-pups plus 4,257 pups).

Aerial surveys and ground counts of California, Oregon, and Washington rookeries and major haulout sites were also conducted during the summer of 1996. A total of 6,555 Steller sea lions were counted in California (2,042), Oregon (3,990), and Washington (523), including 5,464 non-pups and 1,091 pups.

The eastern DPS of Steller sea lions is a transboundary population, including sea lions from British Columbia rookeries (see Wade and Angliss 1997 for discussion of transboundary populations or stocks). Aerial surveys were last conducted in British Columbia during 1994 and produced counts of 8,091 non-pups and 1,186 pups, for a total count of 9,277 (Dept. Fisheries and Oceans, unpubl. data, Pacific Biological Station, Nanaimo, BC, V9R 5K6, reported in Angliss et al. 2002). Complete count data are not available for British Columbia in 1996. However, because the number of Steller sea lions in British Columbia is thought to have increased since 1994, the 1994 counts represent a conservative estimate for the 1996 counts. Combining the total counts for the three regions results in a minimum estimated abundance of 31,028 (15,196 + 6,555 + 9,277) Steller sea lions in the eastern DPS.

The abundance estimate for the eastern U. S. stock is based on counts of all animals (pup and non-pup) at all sites and has not corrected for animals missed because they were at sea. A reliable correction factor to account for these animals is currently not available. As a result, this represents an underestimate for the total abundance of Steller sea lions in this DPS.

(ii) Minimum Population Estimate (Nmin): Angliss et al. (2002) estimated the minimum population estimate by adding 1998 counts from Southeast Alaska (15,196), 1996 counts from WA/OR/CA (6,555), and Canadian counts from 1994 (9,277). This resulted in a minimum population estimate for the eastern U. S. DPS of Steller sea lions of 31,028. This count has not been corrected for animals which were at sea, and also uses the 1994 data from British Columbia where Steller sea lion numbers are thought to have increased.

(iii) Population Trend: In Southeast Alaska, counts (no correction factors applied) of non-pups at trend sites increased by 30% from 1979-2000 from 6,376 to 9,862 (Merrick et al. 1992, Sease et al. 2001)(Table 3.2). During 1979-97, counts of pups on the three rookeries in Southeast Alaska increased by an average of 5.9% per year. Since 1989 pup counts on the three rookeries increased at a lower rate (+1.7% per year) than for the entire period (Calkins et al. 1999). A slightly lower increase in pup counts (3.3% per year from 1979-97) is reported by Sease et al. (2001). In British Columbia, counts (no correction factors applied) of non-pups throughout the Province increased at a rate of 2.8% annually during 1971-98 (P. Olesiuk, pers. comm., Pacific Biological Station, Canada, reported in Angliss et al., 2002).

Steller sea lion numbers in California, especially in southern and central California, have declined from historic numbers. Counts in California between 1927 and 1947 ranged between 5,000 and 7,000 non-pups with no apparent trend, but have subsequently declined by over 50%, remaining between 1,500 and 2,000 non-pups during 1980-98. Limited information suggests that counts in northern California appear to be stable (NMFS 1995). At Año Nuevo, (central) California, a steady decline in ground counts started around 1970, resulting in an 85% reduction in the breeding population by 1987 (LeBoeuf et al. 1991). In vertical aerial photographic counts conducted at Año Nuevo, pups declined at a rate of 9.9% from 1990 to 1993, while non-pups declined at a rate of 31.5% over the same time period (Westlake et al. 1997). Pup counts at Año Nuevo have been steadily declining at about 5% annually since 1990. Overall, counts of non-pups at trend sites in California and Oregon have been relatively stable since the 1980s.

Based on recent trends in southeast Alaska and British Columbia, prospects for slow recovery of the eastern population are encouraging.

Table 3.2 Counts of adult and juvenile Steller sea lions observed at rookery and haulout trend sites by year and geographical area for the eastern U. S. DPS from the 1982 through 2000 (NMFS 1995, Strick et al. 1997, Sease et al. 1999, Sease and Loughlin 1999; P. Olesiuk, unpubl. data, Pacific Biological Station, Nanaimo, BC, V9R 5K6; ODF&W unpubl. data, 7118 NE Vandenberg Ave., Corvallis, OR 97330; Point Reyes Bird Observatory, unpubl. data, 4990 Shoreline Hwy., Stinson Beach, CA 94970; Sease et al. 2001). Central California data include only Año Nuevo and Farallon Islands. Trend site counts in northern California and Oregon include St. George, Rogue, and Orford Reefs. British Columbia data include counts from all sites

Area	1982	1990	1991	1992	1994	1996	1998	2000
Central CA	511[1]	655	537	276	512	385	208	349
Northern CA/OR	3,094	2,922	3,180	3,544	2,834	2,988	3,175	n/a
British Columbia	4,711	6,109[2]	no data	7,376	8,091	no data	9,818	n/a
Southeast Alaska	6,898	7,629	8,621	7,555	9,001	8,231	8,693	9,862
Total	15,214	--	--	18,754	20,263	--	21,864	n/a

[1] This count includes a 1983 count from Año Nuevo
[2] This count was conducted in 1987

3.1.3 Critical Habitat

The term "critical habitat" is defined in the ESA (16 U.S.C. 1532(5)(A) to mean:

> *(i) the specific areas within the geographic area occupied by the species, at the time it is listed in accordance with the provisions of section 4 of this Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management consideration or protection; and (ii) the specific areas outside of the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential to the conservation of the species.*

The ESA also states that "Except in those circumstances determined by the Secretary, critical habitat shall not include the entire geographical area which can be occupied by the threatened or endangered species."

By this definition, critical habitat includes those areas that are essential to the "conservation" of a threatened or endangered species. The ESA defines the term "conservation" as: ". . . to use and the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary." That is, the status of the species would be such that it would be considered "recovered." Therefore, the area designated as critical habitat should contain the physical and biological features necessary to support and sustain a population of a threatened or endangered species that is sufficiently large and persistent to be considered recovered.

3.1.3.1 **Designated Steller Sea Lion Critical Habitat**: On August 27, 1993 NOAA Fisheries designated critical habitat for the threatened eastern DPS, and endangered western DPS, of Steller sea lions (August 27, 1993; 58 FR 45269) at 50 CFR §226.202. The areas designated as critical habitat for the Steller sea lion were determined using the best information available at the time. This included information on land use patterns, the extent of foraging trips, and the availability of prey items. Particular attention was paid to life history patterns and the areas where animals haul out to rest, pup, nurse their pups, mate, and molt. Critical habitat areas were finally determined based upon input from NOAA Fisheries scientists and managers, the Steller Sea Lion Recovery Team, independent marine mammal scientists invited to participate in the discussion, and the public.

3.1.3.2 **Essential Features of Critical Habitat**: Steller sea lions require both terrestrial and aquatic resources for survival in the wild. Land sites used by Steller sea lions are referred to as rookeries and haulouts. Rookeries are used by adult males and females for pupping, nursing, and mating during the reproductive season (late May to early July). Haulouts are used by all size and sex classes but are generally not sites of reproductive activity. The continued use of particular sites may be due to site fidelity, or the tendency of sea lions to return repeatedly to the same site, often the site of their birth. Presumably, these sites were chosen by sea lions because of their substrate and terrain, the protection they offer from terrestrial and marine predators, protection from severe climate or sea surface conditions, and the availability of prey resources.

The regulations at 50 CFR §424.12(b) outline those physical and biological features which should be considered when designating critical habitat for listed species:
(1) Space for individual and population growth, and for normal behavior;
(2) Food, water, air, light, minerals, or other nutritional or physiological requirements;
(3) Cover or shelter;
(4) Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and generally;
(5) Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

The physical and biological features of critical habitat essential to the conservation of Steller sea lions can be broken out into two major habitat categories; terrestrial and foraging habitat. These habitats have features that support successful foraging, resting, refuge, and reproduction. Critical habitat in the action area is considered a haulout and not used for reproduction.

(i) **Terrestrial habitat**: Because terrestrial areas are more easily observed by humans, terrestrial habitat is relatively easy to identify based on use patterns. The shoreline, offshore rocks, cliffs, and caves used by sea lions are likely chosen because they offer refuge from terrestrial predators (e.g., are inaccessible to bears), include suitable substrate for reproductive activities (pupping, nursing, mating), resting (haulouts), provide some measure of protection from the elements (e.g., wind and waves), and are in close proximity to prey resources. Generally, the rookery and haulout sites are well scattered along the Alaska shoreline. They provide access to a variety of prey resources which is represented in the scat collections taken from terrestrial sites (Sinclair and Zeppelin 2001).

Reports of disruption on rookeries and haulouts has been well documented. On rookeries, human disturbance may disrupt breeding and nursing activities, lead to pup abandonment, and possibly increase the likelihood of predation. On haulouts, disturbance can also lead to increased chance of predation and the disruption of the social structure of sea lions. Since the early 1990s and the passage of critical habitat regulations, as well as the Marine Mammal Protection Act, these terrestrial sites have been largely undisturbed by humans, and are not considered to be a major factor in the continued decline of the species. One of the main concerns in the 1980s was that animals were being shot at from vessels nearby rookeries and haulouts. This is considered to be a rare occurrence today.

(ii) **Aquatic-Foraging habitat**: Prey resources are the most important feature of marine critical habitat for Steller sea lions. Marine areas may be used for a variety of other reasons (e.g., social interaction, rafting or resting), but foraging is the most important sea lion activity that occurs when the animals are at sea.

rafting or resting), but foraging is the most important sea lion activity that occurs when the animals are at sea.

The at-sea distribution of Steller sea lions is a critical element to any understanding of potential effects of fisheries on sea lions and their critical habitat. Substantial new information has been collected on the at-sea distribution of the western DPS of Steller sea lions as reported in Loughlin *et. al.* (2002) and ADF&G and NMFS (2001). Although not without limitations (discussed in ADF&G and NMFS 2001), information on location reflects the best scientific information available on the distribution of Steller sea lions in their aquatic habitat. Ideally, location would be combined with dive data to indicate at which locations sea lions are actively foraging. However, this combination of analyses is not yet available. In the absence of this combined information, NMFS must assume that information on location of sea lions does reflect, at least in part, where sea lions forage.

Marine foraging habitat designated as critical in the eastern DPSs include areas immediately around rookeries and haulouts. Rookery and haulout areas were chosen based on evidence that lactating, adult females took only relatively short foraging trips during the summer (20 km or less; Merrick and Loughlin 1997). These areas were also considered to be important because young-of-the-year sea lions took relatively short foraging trips in the winter (about 30 km; Merrick and Loughlin 1997) and are just learning to feed on their own, so the availability of prey in the vicinity of rookeries and haulouts appeared crucial to their transition to feeding themselves. Recent work by Loughlin *et al.* (2002), Sinclair and Zeppelin (2002), and DeMaster *et al* (2001) provide detailed information about sea lion habitat revealing what features of critical habitat that may be more important than others.

3.1.3.3 **<u>Description of Steller Sea Lion Critical Habitat in the Action Area</u>**: Steller sea lion critical habitat is listed in 50 CFR §226.202. All major Steller sea lion rookeries are identified in Table 1 [their Table 1] and major haulouts in Table 2 [their Table 2] along with associated terrestrial, air, and aquatic zones.

(i) **<u>Eastern DPS of Steller Sea Lions</u>**: Critical habitat for the eastern DPS includes the following areas:

A terrestrial zone that extends 3,000 feet (0.9 km) landward from the baseline or base point of each major rookery and major haulout

An air zone that extends 3,000 feet (0.9 km) above the terrestrial zone, measured vertically from sea level

An aquatic zone that extends 3,000 feet (0.9 km) seaward in State and Federally managed waters from the baseline or basepoint of each major haulout in Alaska that is east of 144° W long.

The only haulout designated as critical habitat for Steller sea lions in the immediate action area is Graves Rocks. The Graves Rocks haulout is designated as critical habitat for the eastern DPS of Steller sea lions and is located within the Park boundaries (50 CFR §226.202, Table 2). Little is known about the foraging habitat in the immediate vicinity of the Graves Rocks haulout. However, this designated haulout is sufficiently remote and offers a measure of protection due to its location inside Park boundaries, that it is not believed that disturbance at this location is a major factor in either the population trends or abundance, or the ability to sea lions to successfully forage.

Raum-Suryan and Pitcher (2000) (reported in NPS 2003) reported up to 49 pups at this location in 2000 and 2001; therefore this may have become a new rookery since critical habitat was designated.

(ii) **Western Distinct Population Segment of Steller Sea Lions**: There are no areas designated as critical habitat for the western DPS in the Action Area.

3.2 Central North Pacific Humpback Whale (*Megaptera novaeangliae*) Population

The humpback whale, Megaptera novaeangliae, belongs to the Order Cetacea, suborder Mysteceti. The mysticeti are baleen whales, named for the comb-like plates (baleen) descending from the roof of the mouth that are used to filter prey. Humpback whales are in the family of rorquals, the Balaenopteridae.
The humpback whale is distributed worldwide in all ocean basins. Most humpback whales occur in the temperate and tropical waters of the northern and southern hemispheres in the winter (from 10°-23° latitude). During this period, breeding and reproductive activities are the principal focus of humpback whales. During the warmer months, humpback whales move to northern latitudes where feeding is the principal activity. The historic feeding range of humpback whales in the North Pacific included coastal and inland waters around the Pacific rim from Point Conception, California, north to the Gulf of Alaska and the Bering Sea, and west along the Aleutian Islands to the Kamchatka Peninsula and into the Sea of Okhotsk (Nemoto 1957, Tomlin 1967, Johnson and Wolman 1984).

Three management units (stocks or population stocks) of humpback whales currently are recognized in the North Pacific. The following units migrate between their respective summer/fall feeding areas to winter/spring calving and mating areas in the North Pacific (Calambokidis et al. 1997, Baker et al. 1998):

1) the California/Oregon/Washington and Mexico population stock which are found winter/spring in coastal Central America and Mexico and migrate to the coast of California to southern British Columbia in summer/fall (Calambokidis et al. 1989, Steiger et al. 1991, Calambokidis et al. 1993);

2) the Central North Pacific population stock which are found winter/spring in the Hawaiian Islands and migrate to northern British Columbia/Southeast Alaska (including Glacier Bay) and Prince William Sound west to Kodiak (Baker et al. 1990, Perry et al. 1990, Calambokidis et al. 1997); and

3) the Western North Pacific population stock which occurs in winter/spring off Japan and, based on Discovery Tag information, probably migrate to waters west of the Kodiak Archipelago (the Bering Sea and Aleutian Islands) in summer/fall (Berzin and Rovnin 1966, Nishiwaki 1966, Darling 1991).

There are currently insufficient data to apply the Dizon et al. (1992) phylogeographic approach to classify any further population structure to humpback whales in the North Pacific. Recent discussions within the Alaska Scientific Review (SRG) group and between the Alaska SRG and NMFS have considered redesignating humpback whales of the Central North Pacific stock into separate population segments based on their summer feeding grounds. This approach would potentially create new stocks based on feeding aggregations in Southeast Alaska and several other places within the range of the Central North Pacific stock of humpback whales. Should this occur, the animals in Glacier Bay could be redesignated as part of a new, and separate Southeast Alaska population stock. However, this approach has not as yet been adopted. Until further information becomes available, the currently accepted management units of humpback whales (as described above) are recognized by NOAA Fisheries pursuant to the MMPA. However, it needs to be understood that only one humpback whale population or DPS exists in the North Pacific pursuant to the ESA. NOAA Fisheries recognizes that while only one DPS of humpback whales is found in the North Pacific Ocean, it is doubtful that animals from anything other than the central North Pacific population stock (as identified in Angliss et al. 2002) occurs within the action area. Therefore, for purposes of this consultation, we are going to focus on the Central North Pacific stock and refer to it as a population. This is the group of humpback whales that will be affected by the proposed action and while it is not considered a DPS under the ESA, it is appropriate to focus the analysis of effects of the action on this stock or "population."

(i) Abundance: Baker and Herman (1987) used capture-recapture methodology to estimate the wintering population at 1,407 (95% CI 1,113-1,701), which they considered an estimate for the entire population (NMFS 1991). However, the robustness of this estimate is questionable due to the opportunistic nature of the survey methodology in conjunction with a small sample size. Further, the data used to produce this estimate were collected between 1980 and 1983.

The most recent abundance estimate of humpback whales throughout the North Pacific is based on data collected by nine independent research groups that conducted photo-identification studies of humpback whales in the three wintering areas (Mexico, Hawaii, and Japan). Photographs taken between 1991 and 1993 were used to estimate abundance because samples throughout the entire North Pacific were the largest and most complete during this period. Using Darroch's (1961) method, which utilizes only data from wintering areas, and averaging the 1991-92, 1992-93, and 1991-93 winter release-recovery information resulted in an abundance estimate of 4,005 (CV = 0.095) for the Central North Pacific humpback whale population (Calambokidis et al. 1997). This is the estimate used to assess effects to this listed species by the proposed action. The current annual abundance estimate for the North Pacific population is 6,010 animals (Calambokidis et al. 1997). Therefore the Central North Pacific population consists of 67% of the total number of whales in the entire North Pacific basin.

Using photographs of the unique markings on the underside of each whales' flukes, there were 149 individual humpback whales identified in Prince William Sound from 1977 to 1993 (von Ziegesar 1992, Waite et al. 1999). The abundance of the Prince William Sound feeding aggregation is thought to be less than 200 whales (Waite et al. 1999). The most recent estimate by Straley et al. (2002) indicated that the annual abundance of humpback whales in southeastern Alaska is around 961 animals. Waite et al. (1999) identified 127 individuals in the Kodiak area between 1991 and 1994, and calculated a total annual abundance estimate of 651 (95% CI: 356-1,523) for the Kodiak region. In the Northern British Columbia region (primarily near Langara Island), 275 humpback whales were identified from 1992 to 1998 (G. Ellis, pers. comm., Pacific Biological Station, Nanaimo, BC, V9R 5K6, reported in Angliss et al. 2002). These estimates represent minimum estimates for these feeding areas because the study areas did not include the entire geographic region (i.e., the southeast Alaska study area did not include waters to the south of Chatham Strait). In addition, little is known regarding humpback whale abundance where photo-identification effort is typically low, such as the waters between feeding areas, south of Chatham Strait (southeastern Alaska), the eastern Gulf of Alaska and west of Kodiak Island. As a result, the sum of the estimates from these feeding aggregations (approximately 2,100) is considerably less than 4,005 animals.

(ii) Minimum Population Estimate: The minimum population estimate for this population is calculated according to Equation 1 from the PBR Guidelines (Wade and Angliss 1997): The minimum population estimate = $N/\exp(0.842\times[\ln(1+[CV(N)]^2)]^{1/2})$. Using the population estimate (N) of 4,005 and its associated CV(N) of 0.095, the minimum population estimate for this humpback whale stock is 3,698 (from Angliss et al. 2002).

(iii) Current Population Trend: The current population trend for the Central North Pacific stock of humpback whales is thought to be increasing. Comparison of the estimate provided by Calambokidis et al.

(1997) with the 1981 estimate of 1,407 (95% CI 1,113 - 1,701) from Baker and Herman (1987) suggests that the stock has increased in abundance between the early 1980s and the early 1990s. However, the robustness of the Baker and Herman (1987) estimate is questionable due to the small sample size and the opportunistic nature of the survey. As a result, although the data support an increasing population size for this current Central North Pacific stock, it is not possible to assess the rate of increase (NMFS 2002).

3.2.1 Humpback Whales in Southeast Alaska with Emphasis on the Action Area

The humpback whales of the central North Pacific population show a high degree of fidelity to feeding areas. This fidelity is maternally directed; that is, whales return to the feeding areas where their mothers first brought them as calves (Martin et al. 1984, Baker et al. 1987). The humpback whales in the central North Pacific stock show fidelity to either the southeast Alaska or the Prince William Sound feeding areas. Photographs taken from 1979-1996 indicate that under 1% of the individual whales photographed in these areas moved between areas. Therefore, while humpback whales in Glacier Bay belong to a much larger population, a smaller group of whales return to the action area from year to year to forage.

The Park Service has monitored humpback whales in the bay every year since 1985 to document the number of individuals, residence times, spatial and temporal distribution, feeding behavior and interactions with vessels (Doherty and Gabriele 2001). This monitoring program covers most of Glacier Bay and Icy Strait. The number of whales using the park rises in mid-June, peaks in July and August, then declines again in September, and is lowest from October through April (NPS 2003).

Largely as a result of the site fidelity of foraging humpback whales to this area, the percentage of the range of the Central North Pacific population of humpback whales which occurs in Glacier Bay and adjacent waters, and the number of animals that return annually to the action area, are both relatively small compared to the overall range and abundance of the entire population. The number of whales that used Glacier Bay and Icy Strait each year from 1985 to 2002 ranged from 41 to 104 individuals (Doherty and Gabriele 2002). A current estimate of abundance for animals inside Glacier Bay is 169 (95% CI=97-229) (Straley et al. 2002). The most recent estimate of abundance for Southeast Alaska is 961 whales (95% CI = 657-1076) (Straley et al. 2002). Therefore the percentage of whales in Glacier Bay is approximately 18% of the total number of whale throughout southeast Alaska, and less than 5% of the entire Central North Pacific population.

Humpback whale abundance in Glacier Bay has shown some increase since the earlier counts in the Bay which were the basis for earlier biological opinions. Standardized counts for the Bay itself show a low of 15 animals in 1985 with generally increasing numbers to 62 animals in the Bay in 1998. The whale count has declined since 1998 to a low of 45 animals in 2001 and 44 animals in 2002. The total count of whales in 2002 was 85 whales; however most were seen in Icy Strait not in the Park. The overall number of whales in Glacier Bay and Icy Strait combined has generally increased over the last 20 years. In 2002 whales were first sighted in the Bay in April and through November. Survey effort is somewhat inconsistent; although the effort is consistently higher over the years in the months of June, July and August. Whales are generally distributed in nearshore areas as opposed to the main central areas of Glacier Bay (Doherty and Gabriele 2002).

The crude birth rate (calculated as the number of calves divided by total number of whales) of humpback whales in Glacier Bay has fluctuated over the last 20 years of data from a low of 4.0% to a high of 18.5%. There does not appear to be an apparent trend in crude birth rate during this 20 year span. The last two years (2001-2002) the crude birth rate was 12.1 and 12.9% respectively, up significantly from the previous three years (Doherty and Gabriele 2002). The number of calves observed in 2002 is the second highest number of calves that have been observed in the study area since 1982 and is significantly higher than the average number of calves per year (6.5) for all years studied.

Whales in the study area typically feed primarily on small schooling fishes such as capelin (*Mallotus villosus*), juvenile walleye pollock (*Theragra chalcogramma*), sand lance (*Ammodytes hexapterus*) and Pacific herring (*Clupea harengus pallasi*) (Wing and Krieger 1983; Krieger and Wing 1984, 1986) . Groups of whales have been commonly seen feeding at Point Adolphus, Bartlett Cove, and Pleasant Island Reef (reported in NPS 2003). The availability of prey species appears to vary from year to year within the Park, and the number of whales in the park each year is dependent to a great degree on the availability and concentrations of prey in the park each year. Low numbers of whales are believed to correlate~~d~~ with years of low prey availability.

3.2.2 Critical Habitat for Humpback Whales in the Action Area

Critical habitat has not been designated for humpback whales anywhere throughout their range.

3.2.2.1 <u>High-use "Whale Waters" in the Action Area</u>: NPS (2003) has identified "whale-waters" within the boundaries of the National Park and Preserve based on the high probability of whale occurrence by humpback whales in these waters. The definition of whale-waters is found at Chapter 2.2.3 of this document. Another area with the high probability of whale occurrence inside the action area but outside the boundaries of the Park is Pt. Adolphus, across Icy Strait from the entrance to the Park.

4.0 ENVIRONMENTAL BASELINE

4.1 Biological Factors That May Affect Listed Species Within the Action Area.

Natural factors that determine the biogeography of listed species in the action area include climate and oceanography, avoidance of predators, distribution and availability of prey, the reproductive strategy of the species (Steller sea lions only), and movement patterns between sites. The marine habitats of Steller sea lions and humpback whales in the North Pacific tends to reduce variation in important environmental or climatic features, allowing both listed species to disperse widely around the rim of the North Pacific Ocean. Avoidance of terrestrial predators must clearly be an important factor for Steller sea lions, as rookeries and haulouts are virtually all located at sites inaccessible to such predators. Distribution and availability of prey are likely critical determinants of the biogeography for both Steller sea lions and humpback whales, and probably determine the distribution of both species during their non–reproductive seasons.

The reproductive strategy of the species (Steller sea lions), on the other hand, requires aggregation at rookery sites, and therefore likely places important limits on the species' movement patterns and dispersion. Reproduction of Steller sea lions in the action area has recently been observed (Raum-Suryan and Pitcher 2000). Humpback whales do not calve in the area. Finally, movement patterns and site-fidelity between sites determine, in part, the extent to which such groups of sea lions at different rookeries and haulout sites, and different foraging stocks or assemblages for humpback whales in the Central North Pacific population of whales, are demographically independent.

4.1.1 Effects of Disease on the Status of Listed Species

As with any wild mammal population, a multitude of infectious (viral, bacterial, parasitic, or mycotic) or toxicological (heavy metal, organochlorine) diseases may affect both listed species especially Steller sea lions. Many anatomical and clinical studies have been performed to determine disease prevalence, with an ultimate goal of determining incidence, interactions with environment, and what role disease may play in the population decline or as an impediment to recovery. Disease has not been considered to have played a significant role in the overall decline of the western stock of Steller sea lions (NMFS, 1995), but it is inconclusive to what extent it played as a contributory factor, and to what extent disease may be operating as a limitation to recovery. In declining populations, decreased genetic diversity and synergistic effects from chemical contaminant toxicity can act to compound factors that lead to reduced fitness (Bickham *et al.*, 2000). Disease is not believed to be a factor in the population trends of either the eastern DPS of Steller sea lions or humpback whales in the action area.

4.1.2 Effects of Climatic Variability on Prey Availability And Species Foraging: From 1940-1941 an intense Aleutian Low was observed over the BSAI, and GOA, this was followed from December 1976 to May 1977 with an even more intense Aleutian Low. During this latter period, most of the North Pacific Ocean was dominated by this low pressure system which signaled a change in the climatic regime of the BSAI, and GOA (NRC, 1996). The system shifted from a "cold" regime to a "warm" regime that persisted for several years. Since 1983, the GOA and Bering Sea have undergone different temperature changes. Sea surface temperatures in the GOA were generally above normal and those in the Bering Sea were below normal. The temperature differences between the two bodies of water have jumped from about 1.1° C to about 1.9° C. Recent evidence now indicates that another regime shift occurred in the North Pacific in 1989 (NRC, 1996).

Most scientists agree that the 1976/77 regime shift dramatically changed environmental conditions in the BSAI and GOA (Benson and Trites, 2000). However, there is considerable disagreement on how and to what degree these environmental factors may have affected both fish and marine mammal populations. Productivity of the Bering Sea was high from 1947 to 1976, reached a peak in 1966, and declined from 1966 to 1997. Some authors suggest that the regime shift changed the composition of the fish community and reduced the overall biomass of fish by about 50 percent (Merrick *et al.*, 1995; Piatt and Anderson, 1996). Other authors suggest that the regime shift favored some species over others, in part because of a few years of very large recruitment and overall increased biomass (Beamish, 1993; Hollowed and Wooster, 1995; Wyllie-Echeverria and Wooster, 1998).

It is reasonable to conclude that the regime shift created environmental conditions that produced very large year classes of gadids (i.e. pollock and Pacific cod). However, because of the historically high catches of gadids before the regime shift occurred, it is not likely that the regime shift favored gadids in a way which would allow them to out- compete other fish species and dominate the ecosystem, although the absolute level of biomass is not well known. The important question is whether the diet of listed species was adversely affected by the regime shift.

Shima *et. al.* (2000), looked at the GOA and three other ecosystems which contained pinniped populations, similar commercial harvest histories, environmental oscillations, and commercial fishing activity. Of the four ecosystems only the GOA pinniped population (western DPS of Steller sea lions) were decreasing in abundance. They hypothesized that the larger size and restricted foraging habitat of Steller sea lions, especially for juveniles that forage mostly in the upper water column close to land, may make them more vulnerable than other pinnipeds to changes in prey availability. They further reasoned that because of the behavior of juveniles and nursing females, the entire biomass of fish in the GOA might not be available to them. This would make them much more susceptible to spatial and temporal changes in prey, especially during the critical winter time period (Shima *et. al.*, 2000).

The eastern DPS of Steller sea lions have not been affected by environmental influences in the same manner as has the western DPS. Forage appears to be available in sufficient quantities to the eastern DPS such that reproduction and survival have not been compromised. The eastern DPS of Steller sea lions continues to increase in abundance at approximately 1.8% per year.

Other natural factors such as local prey fluctuations may occur and could affect humpback whales. However, prey fluctuations within Glacier Bay and waters immediately adjacent to the Bay, are not likely to be caused by these large-scale environmental influences affecting the western DPS of Steller sea lions in the BSAI or western GOA. The quantification of prey fluctuations is not possible at this time with few data available.

4.2 Known Anthropogenic Factors Affecting the Species Environment

Anthropogenic, or human-caused, activities can affect listed species through incidental takes, or through directed taking by several methods. Those discussed in this section include commercial fishing; direct takes from the subsistence harvest (Steller sea lions only); vessel traffic and disturbance; and vessel noise and disturbance.

4.2.1 Direct Effects of Commercial Fishing on Listed Species

A primary source of data for the rate of mortalities that occur incidental to commercial groundfish fishing is from the North Pacific Groundfish Observer Program database.

4.2.1.1 <u>Direct Effects of Commercial Fishing on Listed Species</u>: Six different commercial fisheries operating within the range of the western DPS of Steller sea lions were monitored for incidental take by fishery observers during 1990-1999. However, many fisheries known to interact with Steller sea lions have not been observed, and thus estimates of direct takes by fisheries should be considered minimum estimates. The mean annual estimate of (total) mortality for the most recent 5-year period was 7.8 (CV = 0.21) for the Bering Sea groundfish trawl fishery, 0.6 (CV = 0.6) for the GOA groundfish trawl fishery, and 1.2 (CV = 1.0) for the GOA groundfish longline fishery. Combining the mortality estimates from all fisheries interacting with the western DPS of sea lions results in an estimated mean annual mortality rate in the observed fisheries of 24.1 (CV = 0.6) sea lions per year from the western DPS (Table 4.1, data from Angliss et al. 2002).

Entanglement of Steller sea lions in derelict fishing gear or other materials seems to occur at frequencies that do not have significant effects upon the population. Entanglement of sea lions in derelict fishing gear or other marine debris does not appear to represent a significant threat to the population.

Table 4.1: Summary of incidental mortality of Steller sea lions (western U. S. stock) due to commercial fisheries from 1990 through 2000 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information. Data from 1996 to 2000 (or the most recent 5 years of available data) are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. n/a indicates that data are not available. * Data from the 1999 Cook Inlet observer program are preliminary.

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	90-00	obs data	53-76%	13, 13, 15, 4, 9, 2, 4, 6, 6, 8, 6	13, 19, 21, 6, 11, 3, 4, 10, 9, 9, 7	7.8 (CV = 0.21)
Gulf of Alaska (GOA) groundfish trawl	90-00	obs data	33-55%	2, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0	4, 0, 0, 3, 3, 0, 0, 0, 3, 0, 0	0.6 (CV = 0.6)
GOA groundfish longline (incl. misc. finfish and sablefish fisheries)	90-00	obs data	8-21%	1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1	2, 0, 0, 0, 1, 4, 0, 0, 0, 0, 6	1.2 (CV = 1.0)
Prince William Sound salmon drift gillnet	90-91	obs data	4-5%	0, 2	0, 29	14.5 (CV = 1.0)
Prince William Sound salmon set gillnet	90	obs data	3%	0	0	0
Alaska Peninsula/Aleutian Islands salmon drift gillnet	90	obs data	4%	0	0	0
Cook Inlet salmon set gillnet*	99-00	obs data	2-5%	0, 0	0, 0	0

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Cook Inlet salmon drift gillnet*	99-00	obs data	2-5%	0, 0	0, 0	0
Observer program total						24.1 (CV = 0.64)
				Reported mortalities		
Alaska Peninsula/Aleutian Islands salmon set gillnet	90-00	self reports	n/a	0, 1, 1, 1, n/a n/a, n/a, n/a, n/a	n/a	[≥0.75]
Bristol Bay salmon drift gillnet	90-00	self reports	n/a	0, 4, 2, 8, n/a n/a, n/a, n/a, n/a, n/a	n/a	[≥3.5]
Prince William Sound set gillnet	90-00	self reports	n/a	0, 0, 2, 0, n/a n/a, n/a, n/a, n/a, n/a	n/a	[≥0.5]
Alaska miscellaneous finfish set gillnet	90-00	self reports	n/a	0, 1, 0, 0, n/a n/a, n/a, n/a, n/a, n/a	n/a	[≥0.25]
Alaska halibut longline (state and federal waters)	90-00	self reports	n/a	0, 0, 0, 0, 1 n/a, n/a, n/a, n/a, n/a	n/a	[≥0.2]
Alaska sport salmon troll (non-commercial)	93-00	strand	n/a	0, 0, 0, 0, 1, 0, n/a	n/a	[≥0.2]
Minimum total annual mortality						≥29.5 (CV = 0.64)

The number of animals taken from the eastern DPS of Steller sea lions by commercial fisheries during the period 1990-1998 in the Southeast Alaska salmon drift gillnet fishery (Table 4.2) resulted in an annual mean of 1.25 mortalities from interactions with commercial fishing gear. However, because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994), these are considered to be minimum estimates. During 1990, 11 Steller sea lion injuries incidental to the Alaska salmon troll fishery and one Steller sea lion injury incidental to the CA/OR/WA salmon troll fishery were reported. Logbook data are available for part of 1989-1994, after which incidental mortality reporting requirements were modified. Under the new system, logbooks are no longer required; instead, fishers provide self-reports. Data for the 1994-95 phase-in period is fragmentary. After 1995, the level of reporting dropped dramatically, such that the records are considered incomplete and estimates of mortality based on them represent minimums.

Table 4.2 Summary of incidental mortality of Steller sea lions (eastern U. S. DPS) due to commercial and tribal fisheries from 1990-2000 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate from self-reported fisheries information or stranding data. Data from 1996-2000 (or the most recent 5 years of available data) are used in the mortality calculation when more than 5 years of data are provided for a particular fishery. n/a indicates that data are not available. * indicates a mortality seen by an observer, but during an unmonitored haul; because the haul was not monitored, no extrapolation can be done (from Angliss et al. 2002)

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
CA/OR thresher shark and swordfish drift gillnet	90-00	obs data	4-27%	0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0	0, 0, 7, 0, 6, 0, 0, 0, 0, 0, 0	0
WA/OR/CA groundfish trawl (Pacific whiting component)	90-00	obs data	44-72%	0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 0	0, 0, 0, 0, 1, 0, 0, 2, 0, 0, 1*	0.5 (CV = 1.0)
Northern WA marine set gillnet (tribal fishery)	90-98	obs data	47-98%	0, 0, 0, 0, 0, 0, 1, 0, 0	0, 0, 0, 0, 0, 0, 1, 0, 0	0.2 (CV = 1.0)
Observer program total						0.7 (CV = 1.0)
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-00	self reports	n/a	0, 1, 2, 2, n/a, n/a, n/a, n/a, n/a, n/a, n/a	n/a	[≥1.25]
Alaska salmon troll	92-00	strand data	n/a	0, 0, 0, 1, 0, 0, n/a, n/a	n/a	[≥0.2]
British Columbia aquaculture predator control program	91-00	permit reports	n/a	14, 8, 10, 11, 6, 13, 34, 63, 91, na , na	n/a	41.4

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Minimum total annual incidental mortality (includes an estimate of 0.8 fishery-related strandings per year; see text)						≥2.85 (CV = 1.0)
Minimum total annual mortality (includes intentional mortalites in the BC predator control program)						≥44.3 (CV = 1.0)

Stranding reports of Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. During the 5-year period 1995-1999, there were 4 fishery-related strandings in Southeast Alaska. One of these strandings has been attributed to the Alaska salmon troll fishery and has been included in Table 4.2. Details regarding which fishery may be responsible for other fishery-related strandings between 1994-99 is not available at this time. In 2000, there were reports of 3 Steller sea lions observed in southeast Alaska with "flashers" lodged in their mouths and one animal entangled in fishing line; all animals were alive when seen. It is not clear whether these entanglements resulted from the commercial or recreational fisheries, nor is it clear whether the interactions resulted in mortality. However, based on Angliss and DeMaster (1998), it would be appropriate to call these "serious injuries". During the 5-year period from 1996-2000, there were 6 fishery-related stranding events. This results in an estimated annual mortality of 1.2 animals from this population. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported.

Stranding reports of Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear are another source of mortality data. During the 5-year period 1995-1999, there were 4 fishery-related strandings in Southeast Alaska. One of these strandings has been attributed to the Alaska salmon troll fishery and has been included in Table 4.2. Details regarding which fishery may be responsible for other fishery-related strandings between 1994-99 is not available at this time. In 2000, there were reports of 3 Steller sea lions observed in southeast Alaska with "flashers" lodged in their mouths and one animal entangled in fishing line; all animals were alive when seen. It is not clear whether these entanglements resulted from the commercial or recreational fisheries, nor is it clear whether the interactions resulted in mortality. However, based on Angliss and DeMaster (1998), it would be appropriate to call these "serious injuries". During the 5-year period from 1996-2000, there were 6 fishery-related stranding events. This results in an estimated annual mortality of 1.2 animals from this population. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found or reported.

The minimum estimated mortality rate incidental to commercial fisheries (both U.S. and Canadian) is 3.35 sea lions per year, based on observer data (0.7), self-reported fisheries information (1.25), and stranding data (0.2 + 1.2 = 1.4) (Table 4.2, from Angliss et al. 2002).

4.2.1.2 **<u>Direct Affects of Commercial Fisheries on the Central North Pacific Humpback Whale Population:</u>** Four different commercial fisheries operate in Alaska waters within the range of the Central North Pacific humpback whale stock, and were monitored for incidental take by fishery observers during 1990-1999 BSAI groundfish trawl, GOA groundfish trawl, longline, and pot fisheries. One humpback whale mortality was observed in the BSAI groundfish trawl fishery in 1998 and one in 1999. Average annual mortality from the observed fisheries in Alaska was 0.4 humpbacks from this stock (Table 4.3). The range of observer coverage for this fishery, as well as the annual observed and estimated mortalities, are presented in Table 4.3.

The observer program in the Hawaii in 1994 became mandatory and observer coverage has been approximately 4-5% since that time. Fishery observers recorded one humpback whale entangled in longline gear in 1991. The fate of this animal is unknown, though it is presumed to have died. The mortality rate was not estimated from the 1991 mortality due to the low level of observer coverage in that year (<1%). Therefore, that single mortality also appears as the estimated mortality for 1991 and should be considered a minimum estimate. Note that another humpback whale was reported by fishers and whalewatch operators entangled in longline gear off Maui during 1993 (E. Nitta, pers. comm, NOAA Fisheries). This report was never confirmed and the fate of this animal is also unknown. The estimated mean annual mortality rate in all observed fisheries during the 5-year period from 1994-98 is 0.2 humpback whales per year from this stock.

An additional source of information on the number of humpback whales killed or injured incidental to commercial fishery operations is the self-reported fisheries information required of vessel operators pursuant to the MMPA. In 1994, the incidental take of a humpback whale was reported in the Southeast Alaska salmon purse seine fishery. Another humpback whale is known to have been taken incidentally in this fishery in 1989, but due to its historic nature has not been included in Table 4.2. In 1996, a humpback whale was reported entangled and trailing gear as a result of interacting with the Southeast Alaska drift gillnet fishery. This whale is presumed to have died. Together, these two mortalities result in an annual mortality of 0.4 (0.2 + 0.2) humpback whales based on self-reported fisheries information (Table 4.3). This is considered to be a minimum estimate because logbook records (fisher self-reports required during 1990-94) are most likely negatively biased (Credle et al. 1994).

Reports of entangled humpback whales found swimming, floating, or stranded with fishing gear attached occur in both Alaskan and Hawaiian waters. Two such reports from Alaska are included in Table 4.3 because they could be attributed to the Southeast Alaska salmon drift gillnet fishery.

An entanglement of a humpback whale occurred in this fishery in 1992 but was reported as a stranding. In 1994, a humpback whale was reported in a weakened condition entangled in a fishing net with floats attached and is presumed to have died. Given the location of this animal (Chatham Strait), the mortality was attributed to the Southeast Alaska salmon drift gillnet fishery. Details of other strandings that occurred between 1992 and 1999 in these areas are presented in Table 4.4. Fishery-related strandings from Hawaii and Alaska during 1994-99 as listed in Table 4.4 result in an estimated annual mortality of 2.2 humpback whales from this stock. This estimate is considered a minimum because not all entangled animals strand and not all stranded animals are found, reported, or cause of death determined.

The estimated minimum mortality rate incidental to commercial fisheries is 4.1 humpback whales per year, based on observer data (0.4), and self-reported fisheries information (0.4) , stranding records traceable to a

Table 4.3: Summary of incidental mortality of humpback whales (Central North Pacific Population) due to commercial fisheries from 1990 through 2000 and calculation of the mean annual mortality rate. Mean annual mortality in brackets represents a minimum estimate. For a particular fishery, the most recent 5 years of available data are used in the mortality calculation when more than 5 years of data are provided. n/a indicates that data are not available (from Angliss et al. 2002)

Fishery name	Years	Data type	Range of observer coverage	Observed mortality (in given yrs.)	Estimated mortality (in given yrs.)	Mean annual mortality
Hawaii swordfish, tuna, billfish, mahi mahi, oceanic shark longline/setline	90-00	obs data	<1-5%	0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0	0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0	0
Bering Sea/Aleutian Is. (BSAI) groundfish trawl	90-00	obs data	53-74%	0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0	0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0	0.4 (CV = 0.61)
Observer program total						0.4
				Reported mortalities		
Southeast Alaska salmon drift gillnet	90-00	self reports	n/a	0, 0, 0, 0, n/a, n/a, 1, n/a, n/a, n/a, n/a	n/a	[≥0.2]
Southeast Alaska salmon purse seine	90-00	self reports	n/a	0, 0, 0, 0, 1, n/a, n/a, n/a, n/a, n/a, n/a	n/a	[≥0.2]
Southeast Alaska sálmon purse seine	92-00	stranding records		1 in 2000	n/a	[≥0.2]
Southeast Alaska salmon drift gillnet	92-00	stranding records	n/a	0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0	n/a	[≥0.2]
Crustacean pot		stranding records	n/a	1 each in 1998 and 1999	n/a	[≥0.4]
Minimum total annual mortality						[≥1.6]

specific fishery (0.8) and other stranding records indicating mortality or serious injury (Table 4.5). As mentioned previously, this estimate should be considered a minimum. No observers have been assigned to several fisheries that are known to interact with this stock, making the estimated mortality rate unreliable. Further, due to limited Canadian observer program data, mortality incidental to Canadian commercial fisheries (i.e., those similar to U.S. fisheries known to interact with humpback whales) is uncertain. Though interactions are thought to be minimal, the lack of data regarding the level of humpback whale mortality related to commercial fisheries in northern British

Table 4.4 Human-related strandings and entanglements of humpback whales (central North Pacific Population), 1996-2000. An asterisk in the "number" column indicates cases that were not considered serious injuries (from Angliss et al. 2002)

Year	Number	Area	Condition	Description
1996	1*	"Hawaiian waters"	Released alive	Disentangled from non-fishing gear
1996	1	Oahu, HI	Injured; status unknown	Ship strike
1996	1	Oahu, HI	Injured; status unknown	Partial disentanglement from Hawaiian crab fishery gear; some gear around pectoral fin and mouth still attached
1996	1	Sand Point, AK	Injured; status unknown	Released from fishing gear, but appeared injured; thought to have died
1996	1*	Alitak Beach, Kodiak Island, AK	Released alive	Released from commercial purse seine net
1997	1*	Island of Hawaii	Released alive	Alaska crab pot floats removed by U.S. Coast Guard
1997	1*	57 30 N 135 13 W NW Shelter Island	Alive	Collision with skiff
1997	1	Peril Straits, AK	Injured	Entangled in line; attempt to disentangle failed
1997	1	58 18 N 134 24 W NW Shelter Island	Injured	Tail wrapped in crab pot line
1997	1	58 21N 134 57 W NW Admiralty Island	Alive; entangled	Line and 2' diameter buoy attached
1998	1	Maalaea Bay, Lanai	Alive; entangled	Disentangled from gear, but some line still attached
1998	1	Sitka, AK	Alive; entangled	Commercial gillnet around flippers
1998	1*	Jakolof Bay	Alive	Disentangled from personal use pot gear
1998	1	Ketchikan, AK	Injury; status unknown	Salmon purse seiner net (commercial) torn through, thought to have died
1998	1	Juneau, AK	Injured	Ship strike (8/11)
1998	1	Juneau, AK	Entangled	No details available
1998	1*	Wrangell, AK	Alive	Commercial crab pot buoy removed
1998	1*	Homer, AK	Alive	Tanner crab pot cut loose
1998	1	Juneau, AK	Injured	Ship strike (9/24)
1998	1*	Sitka, AK	Alive	Commercial crab pot line cut free

1998	1	Ketchikan	Entangled	Swimming freely with pot gear attached
1999	1	Homer	Entangled	In crab pot gear; released
1999	1	Prince of Wales Island	Entangled	In unknown pot gear, released
1999	1	Metlakatla	Injury; status unknown	Ship strike
2000	1*	Lynn Canal	Entangled, released alive, status unknown	Purse seine gear
2000	1*	Skagway	Entangled, released alive	Shrimp pot gear
2000	1	Uyak Bay	Entangled	Unknown gear

Columbia are not available, again reinforcing the point that the estimated mortality incidental to commercial fisheries is underestimated for this stock.

At this time the number of entanglements that might result in serious injury or mortality for humpback whales is not known to be at a level to have population level effects on the Central North Pacific population.

4.2.1.3 Commercial Fishing inside the Immediate Action Area: Commercial fishing is authorized within the non-wilderness waters of the Park, subject to provisions in 36 CFR 13.65. Commercial fishing is administered pursuant to a cooperatively developed State/Federal park management plan, and existing federal law. Three types of fishing are authorized in Glacier Bay non-wilderness waters: longline fishing for halibut; pot and ring fishing for Tanner crab; and trolling for salmon (36 CFR 13.65(a)(3)). Of these only the fixed gear fishing may be of concern to listed species. Therefore incidental bycatch or competition for available fishes between commercial fisheries and listed species in the immediate action area (inside the Park boundaries) is minimized. The concern is primarily due to the potential for entanglement of humpback whales in longline or pot gear. All other commercial fishing is prohibited.

The indirect effects of fishing on prey availability or disruption of prey patterns is not a concern inside Glacier Bay. Both factors, prey fluctuations and entanglements in fishing gear, could also have some level of current impact outside of the Bay but on the same animals that frequent Glacier Bay waters. The level of entanglements in fishing gear in Southeast Alaska in general, has been increasing in recent years (NMFS unpublished data) and activity outside of the action area could affect those animals within the action area.

4.2.2 Direct Effects of the Subsistence Harvests on Listed Species

The 1992-1996 subsistence harvests of Steller sea lions in Alaska has been estimated by the Alaska Department of Fish and Game, under contract with the NMFS (Table 4.5; Wolfe and Mishler 1993, 1994, 1995, 1996, 1997; Wolfe and Hutchinson-Scarbrough 1999). Data were collected each year through systematic interviews with hunters and users of marine mammals in approximately 2,100 households in about 60 coastal communities within the geographic range of the Steller sea lion in Alaska.

4.2.2.1 Subsistence Harvest of the Western DPS of Steller Sea Lions: Steller sea lions are primarily taken for subsistence purposes in communities within the range of the western DPS. Pinniped harvests in southeast Alaska tend to be dominated by harbor seals rather than Steller sea lions. Most Steller sea lions are harvested in the Pribilof Islands, well outside the action area. Estimates of the total number of sea lions taken (harvested plus struck and lost) during 1992 - 1998 ranged from 549 to 171 per year (Angliss *et al.*, 2001), with an overall mean annual take of 329 sea lions for the entire period. Harvest levels typically have been lowest during June - August, peaking during September - November and declining through May, but this seasonality has been less pronounced since 1996 with declining harvest rates (Wolfe and Mishler, 1997). In 1998, an estimate of 171 Steller sea lions were taken, of which approximately 128 were harvested and 43 were struck and lost. Evidence indicates that the harvest levels in 1996 and 1997 were substantially lower than those in 1993- 1995. Data were not collected in 1999. Harvests in 2001 and 2002 have continued to decline.

4.2.2.2 <u>**Subsistence Harvest of Steller Sea Lions from the Eastern DPS**</u>: A very small percentage (<1%) of the statewide subsistence take of Steller sea lions was from the eastern U. S. population. The total subsistence take of Steller sea lions from this DPS was estimated at 6, 1, 5, 0, 0, and 0 animals in 1992-97, respectively. These values for total take include one animal per year during 1992-94 that was reported struck and lost. The mean annual subsistence take from this stock over the 3-year period from 1995 to 1997 was zero sea lions from this DPS.

Table 4.5 Summary of the subsistence harvest data for the western U. S. stock of Steller sea lions, 1992-98. Brackets indicate that the 1996 data remain in dispute and the 1997 data are preliminary. Subsistence harvest data were not collected in 1999 or 2000 (from Angliss et al. 2002)

Year	Estimated total number taken	95% confidence interval	Number harvested	Number struck and lost
1992	549	452-712	370	179
1993	487	390-629	348	139
1994	416	330-554	336	80
1995	339	258-465	307	32
1996	[179]	[158-219]	[149]	[30]
1997	[164]	[129-227]	[146]	[18]
1998	171	130-246	128	43
Mean annual take (1997-98)	167.5			

An unknown number of Steller sea lions from this stock are harvested by subsistence hunters in Canada. The magnitude of the Canadian subsistence harvest is believed to be small. Alaska Native subsistence hunters have initiated discussions with Canadian hunters to quantify their respective subsistence harvests, and to identify any effect these harvests may have on the cooperative management process.

4.2.2.3 Subsistence Harvest of Humpback Whales: Humpback whales are not harvested by Alaska Natives.

4.2.3 Other Direct Takes and Mortalities of Listed Species

(i): Illegal Shooting of Steller Sea Lions: The illegal shooting of Steller sea lions occurs, but the frequency of occurrence is difficult to estimate. NOAA Fisheries successfully prosecuted two cases of illegal shooting of sea lions in the Kodiak area in 1998, and two cases in southeast Alaska between 1995 - 1999 (Angliss *et al.*, 2001). Illegal shooting of sea lions was thought to be a potentially significant source of mortality prior to the listing of sea lions as "threatened" under the ESA in 1990. Such shooting has been illegal since the species was listed as threatened. There are no reports of illegal takes in the action area. Strandings of Steller sea lions from the eastern DPS with gunshot wounds do still occur, along with strandings of animals entangled in gear that is not fishery-related.

During the period from 1996-99 human-related strandings of animals with gunshot wounds from this stock occurred in Oregon, Washington, and Alaska in 1996 (2 animals), 1997 (3 animals), 1998 (1 animal), and 1999 (2 animals), resulting in an estimated annual mortality of 2.0 Steller sea lions from this stock during 1996-99. This estimate is considered a minimum because not all stranded animals are found, reported, or cause of death determined (via necropsy by trained personnel). In addition, human-related stranding data are not available for British Columbia. Reports of stranded animals in Alaska with gunshot wounds have been included in the above estimates. However, it is not possible to tell whether the animal was illegally shot or if the animal was struck and lost by subsistence hunters (in which case the mortality would have been legal and accounted for in the subsistence harvest estimate). However, one of the two 1996 reports was from Alaska and has been included because there were no subsistence struck and lost reports during that year.

Stranding data also provide information on additional sources of potential mortality. In 2000, 4 Steller sea lions were entangled in rope or line that was not necessarily related to a commercial or recreational fishery, and one animal was seen entangled in a 14" tire. All of these animals were alive when sighted; the animal entangled in the tire was successfully released. It is not clear whether the occurrence of these interactions in stranding data in 2000 but not in previous years reflects an increase in these types of interactions or an increase in reporting. If the number of interactions is averaged over 5 years, the "other" interaction rate would be a minimum of one animal per year (from Angliss et al. 2002).

(ii) Predator Control: Steller sea lions are taken in British Columbia during commercial salmon farming operations. Preliminary figures from the British Columbia Aquaculture Predator Control Program indicated a mean annual mortality of 44 Steller sea lions from this DPS over the period from 1995 to 1999 (P. Olesiuk, pers. comm., Pacific Biological Station, Canada, reported in Angliss et al; 2002).

4.2.4 Effects of Historic Whaling on the Central North Pacific Population of Humpback Whales

The worldwide population of humpback whales was thought to have been in excess of 125,000 animals (NMFS 1991) pior to commercial whaling. Appoximately 15,000 animals were believed to have been present in the North Pacific prior to 1905. Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century and may have reduced this population to as few as 1,000 before it was placed under international protection by the International Whaling Commission (IWC) in 1965. This estimate likely underestimates the actual kill as a result of under-reporting of the Soviet catches (Yablokov 1994).

Humpback whales are protected from hunting worldwide by the IWC. Humpback whales were listed as endangered under the ESA in 1973 due to the reduced population size that resulted from the significant mortality of commercial whaling. Humpback whales of the North Pacific basin have apparently been increasing since being placed under the protection of the whaling moratorium. The Central North Pacific population has increased substantially in recent years based on available data; although the rate of that increase is not known because of uncertainty in earlier abundance estimates.

Whaling was considered the primary threat to the worldwide populations of humpback whales when the species was placed under the protection of the IWC. Commercial whaling is no longer a threat to this species.

4.2.5 Potential Direct Effects of Vessels on Listed Species

The past 7 years of opportunistic data on vessel collisions with humpback whales have shown an average of one humpback whale struck per year (Table 4.6). This is a minimum estimate as not all whales struck are reported and not all whales struck are identified to species or cause of mortality. The fate of struck animals is also not always determined unless the whale dies immediately upon impact or is discovered as a carcass on the bow of a ship and it can be determined that the strike was the cause of death.

Humpback whale distribution overlaps significantly with the transit routes of large commercial vessels that ply the waters off Alaska. The larger vessels are cruise ships, large tug and barge transport vessels and oil transport tankers. Cruise ships frequent the inside waters of Southeast Alaska, passing through areas of concentrated humpback whale abundance such as Glacier Bay National Park and Preserve, Point Adolphus and other areas adjacent to the action area. Tug and barge transport follows much of the traffic pattern of the cruise ships as they frequent the same coastal communities. Except for transit through Prince William Sound, oil transport tankers are generally operating farther offshore where there are presumably fewer concentrations of humpback whales.

Table 4.6 Vessel strikes of humpback whales in Alaska as reported to NMFS, Alaska Region 1996-2002. Condition of animal is as reported immediately after animal was struck. Fate of animals deemed "alive" is not known.

Year	Number	Animal Condition	Vessel speed	Location
2002	0			
2001	2	alive/inj dead	12kts unknown	Dixon Entrance Point Gustavus
2000	0			
1999	2	unknown dead	unknown unknown	Metlakatla 60mi S of Juneau
1998	2	alive alive	2 kts 15-18 kts	Juneau Juneau
1997	2	alive alive	22 kts unknown	Seward Juneau
1996	0			

Several incidents of vessel interactions with humpback whales in Glacier Bay were documented in 2002 (Doherty and Gabriele 2002). These included close approaches and possible harassment by several vessels of different vessel classes including a kayak, a cruise ship and a float plane. Researchers also documented an injury to the dorsal fin that likely resulted from a vessel strike. It is likely that mortality of humpback whales will continue into the future and it is not known to what extent, if any, the proposed action will result in an increased rate of mortality as a result of ship-strikes.

4.2.6 Noise in the Action Area

Vessel noise is everywhere in the action area as a result of ambient conditions and noise from current operating procedures for vessels in the National Park. Chapter 3.2.2 (NPS 2003) provides a background for the levels of sound found in the action area which are produced from natural and anthropogenic sources. The reader is referred to this technical and thorough section for baseline information on sound in the action area.

4.3 Summary of Environmental Baseline Effects

Disease has not been considered to have played a significant role in the overall decline of the western stock of Steller sea lions (NMFS, 1995), but it is inconclusive to what extent it played as a contributory factor, and to what extent disease may be operating as a limitation to recovery. In declining populations, decreased genetic diversity and synergistic effects from chemical contaminant toxicity can act to compound factors that lead to reduced fitness (Bickham *et al.*, 2000). Disease is not believed to be a factor in the population trends of either the eastern DPS of Steller sea lions or humpback whales in the action area.

Environmental influences have affected the western GOA and BSAI during the past several decades. Those influences may be affecting the population trends of pinnipeds in those areas. The eastern DPS of Steller sea lions likely has not been affected by environmental influences in the same manner as has the western DPS. Forage appears to be available in sufficient quantities to the eastern DPS such that reproduction and survival have not been compromised. The eastern DPS of Steller sea lions continues to increase in abundance at approximately 1.8% per year. Other natural factors such as local prey fluctuations may occur and could affect humpback whales. However, prey fluctuations within Glacier Bay and waters immediately adjacent to the Bay, are not likely to be caused by these large-scale environmental influences affecting the western DPS of Steller sea lions in the BSAI or western GOA.

The direct effects of commercial fishing on Steller sea lions has been documented in Angliss <u>et al.</u> (2002) and are summarized in this section. The potential indirect effects of fishing on the western DPS of Steller sea lions has been the subject of much discussion in the past few years and has been summarized in several recent environmental impact analyses and biological opinions released by NOAA Fisheries on the effects of the GOA and BSAI on the western DPS of Steller sea lions (NOAA Fisheries 2000, 2001a, 2001b). Generally the western DPS of Steller sea lions minimally occurs in the action area. The eastern DPS of sea lions is found throughout the action area. The eastern DPS has been increasing and the effects of fishing in the action area on this population appear minimal. Recent observations suggest that a haulout has become a rookery in recent years suggesting little disturbance from any activity. The number of animals known to be taken by commercial fishing from this population is considered negligible pursuant to the MMPA.

The estimated minimum mortality rate of humpback whales from this population incidental to commercial fisheries is 4.1 whales per year, based on observer data, self-reported fisheries information, stranding records traceable to a specific fishery and other stranding records indicating mortality or serious injury. The level of entanglements in fishing gear in Southeast Alaska in general, has been increasing in recent years (NMFS unpublished data) and activity outside of the action area could affect those animals within the action area.

Three types of fishing are authorized in Glacier Bay non-wilderness waters: longline fishing for halibut; pot and ring fishing for Tanner crab; and trolling for salmon. Of these only the fixed gear fishing may be of concern to listed species. Therefore incidental bycatch or competition for available fishes between commercial fisheries and listed species in the immediate action area (inside the Park boundaries) is minimized. The concern is primarily due to the potential for entanglement of humpback whales in longline or pot gear. All other commercial fishing is prohibited. The indirect effects of fishing on prey availability or disruption of prey patterns is not a concern inside Glacier Bay. Both factors, prey fluctuations and entanglements in fishing gear, could also have some level of current impact outside of the Bay but on the same animals that frequent Glacier Bay waters.

Steller sea lions are primarily taken for subsistence purposes in communities within the range of the western DPS. Most Steller sea lions are harvested well outside the action area. Evidence indicates that the harvest levels in 1996 and 1997 were substantially lower than those in 1993- 1995. Data were not collected in 1999. Harvests in 2001 and 2002 have continued to decline. A very small percentage (<1%) of the statewide subsistence take of Steller sea lions was from the eastern U. S. population. The mean annual subsistence take from the eastern DPS over the 3-year period from 1995 to 1997 was zero sea lions from this DPS. Humpback whales are not harvested by Alaska Natives. Subsistence harvests are not considered a factor in the current trends of any of the listed species.

Whaling was considered the primary threat to the worldwide populations of humpback whales when the species was placed under the protection of the IWC and listed under the ESA. Intensive commercial whaling removed more than 28,000 animals from the North Pacific during the 20th century and may have reduced this population to as few as 1,000 before it was placed under international protection by the IWC in 1965. Commercial whaling is no longer a threat to this species. The Central North Pacific population has increased substantially in recent years based on available data.

The past 7 years of opportunistic data on vessel collisions with humpback whales have shown an average of one humpback whale struck per year. Humpback whale distribution overlaps significantly with the transit routes of large commercial vessels that ply the waters off Alaska including cruise ships. It is likely that mortality of humpback whales will continue into the future and it is not known to what extent, if any, the proposed action will result in an increased rate of mortality as a result of ship-strikes.

Vessel noise is everywhere outside and inside the action area as a result of ambient conditions and noise generated from vessels. The effects of noise on listed species is dependent upon several factors including intensity, duration, behavior of animal, and proximity of noise source to animal. The effect of vessel noise on listed species, especially humpback whales, is the principal factor that needs to be monitored as a result of this action. These effects are discussed in greater detail in section 5 of this document.

5.0 EFFECTS OF THE FEDERAL ACTION

Pursuant to Section 7(a)(2) of the ESA (16 U.S.C. §1536), federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of their critical habitat. This biological opinion assesses the effects of NPS' proposed vessel entry quota and operating requirements for Glacier Bay National Preserve and Park. In Section 2 of this biological opinion, NOAA Fisheries provided an overview of the proposed action, particularly the increase in the number of vessels by vessel type to be allowed into the Action Area under the proposed action and which might negatively affect listed species and/or adversely modify their critical habitat.

In this biological opinion, NOAA Fisheries assesses (1) the probable direct and indirect effects of the proposed action on two Distinct Population Segments of Steller sea lions, and the Central North Pacific population of humpback whales; and (2) the effect of the action on designated critical habitat for the eastern DPS of Steller sea lions that is located in the action area.. Critical habitat for the western DPS of Steller sea lions is not located in the action area, and critical habitat has not been designated for humpback whales. The purpose of the assessment is to determine if it is reasonable to expect that the proposed action can have direct or indirect effects on threatened and endangered species that appreciably reduce their likelihood of surviving and recovering in the wild, or destroy or adversely modify designated critical habitat for threatened and endangered species in the wild.

Alternative 3 (as identified in the March 2003 NPS DEIS) proposes to continue using existing vessel quotas and operating requirements within the bounds of Glacier Bay National Park and Preserve. The preferred alternative would apply to Glacier Bay proper. The proposed action addresses motorized use of Glacier Bay, with specific focus on potential increases in cruise ship traffic. The preferred NPS alternative would provide for potential future increases in cruise ships up to 184 for the season (June 1 to August 31). Any increase would be contingent on the completion of studies that demonstrate that increases would be compatible with Park resources and values. These studies are generally identified as studies focusing on air quality, humpback whales, nesting birds and visitor experience.

Alternative 6 maintains the current daily vessel quotas for all vessel types in Glacier Bay (NPS 2003, Chap 2.7, pp 2-16). However, the vessel management season for cruise ships would be extended into May and September, rather than from June 1-August 31 as in Alternative 3, to limit entries to the same average levels (1.5 entries per day) found in June-August, a decrease from the average of 2 per day in May and September allowed under Alternative 3. The other vessel classes would maintain the June through August season. Both Alternatives 3 and 6 allow a maximum of 25 private vessels per day. However Alternative 5 increases private vessel use in Glacier Bay to a maximum of 25 per day, every day (2,300 seasonal use days), in contrast to the average 22.2 private vessels per day (1,971 seasonal use days) under Alternative 3. Operating requirements would be modified from Alternative 3 including eliminating the unregulated traffic from vessels 'based in Bartlett's Cove,' decreased speed for large vessels throughout Glacier Bay not just in whale waters, and removing the designated whale waters except for those in the lower Bay.

This opinion examines the effects of an increase in cruise ship traffic from the current level of 139 vessels to a potential new level of 184 vessels in June through August. Tour and charter vessel quotas would remain the same as currently allowed. The existing operating requirements and vessel quotas represent the vessel management plan completed in 1996 and the plan for which NMFS did a Biological Opinion in 1993. The NPS proposed action would allow seasonal entries (i.e., June 1 through August 31) of the following vessel classes: cruise ships, 139 up to 184; tour vessels 276; and charter vessels 312, private vessels 2300. Daily entries during this same period would be limited at 2 for cruise ships; 3 for tour vessels; 6 for charter vessels; and 25 for private vessels (under Alternative 6).

5.1 Factors Contributing to an Effect of the Action on Humpback Whales

Vessel traffic within Glacier Bay has the potential to affect humpback whales and Steller sea lions, and increases in vessel traffic within the Bay under the proposed action may increase the probability of an effect to a listed species in the Park. The following are factors that could contribute to the nature of an effect on listed species (from NPS 2003).

(i) <u>Proximity to the Action and Distribution</u>: The action area for the proposed vessel quota increase is Glacier Bay proper. Humpback whales in Park boundaries overlap significantly with the action. Humpback whales frequent the same waters as the vessel traffic going into the Bay, up the Bay to the tidewater glaciers and exiting the Bay by the same route. Indeed one of the objectives of the cruise ship and tour, charter and private vessel use of the Bay is to explicitly watch whales. Although motorized vessels in whale-waters are required to stay more than 1 mile off shore and are prohibited from approaching within ¼ mile of whales, the vessels are often in areas occupied by the whales. This overlap is somewhat restricted by the bathymetry of the Bay and the natural distribution of the whales in the Bay.

Humpback whales generally feed in nearshore, more shallow waters of the Bay. Steller sea lions are also more accessible for viewing at haulout locations. Along with the Park regulation, the large cruise ships are necessarily restricted by vessel draft to the deeper more mid-channel courses of the Bay. The smaller tour and charter vessels are more likely to travel closer to shore than larger vessels, as they are less restricted by water depth. The small private vessels, therefore have greater potential to travel closer to Steller sea lion haulouts in Glacier Bay proper and areas occupied by whales. Non-motorized vessels such as including kayaks, not considered as part of the NPS proposed action, are the most likely vessels to be in very close proximity to marine mammals in Glacier Bay. Kayaks are slow-moving, are more maneuverable, travel closer to shore and are more likely in direct search of a whale or sea lion for observation.

(ii) <u>Timing</u>: Vessel traffic is present in the Bay mainly during the summer months. This applies to the large cruise ships as well as the smaller vessel classes that serve the visitor industry. The less temporally predictable vessel class is the private vessel, which may be in the Bay earlier and later than those vessels of the tour industry.

The seasonal distribution of whales in Glacier Bay is such that it overlaps significantly with the presence of the tour industry vessels. As 2002 Glacier Bay Park data demonstrate, the first whale was observed in April and the last observations occurred in November. Cruise ship vessel traffic is more concentrated around the summer months of June through August but some pre and post season traffic in May and September has become increasingly popular in recent years. The seasonal peaks of whales also generally peaks in July and numbers typically remain high through September.

(iii) <u>Nature of the Effect</u>: Feeding in the productive waters off Alaska (including the Action Area) represents a critical component in the life history of both listed species, especially humpback whales. Feeding occurs in late spring through fall, during the same period of time that the cruise ships are present in the Bay. Humpback whales, although not limited to these areas, return to specific feeding locations such as Frederick Sound, Chatham Strait, North Pass, Sitka Sounds, Glacier Bay, Pt. Adolphus, and Prince William Sound, as well as other similar coastal areas. Should the animals not get enough food during the time spent in Alaska compensation will not occur in other locations or at other times of the year.

Increased vessel traffic could result in disturbance thereby interfering with the ability of humpback whales to access prey present in the Bay. Reduced prey consumption could place a nutritional stress on the animal that may reduce its individual fitness and potentially its contribution to the fitness of the whole population by impacting that individual's reproductive ability. For the group of whales that frequents the Bay, some of whom return annually, and may feed principally within Park waters, the impacts from cruise ship traffic could displace the animals from prime feeding sites or altogether from the Bay. Should such an effect occur, increases to the vessel traffic under the proposed action could exacerbate the potential negative effect on the animal or population.

Steller sea lions are also found in the Bay during the peak tourist season and foraging is a principal component of a sea lions behavior in waters adjacent to these haulouts. Anecdotal information suggests that animals have different tolerances to boat traffic. In some areas sea lions are known to co-exist with fishing vessels, often taking advantage of the presence of nets to catch fish, in other areas tour vessels have been known to come within a few feet of a sea lion haulout with no observed impact on the group. However, there are also anecdotal accounts of smaller cruise vessels sounding a loud horn in order to evacuate a haulout and provide a show for the tourists on board, and other accounts from research vessels indicate that the animals on most haulouts will become nervous when a boat is within 3,000-2,000 feet and abandon the site. Therefore there is some concern for the take of animals due to encroachment by humans near sites for viewing.

(iv) Duration and Frequency of Disturbance: The proposed action could increase the annual cruise ship limit from 139 vessels up to 184 vessels in Glacier Bay with most of that potential increase likely to occur during the early and later parts of the summer season of June 1 to August 31. This would result in an impact to humpback whales occurring during the whales' prime feeding period. The potential increases in vessel traffic would be in existence annually for the foreseeable future, which would likely result in the same whales being exposed to the same potential impact over a long period of time, because of the high rate of site fidelity of humpback whales to particular feeding areas.

5.2 Potential Direct and Indirect Effects of Vessel Numbers on Humpback Whales

Humpback whales within Glacier Bay may be affected by several direct and indirect factors as a result of implementing the preferred alternative: an increase in the number of collisions with cruise ships or other smaller vessels; harassment or displacement of the whales by vessels or disturbance of the whale prey by vessels which may cause whales to redistribute; an increase in acoustic impacts from vessel noise which could impede passive listening or damage or interfere with hearing; disruption and alteration of normal feeding, resting and other critical behaviors; habitat modification, including prey disruption; and ultimately, reduced fitness, leading potentially to reproductive effects or population level changes.

Glacier Bay currently allows 139 cruise ships in the Bay, the minimum level of vessel traffic that is expressed by the proposed action. Other vessel traffic such as tour, charter, and private boats is present in the Bay and could also produce some of the same effects on humpback whales. The potential for vessels to cause disturbance to cetaceans, and other marine mammals, is widely recognized.

Studies of vessel impact to marine mammals have most often looked at short-term effects (e.g., measuring disturbance or avoidance behaviors) rather than longer-term or cumulative effects of repeated exposure to numerous vessels over time (e.g., decreased survivability or reproductive effects such as increased birthing intervals which are directly related to productivity). Immediate responses to vessel presence, such as avoidance behavior or changes in dive patterns, can be measured more easily; longer-term effects can often be difficult to define and to measure. Most studies have not addressed long-term impacts. Typical measures of a whale's reaction to the presence of a vessel have been visible changes in behavior, such as avoidance reactions or displacement, increased fluke or flipper activity, blow intervals or dive patterns and swimming orientation and speed. These reactions are measurable and can be assumed to have a certain energetic cost. However, animals could also incur an energetic cost through behaviors that is not necessarily measurable (i.e., physiological stress responses such as increased heart rate or pathological conditions). Vessels could also interfere with prey dynamics, forcing animals to expend more energy in foraging efforts for the same amount of prey captured. The difficulty lies in quantifying the energetic cost or determining the net effect of a potential stressor on the animal's overall energy burden. An energetic cost that results from vessel disturbance might otherwise be devoted to reproduction. Should this occur, there may be long-term negative effects associated with vessel activity that might not be demonstrated through short-term studies. Therefore, it should not be assumed that the regular presence of animals in an area is an indication that the activities in the area have no impact. Long-term studies could yield additional information on the effects of disturbance on the overall population. However, this kind of information is not currently available.

These are generally changes that are manifested at the level of the individual, in either short-term or long-term changes in the individual that may or may not be measurable (i.e., obvious gross behavioral changes or undetected physiological changes). Impacts could also manifest in long-term changes at the level of the population(s) such as a range redistribution, or a reduction in some parameter such as fecundity or survival that would affect the status of the population. Short-term changes can be difficult to interpret in terms of the significance to the individual or the population. In instances of apparent lack of change in the individual or of habituation there is the risk of falsely interpreting this as no effect.

Whales frequenting Glacier Bay have been exposed to some level of cruise ship and other vessel traffic for many years. Whales may leave an area if sufficiently disturbed . It is more likely they will leave an area if not actively involved in feeding at the time of the disturbance. Although the number of ships has steadily increased over the last twenty years, from an average of 1.2 ships per day in the 1980's, the number of whales in the Park has also generally increased during the same period. Generally, there is no demonstrated relationship between cruise vessel numbers and whale numbers in Glacier Bay during the period the studies. While it is likely that there is a threshold above which the number of vessels may limit the habitat in the Park to whales or the ability of a whale to successfully forage, there is no evidence that this threshold has been reached at this time.

Indirect effects of vessel traffic such as redistribution of prey or redistribution of the whales are not well studied or understood. Such effects can only be supposed at this time and the real impact of indirect effects cannot be determined.

5.2.1 Potential Increases in Direct Collisions between Vessels and Whales or Sea Lions

Increased mortalities as a result of a collision between a vessel and a whale would be the principal concern with regards to an increase in cruise ship entries into the Park. Collisions involving cruise ships are known to result in mortalities to whales whereas a collision with a smaller vessel may result in injury other than death to the whale.

The past seven years of opportunistic data on vessel collisions with humpback whales have shown an average of one reported humpback whale struck per year in Alaska. Cruise ships frequent the inside waters of Southeast Alaska, passing through areas of concentrated humpback whale abundance such as Glacier Bay National Park, Point Adolphus and other areas adjacent to the action area. Several incidents of vessel interactions with humpback whales in Glacier Bay were documented in 2002 (Doherty and Gabriele 2002) including one mortality inside Park waters and several collisions. These also included close approaches and possible harassment by several vessels of different vessel classes including a kayak, a cruise ship and a float plane. Researchers also documented an injury to the dorsal fin of a whale that could have been caused by a vessel collision/interaction. In 2001 a dead humpback whale was discovered in Park waters. Upon necropsy the whale was determined to have been killed by blunt trauma, likely the result of a collision with a large vessel.

A humpback whale was also necropsied in 2003 that had been first seen at Pt. Manby, Yakutat Bay. The results of that necropsy also indicated that the whale had been killed by blunt trauma as a result of large vessel collision.

In addition to these larger ships, which are most likely to cause significant injury or death to humpback whales, smaller tour, charter and private vessels also significantly overlap with inshore humpback whale distribution in Alaska waters. Smaller ships also have the potential to cause disturbance, serious injury, and possibly mortality.

The proposed action will not reduce the effects of, or numbers of, collisions between cruise ships and whales. It is not known to what extent the increased vessel traffic into the action area will result in an increase in humpback whale mortality due to ship strikes but it can be expected that these mortalities will continue at least at the current rate. The numbers of disturbances as a result of increasing small vessels in Glacier Bay (Alternative 6) would likely result in an increase of potential disturbances to whales but it is unlikely that it will increase mortalities as a result of the increased traffic, and it is not certain whether this disturbance will result in an increase in takes through harassment (See Chapter 5.3, this document).

There is no evidence that an increase in vessel traffic in the action area will result in an increase in direct collisions of Steller sea lions with vessels. The more likely scenario is that small vessel activity around sea lions at haulouts or in the water may increase but due to the mobility of the animals around vessels there is no reason to believe that this will result in a collision with a sea lion. There are no regulations specifically keeping vessels a distance away from sea lions; however the Alaska Marine Mammal Viewing Guidelines present other measures for vessel operation to minimize impacts to Steller sea lions, and other marine mammals, including a recommended minimum approach distance of 100 yards.

5.2.2 Effects of Vessel Speed on the Likelihood of Collisions between Cruise Ships and Humpback Whales

Generally, there is a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. Most mortalities that have been documented occur when a vessel is traveling in excess of 13 knots (Laist et al. 2001). Vessel speed restrictions for cruise ships vary between alternatives considered, ranging from applying only to "whale waters" in the proposed action (Alternative 3) to a limit of 13 knots throughout the Park including whale waters (Alternative 6). Vessels less than 80m in length could still travel at any speed outside of whale waters under Alternative 3. There are no speed restrictions outside Glacier Bay, including Icy Strait which is considered part of the action area for purposes of this consultation. Collisions are expected events and generally occur throughout all of southeast Alaska peaking during the tourist season. Approximately one vessel strike per year results in a known mortality to a humpback whale in southeast Alaska. These are often the results of collisions with cruise ships operating at speeds considerably greater than 10 knots.

Some additional impact from harassment by tour vessels may also occur for humpback whales due to increased levels of noise projected into the water column as a function of increased vessel speed (See Section 5.2.1, this document). However, in an attempt to address this issue and minimize the potential for impact from harassment, NMFS implemented regulations in 2001 that imposed a restriction on approaching humpback whales by a vessel closer than 100 yds. A requirement for operating at a "slow, safe speed" when near humpback whales was also implemented. The Park Service has implemented even greater minimum approach distances (1/4 mile in all Park waters) for humpback whales, which likely reduces the whales' underwater noise exposure and potential for behavioral disturbance.

The effects of the range of vessel speeds considered in the alternatives (1) do not address vessel speed outside the boundaries of the Park, and (2) vessel speeds inside the boundaries of the Park will increase in waters that have a high probability of having whales present while decrease in waters where whales are not likely to be present.

5.3 Effects of Vessel Noise on the Behavior of Marine Mammals

Reactions to sounds by marine mammals are variable and often related to their initial behavior. Watkins (1986) indicated that the primary cause of reaction by whales [to vessels] was to underwater sound. His study found some degree of habituation to relatively "non-disturbing" stimuli. Whales near shore became less wary, over time, of boats and their noise and the animals appeared to be less easily disturbed. This appeared to be particularly the case with humpback whales. It should be noted, however, that the conclusions drawn in this study did not result from controlled experiments on the impact of human activity on humpback whales. While measurable startle responses might diminish with time, this does not necessarily indicate that a negative impact has diminished as well. Generally foraging is important enough that some whales do not leave an area even if the area is compromised by disturbance from vessel noise. Other whales may shift their distribution in response to vessels presence or noise. However, it is not known what effect this habituation has on whales. Vessels could still cause stress impacts or could disrupt prey aggregations forcing whales to spend a greater amount of time and energy foraging. It is conceivable that habituation could also put whales at greater risk of collisions with vessels.

Baker and Herman (1989) conducted controlled studies on the impact of vessel traffic on humpback whales in Glacier Bay and in the Frederick Sound area of southeast Alaska. They examined responses to obtrusive, unobtrusive, and "passby" conditions conducted by different vessel classes. In that study, respiratory behaviors were the most sensitive indicators of response to a vessel. The obtrusive condition resulted in a striking increase in the frequency of blows when the whale was near the surface and an increase in the longest submergence observed (Baker and Herman 1989). The effects declined as the activity of the vessel moderated during the unobtrusive and "pass-by" conditions. Within the 400 m range of influence, vessel operations accounted for 27.5% of the variance in the blow intervals of whales.

Baker and Herman (1989) also noted the tendency of humpback whales to orient in the direction of a vessel as it approached, and then to turn away at a perpendicular as the vessel reached its closest point of approach. The percentage of whale movement devoted to avoidance behavior increased from 15% at a distance from the vessel of 4000 m to 27% at a distance from the vessel of 1000 m. Some of the other factors examined were difficult to analyze due to the infrequency and variability of the behaviors. Of note, however, is that predictable behavioral reactions were evident up to a distance of 4000 m from the vessel.

Baker and Herman (1989) also observed changes in aerial behavior and pod composition with the proximity and presence, respectively, of vessels. The presence of large vessels was correlated with changes in pod composition; aerial behavior occurred with a 50% probability when vessels approached within 478m of the focal pod. Baker and Herman concluded that humpback whales exhibit a considerable degree of short-term changes in their behavior in response to vessel traffic.

Other studies on humpback whales in their wintering grounds indicate some changes in behavior in response to vessels. Corkeron (1995) showed that animals dove more often in the presence of vessels when the vessels were within 300 m of the animal. Calf pods almost never dove when vessels were absent yet did so when vessels were present. Also, for non-calf pods the rates at which certain behaviors (e.g., roll, lunge, fluke and flipper activity, and breaching) occurred were significantly different when vessels were present than when vessels were absent.

Richardson et al. (1984) observed a strong avoidance reaction of bowhead whales to approaching vessels in arctic waters. Some bowheads reacted strongly to the presence of vessels by orienting and swimming rapidly away from the vessel. There was a highly significant orientation away from the vessel when the vessel's engine was engaged. The orientation away from the vessel was significant at a distance from the vessel of <900m. Significantly more whales also moved at a moderate to fast speed away from the vessel when the vessel was as far away as 4 km. An increase in whale swimming speed was also observed as vessel distance decreased to <2 km. Bowheads also exhibited significantly shorter surfacing times with fewer respirations per surfacing when the vessel was within 4 km. Some disruption of social groups was also observed in response to vessel approaches. The authors of this study note that bowheads responded to vessels more dramatically and consistently than to other human disturbances.

5.3.1 Potential Effects of Noise Levels on Humpback Whales from Vessel Traffic in the Action Area

NPS (2003) identified several issues of concern during the scoping process on the EIS related to the increased input of sound into the water column as a result of the proposed action. Any increases in maximum speeds would, at a minimum, project increased levels of noise (increased decibels) into the water column. These issues included several concerns around the fact that noise may alter marine mammal behavior. NPS recognizes that vessel noise is prevalent throughout the Bay. Ambient noise monitoring at a stationary hydrophone in lower Glacier Bay indicated that vessel noise was present in an average of 60 percent (52-69 percent) of hourly samples in the summer months (the season of peak presence of whales and vessels) at mean received levels of 93-97 dB re 1 microPascal (Kipple 2002; NPS 2003, p. 4-115).

Effects from the proposed action are likely to be direct effects. Based on the fidelity of the whales to the action area, and the observations of individual whales over the past decade, the likelihood of a whale leaving this area as a result of noise levels appears to be minimal.

5.3.2 Effect of Vessel Speed on Noise Input into the Water Column

Speed is related to the amount of noise put into the water column. For vessels traveling at greater than 10 knots, ensonification occurs over a much larger area. NPS indicated that "ensonification" in their analyses means to create noise greater than 130 decibels. Cruise ships traveling at or above 10 knots ensonify the area for up to 500m (LGL 2003). One ship traveling at 19 knots projected sound in the water column up to 3 miles. Because of the great distance that cruise ships project noise, and because they are found throughout the action area, most of the waters of the Bay are exposed to approximately 120-130 decibels of sound part of every day throughout the tourist season. An increase in cruise vessel traffic as proposed (Alternative 3) would increase the duration of this level of sound throughout the action area. The intensity of cruise ship noise would be greater in Alternative 3 because ships could travel at any speed outside of whale waters. Under Alternative 5 all waters of the Park would be exposed to cruise vessel speeds of 13 knots. Other vessel types produce comparatively small amounts of noise present less of a management concern.

According to analyses provided by NPS (2003) the maximum duration that any one point would be exposed to sound levels over 130 decibels is in the range of less than 3.5% of the time from June through August. Under Alternative 3 this level would increase in May and September because 2 ships per day typically enter the Bay at that time of year, whereas under Alternative 5 the 3.5% level would remain the same in May and September because cruise ship entries would occur at the average of 1.5 per day found in the main summer season.

Alternative 3 will not reduce vessel speeds and therefore, at a minimum, the effect of the action will be to keep noise in the action area at current levels with the possibility that both duration and intensity of noise may increase with the increase in minimum vessel speeds from 10 to 13 knots in whale waters being allowed. If the NPS incorporated the cruise ship speed of 13 knots throughout the Bay from Alternative 5 in the action, this would result in a net decrease of underwater sound in Glacier Bay.

5.3.3 Effects of Increased Noise Levels on the Potential for Hearing Loss in Humpback Whales

Hearing in marine mammals is a function of the level of sounds that marine mammals can hear in the absence of ambient noise (hearing thresholds); the ability of the animal to discriminate between different frequencies and intensities; effects of masking (the ability to distinguish signal from ambient; and individual variability (summary in NPS 2003, Chapter 3). In terrestrial mammals, and presumably in whales, received sound levels must exceed the animal's hearing threshold (sensitivity) for there to be any temporary threshold shift (TTS) and must be even higher for there to be risk of permanent threshold shift (PTS) (Richardson *et al* 1995).

The current incomplete understanding of hearing in baleen whales, including humpback whales, is based on anatomical evidence, studies and behavioral observations, and extrapolations from other marine mammals. Field observations of the responses by whales to sounds have set thresholds for detection of sounds by baleen whales. However, it is not possible to determine at what point the whale heard the sounds but did not respond. Responses vary with behaviors; the same frequency might result in a response from migrating whales whereas feeding whales do not respond at all, or the response may not be detectable to researchers. In addition, whales' responses to various types of sounds (e.g. vessel noise, oil exploration, military sonar) at equivalent sound levels may be quite different.

Anatomical evidence indicates that baleen whales are adapted to hear low-frequency sounds (Ketten 1998). Observations of whale responses to low frequency sound sources also support this (Richardson and Greene 1993; Richardson et al 1995). Migrating gray whales would avoid a sound source 50% of the time when the received level was 116-124 decibels (Malme et al. 1984, 1983). However when similar noises were played to feeding humpback whales, they showed no response at received levels up to 120 decibels (Malme et al 1985). The results of all of these studies lead to the prediction that baleen whales typically show avoidance response to prolonged man-made sounds at received levels greater than 120 decibels (Frankel and Clark 2003). Few studies of humpback whale response to vessels have included specific sound levels where behavioral responses occurred.

Cruise ship and other vessel noise is loud enough under all alternatives at prolonged durations to potentially cause hearing loss in marine mammals. In a recent study at Glacier Bay, the acoustic effects of vessels on humpback whales were modeled using measured vessel sound signatures from the acoustic monitoring program vocalizations, ambient noise and oceanographic parameters from Glacier Bayand estimations of whale hearing abilities, called audiograms (Erbe 2003). The model estimated that humpbacks would experience 4.8 decibel TTS after 20 minutes exposure to sound within 100 meters of the small craft or 4 km of the cruise ship. TTS is difficult to predict given the uncertainty about whales' normal hearing thresholds. The vessel sounds modelled were not nearly loud enough to induce PTS after a single exposure. PTS due to repeated exposure to vessel noise is impossible to predict for humpbacks because it has never been documented and there are no available data on any marine mammals. NPS (2003) states that marine mammals are rarely exposed to cruise ship noise for a duration that this would occur, but it is apparent that it does occur given the "rarely" caveat. Temporary hearing loss should be considered as a possibility if humpback whales or Steller sea lions were exposed to loud vessel sounds in close proximity for a sufficiently long period to induce such loss.

The effects from all classes of vessels are generally some level of disturbance, and usually a temporary disturbance. This depends on vessel speed, activity, type of vessel, and animal behavior at the time of the disturbance and the animal's previous experiences. The NPS correctly assumes that vessels of smaller scale than cruise ships result in a larger number of disturbances. Disturbance to a marine mammal results in an increased energy need; or stated another way, disturbance results in energy loss to the marine mammal which has to be compensated for by increased costs associated with foraging. All of these effects occur at the individual level and there is no obvious mechanism for sub-lethal disturbance in such a small group of whales as found in Glacier Bay, or inside the action area, to have population level effects on the Central North Pacific population.

Based on what is known regarding hearing loss in whales, the expected levels under all alternatives may adversely affect humpback whales but would not likely cause permanent damage or harm to whales. Temporary thresholds may be reached but the long-term effects would likely be minimal. It is expected that vessel noise will result in disturbance to marine mammals on a regular basis, but that duration and intensity of effect would not be sufficient to harm or otherwise cause these species to leave the Bay. Generally in those rare occasions that a cruise vessel remains in an area and produces sound levels sufficiently high to inflict permanent harm, the proposed actions and the Park Service is relying on humpback whales to be disturbed sufficiently enough to move out of the area (at NPS 2003, pp. 4-118). Further, "the mobile nature of humpback whales and Steller sea lions, combined with the mobile sound sources, continue to make the probability of temporary and permanent threshold shift small; effects to marine mammal hearing still would be expected to be negligible to minor ' (NPS 2003, at Chap. 4.3.1, pp. 4-106).

5.3.4 Effects of Increased Noise Levels on Habituation and Sensitization in Humpback Whales

In addition to disturbance, habituation and sensitization also are important when discussing the potential reactions of whales to noise. Habituation refers to the condition in which the repeated experiences with a noise stimulus that has no important consequence for the animal leads to a gradual decrease in response. Sensitization refers to the situation in which the animal shows an increased behavioral response over time to a stimulus that has important consequences for the animal.

Bowheads have become habituated to noises from dredges and drilling over time (Richardson *et al.* 1995) In general there is a tendency for the level of response to noises to be related with the level of unpredictability and variability of the source (Richardson *et al* 1995). For example, over a period of time animals may show little response to a constant humming but react to a noise source that is rapidly changing in intensity. When whales are presented with loud noises, the will react regardless of frequency. Therefore animals are most likely to habituate to sounds that are unvarying and predictable.

The opposite process is sensitization. Sensitization occurs when animals associate a sound with an unpleasant sub-lethal event. In such cases, animals respond when the signal is barely audible. Within a species, the disturbance behavior is affected by the animals activity: animals that are resting would be expected to show greater behavioral change than animals highly motivated to perform an important activity such as feeding. Humpback whales are known to tolerate loud noises when sufficient prey is present. So individuals could stay in an area masking a potential effect of noise as a result of their overriding need for prey. Todd et al. (1996) found evidence of hearing damage in two dead whales that remained in an area to forage despite being exposed to potentially harmful sound levels. Therefore it should not be assumed that the presence of animals in an area is an indication that the activities in the area have no impact.

5.4 NOAA Fisheries Regulatory Interpretation of Effect of Noise on Marine Mammals

The definition of "take or taking" is to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect or kill any marine mammal." NOAA Fisheries (2002) has determined that a change in marine mammal actions does not always result in a disruption of behavior (at 67 FR 46712, July 16, 2002). A disruption of behavior such that it would be considered within a normal range of behavioral responses by the whale or sea lion that result in a change of behavioral over a short time-frame and minimum level of intensity would not be considered a take under this interpretation. So a short-term change in behavior or movement would not necessarily have any biological significance and, therefore, do not rise to a level of a take requiring a take authorization. Furthermore, a noise in the water column that does not provoke a reaction by the marine mammal (a reaction greater than a minor response) is not considered a disruption of behavioral patterns and therefore does not constitute a take. Repetition of minor reactions within an animal's normal repertoire could be interpreted as take if the cumulative effects resulted in an effect that would be considered outside the limits of a normal response or range of responses.

Based on these findings, simple exposure to sound does not necessarily constitute a take due to harassment. Brief disturbances, therefore, do not disrupt normal behavior patterns in a biologically significant manner and, as a result, do not result in a take due to harassment. Therefore short-term disturbance by a vessel that does not alter long-term behavior would not be considered a take by harassment. However, long-term and frequent disturbances could still become biologically significant.

5.5 Summary of Potential Effects of the Preferred Alternative on Listed Species

The general effect of the preferred alternative (Alternative 6) is to allow more cruise vessels into Glacier Bay but require them to travel at slower speeds, and regulate their entries over an extended tourist season. Private vessel traffic will also increase. The result of that proposed action would be, at a minimum, to further increase the number of large vessels into an area where disturbance is already of concern; and to potentially increase the duration and intensity of sounds produced by these vessels into the water column. The intuitive conclusion is, therefore, that the action will amplify all levels of disturbance and concerns to listed species under the preferred alternative that are currently present. These would include the following potential effects:

a continued or possible increase in the potential for mortality to humpback whales due to ship collision due to the increased level of vessel traffic operating in the Park as a result of the preferred alternative. The increase in collision risk could be offset to some degree by the 13 knot speed limit for cruise ships;

an increased potential for disturbance to listed marine mammals as a result of increased vessel traffic into the Park and adjacent waters. This may result in behavioral effects due to disturbances within the normal range of behaviors for the species but which would not result in a disruption of normal behavior patterns in a biologically significant manner and, as a result, would not result in a take due to harassment; and

an increase in the ambient noise level in the water column as a result of increased vessel traffic. The increase in cruise ship and private vessel traffic would likely result in an increase in the percentage of time that underwater sound exceeds the 130 decibel ensonification level. The decibel levels of cruise ship sound should decrease due to the 13 knot speed limit, but the duration of each cruise ship transit in Glacier Bay could be increased due to the ships' slower travel speed. Most travel by all vessels except cruise ships would be at speeds considerably greater than 10 knots, except in whale-waters areas, producing sounds that would exceed 120 decibels, a level approaching that known to produce short term and potential long-term effects in humpback whales [130 decibels] and which would result in a more uniform level of ensonification as a result of cruise ship traffic.

The speed at which the vessels will travel throughout much of the Park introduces the possibility for temporary hearing impairment in marine mammals although it is recognized that the duration of such levels is small enough that permanent hearing loss is probably unlikely. This conclusion assumes that whales and sea lions will leave the area prior to a temporary or permanent effect from noise intensity;

The increased numbers of private vessels to be allowed in the Park under the preferred alternative will likely result in an increase in disturbances to smaller cetaceans and pinnipeds including Steller sea lions. There will likely be an increased potential for disturbance at haulout sites in the Park for Steller sea lions and an increased number of private vessels transiting through whale waters. "Serial" visitations where one vessel remains for a period of time, then is immediately replaced by another once it leaves, may increase with the effect that the whale or sea lion is constantly being affected by the presence of small vessels.

Impacts from noise might include disturbance or some other more "elevated" physiological or behavioral response. Response threshold would likely depend on whether animals have become habituated over time, as well as the animal activity or behavior at the time of the noise input. The energetic consequences of whales being disturbed while feeding has not been evaluated quantitatively. Energetic consequences likely depend, in part, on prey availability. The greater the densities and availability of prey, the less likely a significant energetic consequence. Noise may cause TTS or PTS which would have the potential to diminish the individual's chance for survival. Tolerance for noise is often demonstrated but it does not prove that the animals are unaffected by noise.

All potential and likely effects identified occur as a result of the increased levels of vessels, noise production and potential disturbance. All are considered to have potentially adverse effects on listed species in the action area. The extent to which these potential effects rise to the level of a "take" under the ESA is largely unquantifiable. Even with this uncertainty, however, they would not rise to the level of "jeopardy" by directly or indirectly reducing appreciably the likelihood of both survival and recovery of any of the listed species in the wild by reducing the reproduction, numbers of distribution of that species. This conclusion will be further analyzed in Chapter 7 .

6.0 CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Past and present impacts of state, other Federal and non-Federal actions are part of the environmental baseline discussed in section 4 of this biological opinion.

6.1 Subsistence harvest of Steller Sea Lions

The subsistence harvest of Steller sea lions by Alaska natives results in direct takes that are expected to continue into the foreseeable future. These takes represent the highest level of known direct mortality from an anthropogenic source. The primary areas of subsistence harvest are in the western DPS, outside the action area. The level of subsistence on the western DPS in the action area is considered zero. Subsistence harvest of the eastern DPS of Steller sea lions does occur in the action area but the level of take for subsistence is estimated in the 10s of animals per year (and decreasing in recent years) and, therefore, considered a negligible source of mortality for this population.

The criteria used to generally measure the direct effects of a harvest for significance is the comparison between the total number of takes (level of harvest) to the Potential Biological Removal (PBR) level which is calculated for all marine mammal stocks or DPS. Under the 1994 reauthorized MMPA, the PBR is defined as the product of the minimum population estimate, one-half the maximum theoretical net productivity rate, and a recovery factor: therefore $PBR = Nmin \times 0.5Rmax \times F_R$, or PBR = 1,396 animals (31,028 x 0.06 x 0.75)(Angliss *et al.* 2002). Generally, PBR increases in significance and intensity as it approaches PBR and decreases in significance as it approaches zero. If the take level is less than 10 percent of PBR the level is considered negligible under the MMPA, and not significantly different from zero. A PBR calculation is the most applicable measure of significance for the direct effects of a subsistence harvest.

6.2 State-Managed Commercial Fisheries

Takes of Steller sea lions from both populations will likely continue into the foreseeable future. State managed fisheries affect listed species in both direct and indirect mechanisms. Direct impacts include sea lions killed in nets, as well as short term nonlethal effects such as disturbance of sea lion haulouts, vessel noise, entanglement in nets, and potential preclusion from foraging areas due to activity. Direct mortality to humpback whales as a result of entanglement in gillnets and fixed-line fishing gear such as crab pots and lines occur as well. All interactions occur outside the boundaries of the National Park and in waters of southeast Alaska. Therefore, the effects of fishing in waters outside the entrance to the Park do exist. These were reviewed in section 4.2 of this biological opinion.

6.3 Effects of Vessel Traffic outside the Action Area on Listed Species

The effects of vessel interactions with humpback whales that occur outside the action area are expected to continue into the future at rates consistent with recent records. However, independently of the proposed action, vessel traffic in Icy Strait is expected to increase appreciably in the next few years due to the recreational vessel traffic associated with the new Point Sophia cruise ship dock and cultural attraction scheduled to begin operating in May 2004. Increasing cruise ship traffic in the Hawaii wintering area in recent years presents very similar risks to those analyzed in this opinion. These include interactions that are both direct through collisions with vessels and disturbance, and indirect through the effects of vessel noise and pollution on humpback whale prey and other aspects of their environment. Given the increases in the humpback whale population in Southeast Alaska, vessel interactions of all kinds are likely to increase even if the number of vessels remains the same.

The number and type of disturbances from vessels of Steller sea lions in southeast Alaska also will likely continue and largely go unmonitored. Several recent research studies are ongoing to determine the frequency of disturbance from all vessel categories, especially smaller vessels, but these results are not yet available. Generally the eastern DPS is increasing and even with current levels of disturbance and potential mortality from illegal shootings of animals on haulouts, the population should continue to increase at its current rate.

6.4 Effects of Vessel Noise outside the Action Area on Listed Species

The potential effects of noise on marine mammals range from minor behavioral disturbances to potential injury or death. The noise level throughout the oceans is increasing due to increases in shipping and other activities including seismic activities, drilling and sonar use by the military and noise from research vessels. While there is no hard evidence of a whale population being adversely impacted by noise, biologists believe that it is possible for masking, the covering up of one sound by another, could interfere with marine mammals behavior and communication. Concerns about noise in the action area of this consultation include increasing noise due to increasing large vessel traffic in the action area. The potential cumulative effects of noise on marine mammals, especially whales, are the same as those described in the effects of the action in sections 5.2 and 5.4 of this document.

7.0 CONCLUSIONS

Regulations that implement section 7(b)(2) of the ESA require biological opinions to evaluate the direct and indirect effects of Federal actions to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. 1536; 50 CFR 402.02). Section 7 of the ESA and its implementing regulations also require biological opinions if Federal actions would destroy or adversely modify critical habitat.

7.1 Approach to the Assessment

We identified the likely or probable direct and indirect effects of the proposed action on the listed species found in the action area in section 5.4. Generally, the effect of the Preferred Alternative (Alternative 6) is to allow more cruise vessels into Glacier Bay but require them to travel at slower speeds, and regulate their entries over an extended tourist season. Private vessel traffic would also increase. The result of that Preferred Alternative would be, at a minimum, to further increase the number of large vessels into an area where disturbance is already of concern; and to potentially increase the duration and intensity of sounds produced by these vessels into the water column. The potential effects of this action were identified as:

a continued or possible increase in the potential for mortality to humpback whales due to ship collision due to the increased level of vessel traffic operating in the Park as a result of the Preferred Alternative, though this may be mitigated with a reduced speed limit in Glacier Bay for large vessels;

an increased potential for disturbance to listed marine mammals as a result of increased vessel traffic into the Park and adjacent waters although this potential may be mitigated by established minimum approach distances in place inside Glacier Bay and other vessel operating requirements. The increased numbers of private vessel to be allowed in the Park under the Preferred Alternative would likely result in an increase in disturbances to smaller cetaceans and pinnipeds, including Steller sea lions. There would likely be an increased potential for disturbance at haulout sites in Glacier Bay proper and an increased number of private vessels transiting through whale waters. "Serial" visitations where one vessel remains for a period of time, then is immediately replaced by another once it leaves, may increase with the effect that the whale or sea lion would constantly being affected by the presence of small vessels; and

an increase in the ambient noise level in the water column as a result of increased vessel traffic resulting in a possible increased level of disturbance, particularly to humpback whales, and the continued potential for temporary hearing impairment in marine mammals of concern, particularly humpback whales.

The second step of our analysis determines if we would reasonably expect the listed species to experience reductions in reproduction, numbers or distribution in response to these effects. Finally, we determine if any reductions in a species' reproduction, numbers or distribution (identified in the second step of our analysis) can be expected to appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

The approach to determine whether the Preferred Alternative may adversely modify critical habitat was a much simpler task for this action. First we identified which aspects, if any, of critical habitat would most likely to be affected by the Preferred Alternative. Then we determine if the action is likely to diminish the value of critical habitat. In this case, the Preferred Alternative applies to Glacier Bay proper and Dundas Bay. Both of these areas are part of the Glacier Bay National Park and Preserve. Critical habitat for the eastern DPS of Steller sea lions occurs in the action area only at Graves Rock, a rocky haulout which lies inside the boundaries of the Park but considerably outside the area where the proposed action will occur. The potential increases in cruise ship traffic in Glacier Bay, and consequences of that action, will not occur inside critical habitat, and would minimally, if at all, occur in the vicinity of critical habitat. Critical habitat has not been designated for the western DPS of Steller sea lions or for humpback whales in the Action Area. For these reasons, the Preferred Alternative will have no effect on critical habitat.

The final step in our analysis is to determine whether there would be a reduction in a species' reproduction, numbers, or distribution such that there is a reduction in the species' likelihood of surviving and recovering in the wild. This can be the most difficult step because (a) the relationship is not linear; (b) to persist over geologic time, most species' have evolved to withstand some level of variation in their birth and death rates without a corresponding change in their likelihood of surviving and recovering in the wild; and (c) our knowledge of the population dynamics of other species and their response to human perturbation is usually too limited to support anything more than rough estimates. Nevertheless, our analysis must try to distinguish between anthropogenic reductions in a species' reproduction, numbers, and distribution that can reasonably be expected to affect the species' likelihood of survival and recovery in the wild from other (natural) baseline effects.

7.1.1 Types of Decision Making Errors

As scientists we have two points of reference available when we consider data, information, or other evidence to support our analyses (1) we can analyze the information available and subsequently conclude that an action has an effect, when in fact it does not (false positive), or (2) we can analyze the information available and subsequently conclude that an action does not have an effect, when in fact it does (false negative). In statistics, these two points of reference are called "errors". The first point of reference is designed to avoid what is called Type I error, while the latter is designed to avoid what is called Type II error (see Cohen 1988). Although analyses that minimize either type of error are statistically valid, most biologists and ecologists focus on minimizing the risk of concluding that there was an effect when, in fact, there was no effect (Type I error) and tend to ignore Type II error.

To comply with direction from the U.S. Congress to provide the "benefit of the doubt" to threatened and endangered species [House of Representatives Conference Report No. 697, 96th Congress, Second Session, 12 (1979)], our analyses are designed to avoid concluding that actions would have no effect on listed species or critical habitat when, in fact, there was an effect (Type II error). This approach to error may lead us to different conclusions than scientists who take a more traditional approaches to avoiding error, but we consider our approach to be more consistent with the purposes of the ESA and direction from Congress.

Jeopardy and adverse modification analyses must look into the future to identify the effects of activities conducted today on the future of threatened and endangered species. Some human activities have delayed effects on animal populations, either because a species' population takes time to respond to an effect, because the population only responds when effects accumulate, or a combination of these two. The classic example of a combined response is the bald eagle population's response to DDT, which became apparent only after many years of population declines. These responses pose the challenge of choosing how far into the future we must look to (1) detect a population's response to an effect or (2) detect a change in a species' likelihood of surviving and recovering in the wild (Crouse 1999). If we do not look far enough into the future, our analyses will not detect a population's response to human activities and we are more likely to falsely conclude there was no effect when, in fact, an effect occurred. If we look too far into the future, our analyses can mask short-term collapses in a population and, again, we increase our likelihood of falsely concluding there was no effect when, in fact, an effect occurred.

7.1.2 Evidence Available for the Assessment

Detailed background information on the status of Steller sea lions and critical habitat has been published in a number of documents including the Steller Sea Lion Recovery Plan (NMFS 1992); several biological opinions on the effects of groundfish fishing on Steller sea lions (NOAA Fisheries 2000, 2001a); the SEIS for the Steller sea lions implementing measures (NOAA Fisheries 2001b). The NEPA documents and the section 7 consultations also address the status of humpback whales, as does the Humpback Whale Recovery Plan (NMFS 1991) and considerable literature. The marine mammal stock assessments reports provide information on the status of both species (Angliss *et al.* 2002). Many important studies have been completed on the acoustic properties of baleen whales (Richardson et al. 1995) and of the action area (Malme et al. 1984, 1985; Kipple 2002) and how noise may affect listed species (in Chapter 4.2, NPS 2003; LGL 2003; Erbe 2003).

7.2 Jeopardy Analysis

A description of the ESA standards, pertinent definitions, and a description of this analysis was presented in Section 1.7 of this document. Again, the jeopardy standard that NMFS must insure that any federal action avoids is:

> **Jeopardize the continued existence of [a listed species] means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both survival and recovery of a listed species in the wild by reducing the reproduction, numbers or distribution of that species (50 CFR §402.02).**

Jeopardy analyses usually focus on the effects of an action on a species' population dynamics. A conclusion of "jeopardy" for an action means that the action could reasonably be expected to reduce appreciably the likelihood of both the survival and recovery of a population, not an individual.

The first steps of the jeopardy analysis are to determine (1) if we would reasonably expect the western or eastern populations of Steller sea lions to experience reductions in reproduction, numbers, or distribution in response to the Preferred Alternative; (2) and if we would reasonably expect the Central North Pacific population of humpback whales to experience reductions in reproduction, numbers, or distribution in response to the Preferred Alternative.

The second step of the analysis is to determine if any reductions in a species' reproduction, numbers, or distribution can be expected to appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

The final step is to determine if any reduction in a species' reproduction, numbers, or distribution (identified in the second step of our analysis above) can be expected to appreciably reduce a listed species' likelihood of surviving and recovering in the wild.

7.3 Destruction or Adverse Modification of Critical Habitat Analysis

> ***Destruction or adverse modification*** means a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 CFR §402.02)

Adverse modification analyses usually focus on the effects of an action on the physical, chemical, and biological resources that support a population. A conclusion of "adverse modification" means that the action could reasonably be expected to appreciably diminish the value of critical habitat for both the survival and recovery of a population, not an individual. Such actions include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical (50 CFR 402.02).

7.4 Jeopardy Conclusions

In this section NOAA Fisheries must determine whether the listed species can be expected to survive an adequate potential for recovery under the effects of the Preferred Alternative, the environmental baseline, and cumulative effects. The information available is both quantitative and qualitative. Ultimately, NOAA Fisheries' conclusions are qualitative judgements based on the best quantitative and qualitative information available.

7.4.1 Western Population of Steller Sea Lions

In the section 3 we established that the endangered western DPS of Steller sea lions has been declining throughout its range for almost three decades. The population is approaching a 90 percent decline. Prior to early 1970s, the primary cause of the decline may have been commercial harvests, entanglement of juvenile sea lions in commercial fishing gear, and intentional shooting by fishermen. However, since 1991 these effects have been nearly eliminated, yet the overall rate of decline has been a relatively constant 4-5 percent per year (Loughlin and York 2001). However, there is no reason to believe that vessel traffic in the action area has affected this decline.

The greatest potential for a take to occur to Steller sea lions from activities identified in section 7.1 would be for an increased level of disturbance at haulouts in the action area. However this concern was expressed primarily for the eastern DPS of Steller sea lions which are far more numerous in Glacier Bay than the western DPS. While "western" Steller sea lions do occur in the action area (Matthews 2003), the action area is on the extreme eastern edge of their Alaska range, and the numbers of this DPS observed in the Park have been in the order of single or individual animals. As a result, the proposed action could only result in a minimal number of potential takes from this DPS, certainly at a level that could only have a *de minimis* effect on this population. As there is no reason to believe that vessel traffic in Glacier Bay has affected the decline of this species in the past, there is no reason to believe that the Preferred Alternative, as proposed, is likely to jeopardize the continued existence of the western population of Steller sea lions in the future.

7.4.2 Eastern Population of Steller Sea Lions

The eastern DPS of Steller sea lions is increasing slowly and has not experience the significant decline in recent decades as has the western population. The eastern population is the DPS most likely affected by the proposed action, and the most abundant within the action area. The effect of the Preferred Alternative that is of greatest concern for this species is the likelihood of increased disturbance on haulout sites within Glacier Bay proper. These sites are not designated as critical habitat for this species but do represent locations where sea lions haul out to rest and molt. The area around these sites are primary foraging areas for Steller sea lions in the action area. Factors that determine an area's value to predators like Steller sea lions include the distance of prey from shore, the depth of prey in the water column, the distribution and abundance of prey, and the dispersal of prey over time and space. As such a disturbance to this foraging zone around the haulouts could be of concern.

It is not believed that vessel traffic over the years has, or the Preferred Alternative would, reduce the abundance of prey within local foraging areas and alter the distribution of prey in ways that could reasonably be expected to reduce the foraging effectiveness of sea lions. Therefore, the action would not be expected to reduce the likelihood of their survival and successful reproduction nor their likelihood of recovery in the wild.

Another factor in understanding the effect of the action is understanding the relationship between the number of animals that could be affected relative to the entire DPS. There are very few sea lions from the eastern DPS that actually occur in Glacier Bay. A 1993 count of sea lions within the boundaries of the Park resulted in an estimated 1,100 animals (NPS 2003, Chap. 3.3.1, pp. 3-32). Accounting for a 1-2 percent increase per year since that count results in a current estimate of approximately 1,300 - 1,400 sea lions occurring on Park haulouts. This is approximately 4 percent of the estimated 31, 028 sea lions in the eastern DPS (Angliss *et al* 2002). A large percentage of these occur on Graves Rock which is located on the outside margins of the Park and is not even affected by the Preferred Alternative which occurs in Glacier Bay proper.

After reviewing the current status of the threatened eastern DPS of Steller sea lions, the environmental baseline for the action area, the Preferred Alternative, and the cumulative effects of other actions on the eastern DPS of Steller sea lions, it is NOAA Fisheries biological opinion that the Preferred Alternative may adversely affect but is not likely to jeopardize the continued existence of the eastern population of Steller sea lions.

7.4.3 Central North Pacific Population of Humpback Whales

The Preferred Alternative is most likely to affect this population of humpback whales (from section 7.1) by (1) a continued or possible increase in the potential for mortality to humpback whales due to ship collision due to the increased level of vessel traffic operating in the Park as a result of the Preferred Alternative; (2) an increased potential for disturbance to whales as a result of increased vessel traffic into the Park and adjacent waters; and (3) an increase in the ambient noise level in the water column as a result of increased vessel traffic resulting in a possible increased level of disturbance and the continued potential for temporary hearing impairment in humpback whales. These effects may be mitigated by a reduced speed limit in Glacier Bay for large vessels and minimum approach distances around humpback whales.

Indirect effects of the Preferred Alternative on prey availability are considered unlikely. The availability of prey species appears to vary from year to year within the Park, and the number of whales in the Park each year is dependent to a great degree on the availability and concentrations of prey rather than on the number of cruise ships or vessels allowed in the Park. Low numbers of whales have been generally correlated with years of low prey availability. There is little commercial fishing in the park and these fisheries do not target prey or forage species of humpback whales, so fishing is not considered a factor that could limit or otherwise redistribute prey available to whales or other listed species.

The other principal concerns, increased traffic, the possibility of mortality due to collisions, and the effects of increased noise levels, may adversely affect humpback whales in ways considered in this biological opinion and in NPS (2003), and the takes from these activities are largely unquantifiable at this time. However, even given this uncertainty, we can state with certainty that these effects will not jeopardize the continued existence of the central North Pacific population of humpback whales. This conclusion is based on the relationship between the number of whales which occur in Glacier Bay on an annual basis and cumulatively over the past decade relative to the abundance of the central North Pacific population; and the scale of the effects relative to the range of the population affected. Glacier Bay occupies an extremely small part of the entire range of the central North Pacific population of whales. As a result of these two factors, it can be stated with certainty that the effects of this action would neither rise to a level that would affect the trends, survival or reproduction of the population as a whole, nor could it affect a significant enough component of the habitat or range of the species to limit survival or recovery of the population. For these reasons, and after reviewing the current status of the species, the environmental baseline for the action area, the preferred alternative and proposed action, and the cumulative effects of other actions on the central North Pacific population of humpback whales, it is NOAA Fisheries biological opinion that the Preferred Alternative may adversely affect the central North Pacific population of humpback whales but is not likely to jeopardize the continued existence of the species.

7.5 Destruction or Adverse Modification of Critical Habitat Conclusion

Critical habitat has not been designated for the western DPS of Steller sea lions in the action area, nor has critical habitat been designated for humpback whales. The action area contains one haulout (Graves Rock) designated as critical habitat for the eastern DPS of Steller sea lions. After reviewing the status of critical habitat that has been designated for the eastern DPS of Steller sea lions in the action area, the environmental baseline for the action area, the proposed action, and the cumulative effects, it is NOAA Fisheries biological opinion that the preferred alternative, as proposed, is not likely to destroy or adversely modify critical habitat for this species.

The justification for that conclusion was provided in section 7.1 and expanded in the following paragraphs. The Preferred Alternative occurs in Glacier Bay proper and Dundas Bay. Both of these areas are part of the Glacier Bay National Park and Preserve. Critical habitat for the eastern DPS of Steller sea lions occurs in the action area only at Graves Rock, a rocky haulout which lies inside the boundaries of the Park but considerably outside the area encompassed by the Preferred Alternative. The increases in vessel traffic and consequences of that Preferred Alternative will not occur inside critical habitat, and would minimally, if at all, occur in the vicinity of critical habitat. For that reason, the Preferred Alternative would have no effect on critical habitat.

Further support for this conclusion lies in the fact that Graves Rock was designated as a haulout in the 1993 designation of critical habitat for sea lions. A haulout is an area used for resting, molting, often of seasonal use, and usually surrounded by areas where sea lions can successfully forage. Haulouts are not used for breeding or reproductive purposes. These locations are referred to as rookeries. Recent evidence that pupping is now occurring on Graves Rock (Raum-Suryan, K. and K. Pitcher. 2000) supports the conclusion that there is little disturbance or effects from human induced activities at this location.

8.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement.

8.1 Amount or Extent of Anticipated Take

NOAA Fisheries has determined that there is an unspecified number of takes expected to listed species in the action area as a result of the increased vessel traffic in the action area. However, NOAA Fisheries is not including an incidental take statement for the incidental take of Steller sea lions or humpback whales because the take of these species has not been authorized under section 101(a)(5) (E) of the Marine Mammal Protection Act (MMPA).

The MMPA definition of "take or taking" is to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect or kill any marine mammal". Any activities that may adversely affect marine mammals are considered harassment and are prohibited under the MMPA.

Following issuance of such regulations or authorizations and a finding of no significant impact in a take authorization under the MMPA, NOAA Fisheries will amend this opinion to include an incidental take statement.

8.2 Effect of Takes

This biological opinion does not permit the direct taking of any threatened or endangered species. It is very difficult to describe or quantify the indirect level of take on Steller sea lions and humpback whales as a result of the Preferred Alternative. NOAA Fisheries (2002) determined that a change in marine mammal behavior does not always result in a take by harassment. A disruption of behavior within a normal range of behavioral responses by the whale or sea lion that results in a change of behavior over a short time-frame and minimum level of intensity would not be considered a take under this interpretation because this short-term change in behavior or movement would not necessarily have any biological significance and, therefore, would not require a take authorization (NOAA Fisheries 2002). Therefore, simple exposure to sound does not constitute a take due to harassment. Brief disturbances, that do not disrupt normal behavior patterns in a biologically significant manner do not result in a take by harassment. Therefore short-term disturbance by a vessel that does not alter long-term behavior might not be considered a take by harassment.

Despite this uncertainty, it is NOAA Fisheries biological opinion that the Preferred Alternative, and takes from that action, is not likely to result in jeopardy to the listed species or the destruction or adverse modification of critical habitat for the eastern DPS of Steller sea lions (section 7.4 of this document).

9.0 CONSERVATION RECOMMENDATIONS

Information presented in NPS (2003) and this document on the disturbance effects principally to humpback whales from the presence of vessels represent real concerns for the whales present in the action area. While the number of whales frequenting the Park waters has increased over the last 20 years, the number of vessels transiting Park waters has also increased. It could be argued that the increasing number of vessels present in the Bay has, therefore, not significantly affected the whales in the Bay. However, at some level of disturbance, be it cruise ship disturbance or noise from increased vessel traffic, or other factors, the threshold for tolerance of that factor would presumably be exceeded. The threshold is a function of the magnitude of the impact and the counter" effect" of the need for the animals to remain at a productive feeding site to obtain enough prey to satisfy their nutritional needs. After the threshold is exceeded we could expect to see whales permanently leaving the area, or a possible reduction in the ratio of calves to known females (a reduction in fecundity). While it is impossible to predict that threshold level, one can, with some certainty, predict that it exists. In the absence of such quantitative information we can only assume based on the studies noted above that humpback whales in Glacier Bay may change their behavior (in manners detected to date and likely in ways as yet undetected e.g. acoustic disturbance) in the presence of vessels at relatively close range. Additional vessels in the Bay would add to this effect. The effect may exist immediately only at the level of the individual and current data do not provide information to determine the biological significance of those changes in behavior.

It is NOAA Fisheries' recommendation therefore that NPS should continue to monitor the levels of disturbance from vessels and vessel noise in Glacier Bay National Park Waters to Determine the Occurrence at which a Take of Steller sea lions and Humpback Whales Occurs as a Result of the Proposed Action. Upon determination of appropriate take levels, and issuance of regulations or authorizations under Section 101(a)(5) of the MMPA and/or its 1994 Amendments, NMFS will amend this opinion to include an ESA incidental take statement for listed species in the action area. No increases in cruise ship entries into Glacier Bay from the 2003 levels should occur until these determinations have been made.

In addition to the disturbance effect to humpback whales in Glacier Bay waters from the presence of vessels there is also the potential for collisions to occur that result in serious injury or mortality to the whale. A population in equilibrium can incur a certain level of mortality from anthropogenic sources and maintain stability. However, mortalities above that threshold may negatively affect the population and result in a declining trend. Mortalities related to vessel collisions for the central North Pacific population of humpback whales appears, from available information, to be sustainable at current levels.

As cruise ship numbers in the Bay increase, and with the increases in humpback whales in Park waters, the likelihood of a vessel collision may also increase. However, cruise ship traffic generally maintains a mid-channel course in Park waters, while the whales typically feed in more nearshore waters so the overall probability of vessel collisions inside Park boundaries with whales is likely low. A 13 knot speed restriction for large motor vessels in Glacier Bay may also reduce the risk of a collision between a cruise ship and a whale. Nonetheless, as numbers of whales and vessels increase, the probability of a collision also increases. **It is NOAA Fisheries' recommendation, therefore, that NPS continue to monitor the occurrence of whales in nearshore waters to determine if maximizing private vessel use in Glacier Bay by increasing the number of seasonal use days for private vessels results in increased disturbances to marine**

mammals including sea lions on rocks, or foraging whales.

Another factor in vessel collisions that result in mortality to the whale is vessel length and speed. A vessel greater than 80m in length and traveling at greater than 13 kts was more likely to cause death to the whale with which that vessel collided (Laist 2001). Cruise ships and other large vessels are the most likely vessel classes to cause mortality to a whale should a collision occur. The action area includes all areas to be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action. Therefore, waters immediately adjacent to the park entrance in Icy Strait including Point Adolphus are included in this action. There are no vessel speeds at these locations at this time. **It is NOAA Fisheries' recommendation, therefore, that the NPS should work with NOAA Fisheries, the United States Coast Guard and the State of Alaska to implement vessel speed limits or exclusion zones in nearshore waters of Icy Strait (i.e, within 1 mile of Pt. Adolphus) adjacent to Park waters that contain known concentrations of whales, or establish agreements with cruise and tour vessel concessioners whereby vessel speed and course restrictions are adopted beyond the Park boundaries in these areas where whales are known to forage and occur in large numbers.**

As described earlier, the proposed increases in vessel traffic would occur in an area where disturbance and collision risk are already a concern. **It is NOAA Fisheries' recommendation, therefore, that vessel operating requirements should be monitored for compliance and evaluated to determine if they are effective at protecting whales in these nearshore waters.**

10.0 REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the vessel quotas and operating requirements as described in the Draft Environmental Impact Statement (2003), National Park Service, and the new Preferred Alternative as described by NPS in subsequent communications. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) a mortality to a humpback whale occurs as a result of a vessel strike in the boundaries of the National Park and Preserve; (2) new information reveals effects of the agency action that pertain to listed species or designated critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or designated critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. This opinion expires 5 years after the effective date of signing.

11.0 LITERATURE CITED

Angliss, R. P., Lopez, A., and DeMaster, D. P. 2002. "Draft Alaska Marine Mammal Stock Assessments, 2001.", National Marine Mammal Laboratory, 7600 Sand Point Way NE, Seattle, WA 98115. p. 203.

Baker, C. S., and L. M. Herman. 1987. Alternative population estimates of humpback whales (*Megaptera novaeangliae*) in Hawaiian waters. Can. J. Zool. 65:2818-2821.

Baker, C. S., A. Perry, and L. M. Herman. 1987. Reproductive histories of female humpback whales (*Megaptera novaeangliae*) in the North Pacific. Mar. Ecol. Prog. Ser. 41:103-114.

Baker, C. S., S. R. Palumbi, R. H. Lambertsen, M. T. Weinrich, J. Calambokidis, and S. J. O'Brien. 1990. Influence of seasonal migration on geographic distribution of mitochondrial DNA haplotypes in humpback whales. Nature 344:238-240.

Baker, C. S., L. Medrano-Gonzalez, J. Calambokidis, A. Perry, F. Pichler, H. Rosenbaum, J. M. Straley, J. Urban-Ramirez, M. Yamaguchi, and O. von Ziegesar. 1998. Population structure of nuclear and mitochondrial DNA variation among humpback whales in the North Pacific. Mol. Ecol. 7(695-707).

Baker, C. S., L. M. Herman, A. Perry, W. S. Lawton, J. M. Straley, A. A. Wolman, G. D. Kaufman, H. E. Winn, J. D. Hall, J. M. Reinke, and J. Ostman. 1986. Migratory movement and population structure of humpback whales (*Megaptera novaeangliae*) in the central and eastern North Pacific. Mar. Ecol. Prog. Ser. 31:105-119.

Barlow, J., and P. J. Clapham. 1997. A new birth-interval approach to estimating demographic parameters of humpback whales. Ecol. 78(2):535-546.

Beamish, R.J. 1993. Climate and exceptional fish production off the west coast of North America. Can. J. Fish. Aquat. Sci. 50:2270-2291

Benson, A.J. and A.W. Trites. 2000. A review of the effects of regime shifts on the production domains in the eastern North Pacific Ocean. Unpublished report, Marine Mammal Research Unit, Fisheries Center, University of British Columbia.

Berzin, A. A., and A. A. Rovnin. 1966. The distribution and migrations of whales in the northeastern part of the Pacific, Chukchi and Bering Seas. Izvestiya Tikhookeanskogo Nauchno-Issledovatel'skogo Institut Rybnogo Khozyaistva I Okeanografii 58:179-207. (Translated by Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, Seattle, 1968, pp. 103-136. *In* K. I. Panin (ed.), Soviet Research on Marine Mammals of the Far East.)

Best, P. B. 1993. Increase rates in severely depleted stocks of baleen whales. ICES J. Mar. Sci. 50:169-186.

Bickham, J. W., J. C. Patton, and T. R. Loughlin. 1996. High variability for control-region sequences in a marine mammal: Implications for conservation and biogeography of Steller sea lions (*Eumetopias jubatus*). J. Mammal. 77:95-108.

Braham, H. W., R. D. Everitt, and D. J. Rugh. 1980. Northern sea lion decline in the eastern Aleutian Islands. J. Wildl. Manage. 44:25-33.

Brown, R. F., and S. D. Reimer. 1992. Steller sea lion counts in Oregon during June and July, 1975-1991. In-house Rep., Nongame Wildlife Prog., Oregon Dept. Fish and Wildl., Newport, OR, 97365. 12 pp.

Brueggeman, J. J., G. A. Green, R. A. Grotefendt, and R. W. Tressler. 1989. Marine mammal habitat use on the north Aleutian Basin, St. George Basin, and Gulf of Alaska. Pp. 97-108, *In* L. E. Jarvela and L. K. Thorsteinson (eds.), Proceedings of the Gulf of Alaska, Cook Inlet, and North Aleutian Basin Information Update Meeting. U.S. Dep. Commer., NOAA, NOS, Office of Ocean. and Mar. Assess., 222 W. Eighth Ave., Anchorage, AK.

Byrd, G. V. 1989. Observations of northern sea lions at Ugamak, Buldir, and Agattu Islands, Alaska in 1989. Unpubl. rep., U.S. Fish and Wildlife Service. Alaska Maritime National Wildlife Refuge, P.O. Box 5251, NSA Adak, FPO Seattle, WA 98791.

Calambokidis, J., G. H. Steiger, J. C. Cubbage, K. C. Balcomb III, and P. Bloedel. 1989. Biology of humpback whales in the Gulf of the Farallones. Report to Gulf of the Farallones National Marine Sanctuary, San Francisco, CA by Cascadia Research Collective, 218½ West Fourth Avenue, Olympia, WA. 93 pp.

Calambokidis, J., G. H. Steiger, and J. R. Evenson. 1993. Photographic identification and abundance estimates of humpback and blue whales off California in 1991-92. Final Contract Report 50ABNF100137 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 67 pp.

Calambokidis, J., G. H. Steiger, J. M. Straley, T. Quinn, L. M. Herman, S. Cerchio, D. R. Salden, M. Yamaguchi, F. Sato, J. R. Urban, J. Jacobson, O. Von Zeigesar, K. C. Balcomb, C. M. Gabriele, M. E. Dahlheim, N. Higashi, S. Uchida, J. K. B. Ford, Y. Miyamura, P. Ladrón de Guevara, S. A. Mizroch, L. Schlender, and K. Rasmussen. 1997. Abundance and population structure of humpback whales in the North Pacific basin. Final Contract Report 50ABNF500113 to Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA 92038. 72 pp.

Calkins, D. G., D. C. McAllister, K. W. Pitcher, and G. W. Pendelton. 1999. Steller sea lion status and trend in Southeast Alaska: 1979-1997. Mar. Mammal Sci. 15(2):462-477.

Caughley, G., and A. Gunn,. 1996. Conservation biology in theory and practice. Cambridge, Mass., Blackwell Science.

Cohen, J. 1988. Statistical power analysis and research results. Am. Educ. Res. J. 10: 225-230.

Crouse, D.T. 1999. The consequences of delayed maturity in a human-dominated world. American Fisheries Society Symposium. 23:195-202.

Darling, J. D. 1991. Humpback whales in Japanese waters. Ogasawara and Okinawa. Fluke identification catalog 1987-1990. Final Contract Report, World Wide Fund for Nature, Japan. 22 pp

Darling, J. D. 1991. Humpback whales in Japanese waters. Ogasawara and Okinawa. Fluke identification catalog 1987-1990. Final Contract Report, World Wide Fund for Nature, Japan. 22pp.

Darling, J. D., J. Calambokidis, J., K. C. Balcomb, P. Bloedel, K. Flynn, A. Mochizuki, K. Mori, F. Sato, and M. Yamaguchi. 1996. Movement of a humpback whale (*Megaptera novaeangliae*) from Japan to British Columbia and return. Mar. Mammal Sci. 12(2):281-287.

Darling, J. D., and S. Cerchio. 1993. Movement of a humpback whale (*Megaptera novaeangliae*) between Japan and Hawaii. Mar. Mammal Sci. 1:84-89.

Darling, J. D., and D. J. McSweeney. 1985. Observations on the migrations of North Pacific humpback whales (*Megaptera novaeangliae*). Can. J. Zool. 63:308-314.

Darroch, J. N. 1961. The two-sample capture-recapture census when tagging and sampling are stratified. Biometrika 48:241-260.

DeMaster, D.P., S. Atkinson, R.D. Dearborn. 2001. Is It Food? II Workshop Summary. Unpublished summary from May 30-31, 2001 Is it food? II Workshop, Alaska SeaLife Center, Seward, AK.

Dizon, A. E., C. Lockyer, W. F. Perrin, D. P. DeMaster, and J. Sisson. 1992. Rethinking the stock concept: a phylogeographic approach. Conserv. Biol. 6:24-36.

Doherty, J.L. and C.M. Gabriele. 2001. Population characteristics of humpback whales inGlacier Bay and adjacent waters: 2001. Gustavus, AK: National Park Service, Glacier Bay National Park and Preserve.

Doherty, J.L. and C.M. Gabriele. 2002. Population characteristics of humpback whales inGlacier Bay and adjacent waters: 2002. Gustavus, AK: National Park Service, Glacier Bay National Park and Preserve.

Erbe, Christine. 2003. Assessment of Bioacoustic Impact of Ships on Humpback Whales in Glacier Bay, Alaska.Report to Glacier Bay National Park and Preserve. 38 pp.

Forney, K. A., and R. L. Brownell. 1996. Preliminary report of the 1994 Aleutian Island marine mammal survey. Unpubl. doc. submitted to Intl. Whal. Comm. (SC/48/O 11). 15 pp.

Fowler C.W. and Baker, J.D. 1991. A review of animal population dynamics at extremely reduced population levels. Rep. Intl. Whaling Comm., vol. 41:545-554

Frankel, A. S., and C. W. Clark. 1998. Results of low-frequency playback of M-sequence noise to humpback whales, *Megaptera novaeangliae*, in Hawai'i. Can. J. Zool. 76:521-535.

Frankel, A. S., and C. W. Clark. 2002. ATOC and other factors affecting the distribution and abundance of humpback whales, *Megaptera novaeangliae*, off the North Shore of Kauai. Marine Mammal Sci. 18: 644-662.

Hollowed, A.B., and W.S. Wooster. 1995. Decadal-scale variations in the eastern Subarctic Pacific: II. Response of Northeast Pacific fish stocks. In Climate Change and Northern Fish Populations. Can. Spec. Pub. of the Fish. Aquat. Sci. 121:373-385.

Johnson, J. H., and A. A. Wolman. 1984. The humpback whale, *Megaptera novaeangliae*. Mar. Fish. Rev. 46:30-37.

Julian, F. 1997. Cetacean mortality in California gillnet fisheries: preliminary estimates for 1996. Unpubl. doc. submitted to Int. Whal. Comm. (SC/49/SM). 13 pp.

Julian, F., and M. Beeson. 1998. Estimates of marine mammal, turtle, and seabird mortality for two California gillnet fisheries: 1990-1995. Fish. Bull. 96:271-284.

Jurasz, C.M. and V.P. Jurasz. 1979. Feeding modes of humpback whale, Megaptera novaeangliae in southeast Alaska. Sci. Rept of Whales Res. Inst 31: 69-83.

Kenyon, K.W., and D.W. Rice. 1961. Abundance and distribution of the Steller sea lion. J. of Mammal. 42:223-234.

Ketten, D.R. 1998. Marine Mammal Auditory Systems: a summary of audiometric and anatomical data and its implicaitons for undrewater acoustic impacts. NOAA-TM-NMFS-SWFSC-256. NOAA, NMFS, La Jolla, California.

Kipple, B. M. 2002. Glacier Bay underwater noise - interim report. Naval Surface Warfare Center - Detachment Bremerton. Report to National Park Service. Technical Report NSWCCD-71-TR-2002/579. 65 pp.

Krieger, K. and B.L. Wing (1984). Humpback whale prey studies in southeastern Alaska, Summer 1983. Northwest and Alaska Fisheries Center, Auke Bay Laboratory, Auke Bay, AK, 42 pp.

Krieger, K. and B.L. Wing (1986). Hydroacoustic monitoring of prey to determine humpback whale movements. NOAA Technical Memorandum NMFS F/NWC-98, 62 pp.

Laist, D.W., A. R. Knowlton, J.G. Mead, A.S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Mar. Mammal Sci. 17: 35-75.

LeBoeuf, B. J., K. Ono, and J. Reiter. 1991. History of the Steller sea lion population at Año Nuevo Island, 1961-1991. Southwest Fish. Sci. Center Admin. Rep. LJ-91-45C. U.S. Dep. Commer., La Jolla, CA, 9p + tables +figs.

LGL. 2003. LGL Alaska Research Associates, Acoustic Memorandum, in NPS (2003), Appendix C: 22 pp.

Loughlin, T. R. 1997. Using the phylogeographic method to identify Steller sea lion stocks. Pp. 329-341, *In* A. Dizon, S. J. Chivers, and W. Perrin (eds.), Molecular genetics of marine mammals, incorporating the proceedings of a workshop on the analysis of genetic data to address problems of stock identity as related to management of marine mammals. Soc. Mar. Mammal., Spec. Rep. No. 3.

Loughlin, T. R., D. J. Rugh, and C. H. Fiscus. 1984. Northern sea lion distribution and abundance: 1956-1980. J. Wildl. Manage. 48:729-740.

Loughlin, T.R., M.A. Perez, R.L. Merrick. 1987. *Eumetopias jubatus*. Mammalian Species 283:1-7.

Loughlin, T.R., and A.E. York. 2001. An accounting of the sources of Steller sea lion mortality. Mar. Fish. Rev. 62(4):40-45.

Loughlin, T.R., J.T. Sterling, R.L. Merrick, J.L. Sease, and A. E. York. 2002. Immature Steller sea lion diving behavior. Fishery Bulletin (accepted for publication)..

Malme, C. I., P.R. Miles,C.W. Clark P.L. Tyack, and J.E. Bird. 1983. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. var. Pp.. Available from Bolt, Beranek and Newman, 10 Moulton Street, Cambridge, MA 02238

Malme, C. I., P.R. Miles,C.W. Clark P.L. Tyack, and J.E. Bird. 1984. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Phase II, var. Pp.. Available from Bolt, Beranek and Newman, 10 Moulton Street, Cambridge, MA 02238

Malme, C. I., P.R. Miles, P.L. Tyack, C.W. Clark and J.E. Bird. 1985. Investigations of the potential effects of underwater noise from petroleum industry activities on feeding humpback whale behavior. Var. Pp.. Available from Bolt, Beranek and Newman, 10 Moulton Street, Cambridge, MA 02238.

Martin, A. R., S. K. Katona, D. Mattila, D. Hembree, and T. D. Waters. 1984. Migration of humpback whales between the Caribbean and Iceland. J. Mamm. 65:330-333.

Matthews, E. A. 2003. Observations of Steller sea lions at South Marble Island, Glacier Bay National Park. Unpubl. Report to Glacier Bay National Park and Preserve, 6 pp.

Merrick, R. L., T. R. Loughlin, and D. G. Calkins. 1987. Decline in abundance of the northern sea lion, *Eumetopias jubatus*, in 1956-86. Fish. Bull., U.S. 85:351-365.

Merrick, R.L., D.G. Calkins, and D.C. McAllister. 1992. Aerial and ship-based surveys of Steller sea lions in Southeast Alaska, the Gulf of Alaska, and Aleutian Islands during June and July 1991. U.S. Dep. Commer, NOAA Tech Memo. NMFS-AFSC-1. 37p.

Merrick, R.L., and A.E. York. 1994. A viability analysis for the southwest Alaskan Steller sea lion population, 1985-94. Draft report, 20 pp.

Merrick, R.L., R. Brown, D.G. Calkins, and T.R. Loughlin. 1995. A comparison of Steller sea lion, *Eumetopias jubatus*, pup masses between rookeries with increasing and decreasing populations. Fish. Bull. 93:753-758

Merrick, R.L. and T. R. Loughlin. 1997. Foraging behavior of adult female and young-of-the-year Steller sea lions (*Eumetopias jubatus*) in Alaskan waters. Can. J. Zool. 75; 776-786.

Mizroch, S. A., L. M. Herman, J. M. Straley, D. Glockner-Ferrari, C. Jurasz, J. Darling, S. Cerchio, C. Gabriele, D. Salden, O. von Ziegesar. Estimating the adult survival rate of central North Pacific humpback whales. Unpublished manuscript, in review.

Moore, S. E., J. M. Waite, L. L. Mazzuca, and R. L. Hobbs. 2000. Mysticete whale abundance observations of prey associations on the Central Bering Sea Shelf. J. Cetacean Research and Management 2(3): 227-234.

National Marine Fisheries Service. 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the humpback recovery team for the National Marine Fisheries Service, Silver Spring, Maryland. 105 pp.

National Marine Fisheries Service. 1992. Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Prepared by the Steller Sea Lion Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 92 pp.

National Marine Fisheries Service. 1993. Endangered Species Act, Section 7 Consultation-Biological Opinion, on the Proposed Vessel Management Plan for 1992. NMFS, Office of Protected Resources, Silver Spring, Maryland. Issued Feb 1993.

National Marine Fisheries Service. 1995. Status review of the United States Steller sea lion (*Eumetopias jubatus*) population. Prepared by the National Marine Mammal Laboratory, AFSC, NMFS, NOAA, 7600 Sand Point Way NE, Seattle, WA 98115. 61 pp.

National Park Service. 1995. Glacier Bay National Park and Preserve, Vessel Management Plan and Environmental Assessment, NPS, Alaska Region, May 1995.

National Park Service. 2003. Draft Environmental Impact Statement, Vessel Quotas and Operating Requirements. Glacier Bay National Park and Preserve, Alaska; National Park Service, Department of the Interior. March 2003.

Nemoto, T. 1957. Foods of baleen whales in the northern Pacific. Sci. Rep. Whales Res. Inst. Tokyo 12:33-89.

Nishiwaki, M. 1966. Distribution and migration of the larger cetaceans in the North Pacific as shown by Japanese whaling results. Pp. 172-191, *In* K. S. Norris (ed.), Whales, Dolphins and Porpoises,

University of California Press, Berkeley, CA. Academic Press, New York.
NOAA Fisheries. 2000. Section 7 consultation on the authorization of the Bering Sea and Aleutian Islands groundfish fishery under the BSAI FMP and the authorization of the Gulf of Alaska groundfish fishery under the GOA FMP. Office of Protected Resources, NMFS. Nov. 30, 2000.
NOAA Fisheries (NMFS). 2001a. Endangered Species Act-section 7 consultation, Draft Biological Opinion and Incidental Take Statement, August 2001. Appendix A to the Draft SEIS for Steller Sea Lion Protection Measures, August 2001.
NOAA Fisheries (NMFS). 2001b. Steller Sea Lion Protection Measures, Draft Environmental Impact Statement, NOAA, NMFS, Alaska Region. August 2001..
NOAA Fisheries (NMFS). 2002. Final Rule regarding the Taking and Importing of Marine Mammals; Taking Marine Mammals Incidental to Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar, publ. 67 FR 46712, July 16, 2002.
National Research Council (NRC), Committee on the Bering Sea Ecosystem. 1996. The Bering Sea Ecosystem. National Academy Press, Washington, D.C.
Perry, A., C. S. Baker, and L. M. Herman. 1990. Population characteristics of individually identified humpback whales in the central and eastern North Pacific: a summary and critique. Rep. Int. Whal. Comm. (Special Issue 12):307-317.
Piatt, J.F. and P.J. Anderson. 1996. Responses of common murres to the Exxon Valdez oil spill and long-term changes in the Gulf of Alaska ecosystem. AFS Symposium 18, pp. 720-737.
Raum-Suryan, K. and K. Pitcher. 2000. Trip Report: Brand resights of Steller sea lions within southeast Alaska and Northern British Columbia from June 19-July 10, 2000.
Repenning, C.A. 1976. Adaptive evolution of sea lions and walruses. Syst. Zool. 25:375-390. National Research Council, Committee on the Bering Sea Ecosystem. 1996. The Bering Sea Ecosystem. National Academy Press, Washington, D.C.
Rice, D. W. 1978. The humpback whale in the North Pacific: distribution, exploitation and numbers. Appendix 4. Pp. 29-44, *In* K. S. Norris and R.R. Reeves (eds.), Report on a workshop on problems related to humpback whales (*Megaptera novaeangliae*) in Hawaii. U.S. Dep. Commer., Nat. Tech. Info. Serv. PB-280 794. Springfield, VA.
Richardson, W.J., C.R. Greene, Jr., C.I. Malme, D.R. Thomson. 1995. Marine Mammals and Noise, Academic Press, New York. 576 pp.
Sease, J. L., and T. R. Loughlin. 1999. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in Alaska, June and July 1997 and 1998. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-100, 61 p.
Sease, J. L., W. P. Taylor, T. R. Loughlin, and K. W. Pitcher. 2001. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in Alaska, June and July 1999 and 2000. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-122, 52 pp.
Sease, J. L., and T. R. Loughlin. 1999. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in Alaska, June and July 1997 and 1998. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-100, 61 pp.
Sease, J. L., J. M. Strick, R. L. Merrick, and J. P. Lewis. 1999. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in Alaska, June and July 1996. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-99, 43 pp.
Sease, J. L., W. P. Taylor, T. R. Loughlin, and K. W. Pitcher. 2001. Aerial and land-based surveys of Steller sea lions (*Eumetopias jubatus*) in Alaska, June and July 1999 and 2000. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-122, 52p.
Shima, M., Hollowed, A.B., and VanBlaricom, G.R. 2000. Response of pinniped populations to directed harvest, climate variability, and commercial fishery activity: A comparative analysis. Rev. Fish. Sci. 8(2): 89-124.
Sinclair, E.H. and T.K. Zeppelin. 2001. Seasonal diet trends among the western stock of Steller sea lions

(*Eumetopias Jubatus*). Unpublished NMFS White Paper.

Steiger, G. H., J. Calambokidis, R. Sears, K. C. Balcomb, and J. C. Cubbage. 1991. Movement of humpback whales between California and Costa Rica. Mar. Mammal Sci. 7:306-310.

Straley, J. M., C. M. Gabriele, and C. S. Baker. 1995. Seasonal characteristics of humpback whales (*Megaptera novaengliae*) in southeastern Alaska. Pages 229-237 in D. R. Engstrom, ed. Proceedings of the Third Glacier Bay Science Symposium, 1993. National Park Service, Anchorage, AK.

Straley, J.M.,, T. J. Quinn, and C.M. Gabriele. 2002. Estimate of the abundance of humpback whales in southeastern Alaska 1994-2000. Rept to NMFS, NMML, Grant No. G00000756, SFOS02-223, Seattle Washington, October 2001. 22 pp.

Strick, J. M., L. W. Fritz, and J. P. Lewis. 1997. Aerial and ship-based surveys of Steller sea lions *Eumetopias jubatus*) in Southeast Alaska, the Gulf of Alaska, and Aleutian Islands during June and July 1994. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-71, 55 pp.

Sydeman, W. J., and S. G. Allen. 1997. Trends and oceanographic correlates of pinniped populations in the Gulf of the Farallones, California. U.S. Dep. Commer., Southwest Fish. Sci. Cent., Admin. Rep. LJ-97-02C, 28 pp.

Todd, S., P. Stevick, J. Lienp, F. Marques, and D. Ketten. 1996. Behavioural effects of exposure to underwater explosions in humpback whales (Megaptera novaeangliae). Can. J. Zool. 74: 1661-1672.

Tomlin, A. G. 1967. Mammals of the USSR and adjacent countries. vol. 9, Cetacea. Israel Program Sci. Transl. No. 1124, Natl. Tech. Info. Serv. TT 65-50086. Springfield, VA. 717 pp. (Translation of Russian text published in 1957).

Trites, A.W., and P.A. Larkin. 1992. The status of Steller sea lion populations and the development of fisheries in the Gulf of Alaska and Aleutian Islands. A report of the Pacific States Marine Fisheries Commission pursuant to National Oceanic and Atmospheric Administration Award No. NA17FD0177. Fisheries Centre, University of British Columbia, Vancouver, British Columbia, Canada V6T 1Z4.

Trites, A.W., and P.A. Larkin. 1996. Changes in the abundance of Steller sea lions (*Eumetopias jubatus*) in Alaska from 1956 to 1992: how many were there? Aquat. Mamm. 22:153-166.

von Ziegesar, O. 1992. A catalogue of Prince William Sound humpback whales identified by fluke photographs between the years 1977 and 1991. North Gulf Oceanic Society, P. O. Box 15244, Homer, AK. 29 pp.

von Zeigesar, O. , E. Miller, and M. E. Dahlheim. 1994. Impacts on humpback whales in Prince William Sound. Pp. 173-191, *In* T. R. Loughlin (ed.), Marine Mammals and the *Exxon Valdez*. Academic Press Inc., San Diego, CA.

Waite, J. M., M. E. Dahlheim, R. C. Hobbs, S. A. Mizroch, O. von Ziegesar-Matkin, J. M. Straley, L. M. Herman, and J. Jacobsen. 1999. Evidence of a feeding aggregation of humpback whales (*Megaptera novaeangliae*) around Kodiak Island, Alaska. Mar. Mammal Sci. 15:210-220.

Westlake, R. L., W. L. Perryman, and K. A. Ono. 1997. Comparison of vertical aerial photographic and ground censuses of Steller sea lions at Año Nuevo Island, July 1990-1993. Mar. Mammal Sci. 13(2): 207-218.

Wing, B.L. and K. Krieger (1983). Humpback whale prey studies in southeastern Alaska, summer 1982. Report to the Northwest and Alaska Fisheries Center Auke Bay Laboratory, National Marine Fisheries Service, NOAA, P.O. Box 155, Auke Bay, Alaska, 99821, 60 pp.

Wolfe, R. J., and C. Mishler. 1993. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1992. Final report for year one, subsistence study and monitor system (no. 50ABNF20055). Prepared for the NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 94 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1994. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1993. Final report for year two, subsistence study and monitor system (no. 50ABNF20055). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 60 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1995. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1994. Final report for year three, subsistence study and monitor system (no. 50ABNF20055). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 69 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1996. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1995. Final report for year four, subsistence study and monitor system (no. 50ABNF400080). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 69 pp. + appendices.

Wolfe, R. J., and C. Mishler. 1997. The subsistence harvest of harbor seal and sea lion by Alaska natives in 1996. Technical Paper 241. Draft Final report for year five, subsistence study and monitor system (no. 50ABNF400080). Prepared for NMFS by Alaska Dept. Fish and Game, Juneau, Alaska, 70 pp. + appendices.

Wolfe, R. J., and L. B. Hutchinson-Scarbrough. 1999. The subsistence harvest of harbor seals and sea lions by Alaska Natives in 1998. Technical paper No. 250. Alaska Dept. Fish and Game, Division of Subsistence, Juneau, Alaska.

Wynne, K. M., D. Hicks, and N. Munro. 1991. 1990 salmon gillnet fisheries observer programs in Prince William Sound and South Unimak Alaska. Annual Rept. NMFS/NOAA Contract 50ABNF000036. 65 pp. NMFS, Alaska Region, Office of Marine Mammals, P.O. Box 21668, Juneau, AK 99802.

Wynne, K. M., D. Hicks, and N. Munro. 1992. 1991 Marine mammal observer program for the salmon driftnet fishery of Prince William Sound Alaska. Annual Rept. NMFS/NOAA Contract 50ABNF000036. 53 pp. NMFS, Alaska Region, Office of Marine Mammals, P.O. Box 21668, Juneau, AK 99802.

Yablokov, A. V. 1994. Validity of whaling data. Nature 367:108.

York, A.E. 1994. The population dynamics of northern sea lions 1975-85. Mar. Mamm. Sci 10:38-51.

York, A. E., R. L. Merrick, and T. R. Loughlin. 1996. An analysis of the Steller sea lion metapopulation in Alaska. Chapter 12, Pp. 259-292, *In* D. R. McCullough (ed.), Metapopulations and wildlife conservation. Island Press, Covelo, California.

Wyllie-Echeverria, T., and W.S. Wooster. 1998. Year-to-year variations in Bering Sea ice cover and some consequences for fish distributions. Fish. Oceanogr. 7:159-170.

APPENDIX L

Essential Fish Habitat Assessment

R2U0 07/2110?
UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

July 14, 2003

Nancy Swanton
EIS Project Manager
National Park Service
Glacier Bay National Park and Preserve
2525 Gambell Street
Anchorage, Alaska 99503

RE: Draft Environmental Assessment and EFH Assessment for Glacier Bay National Park Vessel Quotas and Operating Requirements

Dear Ms. Swanton:

The National Marine Fisheries Service (NMFS) has reviewed the Essential Fish Habitat (EFH) Assessment for the Glacier Bay National Park Vessel Quotas and Operating Requirements Draft Environmental Assessment (DEIS).

In the EFH Assessment the National Park Service (NPS) determined that the preferred alternative in the DEIS and the slightly different preferred alternative that is likely to become the preferred alternative in the FEIS, would have minor direct, indirect, and cumulative effects on EFH. The primary effects on marine and anadromous fish resources would be temporary dispersal from areas of high vessel usage due to increased noise levels. The EFH Assessment and the DEIS state that maximum noise level, rather than the frequency of noise events is the most important consideration and that fish populations likely would temporarily avoid the areas where the loudest vessel-related sounds are generated (e.g., cruise ship passages). The NPS has not suggested mitigation for adverse effects on EFH.

We concur that the adverse effects of increased vessel traffic on species for which EFH has been designated would be minor and that mitigation is not practicable.

<u>EFH for Pacific Salmon</u>

Table 3-6 states that "Salmon species do not have essential fish habitat because they are managed by the Alaska Department of Fish and Game, not the NOAA Fisheries [NMFS]; they do have important habitat in Glacier Bay." This statement is incorrect. A fishery management plan (FMP) regulates fisheries in the waters off the entire coast of Alaska. The North Pacific Fishery Management Council

(NPFMC) and State of Alaska have effectively implemented this FMP under a joint agreement whereby State fishery regulations also apply within the EEZ. This management deferral by the NPFMC to the State of Alaska, however, does not exempt the NPFMC from mandatory requirements to implement EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act.

Based on the information provided by the NPS in the EFH Assessment, NMFS concurs with your determination. Therefore, the EFH consultation requirements of the Magnuson-Stevens Fishery Conservation and Management Act have been satisfied. NMFS remains available to assist the NPS if t any additional EFH issues are identified. Please contact Sue Walker at (907) 586-7646 if you require further assistance.

Sincerely,

Donald J. Berg

For James W. Balsiger
Administrator, Alaska Region

United States Department of the Interior

NATIONAL PARK SERVICE
Glacier Bay National Park and Preserve
P.O. Box 140
Gustavus, Alaska 99826-0140

Tel: 907-697-2230
Fax: 907-697-2654

IN REPLY REFER TO:

D-15

July 10, 2003

Mr. Jonathan M. Kurland
Assistant Administrator for Habitat Conservation
NOAA Fisheries
709 West 9th Street, Room 457
P.O. Box 21668
Juneau, Alaska 99802-1668

Reference: Proposed Vessel Quotas and Operating Requirements, Glacier Bay National Park and Preserve

Subject: Assessment of Effects on Essential Fish Habitat

Dear Mr. Kurland:

The National Park Service (NPS) is submitting this letter to initiate Essential Fish Habitat (EFH) consultation with NOAA Fisheries, as required by the 1996 reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act and Department of Commerce regulations (50 CFR 600.905-930). The consultation is for actions under consideration by NPS regarding vessel quotas and operating requirements in Glacier Bay National Park and Preserve.

The NPS recently prepared a draft environmental impact statement (DEIS) on vessel quotas and operating requirements for Glacier Bay proper and Dundas Bay in Glacier Bay National Park Preserve. For your review and comment, we are submitting excerpts of the DEIS which, together, provide an EFH assessment in conformance with the 1996 amendments to the Magnuson-Stevens Fishery Management Act. We also are including a copy of the full DEIS should you want additional, contextual information (the DEIS also is available on the park's website: http://www.nps.gov/glba).

The DEIS considers five alternatives, including a no action alternative, and contains an analysis of the impacts on EFH of each alternative. The analysis is presented primarily in two sections of the DEIS: Chapter 3, Section 3.3.4 (Affected Environment for Marine Fishes), and Chapter 4, Section 4.3.4 (Environmental Consequences for Marine Fishes).

Based on information and analysis in the DEIS, the NPS believes that the direct, indirect, and cumulative effects on EFH would be minor under any of the five alternatives.

Although Alternative 3 is identified as the NPS preferred alternative in the DEIS, the NPS is now considering a slightly different preferred alternative – Alternative 6 – which will be evaluated in the final EIS, scheduled for public release in early October 2003. The environmental effects of Alternative 6 relevant to the EFH assessment are anticipated to be within the spectrum of those identified in the DEIS (i.e., minor); they would be similar to those described for Alternative 3. The elements of Alternative 6 that differ from Alternative 3 are listed in an attachment to the EFH assessment.

We request that NOAA Fisheries review the enclosed EFH assessment and, if necessary, provide the NPS with recommended EFH conservation measures. A response within two to three weeks would be most helpful. Please feel free to call me if you have any questions or need further information. I can be reached by telephone at (907) 644-3696 or you may email me at Nancy_Swanton@nps.gov.

Sincerely,

Nancy Swanton
EIS Project Manager

(cc: Sue Walker)

2 Enclosures

ESSENTIAL FISH HABITAT ASSESSMENT
Proposed Vessel Quotas and Operating Requirements
Glacier Bay National Park and Preserve

INTRODUCTION

The National Park Service (NPS) recently completed a draft environmental impact statement (DEIS), for proposed vessel quotas and operating requirements in Glacier Bay National Park and Preserve and is in the process of preparing the final EIS (FEIS), scheduled for public release in early October 2003. The DEIS contains an analysis of the impacts of five alternatives, including a no action alternative and the NPS preferred alternative.

Appropriate excerpts from the DEIS are presented below in the format necessary for an essential fish habitat assessment of the NPS preferred alternative (Alternative 3). While Alternative 3 is identified as the agency-preferred alternative in the DEIS, the NPS is considering a different preferred alternative for inclusion in the FEIS. This additional alternative, Alternative 6, was developed based on public comment on the DEIS and further agency consideration. Alternative 6 is a minor variation of existing alternatives presented in the DEIS (it includes parts of alternatives 3 and 5). The elements of Alternative 6 that differ from Alternative 3 are listed in Attachment 1. The elements of Alternative 6 that differ from Alternative 5 are listed in Attachment 2. The environmental effects of Alternative 6 relevant to this essential fish habitat assessment are anticipated to be within the spectrum of those identified in the DEIS (i.e., minor); they would be similar to Alternative 3.

DESCRIPTION OF ALTERNATIVE 3 (NPS Preferred Alternative in the DEIS)

Alternative 3 represents the vessel management plan that NPS completed in 1996. Vessel quotas and operating requirements considered under this alternative pertain to Glacier Bay. Alternative 3 would continue the current vessel quotas, but would provide for potential future increases in cruise ships up to 184. The increases would allow up to two cruise ships per day, every day. The current quota season and operating requirements would be maintained. The time period when seasonal-use days are defined would be from June 1 through August 31. Vessel classes would continue to be defined under the existing regulations (see table 2-1 of the DEIS).

Tour, charter, and private vessel quotas would remain the same as currently allowed. Any increase in cruise ship numbers would be contingent upon the completion of studies that demonstrate the increases would be compatible with the protection of park values and purposes. Since 1996 the Park Service has conducted research to determine whether increases are warranted, and each year the superintendent reviews the research results. To date, the research has not clearly demonstrated that further increases are warranted.

Research would continue, with emphasis on air quality, humpback whales, nesting birds, and visitor experience.

Terminology and Definitions

The table below presents the terms and definitions used.

Alternative 3

Term	TERMINOLOGY AND DEFINITIONS Current regulations apply, and current regulatory language is shown below.
Charter Vessel	Any motor vessel under 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that is rated to carry up to 49 passengers, and is available for hire on an unscheduled basis, except a charter vessel used to provide a scheduled camper or kayak drop-off service.
Cruise Ship	Any motor vessel at or more than 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) carrying passengers for hire.
Entry	Each time a motor vessel passes the mouth of Glacier Bay into the Bay; each time a private vessel activates or extends a permit; each time a motor vessel based at or launched from Bartlett Cove leaves the dock area on the way into Glacier Bay, except a private vessel based at Bartlett Cove that is gaining access or egress to or from outside Glacier Bay; the first time a local private vessel uses a day of the seven-use day permit; or each time a motor vessel singularly launched from a permitted motor vessel and operated only while the permitted vessel remains at anchor, or a motor vessel launched and operated from a permitted motor vessel while that vessel is not under way and in accordance with a concession agreement.
Private Vessel	Any motor vessel used for recreation that is not engaged in commercial transport of passengers, commercial fishing, or official government business.
Speed through the Water	The speed at which a vessel moves through the water (which itself may be moving), as distinguished from "speed over the ground."
Speed Over the Ground	NA[a]
Tour Vessel	Any motor vessel under 100 tons gross (U.S. System) or 2,000 tons gross (International Convention System) that is rated to carry more than 49 passengers, or any smaller vessel that conducts tours or provides transportation at regularly scheduled ties along a regularly scheduled route.
Vessel-Use Day	Any continuous period of time in which a motor vessel is in Glacier Bay from 12 midnight on one day to 12 midnight the next day.
Seasonal-Use Days	Not defined in current regulations, but presumed to be the number of vessel-use days allowed during a specific seasonal period.
Daily Vessel Quota	Not defined in current regulations, but presumed to be the number of vessel-use days allowed in an area on any one calendar day.
Administrative Use	Not specifically defined in the current regulations, but presumed to be a motor vessel engaged in official business for the state or federal government. See 13.65(b)(2)(iii). Exceptions from entry permit requirement.
Administrative Vessel	Not defined in the current regulations, but presumed to be any vessel involved in administrative use (as with alternatives 4 and 5).
Whale Waters	Any portion of Glacier Bay, designated by the superintendent, having a high probability of whale occupancy, based upon recent sighting or past patterns of occurrence.
Short-Notice Private Vessel Permits	NA
Bartlett Cove Passenger Ferry[b]	Any motor vessel engaged in the transport of passengers for hire, with sole purpose of accessing park or other authorized visitor services or facilities at, or originating from, the public dock area at Bartlett Cove, as provided in Public Law 105-83, Title I, section 127.

[a]. The term "speed over ground" is referenced in the current regulations, but no definition is provided. It is presumed to be speed measured in relation to a fixed point on the earth.

[b]. See Title I, section 127, of the Department of the Interior and Related Agencies Appropriations Act of 1998 (Public Law 105-83), which authorizes one entry per day for a passenger ferry into Bartlett Cove from Juneau.

NA = Not applicable. CFR = Code of Federal Regulations.

Vessel Quotas

A with all alternatives considered, Alternative 3 would:

- use permits to regulate vessel numbers in Glacier Bay.
- require private vessel operators entering Bartlett Cove to contact park headquarters to obtain an entry permit and receive orientation to the park.
- set quotas (limits) for motorized vessel use of Glacier Bay for cruise ships, and tour, charter, and private vessels.
- allow a maximum of two cruise ships to enter Glacier Bay per day year-round.
- allow for one entry to Bartlett Cove for the ferry service from Juneau — with the sole purpose of accessing park and other authorized visitor services or facilities at, or originating from, the public dock area at Bartlett Cove.

In addition, as under all alternatives, no permit is required by the following types of vessels for entry into Glacier Bay:

- administrative vessels, vessels operated by the Hoonah Indian Association (i.e. Hoonah tribal members operating under a tribal permit), and research vessels (however, research vessels must obtain a research permit).
- vessels granted safe harbor in Bartlett Cove by the superintendent based on hazardous conditions, such as weather or mechanical problems.
- skiffs launched from a permitted motor vessel and operated while the permitted vessel remains at anchor (and skiffs launched to take photographs for marketing materials in accordance with a valid concessions or commercial use permit).
- commercial fishing vessels otherwise permitted and engaged in commercial fishing.

Specifically, Alternative 3 would optimize visitor-use opportunities via cruise ship in Glacier Bay by potentially increasing cruise ship seasonal-entry quotas and seasonal-use days (see table below). This alternative is identical to alternative 1, except that the cruise ship seasonal-entry quota could increase from 139 entries per season to 184 entries per season, based on a determination made annually by the park superintendent. On October 1 of each year, the superintendent would determine, with the director's approval, the number of cruise ship entries for the following summer season (June 1-August 31). This determination would be based upon available scientific and other information and applicable authorities. The number would be subject to the maximum daily limit of two vessel use-days. If the cruise ship vessel quota were increased to 184, two cruise ships would be permitted to enter Glacier Bay every day from June 1 to August 31.

Current exceptions would be maintained, including the exception of administrative traffic and private vessels based at Bartlett Cove. As is currently the case, no permit would be required for private vessels based at Bartlett Cove transiting between Bartlett Cove and waters outside Glacier Bay, or private vessels that are operating in Bartlett Cove in waters bounded by the public and administrative docks.

SUMMARY OF VESSEL QUOTAS FOR GLACIER BAY UNDER ALTERNATIVE 3, JUNE 1–AUGUST 31

Vessel Class	Daily Entries	Seasonal Entries	Seasonal-Use Days
Cruise ship[a]	2	139 (potentially up to 184)	139 (potentially up to 184)
Tour vessel[a]	3	276	276
Charter vessel	6	312	552
Private vessel	25	468	1,971

a. Cruise ships and tour vessels are limited to a maximum of two per day and three per day, respectively, year round. See table 2-1 for an explanation of terms.

Operating Requirements

In areas designated as "special-use areas," operating requirements are set to protect resources. Under all alternatives, special-use area designations would remain the same for seabird nesting colonies, island protection regulations, harbor seal and sea lion haul-outs and lower Glacier Bay whale waters. Special-use areas identified in the park and preserve:

- East Arm and West Arm of Glacier Bay.
- areas with wildlife and other sensitive resources.
- Bartlett Cove.
- outer coast waters.
- wilderness waters.

Non-motorized water designations and seasons for closed waters also would remain unchanged (see figure 2-1 and table 2-13 in the DEIS). In addition, with the exception of speed restrictions, vessel operating restrictions in whale waters would remain the same among alternatives (although the actual waters designated as whale waters would not). Restrictions include the following:

- In designated areas, all motor vessels more than 18 feet long will navigate a mid-channel course and, where possible, maintain a distance of at least 1 mile from the shoreline while in transit through whale waters.

- All vessels are prohibited from operating within 0.25 nautical mile of a humpback whale or pursuing or attempting to pursue humpback whales within 0.5 nautical mile in marine waters within the boundary of the park and preserve.

Under alternative 3, vessel operating requirements would follow the existing regulations (see appendix A in DEIS) and the park compendium (see appendix B in DEIS). The park compendium is a written compilation of designations, closures, permit requirements, and other restrictions imposed by the superintendent under the discretionary authority found in the Code of Federal Regulations.

Vessel Speed. Under alternative 3, vessel speed would be measured as "through the water," or the speed at which a vessel moves through the water (which itself may be moving), as distinguished from "speed over the ground." Vessel speed limits in the designated whale waters of the lower Bay would be in effect from May 15 through August 31. During this time, vessels would continue to be required to operate at speeds of 20 knots or less and at 10 knots or less when the superintendent has designated a maximum speed of 10 knots (due to the presence of whales). The superintendent may impose motor vessel speed restrictions in whale waters.

Whale Waters. Whale waters are any portion of Glacier Bay designated by the superintendent as having a high probability of whale occupancy, based upon recent sightings or past patterns of occurrence. Four areas of Glacier Bay are designated as whale waters from May or June through August. They are: 1) the lower Bay waters, 2) Whidbey Passage, 3) East Arm entrance waters and 4) Russell Island Passage waters (see appendix A of and figure 2-1 in the DEIS). Designated whale waters are in effect from May 15 through August 31 for the lower Bay and from June 1 through August 31 for the other three areas. The superintendent may designate temporary whale waters (due to the presence of whales) and impose motor vessel speed restrictions in whale waters. With some exceptions (detailed in 36 CFR 13.65; see appendix A of the DEIS), operators of motor vessels over 18 feet in length will in all cases where the width of the water permits, maintain a distance of at least one nautical mile from shore, and in narrower areas will navigate in mid-channel in designated whale waters. Unless other restrictions apply, operators may perpendicularly approach or land on shore (i.e., by the most direct line to shore) through designated whale waters.

Vessel Routes and Destinations (Including Non-Motorized Waters). Under alternative 3, vessel routes are not defined, although cruise ships generally follow the mid-channel of Glacier Bay. Closed waters are identified in figure 2-1 and defined in 36 CFR 13.65 (see appendix A of the DEIS). Many of the waters around rocks and islands are closed for protection of sensitive wildlife species. In addition, for the protection of harbor seals, Johns Hopkins Inlet is closed to cruise ships from May 1 through August 31 and to all vessels from May 1 through June 30. From July 1 through August 31, in Johns Hopkins Inlet, all vessels are required to stay 0.25 nautical mile from seals hauled out on ice.

The areas closed from May 1 through September 15 to provide non-motorized backcountry experiences include Adams Inlet, Rendu Inlet, the Hugh Miller complex, and the Beardslee Island group. Additional closures include Muir Inlet, beginning north of McBride Glacier (June 1 through July 15) and Wachusett Inlet (July 16 through August 31; see figure 2-1). These areas also are defined in appendix A (of the DEIS).

ANALYSIS OF INDIVIDUAL AND CUMULATIVE EFFECTS ON EFH

The following analysis combines two sections of the DEIS: Chapter 3, Section 3.3.4 (Affected Environment for Marine Fishes), and Chapter 4, Section 4.3.4 (Environmental Consequences for Marine Fishes). The environmental consequences presented are for Alternative 3, as well as for Alternative 1 (No Action), because, in the DEIS, the impact analysis for Alternative 3 often refers back to the analysis of Alternative 1.

Affected Environment for Marine Fishes

This subsection describes marine fishes that occur in Glacier and Dundas Bays, with separate discussions for pelagic and demersal fish. These discussions include lists of the fish species found in Glacier Bay and Dundas Bay and detailed descriptions of the most abundant species. A description of the various salmon species that occur in these two bays follows these discussions.

Relatively little baseline data exist for the status and distribution of marine fishes in Glacier Bay and Dundas Bay. Fish found by Lenz et al. 2001 in Glacier Bay National Park and Preserve are listed in table 3-5.

TABLE 3-5: FISH FOUND IN GLACIER BAY NATIONAL PARK AND PRESERVE

Common Name	Scientific Name
Pacific Hagfish	*Eptatretus stouti*
Salmon Shark	*Lamna ditropis*
Pacific Sleeper Shark	*Somniosus pacificus*
Roughtail Skate	*Bathyraja trachura*
Big Skate	*Raja binoculata*
Longnose Skate	*Raja rhina*
Starry Skate	*Raja stellulata*
Wolf-Eel	*Anarrhichthys ocellatus*
Pacific Herring	*Clupea pallasii*
Capelin	*Mallotus villosus*
Eulachon	*Thaleichthys pacificus*
Pink Salmon	*Oncorhynchus gorbuscha*
Chum Salmon	*Oncorhynchus keta*
Chinook Salmon	*Oncorhynchus tshawytscha*
Coho Salmon	*Oncorhynchus kisutch*
Sockeye Salmon	*Oncorhynchus nerka*

Table 3-5: Fish Found in Glacier Bay National Park and Preserve	
Steelhead/Rainbow Trout	*Oncorhynchus mykiss*
Cutthroat Trout	*Oncorhynchus clarki*
Dolly Varden	*Salvelinus malma*
Atlantic Salmon	*Salmo salar*
Pacific Cod	*Gadus macrocephalus*
Walleye Pollack	*Theragra chalcogramma*
Rougheye Rockfish	*Sebastes aleutianus*
Pacific Ocean Perch[1]	*Sebastes alutus*
Redbanded Rockfish	*Sebastes babcocki*
Shortraker Rockfish	*Sebastes borealis*
Silvergray Rockfish	*Sebastes brevispinis*
Dusky Rockfish	*Sebastes ciliatus*
Yellowtail Rockfish	*Sebastes flavidus*
Shortbelly Rockfish	*Sebastes jordani*
Quillback Rockfish	*Sebastes maliger*
Black Rockfish	*Sebastes melanops*
China Rockfish	*Sebastes nebulosus*
Tiger Rockfish	*Sebastes nigrocinctus*
Yelloweye Rockfish	*Sebastes ruberrimus*
Harlequin Rockfish	*Sebastes variegatus*
Silverspotted Sculpin	*Blepsias cirrhosus*
Coastrange Sculpin	*Cottus aleuticus*
Spinyhead Sculpin	*Dasycottus setiger*
Buffalo Sculpin	*Enophrys bison*
Red Irish Lord	*Hemilepidotus hemilepidotus*
Brown Irish Lord	*Hemilepidotus spinosus*
Bigmouth Sculpin	*Hemitripterus bolini*
Shaggy Sea Raven	*Hemitripterus villosus*
Northern Sculpin	*Icelinus borealis*
Pacific Staghorn Sculpin	*Leptocottus armatus*
Great Sculpin	*Myoxocephalus polyacanthocephalus*
Sailfin Sculpin	*Nautichthys oculofasciatus*
Tidepool Sculpin	*Oligocottus maculosus*
Tadpole Sculpin	*Psychrolutes paradoxus*
Soft Sculpin	*Psychrolutes sigalutes*
Smooth Lumpsucker	*Aptocyclus ventricosus*
Pacific Spiny Lumpsucker	*Eumicrotremus orbis*
Kelp Greenling	*Hexagrammos decagrammus*

TABLE 3-5: FISH FOUND IN GLACIER BAY NATIONAL PARK AND PRESERVE	
Rock Greenling	*Hexagrammos lagocephalus*
Masked Greenling	*Hexagrammos octogrammus*
Whitespotted Greenling	*Hexagrammos stelleri*
Lingcod	*Ophiodon elongatus*
Sablefish	*Anoplopoma fimbria*
Alaskan/Threespine Stickleback	*Gasterosteus aculeatus*
Pacific Saury	*Cololabis saira*
Searcher	*Bathymaster signatus*
Northern Ronquil	*Ronquilus jordani*
Pacific Pomfret	*Brama japonica*
Jack Mackeral	*Trachurus symmetricus*
Kelp Clingfish	*Rimicola muscarum*
Crescent Gunnel	*Pholis laeta*
Quillfish	*Ptilichthys goodei*
Snake Prickleback	*Lumpenus sagitta*
Pacific Sandfish	*Trichodon trichodon*
Prowfish	*Zaprora silenus*
Northern Smoothtongue	*Leuroglossus schmidti*
Pacific Sand Lance	*Ammodytes hexapterus*
Northern Lampfish	*Stenobrachius leucopsarus*
Arrowtooth Flounder	*Atheresthes stomias*
Slender Sole	*Eopsetta exilis*
Petrale Sole	*Eopsetta jordani*
Flathead Sole	*Hippoglossoides elassodon*
Pacific Halibut	*Hippoglossus stenolepis*
Starry Flounder	*Platichthys stellatus*
Yellowfin Sole	*Plewonectes stellatus*
Rock Sole	*Lepidosetta bilineata*

[1] Lenz et al. (2001) does not list this species as "present in park"; however, it does have essential fish habitat in the park.

Source: Lenz et al. (2001).

Pelagic Species. Pelagic species live and feed in the open sea; they are associated with the surface or middle depths of a body of water (FishBase 2003). Pelagic fishes include the salmon species during their oceanic phase, as well as the various forage fishes and other mid-water and surface-dwelling species. Thirty-one species were found in mid-water trawls, 12 of which previously had not been documented for Glacier and Dundas Bays (Litzow et al. 2002). Pelagic species were often a dominant group among the fish collected in beach seines in the West and East Arms, and the lower and middle portions of Glacier Bay (Robards et al. 2002). Samples from the lower Bay in June 1999 contained mostly pink salmon (85%), with the rest made up of demersal fishes. The catches in August 2000 contained only 20% pink salmon, with an additional 39% coming from herring and sand lance. Samples from the middle Bay in June 1999 contained at least 91% pelagic species, while pelagic fish in the August 2000 sampling comprised at least 98% of the catch. Samples from the West and East Arms typically contained greater percentages of demersal fishes mixed with the pelagic species, and the samples from June and July 2000 also contained greater proportions of demersal fishes in all areas sampled. An exception was the East Arm in August 2000, where 90% of the catch was pelagic species, with sand lance predominating.

Litzow et al. (2002) listed capelin, walleye pollock, Pacific herring, and northern lampfish *(stenobrachius leucopsarus)* as the most common pelagic species caught in Glacier Bay, accounting for 89% of the mid-water catches.

Capelin — Capelin has been reported as the most abundant species caught in mid-water trawls in Glacier and Dundas Bays (Litzow et al. 2002). Capelin, a type of smelt, has an elongated, slender body, and is typically found from the surface to a depth of 655 feet (200 meters). Capelins migrate to nearshore areas to spawn on sandy beaches. They appear to spawn in upper Glacier Bay, as large numbers of young-of-year capelin were caught in these areas (Robards et al. 2002). Capelins are a very important prey item for a broad range of fishes, marine mammals, and seabirds (Sturdevant 1999).

Walleye Pollock — The walleye pollock also is a common species reported from mid-water trawls in Glacier and Dundas Bays (Litzow et al. 2002). The walleye pollock is a member of the cod family *(Gadidae)*. Although found in open water, pollock are also commonly reported from bottom trawls. Walleye pollock also have been reported from beach seines in several park locations, with high concentrations in upper Glacier Bay (Robards et al. 1999); however, they were seldom captured in beach seines in 1999 and 2000 by Robards et al. (2002). Most pollock netted by Robards et al. (1999) were larval. Pollock feed on various crustaceans, herring, and sand lance. They are one of the most important commercial species in the North Pacific Ocean and Bering Sea. Pollack are also an important prey species of humpback whales.

Pacific herring — Pacific herring are fairly common species caught in mid-water trawls in Glacier and Dundas Bays. Pacific herring is a schooling species found in coastal and offshore waters and is important to commercial and subsistence fisheries in Alaska and western Canada (Litzow et al. 2002). Herring are seasonally abundant along the coast of Alaska. Adult Pacific herring have been reported from beach seines at several locations along the shorelines in the middle region of Glacier Bay (Robards et al. 1999). Herring spawn along the coastline in intertidal and shallow subtidal zones (Mecklenburg et al. 2002) by depositing eggs on eelgrass, seaweed, rocks, pilings, or other substrates (Clemens and Wilby 1961). The nearest known major spawning ground is at Auke Bay, approximately 50 miles east of Glacier and Dundas Bays (O'Clair and O'Clair 1998). The Alaska Department of Fish and Game (ADFG) has not identified any locations within park waters for herring spawning (O'Clair and O'Clair 1998). When abundant, they form an important part of the diets of large predatory fishes and marine mammals, such as humpback whales.

Northern lampfish — Northern lampfish are members of the lanternfish family *(Myctophidae)*. Lampfish are equipped with photophores and other luminous tissue that can produce a variety of colors and light patterns. They are of particular importance as forage fish because of a very high fat content, which may be as high as 10 times the fat level of other forage fishes, such as capelin or sand lance (Van Pelt et al. 1997, cited in Robards et al. 2002). Lampfish are typically found in deeper water during the day and rise toward the surface at night. They occasionally are found in salmon stomachs (Clemens and Wilby 1961). They may also be an important prey source to predators in Glacier Bay because of unique oceanographic conditions (Robards et al. 2002). Apparently because of either high turbidity or high productivity near some glacier faces, they are found in the near-surface water column during the day, where they are more available to predation, especially by birds.

Other pelagic species — Other pelagic species in Glacier Bay and Dundas Bay include two additional forage fishes: eulachon *(Thaleichthys pacificus)* and Pacific sand lance *(Ammodytes hexapterus)*. Eulachon are members of the smelt family, and enter large rivers to spawn in fresh water. They are preyed upon by Chinook salmon, fur seals, and a variety of other marine vertebrate predators. The Pacific sand lance feed on plankton and in turn are preyed upon by salmonids, lingcod, halibut, and many other fish species (Clemens and Wilby 1961). They tend to live in clean sandy substrates, coming out of the sand to feed. Sand lance were found throughout Glacier Bay, with the highest concentrations in the middle region, followed by the upper region (Litzow et al. 2002).

Demersal Species. Demersal fishes are found lying on the bottom or living on or near the bottom and feeding on benthic organisms (FishBase 2003). Most demersal fishes found in Glacier Bay and Dundas Bay are members of the skates, cods, rockfishes, sculpins, and flatfishes. Most of these fish lack a swim bladder, leaving them negatively buoyant.

Skates — Skates (family *Rajidae*) are demersal members of a group of vertebrates with a skeleton of cartilage rather than bone, and have been found in Glacier and Dundas Bays (Lenz et al. 2002; Litzow et al. 2002). The *Rajidae* is a large skate family whose members inhabit marine waters nearly world-wide, but are most common in cold temperate to tropical regions (Mecklenburg et al. 2002). Skates live on the bottom in waters near shore to depths of more than 9,840 feet (3,000 meters). They feed on benthic invertebrates and fishes. The longnose skate *(Raja rhina)* has been reported in Glacier and Dundas Bays (Litzow et al. 2002). This species is usually found at depths from 180 to 1,150 feet (55 to 350 meters) on muddy or sandy bottoms. They likely feed on clams and other large invertebrates that may be found on soft substrates. The roughtail, big, and starry skates are found in park waters, while the Aleutian, Bering, and Alaska skates are probably found in the park, but their presence has not been confirmed (Lenz at al. 2002).

Cod — Members of the cod family found in the park include Pacific cod *(Gadus macrocephalus)* and walleye pollock. The Pacific cod is a schooling species, typically found over sand or gravel bottoms in 150 to 600 feet (46 to 183 meters) of water. They typically move to deep water for spawning in the late fall and winter, then return in spring to shallower water for feeding. Common prey items include crustaceans and fish. The walleye pollock is discussed in the pelagic fishes subsection because they are often found in mid-water.

Rockfish — Rockfish are members of the family *Scorpaenidae*. Approximately 30 rockfish species in the genus *Sebastes* inhabit Alaskan waters; they usually populate rocky areas in shallow to moderately deep water, although some species may be found in silty and sandy areas (Mecklenburg et al. 2002). They are a free-swimming species, but are often found close to substrate. Little is known of the breeding habits of rockfishes in Glacier and Dundas Bays, but the presence of larger individuals of some rockfish species in the Bays, and the fact that many species of rockfishes have internal fertilization (Clemens and Wilby 1961) suggest that spawning may occur in the Bay. Four species of rockfishes — rougheye *(Sebastes aleutianus)*, vermilion *(S. miniatus)*, yelloweye *(S. ruberrimus)*, and quillback *(S. maliger)* rockfishes — have been identified in park waters (Litzow et al. 2002; Bishop et al. 1995; NPS 1998a). The rougheye rockfish is found in areas with gently sloping substrates and boulders, and on seamounts. The vermilion rockfish is found on rocky reefs and seamounts, usually deeper than 590 feet (180 meters; Mecklenburg et al. 2002). The yelloweye and quillback rockfish are the most commonly reported rockfish from longline catches in Glacier Bay and adjacent waters (Bishop et al. 1995; NPS 1998a). Other species of rockfishes may also be found in Glacier and Dundas Bays, but are likely to be more common in other areas of the park along the outer coast. Large rockfish often prey upon smaller ones, and many rockfish species are sought after in commercial and sport fisheries in Southeast Alaska, but few are known to occur in Glacier Bay or Dundas Bay.

Sculpins — Numerous species of sculpins in several families have been reported for Glacier and Dundas Bays (Litzow et al. 2002). Sculpins are found from shallow tidepools to waters of considerable depth. Six species of sculpins were reported from bottom trawls in Glacier and Dundas Bays during summer 2001: spinyhead sculpin *(Dasycottus setiger)*, thorny sculpin *(Icelus spiniger)*, armorhead sculpin *(Gymnocanthus galeatus)*, blackfin sculpin *(Malacocottus kincaidi)*, northern sculpin *(Icelinus borcalis)*, and ribbed sculpin (*Triglops pingelii*; Litzow et al. 2002). Yellow and brown Irish lords (*Hemilepidotus jordani* and *H. spinosus*) were the most common sculpins caught in longline surveys (Bishop et al. 1995).

Spinyhead sculpin are found on soft bottoms, usually at depths ranging from 165 to 985 feet (50 to 300 meters), although they also may be found in shallower and deeper waters (Mecklenburg et al. 2002). The northern and blackfin sculpin also are reported to be present, but are not common (Litzow et al. 2002). The remaining sculpin species reported by Litzow et al. (2002) for Glacier and Dundas Bays are in the family *Cottidae*, the largest of the sculpin families. Lenz et al. (2002) lists more than 50 species of cottids as either present or probably present in Glacier and Dundas Bays. The thorny sculpin is found at bottom depths of 30 to 770 meters, although more commonly from 150 to 350 meters. The armorhead sculpin is found on soft bottoms near shore to a depth of 580 meters, although it is most common at depths between 50 and 165 meters (Mecklenburg et al. 2002). The ribbed sculpin is found on sand, pebble, gravel, and rocky bottoms, most frequently at depths of 20 to 150 meters.

Flatfish — The flatfishes in Alaska are in two families: the small family *Paralichthyidae*, which includes sand flounders (or sanddabs), and the larger *Pleuronectidae* (or righteye flounders), which includes flounders, sole, and halibut. Flatfish have highly compressed bodies. Pacific halibut *(Hippoglossus stenolepis)* is the only commercially important flatfish in Glacier Bay. Lenz et al. (2002) list 20 species of flatfishes as present or probably present in Glacier and Dundas Bays. The most common species reported in bottom trawls in Glacier and Dundas Bays were rex sole *(Glyptocephalus zachirus)*, flathead sole *(Hippoglossoides elassodon)*, rock sole *(Lepidopsetta bilineata)*, slender sole *(Lyopsetta exilis)*, and Dover sole (*Microstomus pacificus*; Litzow et al. 2002).

Because of its commercial value, the Pacific halibut is the most high-profile demersal fish species in the park area. Halibut are found on a variety of bottom types. Bishop et al. (1995) reported a significantly higher abundance of halibut on rock and sand substrates than other substrate types in Glacier Bay. Halibut range from shallow water to depths of 1,100 meters, although they are usually found in depths shallower than 300 meters (Mecklenburg et al. 2002). Bishop et al. (1995) reported that halibut in park waters occurred over the entire depth range of their sampling (0 to 325 meters) and that length increased with increasing depth for fish caught from 0 to 250 meters, and decreased thereafter. Young halibut feed mainly on small crustaceans, and as the fish mature, the diet changes to a wide variety of fish species (Hooge and Taggart 1996). Halibut also feed on crabs, clams, squid, and other invertebrates (Clemens and Wilby 1961). Tagging studies in Glacier and Dundas Bays indicate an age-related shift in home range patterns (Hooge et al. in prep.). Juvenile halibut move widely, although often still within the Glacier Bay and Dundas Bay area, while large, sexually mature fish exhibit smaller home ranges, which are often less that 0.5 square kilometer. Occasionally, large halibut alter their pattern of small-home-range use and travel widely before returning to a more sedentary pattern; a few individuals appear to never establish home ranges. More than 95% of halibut tagged in park waters were recaptured within Glacier Bay, indicating a high degree of site fidelity.

Pacific Salmon Species. Five species of salmon occur in the waters of the Glacier Bay and Dundas Bay area. The steelhead trout *(Oncorhynchus mykiss)*, a rainbow trout that spends much of its life in salt water, also is found in the waters of Glacier Bay. These species occur along the Pacific coast of North America, from Southern California to the Arctic coastline of Alaska (Mecklenburg et al. 2002; Groot and Margolis 1991; Morrow 1980). These are anadromous species that spend most of their lives in marine waters, but spawn in fresh water. Salmon are important components of the commercial, subsistence, and sport fisheries in Alaska.

Chinook salmon — Chinook, or king, salmon *(Oncorhynchus tshawytscha)*, is the largest-bodied species of the group. Any occurring in Glacier Bay or Dundas Bay are presumably foraging or moving through the area, because they are not known to breed in the streams in either Glacier Bay or Dundas Bay (ADFG 2002a). Orsi and Jaenicke (1996) identify Southeast Alaska marine waters as an important nursery area for "an amalgam of pre-recruit Chinook salmon stocks originating from Oregon to Alaska." The relative importance of the park's marine waters in this respect is not well known.

Coho salmon — Adult coho salmon *(O. kisutch)* were identified in almost one-third of the streams in Glacier and Dundas Bays (ADFG 2002a). Coho salmon return to natal streams to spawn from mid-summer to winter depending on geographic location. Coho salmon generally spawn in short coastal streams, including several that drain into park waters. Timing for the spawning in park streams is not well known. The fry feed on a variety of food types, including terrestrial insects, aphids, mites, beetles, spiders, and zooplankton. As the young fish grow, they consume larger prey that may include young sockeye salmon. Generally, coho salmon spend one to two years in fresh water before moving to the sea. As the young fish move into the sea, they remain close to shore, feeding on crustaceans. As they grow larger, they move offshore and feed on larger prey, particularly herring and sand lance. In the southern part of their range, coho salmon generally stay close to the shore, while northern populations spread out across the North Pacific and Bering Sea. After two to three years in the ocean, they return to natal streams to spawn.

Pink salmon — Pink salmon *(O. gorbuscha)* migrate to spawning streams between June and September, depending on geographic location. Spawning is typically in tidal areas at the mouths of streams or in streams near the coast. Fry emerge from the gravel in the spring and almost immediately migrate downstream to marine waters. At first, they remain near the coast or in estuaries, where they feed on copepods and larvacean tunicates. As they become larger, pink salmon feed on amphipods, euphausiids, and fish. Pink salmon from the southern part of the range tend to remain closer to the coast during the marine portion of their lives than Alaskan populations, which range across most of the northeast Pacific Ocean. After about 18 months at sea, the adults return to natal streams, although pink salmon demonstrate less site fidelity to natal streams than other salmonid species (Morrow 1980). Use of intertidal areas and streams entering Glacier and Dundas Bays for spawning has been documented for pink salmon, but the extent of use is not well known; however, most park streams accessible to salmonids probably contain pink salmon (Soiseth and Milner 1995).

Sockeye salmon — Sockeye salmon *(O. nerka)* were identified in one-fourth of the streams in Glacier and Dundas Bays (ADFG 2002a). They typically spawn in lake habitats or in streams connected to lakes. Most fry rear one to two years in lake systems before smolting and emigrating to the marine environment. While in fresh water, the fry feed on ostracods, cladocerans, and insect larvae. Once in marine waters, they stay close to shore and feed on zooplankton, insects, and small fish. As they grow, the young fish move out to sea and feed on fish, especially sand lance. They typically return to their natal lake or stream to spawn at four or five years of age.

Chum salmon — Chum salmon *(O. keta)* were found in almost one-half of the streams in Glacier and Dundas Bays (ADFG 2002a). They generally spawn later than other salmonids, with spawning activity peaking in September and October (Morrow 1980). In most populations, chum salmon do not migrate far upstream and only one run per season is evident. Young chum fry emerge from the spawning gravels during the winter and begin their migration downstream. They remain close to shore for several months after reaching salt water, feeding on small crustaceans, terrestrial insects, and young herring. As they grow, their diet changes to copepods, tunicates, euphausiids, squid, and various fish species. Adult chum salmon return to spawn after three to five years at sea.

Essential Fish Habitat. Essential fish habitat (EFH) is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265) as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity (see table 3-6). Essential fish habitat is designated by the NOAA Fisheries for species managed under existing fishery management plans to assist in maintaining sustainable fisheries (see figure 3-10).

TABLE 3-6: SPECIES WITH ESSENTIAL FISH HABITAT IN GLACIER BAY AND DUNDAS BAY

Common Name	*Scientific Name*
Skate	*Raja spp.* and *Bathyraja spp.*
King Salmon[a]	*Oncorhynchus tshawytscha*
Sockeye Salmon[a]	*O. nerka*
Coho Salmon[a]	*O. kisutch*
Pink Salmon[a]	*O. gorbuscha*
Chum Salmon[a]	*O. keta*
Pacific Cod	*Gadus macrocephalus*
Rougheye Rockfish	*Sebastes aleutianus*
Yelloweye Rockfish	*S. ruberrimus*
Shortraker Rockfish	*S. borealis*
Dusky Rockfish	*S. ciliatus*
Pacific Perch	*S. alutus*
Sculpin	*Cottidae* family
Walleye Pollock	*Theragra chalcogramma*
Sablefish	*Anoplopoma fimbria*
Rock Sole	*Lepidopsetta bilineata*
Pacific Halibut[b]	*Hippoglossus stenolepis*

a Salmon species do not have essential fish habitat because they are managed by the Alaska Department of Fish and Game, not the NOAA Fisheries; they do have important habitat in Glacier Bay.

b Halibut do not have essential fish habitat because they are managed by the International Pacific Halibut Commission, not the NOAA Fisheries; they do have important habitat in Glacier Bay.

Source: NOAA Fisheries 2003.

Environmental Consequences for Marine Fishes

This section evaluates the probable effects on marine fish of implementing each of the alternatives.

Issues of Concern Raised during Scoping. Specific concerns from the public regarding fish resources in the park include:

- Airborne contaminants from ship stacks could be deposited in the marine environment and enter the marine food chains through ingestion or dermal contact.
- The presence of artificial light from vessels could alter behavior of marine fauna.
- Waves generated by wakes and prop wash could increase turbidity, affecting the intertidal environment.
- Increases in unauthorized releases of ballast water could introduce invasive species into the marine environment in the park.
- Invasive species could enter the park on the hulls of cruise ships.

Regulatory Framework. The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; 16 USC § 1801-1882) establishes U.S. management authority over all fishing within the 200-mile Exclusive Economic Zone (EEZ), all anadromous fish throughout their migratory range, and all fish on the continental shelf. Additionally, the act mandates that eight regional fishery management councils be established to develop and prepare fishery management plans (FMPs) for the responsible management of exploited fish and invertebrate species in their regions. When Congress reauthorized this act in 1996, several reforms and changes were made. One change was to charge the National Marine Fisheries Service with designating and conserving essential fish habitat (EFH) for species managed under existing fishery management plans. "Essential fish habitat" as defined in the Magnuson-Stevens Act includes "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." This is intended to minimize, to the extent practicable, any adverse effects on habitat caused by fishing or non-fishing activities, and to identify other actions to encourage the conservation and enhancement of such habitat. Essential fish habitat (EFH) will be addressed through consultation with the National Marine Fisheries Service.

Methodology and Assumptions. Two primary habitats for fishes exist in the park: pelagic and demersal. Pelagic fishes contain an air-filled swim bladder that keeps them neutrally buoyant in the water column without significant effort. Demersal fishes lack a swim bladder, leaving them negatively buoyant, and stationary on the sea floor unless actively swimming. Both the pelagic and demersal fishes are long-lived.

This analysis focuses on the potential effects on marine fish of noise generated by vessel traffic for each alternative. Noise has a greater effect on fishes with a swim bladder, because the bladder increases the fishes' sensitivity to noise (Enger and Anderson 1967). Effects of underwater noise on fishes are typically similar for related species (Murberg

1978). The direct effects of noise on fishes include increased acoustic threshold and various avoidance behaviors (Scholik and Yan 2002, Pearson et al. 1992). These effects may result in avoidance by fishes of preferred rearing or feeding locations, increased susceptibility to predation, and decreased ability to catch prey. These effects may be temporary or permanent.

The approach to this analysis focuses on comparing locations and catches of fishes from midwater and benthic trawls and longlines with motorized vessel use of Glacier Bay. It is assumed that if the level of noise from vessel traffic is sufficiently high to produce evasive behavior by fish, they will only be found in those areas of the park seldom visited by vessels. The available data allows for a general analysis of fish population densities in various parts of Glacier Bay proper that may be related to the noise. The analysis assumes that any effects that occur to fish in Glacier Bay would be the same for fish in Dundas Bay since the sources are similar. Table 4-18 lists the threshold criteria used for the evaluation of effects on marine fish.

Table 4-18: Threshold Criteria for Effects Analysis on Marine Fishes

Negligible	No observable changes in marine fish distribution or abundance in Glacier Bay proper or Dundas Bay related to motorized vessel passage would occur.
Minor	Fish species would leave or avoid areas with excessive noise, contaminants, or fuel spills for the duration that the stressor would be present.
Moderate	Fish species would continuously avoid areas with excessive noise, contaminants, or fuel spills, even when the stressor was not present.
Major	Fish populations would decrease and there would be continuous avoidance of areas with excessive noise contaminants, or fuel oil spills, even when the stressor was not present.

Fish may be adversely affected by other aspects of these alternatives, including fuel or contaminants that may be discharged from vessels, and by other issues raised during scoping. Generally, diesel fuel spills have little effect on fish species, as fuel floats above the water surface. The limited water-soluble fraction from diesel fuel could contaminate the water column for a short time. A large proportion of the diesel would evaporate over two days or less (Kennicutt and Sweet 1992). The effects of diesel fuel spills are, therefore, likely to cause little or no damage to pelagic or demersal fish resources.

With respect to airborne contaminants, the air quality effects analysis determined there would be a major effect from all alternatives, except alternative 4, which would be moderate, and that emissions generated would not be not at levels considered to be a risk to human health or the environment (see section 4.2.2), and therefore, are not addressed further in this section.

Artificial light is of little concern because only during a very short time each "night" for much of the summer does natural light levels drop low enough that artificial light would be noticeable. In addition, no research suggests that artificial light affects local fish populations beyond extending feeding in a small area directly around the light source.

Waves increase turbidity along the shorelines of the park. Two sources of waves include vessel wakes and waves generated by wind. Turbidity caused by vessel wake is not as likely to occur as is turbidity resulting from naturally occurring wind waves in the park (see appendix G). Vessel wakes do not directly disturb pelagic communities. Wave energy moves through the fluid medium without appreciably modifying the habitat; therefore, wakes are not considered further in this analysis. Propwash may mix the surface water deeper into the water column. This would not appreciably change the pelagic environment. Fishes are capable of quickly adjusting their depth if altered by the turbulence of propwash. Near-surface plankton are capable of controlling their buoyancy, as shown by their presence in the surface waters, so will return to near-surface waters if displaced. Plankton displaced upwards from greater depths will return to the depths as turbulence decreases.

At this time, no marine invasive species are known to have colonized the waters of Glacier Bay National Park and Preserve. The potential for introductions of invasive species into Glacier or Dundas Bays appears to be low. The Alaska Department of Fish and Game, in a recent publication (Fay 2002), listed the invasive species they consider the greatest threats to Alaska. They only two that might relate to cruise ships and other vessels are the European green crab (*Carcinus maenas*) and the Chinese mitten crab (*Eriocheir sinensis*). Both make some use of marine waters, but are primarily estuarine or freshwater species. Both crabs could possibly reach Glacier or Dundas Bay as larvae on the hulls of cruise ships, but the most likely method of transport is north-moving oceanographic currents. None of the cruise ships or other vessels entering Glacier Bay proper or Dundas Bay discharge ballast water to the environment, unless during a catastrophic event; therefore, ballast water is not a likely source of invasive species. Hines and Ruiz (2000) studied invasive species introductions in the Port of Valdez, an Alaskan harbor with temperature and salinity ranges similar to Glacier Bay. All 15 invasive species identified by Hines and Ruiz were larval; none had reached reproductive age/size. Despite the introduction of approximately 17,000,000 cubic meters of ballast water from oil tankers in 1998 alone, no permanent populations of invasive species have been found in the port (Hines and Ruiz 2000). Compliance with U.S. Coast Guard discharge regulations of bilge water is likely to keep this potential source of invasive species from being introduced into Glacier and Dundas Bays.

Alternative 1 (No Action) – Effects on Marine Fishes. If the maximum daily entries occurred, the lower portions of Glacier Bay would receive up to 72 vessel passages per day.

Direct and Indirect Effects on Marine Fishes – Alternative 1. Each passage potentially disrupts fish populations in Glacier Bay. In general, no cruise ships enter Dundas Bay. The four passages by cruise ships would produce the greatest noise, and therefore likely would produce the greatest changes in fish behavior. In contrast, areas in upper Glacier

Bay would receive fewer passages than the rest of the Bay, depending on visit duration and extent of travel.

Fish studies were conducted under the existing vessel management plan and provide relevant fish distribution data. The data from two recent studies (Robards et al. 1999; Lenz et al. 2002) were used to analyze the relationship between forage fish in Glacier Bay proper and vessel use in the Bay. The results of these studies indicated that vessel traffic has little effect on fish. Beach seine sampling conducted throughout Glacier Bay proper found higher numbers of fish in the lower Bay, where there is more vessel traffic, than further up the Bay (Robards et al. 1999) The number of fish captured at two sites along the exposed western shoreline of Young Island (between 111 and 248 fish) was among the highest in Glacier Bay, with only one site at the north end of the Beardslee island group having a higher catch (over 249 fish). The western shoreline of Young Island receives more vessel traffic than any other location in the park, since all vessels passing into the park must pass this island. The largest pelagic catches were from Sitakaday Narrows, near the mouth of Glacier Bay proper, and in the middle bay near Sebree Island (Litzow et al. 2002). The catches at both stations were between 1042 and 1440 fish. Pelagic catches are dominated by capelin and walleye pollock. Capelin are found near the surface of the water, while pollock are commonly found in midwater or close to the bottom. Smaller catches, ranging between 42 and 456 fish, were made at several other sampling stations in the middle bay. The Sitakaday Narrows station is similar to the beach seine study and located in the area most heavily used by vessels in Glacier Bay proper. Another study by Hooge and Taggert (1996) identified the movements of individual halibut, a demersal fish. The perimeters of individual home ranges for these fish throughout the park were found to include high vessel use corridors.

The presence of large forage fish populations found along the shorelines and offshore at the entrance to Glacier Bay proper, where all vessel traffic passes, is a strong indicator that fish populations continue to inhabit the park despite existing noise conditions. Also supporting this conclusion is the presence of populations of forage fish and halibut in another noisy environment — the middle portion of Glacier Bay, which is close to the cruise ship corridors. By inference, it appears that the existing noise environment found in the park's marine waters is below the threshold that would cause fish species or groups to discontinue their use of Glacier Bay; however, this conclusion should not be interpreted to mean that fish do not exhibit some changes in behavior in response to vessel noise. Available research data suggest that fish will exhibit avoidance behavior, at least temporarily, in response to loud noise like that emitted by cruise ships. Any temporary avoidance behavior by fish of those areas of Glacier Bay where vessel noise is loudest is considered to have a minor effect. By inference, fish in Dundas bay are assumed to behave similarly; therefore, the overall direct and indirect effects of this alternative would be minor.

Cumulative Effects on Marine Fishes – Alternative 1. Marine fish resources in Glacier Bay proper and Dundas Bay may be affected by several activities external to vessel traffic. These include commercial fishing, the presence of vessels in waters outside Glacier Bay proper and Dundas Bay, increases in tourism and human population in

Southeast Alaska, and natural phenomena. Although commercial fishing may decrease fish populations through direct targeting of species, by-catch (unwanted fish caught along with targeted fish), or habitat alteration, the intensity of commercial fishing in Glacier Bay proper will decline over time, lessening these effects; however, changes in technology may increase commercial fishing catch efficiencies or change noise levels in the park's waters. Recreational fishing could increase the pressure on fish stocks in the park by an unknown amount. The fishing effort would not likely to measurably affect the fish resources in Glacier and Dundas Bays; however, certain specific locations, with high utilization by sport fishermen, possibly could see decreases in fish populations, especially halibut.

Vessel activity outside Glacier Bay proper and Dundas Bay may increase water pollution that reaches park waters and add pressure to fish resources through sport-fishing catches of pelagic species that move in and out of park waters. Increases in tourism and human population may increase pressure on fish resources through commercial and sport fishing. Natural phenomena, such as global warming and long-term fluctuations in North Pacific water temperatures (often referred to as decadal shift), may change the structure of fish communities in the park. The most important of these effects, commercial fish and natural phenomena, already occur. Although the above-described actions may individually contribute to potentially adverse effects to marine fish communities, the overall cumulative effects would not significantly alter the marine resources of Glacier Bay proper and Dundas Bay; therefore, the cumulative effects would be minor. Changes in kelp density by sea otters may change some fish populations in Glacier Bay proper and Dundas Bay. Otter predation may limit sea urchin populations, allowing more kelp growth. This, in turn, would provide more habitat for some fish species, potentially increasing their populations.

Impairment Analysis for Marine Fishes – Alternative 1. A long-term major effect to the park's marine fish resources that reduces the marine fish population in Glacier Bay Proper or Dundas Bay would be considered impairment. The potential effects to marine fish of implementing alternative 1 are short-term and considered minor, therefore, this alternative does not result in impairment of marine fish resources in the park.

Potential Mitigation Measures for Marine Fishes – Alternative 1. No mitigation is proposed because the severity of the effects does not warrant it.

Conclusion, Marine Fishes – Alternative 1. The potential direct and indirect adverse effects of the implementation of alternative 1 on fish resources in the park would be minor. Cumulative effects, although minor, would not sufficiently change the direct and indirect effects to change the overall effect. Impairment would not occur from the implementation of this alternative and no mitigation would be necessary; therefore, the overall effect would be minor.

Alternative 3 – Effects on Marine Fishes. Similar to alternative 1, if alternative 3 was implemented, two cruise ships, three tour vessels, six charter vessels, and 25 private vessels could enter Glacier Bay proper daily during the tourist season, resulting in 72 vessel passages per day. The difference of alternative 3 from alternative 1 is an increase in the number of cruise ship visits over the course of the season. No cruise ships would be expected to enter Dundas Bay.

Direct and Indirect Effects on Marine Fishes – Alternative 3. Since maximum noise level, rather than the frequency of noise events, is the most important consideration, there would be no significant differences in the noise environment between alternatives 1 and 3. Although fish populations likely would temporarily avoid the areas where the loudest vessel-related sounds are generated (e.g., cruise ship passages), the direct and indirect adverse effects of implementing alternative 3 would be minor.

Cumulative Effects on Marine Fishes – Alternative 3. Under alternative 3 the same activities described under alternative 1 (i.e., commercial fishing, vessels in waters outside Glacier Bay proper and Dundas Bay, and increases in tourism and human population in Southeast Alaska, natural phenomena) may affect marine resources. But since the overall cumulative effects would not significantly alter the marine resources of Glacier Bay proper and Dundas Bay, the cumulative effects would be minor.

Impairment Analysis for Marine Fishes – Alternative 3. The implementation of alternative 3 potentially would result in avoidance behavior by marine fish. These behaviors would be short-term and only affect individual fish or small groups of fish; therefore, this alternative would not result in impairment of marine fish resources in the park.

Potential Mitigation Measures for Marine Fishes – Alternative 3. No mitigation is proposed because the severity of the effects does not warrant it.

Conclusion, Marine Fishes – Alternative 3. The potential direct and indirect adverse effects of implementing this alternative would be minor. Cumulative effects would be minor, but slightly greater than those that would occur in alternative 1. Impairment would not occur from the implementation of this alternative and no mitigation would be necessary; therefore, the overall effect of the implementation of alternative 3 on fish resources in the park would be minor.

NATIONAL PARK SERVICE VIEWS REGARDING EFFECTS ON EFH

The potential effects of implementation of Alternative 3 on marine fish (including essential fish habitat), in Glacier and Dundas Bays would be minor.

PROPOSED MITIGATION

Alternative 3 does not require any mitigation of effects on essential fish habitat.

Alternative 6 is the same as Alternative 5 with the following exceptions:

Definitions (of terms)

Speed through the water	Same as alternatives 1-4
Speed over ground	Not applicable
Bartlett Cove passenger ferry	Same as alternative 4

Vessel Quotas – Glacier Bay Proper

	June 1 – August 31	May & Sept
Cruise ship seasonal use day	139 (potentially up to 122)	92 (potentially up to 184)

Operating Requirements

Speed restrictions	Same as alternative 5 except speed would be measured as through the water rather than over the ground. Also, the following paragraph would be changed (as indicated by the underlined portions). May 15 through September 30, in waters of Glacier Bay and Dundas Bay, the following is prohibited: operating a motor vessel at more than 13 knots speed through the water would be prohibited (rather than 10 knots over the ground as in alternative 5)
Measurement of vessel speed	Vessel speed is measured as through the water.
Deviation from vessel operating requirements	Deviation from vessel operating requirements may be made when the safety of passengers or the vessel is immediately threatened. Where possible, operators should notify the National Park Service prior to the deviation. In all cases, notifications must be made as soon as it is safe to do so.

The measure regarding deviation from vessel operating requirements would apply to alternatives 4, 5, and 6. Although this measure is not included in the present regulations, the park has used the language in communicating with commercial boat operators to provide conditional departures from regulations for safety reasons while these vessels are in park waters. This measure provides a means to ensure the safety of the passengers and vessel is not sacrificed due to standard park regulations.

Glacier Bay National Park and Preserve
Vessel Quotas and Operating Requirements
Environmental Impact Statement

Alternative 6, to be the preferred alternative in the final EIS, is different from alternative 3, the preferred alternative in the draft EIS, in the following ways:

Definition (of terms)

Charter vessel	Modified to be more accurate, to indicate that it applies to a vessel engaged in transport of passengers for hire, to distinguish between the number of passengers it is rated to transport overnight and for day-time use, to clarify its use as an administrative vessel, and to provide for uninspected vessels of a certain gross tonnage and length to serve as charter vessels. Eliminated reference to being available for hire on an unscheduled basis except as used to provide a scheduled camper or kayak drop-off service.
Cruise ship	Modified to be more accurate, to indicate that it applies to a vessel engaged in transport of passengers for hire, to attach a number of passengers to the classification thereby making it more consistent with the way the other two commercial motor vessel classifications are defined, and to clarify its use as an administrative vessel.
Entry	Not applicable
Tour vessel	Modified to be more accurate, to indicate that it applies to a vessel engaged in transport of passengers for hire, to distinguish between the number of passengers it is rated to transport overnight and for day-time use, and to clarify its use as an administrative vessel.
Vessel-use day	Modified to account for Dundas Bay as well as Glacier Bay and the elimination of seasonal entry quotas.
Seasonal use day	This term is defined for alternative 6 (it is the same as for alternatives 4 and 5). It is not defined in present regulations, which are assumed for Alternative 3.
Daily vessel quota	This term is defined for alternative 6 (it is the same as for alternatives 4 and 5). It is not defined in present regulations, which are assumed for Alternative 3.
Administrative use	This term is defined for alternative 6 (it is the same as for alternatives 4 and 5). It is not defined in present regulations, which are assumed for Alternative 3.
Administrative vessel	This term is defined for alternative 6 (it is the same as for alternatives 4 and 5). It is not defined in present regulations, which are assumed for Alternative 3.

Short-notice private vessel permits	A new measure that would make available permits to private vessels on a short notice basis – with a 48 hour advance reservation.
Bartlett Cove passenger ferry	Defined (not defined in present regulations)

Vessel Quotas – Glacier Bay Proper

Cruise ship seasonal entry	Not applicable (seasonal entry quota is eliminated with this alternative
Cruise ship seasonal use day	Sets a limit for cruise ships for May and September of 92 (consistent with the current level of use from June through August), with the potential to increase to 122 (2 per day every day) based on the results of studies.
Tour vessel seasonal entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Charter vessel seasonal entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Private vessel seasonal entry	Not applicable (seasonal entry quota is eliminated with this alternative)
Private vessel seasonal use day	2,300 (compared to 1,971 with alternative 3)

Vessel Quotas – Dundas Bay

Cruise ship	Not permitted year-round
Tour vessel daily quota	Not permitted in wilderness waters year-round; 1 permitted in non-wilderness waters June 1-August 31
Tour vessel seasonal use day quota	Not permitted in wilderness waters year-round; 92 in non-wilderness waters June 1-August 31
Charter vessel daily quota	No limit
Charter vessel seasonal use day quota	276 June 1-August 31

Operating Requirements

Quota season	Glacier Bay: June 1 through August 31 for tour, charter and private vessels. May 1 through September 30 for cruise ships. Dundas Bay: June 1 through August 31 for tour vessels in the lower bay, and charter vessels. Year-round for cruise ships in

	Dundas Bay and for tour vessels in wilderness waters of Dundas Bay.
Speed restrictions	Maintains a 20 knot (through the water) speed restriction in lower Glacier Bay whale waters from May 15 through August 31 for motor vessels less than 262 feet long. However, sets a year-round of 13 knot (through the water) speed restriction in Glacier Bay for motor vessels of 262 feet or greater in length. Sets a 13 knot (through the water) rather than a 10 knot speed restriction when the superintendent deems it necessary due to the presence of whales. This lowered speed restriction also applies to Dundas Bay.
Whale water geographic locations	Eliminates three of the four designated whale waters, keeping the designation for the lower bay only and extending the time during which the designation is in effect to May 1 and September 30 (vs. 5/15-8/31).
Non-motorized (closed) waters for cruise ships	Adds Beardslee Entrance, extends the closure of Adams Inlet to the entrance of that bay, and includes Dundas Bay.
Non-motorized (closed) waters for tour vessels	Adds Beardslee Entrance, extends the closure of Adams Inlet to the entrance of that bay, and includes the wilderness waters of Dundas Bay.
Ferry vessel operating requirements	Clarifies that the ferry may not deviate from a direct course between the mouth of Glacier Bay and Bartlett Cove.
Harbor seal vessel approach	Extends to year-round a 0.25 nautical mile distance from all harbor seals hauled out on ice in Johns Hopkins Inlet (vs. from July 1-August 31)
Short-notice private vessel	Provides for ten permits to be issued on a short-notice basis (within 48 hours of desired use) to private vessel operators, with a provision for the number to be adjusted annually through use of the park compendium.
Permit exemption for vessels based in Bartlett Cove	Entrance and egress exemptions for vessels based in Bartlett Cove are eliminated. A permit is not required for a vessel that is operated in Bartlett Cove in waters bounded by the public and administrative docks.

APPENDIX M

Response to Comments

RESPONSE TO PUBLIC COMMENTS ON THE GLACIER BAY NATIONAL PARK AND PRESERVE, ALASKA VESSEL QUOTAS AND OPERATING REQUIREMENTS DRAFT ENVIRONMENTAL IMPACT STATEMENT

GENERAL RESPONSES TO MAJOR COMMENTS

This section provides National Park Service's (NPS's or the Park Service's) responses to comments that were made frequently and/or that require a relatively detailed response.

Many individuals and environmental groups raised concerns regarding impacts of vessel traffic on marine wildlife and other resources. The Park Service shares these concerns; protection of park resources and values is paramount. At the same time, the Park Service must continue to provide opportunities for a range of quality visitor experiences consistent with its resource protection mandate. The alternatives presented in the final environmental impact statement (FEIS) consider various quotas and operating requirements for four classes of motor vessels as a way to accomplish this. Under any of the alternatives, and consistent with its mandates, Glacier Bay National Park and Preserve will remain a highly protected area for marine wildlife and other resources.

Additional protection measures are included as NPS requirements outlined in concessioner contracts and as part of voluntary measures contained in concessioner proposals. Commercial vessel operators compete for limited permits in Glacier Bay, and the Park Service considers environmental protection measures when selecting operators. Operators have an incentive to reduce environmental effects of their operations, not only to obtain permits, but also to protect the resource on which their businesses depend.

The primary concern raised among the public and environmental organizations is the potential of increasing cruise ship numbers to levels the Park Service set in 1996 (up to 184 cruise ships from June through August).

NPS management policies (NPS 2001b) state that "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to predominate." When dealing with unknown risks, the Park Service agrees that actions should proceed with caution. As an example, under the NPS preferred alternative, alternative 6, any increase in cruise ship numbers would be incremental and based on an annual evaluation of study results. The superintendent would exercise judgment and caution when considering any increase in cruise ships.

The Park Service is not required to avoid all adverse impacts, either under NPS policy or under the requirements of the National Environmental Policy Act (NEPA). The Park Service is required to leave resources "unimpaired," a standard to which all park managers must adhere. While any effect that results in impairment would be significant, not all significant impacts result in "impairment." Based on the analysis presented in the final environmental impact statement, current vessel numbers are not impairing park resources and values, and none of the other alternatives presented in this EIS would result in impairment.

General Response Number 1.

The environmentally preferred alternative (alternative 4) should be the NPS preferred alternative **—** Each alternative considered in the environmental impact statement responds to two primary purposes common to all national parks: (1) conserving park purposes and values, and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that, "when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate." The alternatives considered represent a range of actions with varied vessel quotas and operating requirements to achieve these purposes. Alternative 4, the environmentally preferred alternative, would allow the fewest number of vessels and would have the most stringent operating requirements. The NPS preferred alternative in this FEIS would conserve park purposes and values but would allow more people to enjoy park resources than alternative 4. The NPS preferred alternative includes several of the protective operating requirements identified in the environmentally preferred alternative. These would include vessel approach distances to wildlife and certain geographic areas ; speed restrictions in areas where whales are present; a 13 knot speed limit for large vessels; and closures of certain areas to cruise ships and tour vessels.

General Response Number 2.

The purpose and need and alternatives were constructed too narrowly **—** The purpose of this environmental impact statement is "to identify and analyze the effects of the 1996 increases in the number of vessel entries" which shall be used to "set the maximum level of vessel entries." The mandate required that the environmental impact statement consider the 1996 increases and that the Park Service use the environmental impact statement to set the maximum level of entries. The alternatives presented in the environmental impact statement represent the reasonable range of alternatives that have evolved for over 20 years.

The alternatives in this EIS not only consider vessel quotas in Glacier Bay but also a range of operating requirements to protect park purposes and values. Further, some of the alternatives consider operating requirements for Dundas Bay, and some consider an extended timeframe over which vessel quotas would be in effect.

Cruise ship numbers vary 100% among the alternatives, from a low of 92 to a high of 184 from June through September.

The current vessel quotas and operating requirements have been established through several plans, consultations with agencies, tribes, and the public. The environmental impact statement is not intended to open up for consideration all the possible ways of managing vessel quotas and operating requirements in Glacier Bay. Instead, this environmental impact statement considers the impacts of the 1996 vessel increases and will be used to determine the maximum level of vessel use.

In summary, the Park Service believes that the range of alternatives meets the requirements of NEPA because the range captures the full-range of vessel quotas and operating requirements that have been evolved over more than 20 years.

General Response Number 3.

The Park Service needs to provide specific criteria for increasing cruise ships **—** The determination whether to increase cruise ship quotas would rely on a set of criteria that define the environmental and social conditions that would need to be met before any additional entries are approved. These criteria would be based on the recommendations and guidance provided by studies looking at the impact of vessels on all park resources. Studies would be identified in a research framework that would be developed and overseen by a Science Advisory Board. This research framework would identify the studies necessary to provide information on the effects of vessel traffic on the environment and develop monitoring information necessary for park management.

Since the 1996 FONSI and the VMP/EA, the NPS has instituted a research program. Several of the studies identified under the 1995 Vessel Management Plan and Environmental Assessment have been accomplished and information from those studies are included in this environmental impact statement. Those studies include, but are not limited to, the following:

- Reaction of Steller sea lions to vessels - Completed in 2000
- Disturbance of harbor seals by motorized vessels in Johns Hopkins Inlet -Completed in 2001
- Monitoring underwater noise in Glacier Bay National Park – Ongoing
- Disturbance of harbor seals at a terrestrial haulout in Glacier Bay National Park – Ongoing
- Population characteristics of humpback whales in Glacier Bay and adjacent waters – Ongoing
- Opportunistic sightings of marine mammals in Glacier Bay National Park – Ongoing
- Humpback whale song recording in Glacier Bay: their frequency and occurrence – Ongoing
- Humpback whale forage study - Completed in 2002
- Coastal resources inventory and mapping project – Ongoing
- Development of coastal monitoring protocols and process based studies - Completed in 2001
- Ecology of selected marine communities in Glacier Bay - Completed in 2003
- Distribution and abundance of small schooling fish in near shore communities - Completed in 2003
- Marine Predator studies in Glacier Bay National Park – Ongoing
- Sea otter distribution, relative abundance, prey analysis, and impact on benthic communities – Ongoing
- Fjord oceanographic processes in Glacier Bay, Alaska – Ongoing
- Mapping the benthic habitat in Glacier Bay, Alaska - Completed in 2001
- Abundance and distribution of forage fish and Plankton - Completed in 1999

General Response Number 4.

The environmental impact statement and alternatives should consider all vessel types, including administrative vessels **—**The scope of this environmental impact statement, as mandated by the U.S. Congress (see subsection 1.2.8), is to identify and analyze the effects of the 1996 increases in the number of vessel entries allowed in Glacier Bay. Those 1996 increases were limited to cruise ships and tour, charter, and private vessels.

Administrative vessel use is determined by the superintendent to ensure visitor safety; respond to emergency situations; monitor impacts to park resources; and otherwise implement the park's mission, purposes, and values. Placing limits on the amount of administrative vessel use would restrict the park's ability to protect the park's resources and values.

Administrative vessels are managed using a decision matrix (see appendix E of the FEIS). This matrix will be used by the superintendent to evaluate each administrative vessel. Administrative vessel use is defined as any vessel use that is not classified as a cruise ship, tour, charter, or private vessel under the standard permit classification system (36 CFR 13.65; see appendix A), or listed as an exception under 36 CFR 13.65(iii).

General Response Number 5.

The Park Service should not reduce whale waters — Examination of a reduced number of designated whale waters is some of the alternatives is appropriate, reflecting knowledge accumulated since the 1996 vessel plan was completed. Experience since 1996 has shown that designating whale waters in other areas where whale presence is not consistent detracts from the effectiveness of the whale protection regulations because it makes the system overly complicated for both visitors and experienced users of Glacier Bay. The lower Bay is the only location where permanent designation of whale waters appears to be necessary. Protection of the areas formerly designated as whale waters (Whidbey Passage, Russell Passage, and the East Arm Entrance) will be accomplished via the superintendent's authority to designate temporary whale waters anywhere where whales are found to be gathering and staying for several days. Biologists conducting near-daily whale monitoring surveys during the summer identify new whale aggregations and recommend to the superintendent that temporary whale waters be established. Park rangers then inform visitors and commercial operators as part of routine communications required upon entering Glacier Bay. Because the temporary whale waters system works well, and because the Park Service wishes to keep regulations as simple as possible, only the lower Bay is included as designated whale waters under the NPS preferred alternative. The Biological Opinion written by NOAA Fisheries, (the Federal agency authorized to manage marine mammal stocks) about the potential impacts of the NPS preferred alternative on threatened and endangered species, did not raise concerns about eliminating the other three areas currently designated as whale waters.

General Comment Number 6.

The Park Service should establish a regulation that requires cruise ships to travel at mid –channel while traveling up Glacier Bay —Cruise ship operators travel generally in mid-channel and the Park Service sees no reason to establish this as a requirement. Cruise ships would still be required to maintain a distance of at least 1 nautical mile from shore, and in narrower areas to navigate in mid-channel while transiting in designated whale waters. Deviation from vessel operating requirements may be made when the safety of passengers or the vessel is immediately threatened. Where possible, operators should notify the National Park Service prior to the deviation. In all cases, notifications must be made as soon as it is safe to do so.

Response to Public Comments

Included in this section is a compilation of written or transcripts of oral comments submitted during the public comment period and the National Park Service's responses to the comments. Responses from the Park Service to substantive comments appear to the right of the comment. Page numbers appear in the list below to assist the reader in locating comments and the associated responses. The diamond symbol (✦) indicates that substantive comments were received from a federal agency, state government, Native organization or corporation, organization, business or individual for which a response is provided in the FEIS.

Federal Agencies

State and Local Governments

Native Organizations or Corporations

Organizations

Businesses

Individuals

Form Letters

MAY 14 2003

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue
Seattle, Washington 98101

Reply To
Attn Of: ECO-088

MAY 12 2003

02-015-NPS

Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, AK 99503-2892

Dear Ms. Swanton:

The U.S. Environmental Protection Agency has reviewed the draft Environmental Impact Statement (EIS) for the proposed **Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements** (CEQ #030114) in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act. The draft EIS proposes daily entries, seasonal entries and seasonal-use day limits for cruise ships, and tour, charter, and private vessels with the Glacier Bay National Park and Preserve. The EIS identifies Alternative 3 as the preferred alternative.

We have assigned a rating of LO (Lack of Objections) to the draft EIS. This rating and a summary of our comments will be published in the *Federal Register*. A copy of the rating system used in conducting our review is enclosed for your reference. While we have rated the EIS LO, we would like to take this opportunity to identify our recommended alternative and provide comments and suggestions for clarifying language and including additional information the final EIS.

Preferred Alternative

1 Alternative 4, the Environmentally Preferred Alternative would allow the lowest level of entries across all vessel classes except private vessels. Alternative 4 would result in the fewest impacts on the physical, biological and human environments of all the alternatives. Therefore, we recommend that Alternative 4 be identified as the preferred alternative in the final EIS.

Environmental Justice

2 The Environmental Justice section (Section 4.5) of the EIS describes some of the economic impacts the residents of Hoonah would experience under each of the proposed alternatives. The Local and Regional Socioeconomic section (Section 4.4.5) of the EIS states that economic impacts from some of the proposed alternatives may have impacts on communities in Haines, Skagway, Juneau, Sitka and Ketchikan as well. The Environmental Justice section of the EIS needs to evaluate whether there will be impacts on low income and people of color communities in these cities and any other communities (i.e., Gustavus, Elfin Cove, Pelican and Yakutat). If low income or people of color communities will be impacted by the proposed project, the EIS should disclose what efforts were taken to meet environmental justice requirements consistent with Executive Order (EO) 12898 (*Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*). This should include the following.

A description of the methodology and criteria utilized for identifying low income and people of color communities, the sources of data utilized for these

Printed on Recycled Paper

Grouping:	Federal Agency
Format:	Comment Letter

NUMBER	RESPONSE
F1-1	The Park Service appreciates the U.S. Environmental Protection Agency's preference for the environmentally preferred alternative. The NPS preferred alternative has been revised in the FEIS to include many of the protective measures contained in the environmentally preferred alternative. Please see general response number 1 for more information.
F1-2	The Park Service found that there would not be disproportionate environmental or human health impacts on minority or low income populations. The Park Service has a close working relationship with the Hoonah Indian Association (HIA) as described in the cultural resources subsection (4.4.1), and will continue to work with the HIA on issues regarding access and protection of natural resources.

analyses, and the references utilized for establishing the criteria.

An accounting of all impacts on low income and people of color, including (but not limited to) cumulative and indirect impacts, and impacts to cultural, historic and protected resources. In addition, the EIS needs to determine if the impacts to low income and people of color communities will be disproportionately higher than those on non-low income and non-people of color communities. For such a determination, the EIS must identify a reference community, provide a justification for utilizing this reference community, and include a discussion of the methodology for selecting the reference community.

The EIS must demonstrate that communities bearing disproportionately high and adverse effects have had meaningful input into the decisions being made about the project. The EIS needs to describe what was done to inform the communities about the project and the potential impacts in will have on their communities, what input was received from the communities, and how that input was utilized in the decisions that were made regarding the project.

Consultation with Native American Tribes

3 The EIS states that the Park Service is consulting with the Hoonah Indian Association regarding their concerns about the proposal for Glacier Bay. However, it does not provide details on the consultations with the Hoonah Indian Association. The proposed alternatives could have significant impacts on Hoonah cultural resources. The EIS should discuss, in detail, the steps taken to consult with all tribal governments, consistent with Executive Order (EO) 13175 (*Consultation and Coordination with Indian Tribal Governments)* and measures taken to assure that treaty rights and privileges have been appropriately addressed.

Thank you for the opportunity to review this draft EIS. If you would like to discuss these issues, please contact Mike Letourneau at (206) 553-6382.

Sincerely,

Judith Leckrone Lee

Judith Leckrone Lee, Manager
Geographic Unit

enclosures

NUMBER	RESPONSE
F1-3	The FEIS includes a more detailed description of NPS consultations with the Hoonah Indian Association.

RECEIVED
MAY 14 2003

STATE OF ALASKA

OFFICE OF THE GOVERNOR
ANILCA IMPLEMENTATION PROGRAM

FRANK H. MURKOWSKI
GOVERNOR

550 W. 7TH AVENUE, SUITE 1660
ANCHORAGE, ALASKA 99501
PH: (907) 269-7477 / FAX: (907) 269-3981
Sally_Gibert@gov.state.ak.us

May 14, 2003

Nancy Swanton
EIS Project Manager
Glacier Bay National Park and Preserve Vessel EIS
2525 Gambell Street
Anchorage, AK 99503-2892

Dear Ms. Swanton:

The State of Alaska has reviewed the March 14, 2003, Glacier Bay National Park and Preserve Draft Vessel Quota and Operating Requirements and Environmental Impact Statement. This letter represents the consolidated views of state agencies.

The State appreciates the Service's efforts to work with numerous parties to resolve the important issues raised in this process. The purpose of this letter is to identify issues of state concern that have arisen in response to this draft plan. Because park management decisions can affect the state's management of fish and wildlife and the public's abilities to access and use the resources, we look forward to the application of coordinated interagency management strategies within park boundaries. We invite the Park Service to work with the state on these issues of concern prior to the release of the Final Glacier Bay National Park and Preserve Vessel Quota and Operating Requirements Environmental Impact Statement.

Jurisdictional Issues

1 As the Park Service is aware, the State has long claimed title to the tide and submerged lands in Glacier Bay National Park and Preserve. Indeed, the State and the United States are now litigating the question of title in an original action before the United States Supreme Court in Alaska v. United States, No. 128, Original. The Draft EIS, however, fails to acknowledge that title is controverted. That omission is improper and we request a correction in the final EIS.

The State of Alaska has managed the water column, shore lands, tidelands, and submerged lands in the vicinity of the Glacier Bay park unit since 1959 without degradation of the resource values. The state has statutes, regulations, and a management structure in place to control all land and water uses in the area. Non-discretionary programs such as mineral entry on state shore lands, tidelands, or submerged lands have not been permitted in the vicinity of the Glacier Bay unit. The State of Alaska's coastal management plan further requires that the productivity and diversity of coastal waters be protected. The State of Alaska has an excellent record that demonstrates its willingness to protect the resources and values of the Glacier Bay area.

Grouping:	State of Alaska
Format:	Comment Letter

NUMBER	RESPONSE
S1-01	The FEIS now includes mention of the referenced litigation and its status.

The state cooperated with National Marine Fisheries Service, National Park Service, and others in the adoption of the 1984 whale protection regulations. Under those regulations, the superintendent was required (36 CFR 13.65(b)(2)(iii)) to consult with other federal and state agencies and the public before designating "whale waters" in Glacier Bay. We request reintroduction of this requirement. State cooperation on those 1984 regulations does not mean the state concedes jurisdiction to enact other regulations in state waters. If, however, the state and Service can agree in concept to an overall management strategy that respects both national and state interests, jurisdictional issues become less important. The Alaska Department of Fish and Game has a vested interest in the management of marine mammals and requests continued consultation. The state understands that the Park Service is acting in response to Congressional direction to prepare this EIS. We nonetheless urge the Park Service to continue working with the state in a coordinated manner to develop a mutually-satisfactory management strategy.

ANILCA and Access

In finding those solutions, the provisions of the Alaska National Interest Lands Conservation Act (ANILCA) should play a more prominent part. Because Glacier Bay Park and Preserve is subject to ANILCA, the Service's closure decisions must follow the ANILCA regulatory framework. Current regulations for Glacier Bay, 36 CFR Section 13.65(b)(3)(ix), cite to the
2 general park regulations under 36 CFR Sections 1.5 and 1.7 instead of the ANILCA specific closure regulations set forth in 36 CFR Section 13.30 or 43 CFR Section 36.11. The state finds this to be inappropriate. To the extent, however, that Superintendent's general closure authority will continue to be identified as falling under Sections 1.5 and 1.6, we urge the Park Service to rely upon Section 1.5(b)'s criteria for heightened procedural protection. We urge that any closures or restrictions considered or authorized under this plan follow those heightened procedures to ensure that the procedural and substantive protections intended to apply under ANILCA are honored.

ANILCA's specific protection of motorized access also sets Alaska parks apart from those in the lower 48. Even in wilderness areas, motorized access can be prohibited only upon a finding that such use would be detrimental to the resource. 16 U.S.C. Section 3170, Section 1110(a). See also 43 CFR 36.11(d) and (h). Section 1110(a) of ANILCA explicitly protects access for "traditional activities", a term which remains largely undefined in the act or by regulation. The state considers the long history of tourists and amateur naturalists making visits to explore Glacier Bay to be a traditional activity in the Park. Today's visitors follow in the tradition of the early adventurers who visited the bay on sightseeing steamship excursions. While more recent visitors enjoy greater comforts, the purposes for visiting remain the same: to sightsee or recreate in this exceptional environment. Others, particularly local area residents, have long visited the area to fish or take advantage of other resources. We recommend that the Service acknowledge that these are traditional activities associated with Glacier Bay. (This is particularly relevant to the Regulatory Framework discussion at pages 4-231- 4-232.)

NUMBER	RESPONSE
S1-02	The Park Service considers the regulations in 36 CFR 1.5 and 1.6 to be appropriate and continues to follow these regulations to manage vessel use in Glacier Bay National Park and Preserve. A definition of traditional activities in not within the scope of the EIS.

3 State Management of Resident Fish and Wildlife

We found no mention of the state's management authority over resident fisheries in the State of Alaska. In the Master Memorandum of Understanding between the National Park Service and the Alaska Department of Fish and Game (ADF&G), the Service recognizes that the State of Alaska has the primary responsibility to manage fish and resident wildlife, including individual species of clams and crustaceans. At a minimum we request mention of this authority in the Regulatory Framework discussion (page 4-85) of the Environmental Consequences chapter, and in the Assumptions for Cumulative Effects Analysis that begins on page 4-7.

4 Ferry Service to Barlett Cove

The State realizes that this EIS addresses types and levels of vessel use, rather than allocations of that use. The State does, however, wish to take this opportunity to make recommendations which may lie at least partly outside the scope of the document. The Alaska Marine Highway System (AMHS) wishes to reserve the option to provide ferry service to Gustavus and the Park via Bartlett Cove. The AMHS will be exploring alternatives to construct a ferry terminal in the vicinity of the existing Gustavus Dock; however, Bartlett Cove may be the only affordable alternative. The Alaska Marine Highway was recently designated a scenic byway by the National Scenic Byways Program. We believe adding the Park to ports served by one of the Nation's newest scenic byways would benefit the independent traveler, the Park, and Gustavus residents. Also in the past the AMHS has provided occasional sight-seeing trips to Glacier Bay with state ferries. The State requests the opportunity to continue occasional trips to afford Alaska residents a low cost cruise of Glacier Bay as vessel availability and public interest permits.

Specific Comments

The remainder of our comments are related to specific sections of the Glacier Bay National Park and Preserve Draft Vessel Quota and Operating Requirements Environmental Impact Statement. These comments do not concede that the Service has jurisdiction or authority for the plan and regulations proposed to restrict activities in the State of Alaska waters adjacent to (the uplands of) Glacier Bay National Park and Preserve. The following comments are organized chronologically, rather than order of importance.

5 • Pg. 1-16 to 1-17 – We request that ANILCA's provisions for access be included in the section mentioning relevant legal mandates, policies, and plans.

6 • Page 2-1 – Alternatives – The State is aware of concerns of Alaska residents, particularly Gustavus residents, that the limited number of short-notice (issued within 48 hours of use) daily permits available has also limited access to traditional personal use harvest of sockeye salmon in Glacier, Dundas and Berg bays. We request consideration of increasing the availability of short-notice permits for private vessel operators to improve access for personal use salmon fishers.

NUMBER	RESPONSE
S1-03	The FEIS now notes the State's authority and the Master Memorandum of Understanding.
S1-04	The Park Service appreciates this recommendation, which, as suggested by the comment, would be best addressed through direct discussions with the superintendent.
S1-05	ANILCA's provisions for access are not relevant to the proposals in this EIS and, consequently, are not referenced.
S1-06	A short-notice permit system would be provided under three of the six alternatives examined in the FEIS, including the NPS preferred alternative. The number of available short-notice permits will be adjusted annually.

7 • Pg. 2-1 – The last bullet on this page should be clarified to note that all alternatives allow one entry ***per day*** for ferry service to Bartlett Cove. The State recognizes that Public Law 105-83 was passed by Congress in 1997 to accommodate *passenger* ferry service between Juneau and Glacier Bay. The State remains on record supporting a provision for both passenger and vehicle ferry service to connect the Gustavus community and the Park to the continental highway system via the Alaska Marine Highway System - a National Scenic Byway.

8 • Pg. 2-6 – We request this section clarify the relationship between the management of Congressional designated wilderness waters with ANILCA Section 1110(a) and supporting regulations at 43 CFR Part 36 which provide for motorized access for traditional activities in all conservation systems units, including wilderness areas. Any consideration of closures or restrictions should be consistent with the provisions of ANILCA, as noted in our general comments.

9 • Pg. 2-34 – We request that the Service develop and describe criteria for assessing current and ongoing research that support determinations of vessel limits in Alternative 3. In addition, it was difficult to find a list of the studies currently being used to determine these limits. Therefore, more citations or page cross-references are needed.

10 • Building on the research noted above, we request the final EIS recognize that the Alaska Scientific Review Group has recommended to the National Marine Fisheries Service that they examine the population stock structure of the central North Pacific stock of humpback whales, including the possibility of recognizing a separate stock for Southeast Alaska waters. If such stock restructuring occurred, the abundance for a new Southeast stock would be less than the currently recognized stock, as well as the number of whales in the Glacier Bay area thus affecting the criteria for determining vessel limits. In addition, stock restructuring would reduce the Potential Biological Removal (PBR) for Southeast Alaska. Currently, The PBR for the central North Pacific stock is 7.4/year, and the annual mortality is estimated at 3-4 whales/year. If the stock is split, this may decrease the threshold and may make annual mortality closer to, or possibly above, the PBR level for a new Southeast stock. Therefore, we request that the most current stock structure information be utilized.

11 • Pg. 2-39 – We request revision of the first bullet under 2.12 "*non-motorized waters allow visitors an enhanced opportunity to experience wilderness.*" In Alaska, wilderness and motorized access are not mutually exclusive. ANILCA Section 1110(a) and supporting regulations at 43 CFR Part 36 provide for motorized access for traditional activities in all conservation systems units, including wilderness areas. Any consideration of closures or restrictions should be consistent with these provisions.

12 • Pg. 2-49 – <u>Marine Birds and Raptors – Alternative 3</u> – We request changing the wording of the sentence in the table to: *The amount of disturbances <u>may</u> increase if cruise ship numbers are increased.* Other entries may also warrant adjustment. The conclusions presented in the table are presented as fact, even though they may only be based on speculation, anecdotal evidence or limited preliminary studies. For example, it is our understanding that on-going studies have not yet clearly established that increased numbers do lead to more disturbances. Any statements made should reflect the actual state of knowledge.

NUMBER	RESPONSE
S1-07	The referenced bullet has been revised to indicate one entry per day.
S1-08	No new non-motorized waters are being considered in this EIS. Consequently, reference to ANILCA Section 1110(a) and the regulations at 43 CFR Part 36 is not necessary.
S1-09	The NPS preferred alternative in the FEIS, alternative 6, includes more information regarding the basis for increasing cruise ship numbers and study needs. Please see general response number 3.
S1-10	The description of humpback whale stocks has been revised from the text presented in the DEIS. The Park Service recognizes NOAA Fisheries (formerly the National Marine Fisheries Service) determination of the appropriate stock as stated in NOAA's biological opinion.
S1-11	No new non-motorized waters are contemplated in this EIS. While wilderness designation in Alaska does not prohibit motorized use, motorized use generates noise, air, and visual disturbances that are counter to wilderness values, including solitude and naturalness.
S1-12	Each cruise ship visit to Glacier Bay results in innumerable encounters with seabirds, causing them to dive, fly, or scoot away over the surface of the water. Increasing cruise ship visits would increase the number of these encounters. Therefore, no change has been made to the text for the FEIS.

13 • Pg. 3-122, Park Wilderness in Relation to the Entire National Wilderness Preservation System – We request this discussion recognize that ANILCA Section 1110(a) allows motorized use, including boats, within designated Wilderness in Alaska.

14 • Pg. 4-121 – We question the sentence stating that *"Some, but not all, of this decline can be attributed to the grounding of Muir glacier and the subsequent loss of ice flows that harbor seals use for haul outs."* In a recent discussion between one of the authors cited (Ms. Mathews) and an ADF&G staff person, the proportion of harbor seals at Muir Glacier before its grounding was quite low, compared to the rest of the park. The number of harbor seals in Glacier Bay peaked in 1994-1995, which was several years after the grounding of Muir Glacier (1992). If there had been an impact of the grounding, a decline in overall numbers likely would have been observed between 1993 and 1995; yet, this did not occur.

15 • Pg. 4-232 The state considers the use of motorized vessels, whether for fishing, sightseeing, recreation, or other pre-ANILCA activity, a traditional activity. As discussed in our general comments above, we encourage the Service to recognize this as well. If the Service wishes to formally determine what activities are considered traditional, then we request the Park document pre-ANILCA traditional activities and methods of access through a cooperative study with the state. The Service and ADF&G completed such a cooperative study for Wrangell-St. Elias Park and Preserve, which could be used as a template.

16 • Pg. 5-5 The ADF&G has management authority for resident *fish* (omitted) and wildlife in the State of Alaska, including the marine waters of Glacier and Dundas Bay.

17 • Appendix B-1. For the final document we assume that the 2003 Compendium with replace the 2002 version that is included in the draft EIS.

• We recognize that this EIS addresses levels of use, not the allocation of that use. We also understand that the Service is working with charter operators and other concession permit holders on ways to allow operators to make better use of the park during days or times when use is low, particularly in Dundas Bay. The state requests an opportunity to review these procedures at the appropriate time.

Thank you for the opportunity to provide these comments. If you have any questions or wish to initiate further consultation, please do not hesitate to contact me.

Sincerely,

Sally Gibert
State ANILCA Coordinator

NUMBER	RESPONSE
S1-13	ANILCA's provisions for access are not relevant to the proposals in this EIS and, consequently, are not referenced in this document.
S1-14	The FEIS has been modified to correct this error.
S1-15	The Park Service considers that a definition of traditional activities is beyond the scope of this EIS and, thus a definition is not included in this document.
S1-16	The Park Service will continue discussions and coordination with the state on this topic.
S1-17	The 2003 compendium is included in this FEIS.

MAY 14 20[illegible]
rec'd
MAY 16 20[illegible]

Hoonah Indian Association
P.O. Box 602
Hoonah, AK 99829-0602
Phone (907) 945-3545 Fax (907) 945-3703

May 6, 2003

Nancy Swanton
EIS Project Manager
Glacier Bay National Park and Preserve Vessel DEIS
2525 Gambell Street
Anchorage, Alaska 99503-2892

Dear Ms. Swanton,

The Hoonah Indian Association, as a federally recognized tribe in accordance with and by the authority of the Acts of Congress of June 18, 1934 (48 Stat. 984) and May 1, 1936 (49 Stat. 1250), is pleased to have this opportunity to submit comment regarding the Marine Vessel Management Plan DEIS for Glacier Bay National Park and Preserve.

The Hoonah Indian Association, Board of Directors offer the following remarks, concerning Glacier Bay and the alternatives provided in the DEIS, having discussed and considered the many issues addressed.

1 In that the Huna Tlingit are the original stewards of Glacier Bay, which we refer to as our *Ancestral Homeland*, we are completely interwoven with, and continue to be an integral part of the biosphere of this area. We consider that we are a living and essential cultural resource of the Glacier Bay environment. Certainly, our desire to protect the Ancestral Homeland far exceeds that of any environmental group or others who may weigh in for further protection of this very special place.

In formal discussion, we have identified a number of immediate and direct concerns that are addressed in the Marine Vessel Management Plan DEIS. We appreciate the hard work that has gone into the study, so far, and we feel that its thoroughness reflects a genuine effort by the National Park Service to take a careful look at the many issues under consideration.

2 The Hoonah Indian Association is all too aware of the dramatic decline in the seal population within the Park. We know this is not a result of over harvest by the Huna people since we have not been allowed to take seal for subsistence or for ceremonial use for a very long time. Yet, we are witness to the decline in seal populations.

Obviously, we wonder if there is a correlation between this decline and the increase in vessel traffic and visitor use in recent decades, within Park waters, particularly the

Grouping:	Native Corporation or Organization
Format:	Comment Letter

NUMBER	**RESPONSE**
N1-1	The Park Service recognizes the intimate and integral relationship that Huna Tlingit have with Glacier Bay National Park and Preserve.
N1-2	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the vessel approach distance to harbor seals hauled out on ice in Johns Hopkins Inlet. The Park Service will continue its long-term studies of harbor seals and their population, as well as studies looking at vessel and marine mammal interactions.

increase in cruise ship traffic. We fear that cruise ships may well disturb seal colonies by approaching too close to the face of the glaciers. These nursery sites may well be disturbed by un-natural noise or sound waves that travel through the air and water. We wonder if the dramatic changes in the levels of underwater noise could be affecting seal behavior by increasing levels of stress and if this could be affecting their feeding, resting or communication patterns as the study indicates. We appreciate your continued efforts to seek answers to this concern.

3 The Hoonah Indian Association is also concerned with the effects of cruise ship traffic and the threats they pose to the Humpback Whale population. We were all made aware of the tragic death of the pregnant female Humpback that was killed, apparently in Park waters, during the 2001 cruise ship season.

Whale #68's carcass bore the markings and revealed the trauma of an encounter of, what was most likely, a cruise ship. While we wait to hear the results of the ongoing investigation by the National Park Service and the U.S. Justice Department, we fear that any increase in cruise ship traffic will put the whale population at even greater risk. We all appreciate the opportunity to visit Glacier Bay but not at the expense of the marine mammal population. We appreciate the Parks effort to identify the cause of this accident and the steps proposed to prevent this from ever happening again.

4 Concerning water quality, we feel that increased vessel quotas will increase the risk of accidents involving cruise ships. The DEIS does not relieve us of this fear. A serious incident involving a cruise ship could have devastating impact on the Glacier Bay environment. Even a small oil spill in ice-filled waters could prove very serious because of the challenges with containment in such an area.

The potential for contamination to be introduced into this pristine environment increases with every vessel. We realize that a typical cruise ship is, in essence, a floating city that carries thousands of people and crew. A ship carrying 3,000 people generates 23 gallons of toxic waste, 11.5 tons of garbage, 270,000 gallons of graywater, 7,000 gallons of oily bilge water and 30,000 gallons of sewage per day. Increased vessel quotas increase the potential for unauthorized releases of harmful pollutants.

We wonder, given the Park's zero discharge policy, if they are not discharging in Glacier Bay, where are they discharging, and to what extent? We know that of the 11.5 tons of garbage that is generated daily by passengers alone, 75 to 80 percent is incinerated and the ash, containing persistent organic pollutants, byproducts of plastic combustion, contains many toxic materials. Where and how is this being disposed of, if not in the Bay or in the surrounding area? By increasing vessel quotas we also raise the risks to areas outside the park.

We wonder how closely and prudently these vessels will be monitored for possible waste-stream discharge, whether intentional or by accident. As of 2002 only five of the twenty-six ships visiting Alaska were equipped with advanced wastewater treatment systems certified by the Coast Guard to meet strict pollution standards. We further realize

NUMBER	RESPONSE
N1-3	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
N1-4	Although Glacier Bay National Park and Preserve does not have a "no-discharge" policy by regulation, the Park Service does favor those applicants who include a no-discharge policy in their concession permit application. Discharges outside of Glacier Bay are regulated by the State of Alaska's commercial passenger vessel compliance program.

most cruise ship company's abysmal record regarding environmental stewardship. Can the Park require ships entering the Bay to be equipped with advanced wastewater treatment systems or to account for where discharge is occurring if not in the Park?

Regarding air pollution, we have all been witness to the dense smog cover that can
develop over Glacier Bay during the tourism season. The mountaintops can become
5 shrouded in haze during these months, which undoubtedly affects the mountain goat
population and other land and marine animals. We wonder to what extent this airborne
contamination affects the streams that find their origin in the upper reaches of the
mountains before flowing down to bay waters to mix with the marine environment. We
have asked ourselves if we can support increased cruise ship stack emissions and the
associated pollutant load that would enter the air column of Glacier Bay.

As the representative body of the Huna Tlingit, the Hoonah Indian Association believes that we are the true environmentalists and most sincere stewards of our Ancestral Homeland. We wish nothing more than to protect and preserve the land, waters, fish and wildlife of our Homeland, Glacier Bay. We assert that air and water pollution defiles sacred elements of Glacier Bay, including the glaciers, and the habitat for fish and wildlife.

We, as a native people, have considered ourselves managers of the resources of Glacier Bay for thousands of years. We have also come to the conclusion that if our beloved Ancestral Homeland were at risk, we would align our selves with the environmental community and lead the effort to protect the Homeland, at all cost.

We accept the heartbreaking reality that we too may have to leave Glacier Bay, in order to protect its pristine condition, should that ever be threatened. We would be the first to stand in the forefront and bar the door. Be assured, we would stand as sentinels in order to protect our Homeland, Glacier Bay.

6 With these things in mind, the Hoonah Indian Association supports Alternative # 2

We thank you for the opportunity to provide these remarks.

Sincerely,

Frank Wright Jr

Frank Wright Jr.
President

NUMBER	RESPONSE
N1-5	The Park Service shares concern about these potentially adverse environmental effects as recognized by our identification of air quality-related values in subsection 4.2.2 of this EIS. Furthermore, in response to this and other comments received on the DEIS, the Park Service developed a new preferred alternative, which is included in this FEIS. Alternative 6, like two other alternatives evaluated in this FEIS, would result in reduced air emissions as compared to existing conditions. This would be accomplished through imposing a year-round 13-knot speed limit throughout Glacier Bay for vessels greater than or equal to 262 feet (80 meters). The effect on haze and its associated environmental effects should be reduced because overall maximum emissions of NOX and overall emissions of SO2 would be reduced by 19% and 51%, respectively, compared to existing conditions.
N1-6	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that 'when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.' The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

MAY 13

Huna Totem Corporation

9301 Glacier Hwy. • Juneau, Alaska 99801
(907) 789-1773 Fax (907) 789-1896

May 9, 2003

Glacier Bay National Park and Preserve Vessel DEIS
CO/Nancy Swanton
EIS Project Manager
2525 Gamble Street
Anchorage, Alaska 99503-2892

Attn: Nancy Swanton

The following are comments directed to the Glacier Bay National Park and Preserve, Alaska Vessel Quotas and Operating Requirements EIS as were invited in the EIS statement.

Huna Totem Corporation Shareholders and ancestors are the historic residents of Glacier Bay and the most affected by Park regulations regarding vessel access. In that regard we offer the following comments:

Huna Totem Corporation generally supports Alternative 3 with the following requests for possible modifications or additions as follows:

- Table 2-1, page 2-3 currently defines **Entry** as follows: Each time a motor vessel passes the mouth of Glacier Bay into the Bay; each time a private vessel activates or extends a permit; each time a motor vessel based at or launched from Bartlett Cove leaves the dock area on the way into Glacier Bay, except a private vessel based at Bartlett Cove that is gaining access or egress to or from outside Glacier Bay; the first time a local private vessel uses a day of the seven-use day permit; etc etc. This definition may conflict or at times might argue with interpretation of the **Vessel Use Day** language that defines Vessel Use Day as 'Any continuous period of time in which a motor vessel is in Glacier Bay from 12 midnight on one day to 12 midnight the next day'. This Vessel Use Day language allows a vessel 24 hours of operation within the Park, however, if a vessel leaves the Bartlett Cove dock once in the 24 hour period and returns less than 24 hours under the Entry definition, it could be interpreted the vessel may not depart the dock again in that 24 hour period which started at the initial departure time from the dock. The entry language definition may restrict the vessel from using the allotted Vessel Use Day of 24 hours by defining any single departure from the Bartlett Cove dock as a single entry, even though the allowed time within the Park was not used. The **Daily Vessel Quota** is not defined in current regulations, but is
1 presumed to be the number of vessel-use days allowed in an area on only one calendar day. *Huna Totem requests that Daily Vessel Quota be defined to allow more than one departure from the Bartlett Cove dock providing the 24 hour*

1

Grouping:	Native Corporation or Organization
Format:	Comment Letter

NUMBER	RESPONSE
N2-1	Under the NPS preferred alternative in this FEIS (alternative 6), quotas would be measured by 24-hour period, not by "entries," thereby addressing the issue raised by this comment.

period is not exceeded and all Park regulations are followed and or increase the
tour boat daily vessel permit quota to 4 per day during June 1-Aug 31 and May
1 *and Sept. and increase seasonal use days to correspond with the vessel permits*
May through September.

- The EIS in section 3.4 addresses Cultural Resources and Tlingit people's history
and cultural sites within the Park in detail. However, none of the commercial
cruise ship and tour vessel entries have any requirement for cultural interpretation.
The Park Service does provide excellent general Park interpretation, however
Cultural interpretation is not provided, except for one cruise line that provides a
Cultural interpretation using Huna Tlingit people. *We recommend that a*
2 *commercial vessel be required to provide a Cultural interpretation program for*
each entry into the Park using Huna Tlingit interpreters.

- Even though cruise ships may be allowed an increase of entries up to 32%, there
3 currently is no alternative listed that allows for any additional entries to the Park
to vessels smaller than cruise ships. There doesn't appear to be any significant
environmental reason given not to support an increase in smaller size vessel
entries even though the data shows that cruise ships make the greatest impact on
visual and physical environments. *We would recommend that the Park Service*
establish physical environmental standards in soundscape, air quality and water
4 *quality, for vessels smaller than cruise ships and additional entries be created for*
smaller vessels that meet those standards. This would provide more access to the
Park for vessels that meet more stringent environmental requirements.

- There does not appear to be any provision or alternative outside of administration
vessel entries that would allow vessel access during May through September to
5 any private or Native land in holdings that may exist in the Park. This vessel
access to private land in holdings should be addressed to allow for access to
existing land in holdings available on a daily basis.

Thank you for the opportunity to comment and make suggestions to the EIS. We are available to further explain our recommendations or comments if additional information or discussion would assist the Park Service during your final deliberations.

Sincerely,

Don Rosenberger
Vice President, Tourism Development

Cc: Huna Totem Board of Directors
Sam Furuness, Acting CEO, Huna Totem Corporation

NUMBER	RESPONSE
N2-2	The issue of requiring Native interpreters on commercial vessels falls outside the scope of the EIS. However, the Park Service is supportive of providing park visitors with the story of Tlingit culture, and strives to include that perspective in all areas of planning, training, and through the concession contracting process.
N2-3	The Park Service is not considering increasing vessels beyond those established in the 1996 decision. Please see general response number 2.
N2-4	The Park Service is not considering increasing vessels beyond those established in the 1996 decision. Please see general response number 2.
N2-5	This issue is outside of the scope of this EIS. However, the NPS preferred alternative in this FEIS (alternative 6) does not restrict private vessels during May or September, and the private vessel seasonal-use day quota would be increased from existing levels during the June - August season. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance. If these provisions are insufficient, the Park Service will work with individuals on a case by case basis to accommodate appropriate access.

Rec'd
MAY 14 2003

Sealaska
CORPORATION

May 13, 2003

Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, AK 99503-2892

Re: Glacier Bay National Park and Preserve Vessel DEIS

Dear Nancy Swanton:

Sealaska Corporation appreciates the opportunity to respond to the Glacier Bay National Park and Preserve (Park), Vessel Quotas and Operating requirements, Draft Environmental Impact Statement. As the regional Native corporation for Southeast Alaska, Sealaska has over 17,000 shareholders, many of whom include Glacier Bay as part of their heritage. In the relatively recent past, Tlingits lived in Glacier Bay and now many of their descendents live in Hoonah, Juneau, and elsewhere in Southeast Alaska. Traditional Native activities have been substantially restricted within the Park, denying economic and traditional rights to Native Americans. Therefore, while this DEIS is narrow in scope, it is important that where opportunities exist to help remedy past injury, they should be included in the future management, assuming that such activities will not significantly diminish the ecology and environment within the Park.

1 Sealaska generally supports Alternative 3 with some modifications. Alternative 3 has the greatest opportunity to benefit the local economy, especially if it allows sufficient vessels to enter the Park and fosters extending the season so that revenue will flow into the local economy. Therefore, the major consideration for managing the Park should include encouraging the tourism industry to lengthen the season and utilize vessel access from May 1 through September 30. Emphasis should include encouraging tour and charter class vessels to utilize the Park waters for sightseeing. Tour and charter vessels tend to be attractive to the independent tourists who generally need onshore accommodations as part of their vacation experience.

Sealaska recommends the following vessel quotas for the Park:

- Cruise ships – Up to 2 per day; 139 entries/seasonal use days initially, and up to 184 based on monitoring throughout the five month season.

2
- Tour vessels – Up to 4 per day with up 368 entries and 368 seasonal use days during June through August. During May and September up to 244 entries and 244 seasonal use days would be allowed.

One Sealaska Plaza, Suite 400 · Juneau, AK 99801-1276 · Phone (907) 586-1512 · Fax (907) 586-1826

Grouping:	Native Corporation or Organization
Format:	Comment Letter

NUMBER	RESPONSE
N3-1	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
N3-2	The Park Service did not consider increasing vessel numbers above those set in 1996. Please see general response number 2.

3 • Charter vessels – Up to 6 per day with up to 432 entries and 552 seasonal use days during June through August. During May and September there would be no limit.

4 • Private vessels – Up to 25 per day with up to 468 entries and 1,971 seasonal use days during June through August. During May and September there would be no limit.

5 In addition, Sealaska supports restrictions regarding vessel speed and noise, especially in sensitive areas such as lower Glacier Bay during times when whales are present. Therefore, seasonal noise restricted areas should be maintained to assure that marine mammals are subjected to reasonable exposure to sightseers.

Thank you for giving Sealaska the opportunity to respond to this DEIS.

Sincerely,

SEALASKA CORPORATION

Russell A. Dick
Natural Resources Manager

NUMBER	RESPONSE
N3-3	This provision has been included in the NPS preferred alternative in the FEIS, alternative 6, described in chapter 2.
N3-4	This provision has been included in the NPS preferred alternative in the FEIS, alternative 6, except that more seasonal-use days would be provided for private vessels. Please see chapter 2.
N3-5	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6. The lower Glacier Bay speed restricted area and the noise restricted areas would continue to be in effect under all of the alternatives.

MAY 14 2003

Alaska Center for the Environment * Alaska Wildlife Alliance * Defenders of Wildlife * National Wildlife Federation * Oceana * The Ocean Conservancy * The Wilderness Society

Ms. Nancy Swanton
National Park Service
Alaska Support Office
2525 Gambell St.
Anchorage, Alaska 99503

May 13, 2003

Dear Ms. Swanton,

The following comments regarding the **Glacier Bay Vessel Quotas and Operating Requirements Draft Environmental Impact Statement (DEIS)** are submitted on behalf of Alaska Center for the Environment, Alaska Wildlife Alliance, Defenders of Wildlife, National Wildlife Federation, Oceana, The Ocean Conservancy, and The Wilderness Society. Thank you for preparing the DEIS on this significant decision affecting the natural resources of Glacier Bay.
1 Glacier Bay is a remarkable place of towering mountain peaks, tremendous tidewater glaciers, and diverse wildlife. **We support Alternative 4, the Environmentally Preferred Alternative.**

While cruise ships and other vessels are a suitable way for people to experience the splendor of Glacier Bay, vessels do impact the bay and its wildlife through water, noise, and air pollution and collisions with whales, like the one that killed a pregnant humpback in Glacier Bay in the summer or 2001. In recent years the cruise ship industry has come under increasing scrutiny as poor environmental practices and even criminal acts have come to light. In Glacier Bay, smokestack emissions from just one cruise ship frequently leave a visible haze that lingers for hours. The cumulative effect of all vessel traffic poses significant impacts to the soundscape both above and below the water surface. According to the EIS, underwater vessel noise is present 70% of the time – a statistic we find alarming. The EIS goes on to list numerous impacts from the NPS preferred alternative that we find unacceptable such as:

- "greatly increase the frequency of visible stack emissions"
- "increase associated noise exposure and risk of collisions"
- "loss of opportunities for solitude"
- "detract from the quality of the experience, including wildlife sightings"
- "increase the overall risk of fuel spills from cruise ships"

For these reasons we support Alternative 4, the environmentally preferred alternative. We are disappointed NPS did not also choose this alternative. Regardless of the alternative chosen, it is especially disappointing the NPS preferred alternative did not include the new mitigation

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR1-1	Please see general response number 1.

measures outlined in Alternative 4. We support all these additional environmental safeguards especially the following measures:

2 - Extending vessel quotas into May and September
3 - Prohibiting cruise ships and tours boats from entering Dundas Bay
4 - Reducing cruise ship speed to 13 knots to reduce collisions with marine mammals and improve air quality.
5 - Eliminating the "based in Bartlett Cove" loophole by requiring a permit for these boats.
6 - Closing the East Arm to cruise ships and tour boats
- Prohibiting cruise ships and tour boats from Dundas Bay

The essence of Glacier Bay lies in its pristine marine environment, our nation's largest protected marine ecosystem. Glacier Bay is host to a rich array of wildlife from starfish and sea anemones to threatened Steller sea lions and endangered humpback whales. It is incumbent upon NPS to carefully balance visitor access with resource protection. Where probable impacts or conflict exists, the emphasis must be on resource protection. Thank you for the opportunity to submit comments.

Sincerely,

Cliff Eames, Public Lands Director
Alaska Center for the Environment
807 G St,Suite 100, Anchorage, Alaska 99501

Paul Joslin, Conservation Biologist
Alaska Wildlife Alliance
PO Box 202022, Anchorage, AK 99520-2022

Karen Deatherage, Alaska Program Associate
Defenders of Wildlife
308 G St, Suite 310, Anchorage, AK 99501

Tony Turrini, Director of Alaska Office
National Wildlife Federation
750 W. 2nd Ave, Suite 200, Anchorage, AK 99501

Jim Ayers, Director of Pacific Region
Oceana
175 S. Franklin St, Suite 418, Juneau, AK 99801

Kris Balliet, Director of Alaska Office
The Ocean Conservancy
425 G St, Suite 400, Anchorage, AK 99501

Eleanor Huffines, Alaska Regional Director
The Wilderness Society
430 W. Seventh Ave, Suite 210, Anchorage, AK 99501

NUMBER	RESPONSE
OR1-2	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
OR1-3	Under the NPS preferred alternative, Dundas Bay wilderness waters are closed to tour vessels, and all of Dundas Bay is closed to cruise ships.
OR1-4	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
OR1-5	The "based in Bartlett Cove" exemption is eliminated under the NPS preferred alternative in the FEIS, alternative 6. Short-notice permits will be issued for anyone who makes a reservation 48 hours in advance.
OR1-6	In the NPS preferred alternative in this FEIS, alternative 6, Adams Inlet would be closed to tour vessel and cruise ships.

Rec'd 5/6/03

ATIA
ALASKA TRAVEL INDUSTRY
ASSOCIATION

May 1, 2003

Glacier Bay National Park & Preserve Vessel DEIS
c/o Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, Alaska 99503-2892

Dear Ms. Swanton:

The Alaska Travel Industry Association (ATIA) Board of Directors has approved the attached recommendation for consideration as your office finalizes the Glacier Bay National Park and Preserve Vessel Draft Environmental Impact Statement. Thank you for giving ATIA and its almost 1,000 tourism and travel members an opportunity to respond.

Congratulations on bringing this huge undertaking to a successful close that should benefit Alaskan tourism for many years to come.

ATIA looks forward to continuing cooperation with Glacier Bay National Park and Preserve on matters related to tourism in Alaska, as we work to mutually grow visitors to Alaska and improve the quality of the visitor experience.

Sincerely,

Ron Peck
President & COO

2600 Cordova Street, Suite 201
Anchorage, AK 99503-2745
Tel: 907-929-ATIA (2842)
Fax: 907-561-5727
ATIA@alaskatia.org
www.alaskatia.org

This page intentionally left blank.

ATIA Alternative 3 Recommendation
Glacier Bay National Park (GBNP) Vessel Management & Operations DEIS
May 1, 2003

ATIA Recommendation:

1 Support Alternative 3.

What ATIA Understands Alternative 3 Will Do?

Provides for a return of vessel entries into the GBNP waters for cruise vessels by up to 139 seasonal entries from June 1 to August 31 annually while allowing evaluation for up to 184 seasonal entries, limited at all times to 2 entries per day. Additionally, tour, charter and private vessels are allowed to return to pre-EIS highs, with up to 3 daily entries by tour vessels, 6 per charter and 25 for private vessels. These numbers allow for environmentally safe operations affording the greatest exposure to the majestic beauty of GBNP by the marine vessel traveling public and establish a framework within which further entries and environmental impacts can be evaluated and enacted without the need for another EIS.

NUMBER	RESPONSE
OR2-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

RECD
MAY 14 2003

Cascadia Wildlands Project   Alaska Field Office

POB 853
Cordova, AK 99574

May 11, 2003

Nancy Swanton
National Park Service
Alaska Support Office
2525 Gambell St.
Anchorage, AK 99503

Nancy Swanton:

Please consider the following comments on behalf of the Cascadia Wildlands Project, and myself as an individual, regarding the Glacier Bay Vessel Quotas and Operating Requirements DEIS:

Ideally, an EIS is supposed to meaningfully inform decision-makers of the environmental consequences of potential decisions. In this case, however, the significant decisions seem to have all been already made, and the DEIS only attempts to catalogue the damage.

1 The purpose and need statement is unnecessarily narrow. The assumption that demand for industrial tourism can be met while preserving park resources is fundamentally flawed. Endless industrial growth is not compatible with the values the Park and wilderness was created to preserve. It is unreasonable to think there is no limit to growth. The effect of the purpose statement phrasing is to imply that reduction or termination of industrial tourism shouldn't be considered.

It is also unreasonable to assume that some arbitrary amount of industrialization is necessarily compatible with the park. The DEIS does not consider a full range of alternatives, particularly for cruise ship quotas. The idea that two cruise ships per day, every day, is compatible with preservation of the park, is arbitrary. Since the DEIS never compares the impacts between different intensities of cruise ship use, it fails to disclose the impact of two cruise ships every day, as opposed to ten, or no, cruise ships every day, or on staggered days. Another DEIS should be prepared which examines a reasonable range of alternatives in intensity of cruise ship traffic.

2 Large cruise ships aren't compatible with the values the park and wilderness were created to preserve, and we urge you to seriously consider banning them in a revised DEIS. Air quality problems, untracked dumping of poisons, and legal unaccountability are routine in the wake of these ships. Cruise ships aren't

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR3-1	Please see general response number 2.
OR3-2	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

compatible with wilderness, period. It is a lie to call a shoreline wilderness when there's a 3,000-person city floating just off it.

3 We are concerned about disturbance impacts, particularly from large ships and belligerent whale-watchers, to marine mammals (in particular, harbor seal, sea lion, Dall's porpoise, orca, sea otter, humpback whale, harlequin ducks and waterfowl, kittlitz's murrelet and other seabirds, raptors, and shorebirds, ,). The DEIS doesn't support a high degree of confidence in the conclusion that populations will not be negatively impacted. This is especially worrisome for those whales and sea lions who are currently, officially at risk of extinction.

4 The threshold determinations of what is and isn't important to marine mammals and birds as far as disturbance are arbitrary. The assurances (pg.4-114) that disturbance won't rise to Level B harassment are based in legalisms and semantics, not ecological information. The assumption that changing use areas for these critters is unimportant isn't supported.

5 The risk of invasive species is very real, and should be guarded against by banning cruise ships from the bay. One publication from ADF&G doesn't sufficiently support labeling the risk "low" (p.4-153). Potential impacts are so large that any risk is high. Absence of conclusive evidence that some species is on its way over on some ship shouldn't be mistaken for evidence that there isn't a risk.

6 We are concerned about legal or illegal dumping from cruise ships in particular, but also by all the boats who use the bay. The sinister record of Carnival Corp. is sufficient to ban them from the bay for fear of illegal dumping alone. Cruise ships shouldn't be allowed.

7 A related concern is of a large oil or fuel or other hazardous material spill. Holding the most fuel by far, cruise ships are a serious threat. Simply relying on state and federal regulations to mitigate impacts isn't appropriate.

Thank you for thoughtfully considering these comments, and please include us in any future notices.

Sincerely,

Gabriel Scott
Alaska field representative
Cascadia Wildlands Project

NUMBER	RESPONSE
OR3-3	The assessment of humpback whales, marine mammals, and fish conclude that vessel noise likely agitates and disturbs marine organisms, but not to the point that populations are reduced.
OR3-4	Marine mammals are disturbed by vessels, as discussed in the EIS. However, the reactions of marine mammals is generally within their normal range of behaviors and is not sufficient to cause population declines or to eliminate certain marine mammals from portions of Glacier Bay or Dundas Bay.
OR3-5	The Park Service appreciates that there are risks associated with potential invasive species. The risk is anticipated to be less than in ports because ships do not discharge ballast water in the park.
OR3-6	The Park Service is concerned about any type of dumping in the park. In general, cruise ships do not discharge in the park. As part of the process of selecting concessioners, the cruise ships and tour vessels submit environmental management plans. These plans detail the precautions that the ships undertake to prevent accidental discharges. All other vessels must comply with the state, federal, and international maritime laws regarding discharges.
OR3-7	The Park Service appreciates that oil, fuel or hazardous material spills are possible and has existing plans to address those concerns.

postmarked
MAY 14 200

Rec'd
MAY 20 2

Center for Biological Diversity
Sitka Conservation Society

Glacier Bay National Park and Preserve Vessel DEIS **5/14/03**
C/O Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, Alaska 99503-289

Comments on Glacier Bay EIS on Vessel Quotas and Operating Requirements

The following comments are submitted on behalf of the staff, board and members of the Center for Biological Diversity (The Center), the Coastal Coalition and the Sitka Conservation Society. The Center works to protect endangered species and the ecosystems they depend upon. The Coastal Coalition was formed in the wake of the Exxon Valdez Oil Spill to promote the protection and restoration of ecosystems. In recent years, they have been involved in global marine, forest, and biodiversity preservation issues. The Sitka Conservation Society's work falls into in 3 main areas: forest conservation, coastal protection, and the preservation of wilderness and wilderness values.

Cruise ships have real and significant impacts on the marine environment and the wildlife it supports. We are concerned about the potential impacts increased vessel traffic may
1 have on a host of species such as the federally threatened Steller sea lion, the federally endangered humpback whale, the killer whale, harbor seal, harbor porpoise, bald eagle, marbled murrelet, Kittlitz's murrelet and others. Several of these species are experiencing significant population declines including: harbor seals (34-50%), Kittlitz murrelets (60%) and marbled murrelets (75%). The Park Service's preferred alternative will increase noise exposure and risk of collisions with marine mammals, increase risk of fuel spills,

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR4-01	The Park Service is very much concerned with these species as well, and many of the operating requirements have been established to protect these species while allowing people to visit the park. The DEIS included the conclusions that effects on murrelets would be moderate, meaning these effects warrant careful consideration and monitoring.

increase air and water pollution, and destroy the wilderness character of this area. We
2 strongly discourages adoption of the Service's preferred alternative and hopes the environmentally preferred alternative, alternative 4, will be adopted in the forthcoming FEIS and Record of Decision.

3 **Allowing increased vessel activity in Glacier Bay may constitute a take under the Endangered Species Act**

The Endangered Species Act prohibits federal agencies from either jeopardizing listed species or degrading their habitat.[1] Furthermore, a special permit is required to "take" any listed species protected under the act. 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.[2] "Harass" is further defined as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behaviors which include, but are not limited to, breeding, feeding, or sheltering. "Harm" is further defined as an act which may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.[3] It is indisputable that all the alternatvies, but the no action, has the potential to jeopardize, take, harass and harm the steller seal lion and humpback whale in violation of the Endangered Species Act.

[1] 16 U.S.C. § 1536.
[2] 16 U.S.C. § 1532(19).

NUMBER	RESPONSE
OR4-02	Please see general response number 1.
OR4-03	The Park Service and NOAA Fisheries have consulted regarding this matter. Please refer to NOAA Fisheries biological opinion for this proposal. The Park Service will continue to work with NOAA Fisheries on matters related to the effects of vessel traffic on marine mammals.

4 **Increased Vessel Traffic may violate the Marine Mammal Protection Act**

The MMPA was passed in 1972 in response to widespread concern that large numbers of marinec mammals, particularly dolphins, were being killed. Congress found that "certain species and population stocks of marine mammals are, or may be, in danger of extinction or depletion as a result of man's activities."[4] The overriding intent of the MMPA is that "such species and population stocks should not be permitted to diminish beyond the point at which they cease to be a significant functioning element in the ecosystem of which they are a part, and, consistent with this major objective, they should not be permitted to diminish below their optimum sustainable population."[5] The primary mechanism by which the MMPA protects marine mammals is through the implementation of a "moratorium on the taking" of marine mammals.[6] Similar to the ESA, "take" is defined broadly by the MMPA to mean "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture or kill any marine mammal."[7] It is clear that permitting cruiseships and other vessels in Glacier Bay may result in the "take" of whales, sea lions, harbor seals and other marine mammals in violation of the MMPA.

5 **Increased vessel traffic poses a risk to the declining Kittlitz's murrelet and other birds in the Bay.**

On May 10, 2001, the Center for Biological Diversity, Coastal Coalition, Eyak Preservation Council, Lynne Canal Conservation, and Sitka Conservation Society formally petitioned the USFWS to list the Kittlitz's Murrelet (*Brachyramphus*

---

[3] DEIS IV-174
[4] 16 U.S. C. § 1631(1).
[5] 16 U.S. C. § 1631(2).
[6] 16 U.S.C. § 1371(a)
[7] 16 U.S.C. § 1362(13).

NUMBER	RESPONSE
OR4-04	The Park Service is consulting with NOAA Fisheries under both the Endangered Species Act and the Marine Mammal Protection Act to ensure compliance with these laws.
OR4-05	The DEIS included the conclusions that effects on murrelets would be moderate, meaning these effects warrant careful consideration and monitoring. Please see general response number 3 for the decision-making framework that would be used to determine if cruise ship entries could be increased.

brevirostris) as endangered under the Endangered Species Act. The agency has failed in its legal obligation to make a finding on this petition.

The Kittlitz's murrelet, *Brachyramphus brevirostris*, is a small diving seabird in the Alcid family which breeds only in certain sections of coastal Alaska and to a limited extent in the Russian Far East. The largest known populations occur in Southeast and Southcoastal Alaska, where dramatic population declines have been observed over the past decade or so. Glacier Bay is believed to be the Kittlitz's murrelet largest breeding ground, with birds concentrating near the tidewater glaciers in the northern reaches of the bays. Surveys suggest a decline of 80% in Glacier Bay, between 1991 and 1999. The current worldwide population for this species likely numbers approximately 10,000 individuals, a dramatic decline from the several hundred thousand estimated to occur in the Gulf of Alaska alone in 1972.

While the exact causes of decline for this species is unknown, a variety of factors are suspected which include: widespread reproductive failure, the elimination of suitable breeding and foraging habitat by global warming, reduction in its forage fish prey due to a climactic regime shift, oil spills, disturbance from tourism and other vessel traffic, fisheries bycatch, and other factors.

Kittlitz's murrelets tend to concentrate in the same fjords and bays that cruiseships tend to target, so vessel disturbance is a particularly pressing issue for the future viability of this species. Glacier Bay National Park, which is protected from gillnet fisheries, is visited by throngs of cruiseships during the nesting season. Human activity, in particular vessel traffic, could impact the Kittlitz's murrelet in a number of ways. The DEIS fails to adequately assess these impacts. Vessels may disturb the birds and decrease feeding efficiency and/or interrupt reproductive behavior. The disturbance may be from the visual aspects (e.g. a large cruiseship with many humans standing on the deck) or from the

This page intentionally left blank.

underwater noise produced by the ship. The DEIS also fails to discuss the impacts on vessel traffic is terms of scattering forage fish, prey of the Kittlitz's murrelet and many other bird species, which could greatly decrease feeding efficiency. Young chicks may be disproportionately affected, since they are completely dependent on fish brought to them by their parents, and cannot switch to alternate forms of food if forage fish are unobtainable.

The precise effect of vessel traffic on the Kittlitz's murrelet is unknown, but the potential for harm is very high. Man-made underwater noise is a serious issue. Kittlitz's murrelets, like all other marine creatures, live in a sound environment influenced by both natural and man-made factors. The effect of man-made noise on the Kittlitz's murrelet must be assessed relative to the naturally occurring background noise level in the ocean. Sound is measured by the decibel unit, which is the ratio between a measured pressure value and a reference pressure value.[8]

An important acoustic principle is that decibel measurements are logarithmic.[9]
This means that each 10 decibel increase is a ten-fold increase in pressure.[10]
The decibel level encountered by a Kittlitz's murrelet from a given source
depends on a number of factors including the source level, source frequency, whether the source is above or below the water and how far above or below, distance of the bird from the source, and propagation of the sound through the water. The propagation of sound through the water in turn depends on water depth, temperature, salinity, topographical

---

[8] National Marine Fisheries Service. 1999. Biological Opinion for Proposed Construction and Operation of the Northstar Oil and Gas Project. March 4, 1999.
[9] U.S. Department of the Navy. 1999. Draft Overseas Environmental Impact Statement and Environmental Impact Statement for Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar. SURTASS LFA Sonar OEIS/EIS Program Manager, 901 North Stuart Street, Suite 708, Arlington, VA 22203.
[10] Id.

This page intentionally left blank.

features and other factors.[11] Putting all these principles together, one can see, for example, that a noise that raises the ambient noise level by 25 decibel 1 km from the source will make the ambient noise level 300 times greater than it would normally be.[12]

Most medium to large ships (like cruiseships) produce source sound levels in the range of 165-175 decibels, though some with source levels as high as 175-185 decibels may occur. Smaller outboard and inboard motorboats produce source levels generally less than 167 decibels, however several small boats operating near each other may produce sound levels similar to that of a larger ship.[13] It is obvious at the outset that vessel traffic within the range of the Kittlitz's murrelet produces sound levels many hundreds of times greater than what would ever be encountered in the absence of human activity. Cruiseships and Kittlitz's murrelets both tend to congregate in the heads of fjords and bays. This means that the ships approach extremely close to the birds. It may also have important consequences for sound propagation, as the noise from the ship may "bounce" off the walls of the fjords, creating an even greater sonic disturbance. Finally, sounds propagate better at greater depths, and therefore birds would be unable to escape the noise by diving more deeply. Diving, in fact, would make any disturbance from the noise worse.

Assessing the effect of human-caused noise on the Kittlitz's murrelet is extremely complex, and such studies have not yet been attempted. However, it is clear that there are at least three ways that Kittlitz's murrelets could be affected by underwater noise: (1) feeding and/or reproductive behavior could be disrupted because the birds are disturbed by the noise; (2) forage fish prey may be scattered, decreasing feeding efficiency; (3)

---

[11] Richardson, W. John. and Charles I. Malme. "Man-Made Noise and Behavioral Responses." *In*: The Bowhead Whale. Eds. J.J. Burns, J.J. Montague, C.J. Cowles. The Society for Marine Mammology. Special Publication Number 2. Lawrence: Allen Press, Inc., 1993. Pp. 631-700.
[12] NMFS 1999.
[13] Richardson and Malme 1993.

This page intentionally left blank.

individual birds could suffer permanent or temporary hearing impairment from the noise.

The Kittlitz's murrelet is on a trajectory towards extinction. The Park Service has a unique opportunity with the current Glacier Bay Environmental Review to implement regulations that may help reduce one of the primary stresses on this population, human disturbance through vessel traffic. The Service's preferred alternative is a step in the wrong direction, again we urge the environmentally preferred alternative, #4, be selected to protect this at-risk species.

Impacts on Marine Mammals:

Collisions:

6 During the scooping phase of this project, collisions with marine mammals was raised as a significant issue of public concern. An increase in vessel numbers, automatically results in an increased threat of collisions with marine mammals, including the endangered humpback whale. In July 2001, a cruise ship hit and killed a 45-foot pregnant humpback whale near the entrance to Glacier Bay National Park. This is not an isolated incident. In July 1999, the death of a humpback whale was documented in Frederick Sound hit by the cruiseship Westerdam. In 2002, the death of four fin whales were documented when their bodies were caught on the bows of ships coming into Puget Sound. Again, the Service has an legal obligation to insure mammal mammals are not injured or harmed and that no illegal take of species listed under the ESA is permitted.

The DEIS claims that collisions of large vessels with whales is not a huge concern because most whales travel nearshore (with 1 mile) while the larger boats tend to travel in the middle, deeper channel. This statement is absurd since many inlets and some of the Bay are narrow (less than 2 miles across), therefore it is highly likely there will be times when both whales and the large vessels are traveling within the same zone. Furthermore,

NUMBER	RESPONSE
OR4-06	The Park Service appreciates the concerns related to vessel collisions with marine mammals. The NPS preferred alternative in this FEIS, alternative 6, includes the 13-knot speed restriction for large vessels (vessels greater than 80 meters in length). The DEIS assessment does not dismiss the possibility of collision, in fact it includes the conclusion that collisions are inevitable. The fact that cruise ships tend to travel mid-channel, while marine mammals tend to be near shore, is a factor that reduces, but does not eliminate, the overall risk of cruise ships hitting marine mammals.

the Service's reasoning that impacts on marine mammals, whales in particular, is not a great concern because whale number are increasing at the same time that cruiseship traffic is increasing in the area. The DEIS fails to recognize that no correlation whatsoever exists between an increase in whales and large vessels. The increase in whales is directly related to a decrease in commercial whaling. For the Service to try and shirk its responsibility to protect these whales based on an increased number of whales is not only illegal, but also discouraging. The Service should be exercising all of its regulatory power to protect these majestic creatures and their habitat. More vessels and whales using the area, means collision are more likely, therefore more protective measures are need, not less.

In regards to collisions with sea lions and other smaller marine mammals, the DEIS erroneouslyconcludes this is not an issue since no documentation of such collisions exists. Again, this reasoning is illogical. When hit, sea lions and other smaller marine mammals such as harbor seals and are likely to immediately sink. Eventually the body will float to the surface as enough gas builds up in the carcass. Once resurfaced, it is often difficult to spot a rotting carcass, and at that point to accurately detect the cause of mortality. These smaller marine mammals are more susceptible to collisions with either a small or a large vessel. As with whales, the Agency needs to be considering ways to prevent such collisions rather than turn a blind eye to the problem.

Evidence exists clearly demonstrating that when a whale hits a large vessel traveling at speeds of 14 knots or greater, the collision will likely prove fatal. To prevent the likelihood of an illegal take under the ESA, we strongly urge the final alternative selected by the Service include clear stipulation that any vessel over 80 meters may not travel faster than 13 knots anywhere in the Bay. Reducing the speed to 13 knots will also reduce underwater ensonification (noise disturbance), thereby also benefiting wildlife in the area as discussed in detail below.

This page intentionally left blank.

Noise Disturbance:

We are extremely concerned about the impacts of noise from vessels within Glacier Bay. The cumulative effect of all vessel traffic poses significant impacts to the soundscape both above and below the water surface. The DEIS states underwater vessel noise is present in the area 70% of the time. This noises poses serious risks to the wildlife in Glacier Bay and is not acceptable.

7 The DEIS recognizes the risk for noise disturbance associated with such vessels, but writes it off as negligible. Yet, the document fails to provide any scientific support for the assertion that such disturbance is not significant and therefore does not constitutes harassment under the ESA. Furthermore, this section of the DEIS is remarkably speculative and fails to incorporate the best available science regarding noise-impacts to wildlife. Assessing the effect of industrial noise on marine mammals is complex. Despite the complexity of the science and the many unknown variables, it is clear that such noise may impacts marine mammals in three major ways : avoidance, masking, and temporary or permanent hearing impairment.[14]

8 In a recently release report from the National Research Council it was documented there is a disturbing lack of knowledge about the effects of ocean noise on marine mammals.[15] The report states, "Remarkably few details are known about the characteristics of ocean noise, whether it be of human or natural origin, and much less is understood of the impact of noise on the short and long term well being of marine mammals and the ecosystems on which they depend." The researchers expressed particular concern regarding the lack of

---

[14] Richardson, W. John. and Charles I. Malme. "Man-Made Noise and Behavioral Responses." *In*: The Bowhead Whale. Eds. J.J. Burns, J.J. Montague, C.J. Cowles. The Society for Marine Mammology. Special Publication Number 2. Lawrence: Allen Press, Inc., 1993. Pp. 631-700.

[15] *Ocean Noise and Marine Mammal.* Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals, National Research Council. 2003.

NUMBER	RESPONSE
OR4-07	The conclusion that current levels of noise disturbance would be minor for humpback whales and Steller sea lions is based on the apparent increasing population trends for both species in Glacier Bay. Regarding effects at the individual level, the Park Service remains committed to gathering and using the best possible information to minimize vessel noise disturbance, as can be seen by the results of its acoustic monitoring program and the inclusion of a 13-knot cruise ship speed limit in three of the six alternatives, including the NPS preferred alternative. The Park Service will continue to work with NOAA Fisheries on matters related to the effects of vessel traffic on marine mammals.
OR4-08	Detecting the effects of vessel noise on marine mammals is hindered by a lack of information on their hearing abilities and by the wide variability in their natural behavior. The Park Service will continue to conduct research to isolate the direct and indirect effects of vessel noise on marine mammals, and is in the meantime using the best available information to design management strategies that minimize these effects. Please see general response number 3 regarding the study framework to be used before increasing cruise ship traffic.

knowledge surrounding the effects of noise from the growing number of ships and oil rigs and from marine and coastal development and the overall cumulative impacts that human generated noise has on marine mammal behavior. On Alaska's North Slope, it has been documented that bowheads react to vessels more so than other industrial noise. Reactions have been documented beginning as far away as 8 miles. In general, bowheads react strongly and consistently to approaching ships by interrupting their normal behavior and swimming rapidly away. Bowheads will attempt to outswim the vessel, and if overtaken will swim away from the vessel's path. Surfacing, respiration, and diving cycles are also affected.[16] While bowheads range does not include Glacier Bay, these findings provide important insight on how other whale species may react to underwater noise.

Research recently completed on harbor seals in Disenchantment Bay, inside Yakutat Bay, between May and August 2002 found harbor seals are likely to vacate their ice floes when cruise ships approach them. The study found that 75 percent of seals entered the water when ships passed within 200 meters (656 feet). While the study is not conclusive, disturbance of seals during their late spring-early summer pupping time may significantly impact seal populations. Consistent with the recent findings in the Disenchantment Bay study, we request the seal buffer approach buffer zone be increased from the current ¼ mile to a more appropriate ½ mile. This will reduce the risk of collisions as well as distrurbance.

9

Additional Vessel Traffic Means Added Pollution.

The DEIS fails to adequately assess the risks of oil spills and other marine pollution from the view of vessel malfunction or accidents, particularly in the upper icy portions of the Bay. Three separate vessel accidents have occurred in the Bay within the past 10 years (two groundings and one fire) highlighting the inevitability of future accidents and the probability of a significant oil spill. While oil spill response in Glacier Bay is generally

[16] Richardson and Malme 1993.

NUMBER	RESPONSE
OR4-09	A major spill (i.e. over 100,000 gallons) would have a major effect. However, the risk of such a spill is very unlikely. The EIS concluded the effects to water quality would be minor, with the exception of a catastrophic oil spill.

good, no amount of response effort will aid in the case of a spill in ice filled waters since no technology exists to clean up such a spill. An oil spill resulting from a vessel malfunction or accident in the upper bays could be devastating to fish and wildlife resources. For species like the Kittlitz's murrelet, marine oil pollution is an extreme threat to the species continued survival. The lack of analysis in the DEIS on impacts of such pollution to this species and others issue is discouraging . This environmental review process is a unique opportunity to reduce the threat of an oil spill within a significant portion of the range of the Kittlitz's murrelet and other seabirds.

Lastly, we were distraught to see no analysis of impacts of potential oil spills to deep benthic environments. The DEIS writes off this risk by stating, "These habitats occur well below the depth at which they might be affected by ... oil spills". Science and common sense clearly demonstrate that spilled oil eventually sinks. The omission of such analysis is inexcusable.

Additional Safeguards are needed to protect the wildlife and wilderness quality of this area.

We request the Service adopt several mitigation measures in the FEIS to reduce the
impact of vessel traffic in Glacier Bay. First, cruise ships and tours boats should be
10 prohibited from entering Dundas Bay. The Service should be monitoring use in this are
11 and be prepared to implement a quota or prohibition on private vessel use in this area as
well if warranted in the future. Second, to reduce collisions with marine mammals,
12 reduce underwater ensonification and reduce air emissions, maximum cruise ship speed
cruise ship permitted should be 13 knots in all areas of the Bay. Third, boats" based in
13 Bartlett Cove" must be required to hold a permit like all other users, or else a large
loophole will exist in the regulations. Forth, to reduce impacts to harbor seals the
14 approaching buffer needs to be increased from ¼ mile to ½ mile. This buffer is consistent

NUMBER	RESPONSE
OR4-10	Regarding Dundas Bay, the NPS preferred alternative in this FEIS (alternative 6) establishes limits for tour and charter vessels and prohibits cruise ships. Tour vessels would be limited to one per day during the quota season and would be allowed only in the non-wilderness waters of lower Dundas Bay. Charter vessels would be limited by a seasonal-use day limit but not a daily quota during the quota season.
OR4-11	The current level of private vessel use does not warrant restricting private vessels in Dundas Bay. The Park Service does periodically monitor use in Dundas Bay and would consider additional measures if warrented.
OR4-12	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
OR4-13	The "based in Bartlett Cove" exemption would be eliminated under three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.
OR4-14	The Park Service will develop a research framework to assist the superintendent in evaluating the current vessel approach distance to harbor seals hauled out in Johns Hopkins Inlet. See general response number 3.

15 with the final results of the research Disenchantment Bay. Lastly, the East Arm should be closed to all cruise ships and tour boat traffic.

Conclusion

We applaud the Service's efforts of analyzing the impacts of increased vessel traffic in Glacier Bay. However, we feel there are several areas where scientific information is lacking and where the analysis in the DEIS is inadequate or speculative at best. The result being management decisions are being made in a vacuum. To alleviate this concern we strongly request the development of a comprehensive science plan to study the many potential impacts to park resources (air, water, wildlife) from vessel use in the Bay. We encourage this plan be designed prior to and included in the FEIS and Record of Decision. The FEIS, at a minimum must recognize the need for such a plan and strictly tie vessel numbers, especially any increase in large vessels, to the plan's development, implementation and ultimate findings.

Lastly, in the face of so much uncertainty, particularly in regards to impacts of vessels on fish and wildlife, we urge the Service to adopt the precautionary principle. Until science clearly demonstrates that these vessels are not impacting fish, wildlife, air and water quality, the Service must move slowly. Glacier Bay is an irreplaceable international treasure, we hope the Park Service moves carefully to insure it remains a wild and pristine place for generations to come.

Corrie Bosman
Alaska Program Coordinator
Center for Biological Diversity
201 Lincoln Street, #1
Sitka, Alaska 99835

Page Else
Acting Executive Director
Sitka Conservation Society
201 Lincoln Street, #4
Sitka, Alaska 99835

NUMBER	RESPONSE
OR4-15	Under the NPS preferred alternative in the FEIS, alternative 6, cruise ships and tour vessels would be allowed within the East Arm, but prohibited from entering Adams Inlet. Cruise ships rarely enter the East Arm.

David Grimes
Coastal Coalition
P.O. Box 1636
Cordova, AK 99574

This page intentionally left blank.

MAY 14 2003

FRIENDS OF GLACIER BAY

P.O. Box 135

Gustavus, AK 99826

May 14, 2003

Comments regarding the Draft Environmental Impact Statement (DEIS) for Vessel Quotas and Operating Requirements in Glacier Bay National Park and Preserve, Alaska.

C/O Nancy Swanton

EIS Project Manager

2525 Gambell Street

Anchorage, AK 99503-2892

Dear Nancy Swanton and the National Park Service,

Friends of Glacier Bay (FOGB), founded in 1979, is a small grassroots local environmental organization with a membership of 120 dedicated to preserving "ecological integrity" and "opportunities for solitude" in Glacier Bay National Park. Thank you for giving us the opportunity to respond.

The DEIS offers a preferred alternative (Alternative #3) that we cannot and do not support. Alternative #3, as stated in the DEIS, "would provide for potential future increases in cruise ships up to 184 (a 32% increase) from June through August." It further states that "Any increase in cruise ship numbers would be contingent upon the completion of studies that demonstrate the increases would be compatible with the protection of park resources."

1 No scientific study, or series of studies, no matter how detailed, thorough, or illuminating, can provide an unassailable argument for any ideology determined to have its way in Glacier Bay. To ask science to prove that an increase in cruise ship traffic would, for example, be harmful to humpback whales or harbor seals, is a set up. Scientists in Glacier Bay have already reported that 60% of all summertime hydrophone recordings of humpback whales in Glacier Bay have vessel noise in them.

Does this level of vessel noise disrupt the whales' ability to communicate? To find food? To rest? Nobody knows, and won't know (definitively) for a long time. That unknowing calls for caution. Faced with an industry dedicated to growth, the burden of proof must rest with that industry (to prove no harm) rather than on science (to find definitive damage to wildlife and other park resources) in the wake of increasing vessel traffic.

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR5-01	Please see general response number 3.

And what about harbor seals? Their numbers are down 65% in Glacier Bay over the last
2 ten years. Are they being impacted in any way by increased numbers of vessels (over the
last ten years) and the noise they dump into the bay each day? There are plenty of studies
to conduct at current levels, and at reduced levels, before embarking on the increases in
cruise ships specified in Alternative #3.

Alternative #3 would damage the integrity of the bay in many other ways. The following are all quotes taken directly from the Draft EIS relating to Alternative #3:

1. "would greatly increase the frequency of visible stack emissions"
2. "increase associated noise exposure and risk of collisions"
3. "eliminate opportunities to undertake traditional activities in the central portions of Glacier Bay without the presence of a cruise ship.
4. "charter and private vessel passengers and backcountry visitors could experience a loss of opportunities for solitude due to increase cruise ship traffic."
5. "reduce the naturalness of wilderness near the tidewater glaciers"
6. "eliminate days when the natural soundscape is not altered by cruise ships during the summer months."
7. "have the highest potential level of risk for whale deaths due to vessel strikes."
8. "sounds would increase up to two times per day every day in the popular destination inlets of Glacier Bay's West arm."
9. "would likely detract from the quality of experience, including wildlife sightings."
10. "increase in the overall risk of fuel spills from cruise ships"
11. "increase the number of events during which congestions would occur in inlets."

3 12. "would result in two entries per day every day of the summer season, representing the worst-case daily emission potential."

For all these reasons, Alternative #3 should not be the preferred alternative, as it now is.

Glacier Bay today has more ships, more boats, more planes, more people, and more noise
than ever before. This has to stop. In the seventh century the Moors invaded Spain; in the
twentieth century the "Mores" invaded Glacier Bay. It's time for restraint. Vessel
numbers should be reduced in Glacier Bay, the only national park in Alaska where the
4 park boundary does not end at the mean high tide line, the only place in Southeast Alaska
(and the entire Inside Passage) that controls the numbers of vessels and preserves for
wildlife and boaters a sense of quiet in favorite coves and anchorages.

Glacier Bay is our best candidate for status as a national marine preserve in Alaska, if we can keep it. For this reason FOGB supports Alternative #4, the "environmentally-preferred alternative."

At the beginning of the Executive summary of the DEIS, the NPS states: "Based on your comments, a final EIS will be prepared followed by a decision."

NUMBER	RESPONSE
OR5-02	The FEIS acknowledges that several species of wildlife, including harbor seals and Kittlitz's murrelets, have experienced population declines throughout Southeast Alaska and in Glacier Bay. Vessel traffic may cause disturbances to harbor seals and Kittlitz's murrelets; however, currently, the cause(s) of these declines is unknown. Future studies in Glacier Bay will be directed toward examining these declines and indentifying their potential causes.
OR5-03	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that 'when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.' The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.
OR5-04	Please see general response number 1.

FOGB is concerned about this. We believe this entire process is being produced by the present administration and like-minded ideologues. In the wake of a lawsuit (filed by the National Parks & Conservation Association) and a cruise ship striking a pregnant whale in the summer of 2001, killing that whale, and not reporting it… we think this entire process is being forced upon the National Park Service (indirectly if not directly) by the offices of the Secretary of the Interior and others who see nothing wrong with vessel increases in Glacier Bay, and who have little regard for public opinion when it doesn't go their way.

As reported this month's in *Sierra* Magazine, the Department of Interior recently received 360,000 public comments about snowmobiles in Yellowstone National Park. Eighty percent wanted the noisy machines banned. The administration not only approved their continued use, but increased the number allowed. In Utah, the Bureau of Land Management (BLM) wanted to open a two-million-acre region – including many potential wilderness areas – to oil and gas exploration. The BLM received fewer than 200 comments in favor of the project, and 25,200 opposed, and approved it anyway.

5 What's going on here? As one reporter recently said, "Dissenting voices carry little weight with the Bush administration – even when they represent the popular majority."

Seven years ago in Glacier Bay, during the creation of the last Vessel Management Park Regulations (cite Federal Register Vol.65, no.105, May 5, 1996, 36 CFR Part 13), "The majority of commenters (about 85%) were opposed to Alternative 5, which included a 72% increase in cruise ship entries… The majority of commenters (about 85%) favored Alternative 4, which proposed increased resource protection and decreased vessel entries… The majority of commenters (about 90%) wrote to support the proposed vessel closures or other mitigation measures." And yet the National Park Service implemented the preferred alternative. When a FOGB board member questioned the superintendent about it, his response was that the NPS felt that it didn't get a broad cross-section of comments that represented the public-at-large. According to NEPA, the NPS has no authority to make subjective decisions on who responds and who doesn't. NEPA states that (by law) the regulatory agency must give strong consideration to the comments received in making its decision.

FOGB asks the National Park Service to stand with courage and conviction and choose Alternative #4 as the final alternative, with these additions and modifications:

1. NPS vessels must themselves be limited in the park. As James Madison said in the founding of our democracy, our system of rules and laws will
6 work if two things happen: 1) if the people accept the rule of law, and 2) if the government that imposes that rule also accepts it, and does not exempt itself. The government must be accountable as well. If not, the people will remain in constant antagonism of its authority.
2. Limit vessels in Bartlett Cove. The nearby town of Gustavus, population
7 350, had only 80 people 25 years ago. As presently platted by the State of Alaska, the town could one day have 1,000 homes & 5,000 people. If

NUMBER	RESPONSE
OR5-05	Public comments are considered and addressed in accordance with the National Environmental Policy Act provisions, the Council on Environmental Quality regulations, and NPS policy. The Park Service considers them carefully, and substantive comments are addressed. The NPS preferred alternative presented in the FEIS, alternative 6, came about, in part, to respond to public comment.
OR5-06	Please see general response number 4.
OR5-07	The size of the Bartlett Cove marina or the number of moorings in Bartlett Cove is outside of the scope of this EIS.

Bartlett Cove, which serves as a marine trailhead into the park, one day becomes a de facto community boat harbor or home port based on having a "mooring buoy," the trailhead – and the trail (the park) – will get trampled. Strict limits must be set on vessels mooring in Bartlett Cove.

8 3. Extend the vessel quota season into all of May and September.
9 4. Address vessel restrictions in Dundas Bay.
10 5. Do not shrink whale waters.
11 6. Address commercial fishing vessels and kayaks, which can disturb nesting birds and other wildlife in ways no other vessels can.
12 7. Address the "noise signatures" of different vessels. In the future, reward quieter vessels with easier access. Work with the U.S. Coast Guard to establish a prototype "noise scale" in marine waters, a rating system for vessels that determines if they can or cannot enter Glacier Bay.

Glacier Bay is here to overwhelm us, not for us to overwhelm it. Presently we are overwhelming it, one "more" boat and ship at a time. If we expect to teach people about sensitivity and rarity, about gratitude, respect and restraint, and how to go about saving the America that used to be… if we are truly borrowing this place from our grandchildren and not just inheriting from our grandfathers, then we have to set limits, not only for others but for ourselves as well.

Friends of Glacier Bay – 120 people of diverse professions who all know the bay well – asks the National Park Service to do this. Choose Alternative #4 and our membership will be there to back you up.

Thank you,

Kim Heacox, FOGB

NUMBER	RESPONSE
OR5-08	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
OR5-09	Regarding Dundas Bay, the NPS preferred alternative in this FEIS (alternative 6) establishes limits for tour and charter vessels and prohibits cruise ships. Tour vessels would be limited to one per day during the quota season and would be allowed only in the non-wilderness waters of lower Dundas Bay. Charter vessels would be limited by a seasonal-use day limit but not a daily quota during the quota season.
OR5-10	Please see general response number 5.
OR5-11	A discussion of the effects of commercial fishing vessels and kayaks on nesting birds is included in the marine birds cumulative effects section of the FEIS.
OR5-12	The Park Service appreciates the need for this information and is continuing to monitor underwater ambient noise and collect vessel sound signatures from a variety of vessel types. The establishment of underwater noise standards for commercial vessels entering Glacier Bay will be considered by the Park Service if it is determined to be practicable, given the wide variation in the characteristics of vessels sounds.

MS. FRANKEVICH: Hi, I'm Joan Frankevich with National Parks Conservation Association, commonly referred to as NPCA. And I want to thank you for this forum and the opportunity to comment on the EIS and mostly I want to thank the Park Service and the consultants for preparing an EIS. We appreciate that the EIS has been prepared. We strongly believe that is the proper process and are very pleased that that's been followed.

Also we appreciate the EIS contains all the previous protective measures from the earlier EA, from the 1996 decision and we support retaining all of those.

Our goal, our priority remains with the protection of the resources, the values and purposes of Glacier Bay and vessel management is a key issue for that. There's a variety of vessels that use Glacier Bay ranging everywhere from, you know, kayaks, mid-size to large cruise ships, and they each provide a different experience, each has a place and they each have impacts. And so each needs to be managed to minimize those potential impacts for the long-term future of Glacier Bay. As we all know Glacier Bay is an extraordinary treasure and of all the places on earth it needs to be held to some of the highest standards.

We believe the resource protection has to come first, and that visitor enjoyment is secondary to that.

Just to reiterate for some of those who might be less familiar, vessels certain can and do have resource impacts, cruise ships have a long list of violations within Alaska, elsewhere in the world violating air quality standards, negligent discharges, even willful acts of illegal dumping. Some of our top concerns that vessels impact that we're concerned with in Glacier Bay are air pollution, oil spills and disturbance to wildlife. And some of these, we think, are verging on unacceptable levelsalready and so any increase in vessels, these things need to be very closely monitored. Air pollution already weather inversions can -- in certain days when there's air inversions cruise ships can leave a visible emissions that last for hours and according to the EIS inversions occur on one-third of all days, that's a pretty high number of potential impact there or an impact that frequently occurs.

Oil spills, there have been a number of accidents within Glacier Bay in recent years and so recognition that the greater number of vessels the greater potential for a devastating accident, and it's certainly within possibilities to have a major oil spill especially with the size of some of the cruise ships today in Glacier Bay.

And then we're especially concerned about any kind of wildlife disturbance, the decline in harbor seal population concerns us. The declines in kittlitz and marbled murrelets, collisions with whales are definitely a concern. And a little bit of a red flag concern that popped out for me on the EIS is with soundscape and that according to the EIS, nearly 70 percent of sound samples taken contained vessel noise. That to me seemed -- I was surprised by that, it seems extremely high and I think we need to continue studies on how that affects the marine mammals because I already feel like we might be on the verge of maximum levels for that.

Grouping:	Organization
Format:	Public Hearing Transcript

NUMBER	RESPONSE
OR7-1	Since your comments were contained in the letter that the National Parks Conservation Association (NPCA) submitted, please see the responses to the NPCA letter.

Given the potential for resource impacts we're especially concerned with the operation of vessels and their management. We support all the operating requirements in Alternative 4. We're very pleased to see those and we support all of them. It's the behavior of the boats that can potentially have some of the most damagingimpact, even more so than numbers, is the behavior.

And so we specifically support the following provisions; extending the season for quotas and vessel limits for all vessels into May and September. Whales are certainly there, the air quality, oil spills, all those concerns are just the same in May and September.

Placing all boats under permit, including boats that are private boats that are based in Bartlett Cove and not under any existing permit, removing that loophole in Alternative 4 we very much support.

Defining mid-channel routes for cruise ships. Reducing speeds from 20 knots to 13 knots for largevessels to just reduce risk for collision with marine mammals.

Extend the quarter mile limit for boats approaching seals hauled out on ice to year-round limits. And we also would like you to consider maybe even making that limit for large boats even greater, perhaps a half mile from a quarter mile.

We support the additional non-motorized waters in Alternative 4 and we support establishing vessel quotas in Dundas Bay.

We're disappointed that these measures were not chosen as the preferred alternative. And regardless of what final alternative is chosen, we recommend that these protective measures be included in that final decision.

Just some more specific recommendations. We're still evaluating the EIS so this is not at all complete, but some additional recommendations is more specific justification on what is necessary, what would be considered adequate to increase cruise ships above the status quo.

Perhaps pick some indicators such as number of whales or just, you know, amount of air pollution or amount of sound and if you reach certain levels or reach certain impacts have a plan that would reduce vessel numbers until you fall back within what's acceptable levels. And also to consider a top speed limit for all vessels in the Bay.

And just to sum up, we realize science isn't perfect. It can't answer every question. But when answers aren't clear then we feel like it's incumbent that we err on the side of protection.

Thanks.

This page intentionally left blank.

postmarked
MAY 14 2003
rec'd
MAY 22 2003

NATIONAL PARKS CONSERVATION ASSOCIATION®

Protecting Parks for Future Generations®

May 14, 2003

Nancy Swanton
National Park Service
2525 Gambell Street
Anchorage, Alaska 99503

RE: Glacier Bay Vessel Quotas and Operating Requirements Draft EIS

Dear Ms. Swanton,

Thank you for the opportunity to comment on the Vessel Quotas and Operating Requirements Draft Environmental Impact Statement (EIS) for Glacier Bay National Park & Preserve. The National Parks Conservation Association (NPCA) was established in 1919 to protect and enhance the National Park System. Today we have more than 300,000 members of which 1,000 are in Alaska.

NPCA's priority remains with the protection of the resources, values, and purposes of Glacier Bay. Glacier Bay National Park is a world of glaciers and whales, seals and seabirds, snowcapped mountains and deep fjords. Pristine marine waters provide habitat for an extraordinary array of wildlife. On the land, pioneer plant communities grow in areas recently exposed by receding glaciers. It is an iconic place of unrivaled scenic, geologic, and wildlife values that are of world significance. Careful vessel management is key to fulfilling the mandate of the Organic Act and managing Glacier Bay National Park unimpaired for future generations.

NPCA has a long history of involvement with Glacier Bay and with the 1996 Vessel Management Plan in particular. The preferred alternative, as it is currently written, does not address the concerns of the United States Court of Appeals for the Ninth Circuit in NPCA v. Babbitt, 241 F.3d 722 (2001). The necessary research has not been done to
1 warrant an increase to 184 cruiseships and the EIS correctly states that. Furthermore, the EIS does not indicate how these research short-falls will be addressed. We believe that this can only be addressed through a comprehensive science plan that includes research timelines, testable hypotheses, and outcomes that would allow for increases to be made –
2 or decreases if the research so warrants. This science plan should be adopted as part of this environmental process to strictly tie vessel numbers, especially any potential cruiseship increase, to the plan's ultimate findings.

ALASKA REGIONAL OFFICE
750 West 2nd Avenue, Suite 205 • Anchorage, AK 99501
(907) 277-6722 • Fax (907) 277-6723
alaska@npca.org • www.npca.org

NATIONAL OFFICE
1300 19th Street, N.W. • Washington, D.C. 20036
(202) 223-NPCA(6722) • Fax (202) 659-0650
npca@npca.org • www.npca.org

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR6-01	Please see general response number 3.
OR6-02	Please see general response number 3.

NPCA Preferred Alternative

Operating Requirements

Given the potential for resource impacts, we are especially concerned with vessel operation and management. We enthusiastically support all the new criteria and additional operating requirements in Alternative 4. It is the behavior of boats that is potentially the most damaging to park resources. The NPS preferred alternative must include the new protection measures outlined in Alternative 4. Regardless of what final alternative is chosen, we strongly recommend that Alternative 4's provisions be included. We specifically support the following provisions:

3 1. Extending the season for quotas and speed limits for all vessels into May and September.

4 2. Placing ALL boats under permit by removing the loophole that allows private boats to be "based in Bartlett Cove" and therefore not under any existing permit or limit.

5 3. Defining mid-channel travel routes for cruise ships.

6 4. Reducing speeds from 20 knots to 13 knots for cruise ships to reduce the risk of collision with marine mammals and improve air quality.

7 5. Extend the ¼ mile limit (although NPCA recommends a ½ mile limit) for boats approaching seals hauled-out on ice in John Hopkins inlet to year around.

8 6. Closing the East Arm to cruise ships and tour boats.

9 7. Establishing vessel quotas for Dundas Bay that eliminate cruise ships and tour boats.

10 The failure of the National Park Service to include, in its preferred alternative, the additional protection measures as outlined in alternative 4 is inconsistent with the guidance of the 9th Circuit Court and the National Park Service's obligations under the Organic Act.

Additionally, the final EIS must include the following protective measures:

11 1. Increase the limit to approaching seals from ¼ mile to ½ mile based on the final results of the recent research in Disenchantment Bay (preliminary results indicate 600 meters – a bit less than ½ mile – as an appropriate distance to avoid disturbance).

12 2. Create a cap on NPS administrative use. We fully support NPS vessel traffic for administrative, law enforcement and scientific purposes. Nonetheless, we believe it would be helpful for NPS to put limits on themselves to be seen as a credible authority for imposing limits on others, and to improve its community relations.

13 3. A quota for private vessels in Dundas Bay. It's not unusual for use patterns to change suddenly and unexpectedly. At the very least we recommend NPS monitor and be prepared to implement a quota if necessary.

14 4. Expand the 10 knot speed limit beyond designated whale waters to other parts of the bay when whales are present. This will broaden the recognized benefits of the 10 knot limit to all whales regardless of where they are encountered in the bay.

NUMBER	RESPONSE
OR6-03	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
OR6-04	The "based in Bartlett Cove" exemption would be eliminated under three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.
OR6-05	In general, cruise ships stay mid-channel when traveling within the park. Therefore, the Park Service has determined that defining mandatory routes would be unnecessary.
OR6-06	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
OR6-07	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the seasonal timeframe of when vessels must remain greater than 0.25 mile (0.4 kilometer) from harbor seals hauled out on ice in Johns Hopkins Inlet. (The current seasonal restriction is from July 1 through August 31.)
OR6-08	Under the NPS preferred alternative in this FEIS, alternative 6, the East Arm would remain open to both cruise ships and tour vessels; however, Adams Inlet is closed to all cruise ships and tour vessels. Under current regulations, upper Muir Inlet is closed to all motorized vessels from June 1 to July 15. In general, cruise ships do not currently travel into the East Arm.
OR6-09	Regarding Dundas Bay, the NPS preferred alternative in this FEIS (alternative 6) establishes limits for tour and charter vessels and prohibits cruise ships. Tour vessels would be limited to one per day during the quota season and would be allowed only in the non-wilderness waters of lower Dundas Bay. Charter vessels would be limited by a seasonal-use day limit but not a daily quota during the quota season.
OR6-10	As indicated above, the NPS preferred alternative in the FEIS, alternative 6, includes many of the additional protective measures outlined in alternative 4.
OR6-11	The Park Service will develop a research framework to assist the superintendent in evaluating the current vessel approach distance to harbor seals hauled out in Johns Hopkins Inlet. See general response number 3.
OR6-12	Please see general response number 4.
OR6-13	The current level of private vessel use does not warrant restricting private vessels in Dundas Bay. The Park Service does periodically monitor use in Dundas Bay and would consider additional measures if warrented.
OR6-14	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.

Cruise, Tour, and Charter boat numbers
Based on the lack of the specific new operating requirements found in alternatives 4, and
the resource concerns and EIS shortcomings stated below, NPCA has serious concerns
with the NPS preferred alternative. We only support the current vessel numbers for
15 charter, tour, and cruise ships. Any potential increase to 184 cruiseships could only occur
if the science demonstrates there will be no harm to the resources and with major
modifications to the final preferred alternative including:

- Adoption of all the new criteria and operating requirements outlined in
16 Alternative 4
- Creation and implementation of a science plan to gather the information necessary to ensure increased vessel numbers will not impact park resources and linking any cruiseship increase to findings of no resource impairment.

Private vessel numbers
17 We accept the small increase to private boat entries in Alternative 4 as it generally
mirrors the status quo by including currently non-permitted travel into the permit system.
18 We don't support additional increases to private vessel quotas (such as in Alternative 5)
because of concerns about resource impacts, especially wildlife, associated with large
numbers of private boats. Private boats typically travel close to shore and are generally
piloted by those lacking local experience.

We also support decisions reflected in the EIS to retain all five Wilderness Waters and
three non-motorized waters; to not include an unrestricted vessel corridor to Bartlett
Cove; and to include several of our scoping suggestions such as extending the operating
19 season to May and September, adding a 92 cruise ship limit alternative, and lowering
speed limits. Conversely, NPCA suggestions that the No Action alternative should be
20 107 cruise ships, and that NPS should work collaboratively with the State to protect
whales in Icy Straits should have been adopted.

Vessel Impacts and Resource Concerns
A wide variety of vessels are used in Glacier Bay ranging from cruise ships to mid-sized motorboats to kayaks. Each provides a different experience and has its place. Each has its own impact to wildlife, fragile marine ecosystems, air and water quality. All vessels need to be managed to avoid or minimize impacts. (Although this document covers motorized vessels only, we look forward to addressing proper management of kayaks in the upcoming Backcountry Plan.)

Cruise ships especially have a long list of violations in Alaska and throughout the world including exceeding air quality standards, negligent discharges, and willful acts of illegal dumping. Within Glacier Bay:

- cruiseships routinely leave a visible haze that lasts for hours
- a cruiseship hit and killed a pregnant humpback whale in July 2001
- three vessel accidents in the past 10 years (two groundings and one fire) highlight the inevitability of future accidents and the probability of a significant oil spill.

NUMBER	RESPONSE
OR6-15	The NPS preferred alternative in the FEIS, alternative 6, includes more information regarding the basis for increasing cruise ship numbers and study needs. Please see general response number 3.
OR6-16	Please see previous responses to NPCA comments regarding operating requirements.
OR6-17	The NPCA's acceptance of an increase in private vessels under alternative 4 is noted.
OR6-18	As noted in the DEIS, the additional private vessels under alternative 5 and the NPS preferred alternative in the FEIS, alternative 6, result from the removal of seasonal entry limits. Daily limits would remain at 25. The actual use is anticipated to be lower than the maximum allowable because rarely are maximum use levels achieved. Historically, maximum use occurs only during July. The elimination of the "based in Bartlett Cove" exemption would offset some potential increases in private vessel entries, particularly for traffic in lower Glacier Bay. Overall, private vessel use is expected to be similar to that that would occur under the no-action alternative, alternative 1. The analysis in the EIS acknowledges that private vessels can cause unique adverse effects.
OR6-19	The no-action alternative is the status quo, which is the vessel quotas and operating requirements currently in place, including 139 cruise ship entries during June through August.
OR6-20	The actions considered in the EIS are limited to Glacier and Dundas Bays. The Park Service welcomes opportunities to protect other areas, including working cooperatively with others to develop management strategies for areas such as Icy Strait. However, any actions outside of Glacier and Dundas Bays are outside the scope of the EIS.

We continue to have concerns about these and other resource impacts to Glacier Bay. The EIS repeatedly states many of these existing impacts will be greatly increased under Alternative 3, some of which (such as air quality, soundscape, and risk of oil spills) are already reaching unacceptably high levels. Those of utmost concern include:

Air Pollution – Visible haze from just one cruise ship frequently occurs during weather
inversions. The EIS estimates that "inversions occurred for at least part of the day on
21 about one-third of all days, and occurred mainly during clear conditions." (p. 3-22). We
find the likelihood of visible haze on 1/3 of all days to be shockingly high. This impact is
severe enough to be impairment of the park's air quality resource. Studies to measure the
level of permanent impact of air pollution on vegetation, especially the emerging lichens,
22 should be included as part of the science plan. Further, no vessel should be permitted in
Glacier Bay National Park without best available control technology to minimize air
23 pollutants.

Wildlife Declines - Recent declines of the following species are of high concern: harbor
24 seals (34-50%), Kittlitz murrelets (60%) and marbled murrelets (75%). Whether these
declines are due to vessel impacts, natural causes, or are unknown, it is important to
lessen avoidable human caused impacts while populations are stressed.

Collisions – According to the EIS collisions with marine mammals "are rare, but
25 unavoidable." Is any collision acceptable, even if its rare?

Soundscape – According to the EIS one study of underwater noise found "nearly 70% of
26 sound sample taken contained vessel noise." Noise has profound effects on marine
mammals, such as the endangered humpback whale. This is extremely worrisome and
may be verging on impairment.

27 Oil Spills - Generally the spill response is good throughout Glacier Bay except in ice
filled waters where no response is possible. An oil spill resulting from a vessel
malfunction or accident in the upper bays could be devastating.

Shortcomings of the EIS

Some topics in the EIS are lacking and conclusions reached are frequently speculative. Science is not linear, yet in numerous places conclusions were inaccurately based on direct proportional/linear effects between effect and vessel traffic. Listed below are those areas of most concern to NPCA.

28 Increase to 184 cruise ships – The preferred alternative includes the option to increase
cruise ship quotas to 184, yet fails to outline clear criteria or methods for such an
increase. Any future increases should not be allowed until extensive studies are
completed and rigorously reviewed to assure that the values and purposes of Glacier Bay
29 are protected. If increases are approved, they should be phased in slowly to effectively
measure any impacts of the increase. Multi-year or decades long time-lags should be
used to allow adequate observation of effects of any increased vessel traffic. Again the

NUMBER	RESPONSE
OR6-21	Additional information about air quality, based on direct observations, has been included in the FEIS. The EIS notes that visible haze does occur under current conditions. The NPS preferred alternative in the FEIS, alternative 6, requires that specific monitoring and standards be established to better understand current air quality conditions and to prevent further deterioration of visibility. Cruise ship numbers could not be increased until air quality and visibility standards are set and monitoring is in place.
OR6-22	Based on the threshold levels presented in the EIS for air quality, air quality would not be impaired under any of the alternatives. However, sufficient information is lacking related to air quality to justify any increase in cruise ships. The NPS preferred alternative, althernative 6, requires very specific air quality standards and monitoring prior to any increase in cruise ship numbers.
OR6-23	The Park Service considers favorably prospective concessioners with environmentally responsive proposals. However, the Park Service may not impose any additional permittee operating conditions in the areas of air, water, and oil pollution beyond those determined by other appropriate agencies.
OR6-24	The FEIS acknowledges that several species of wildlife, including harbor seals and Kittlitz's murrelets, have experienced population declines throughout Southeast Alaska and in Glacier Bay. Vessel traffic may cause disturbances to harbor seals and Kittlitz's murrelets; however, currently, the cause(s) of these declines is unknown. Future studies in Glacier Bay will be directed toward examining these declines and indentifying their potential causes.
OR6-25	With vessels and whales being in the same area, the possibility of collisions cannot be ruled out.
OR6-26	The assessment of humpback whales, marine mammals, and fish conclude that vessel noise likely agitates and disturbs marine organisms, but not to the point that populations are reduced.
OR6-27	A major spill (i.e. over 100,000 gallons) would have a major effect. However, the risk of such a spill is very unlikely. The EIS concluded the effects to water quality would be minor, with the exception of a catastrophic oil spill.
OR6-28	Please see general response number 3.
OR6-29	Any future increases in cruise ship numbers would be incremental.

science plan will be important for elucidating suitable chronology for increases that allow for an acceptable level of certainty that impacts could be detected.

<u>Deep Benthic Environments</u> – The omission of deep benthic environments from detailed
30 analysis is unfounded. Spilled oil eventually sinks; therefore the statement "These
habitats occur well below the depth at which they might be affected by … oil spills" (p.1-25) is inaccurate.

31 <u>Soundscapes</u> – Soundscapes are an important component of this EIS, yet this section is
remarkably speculative and does not incorporate current best science on noise-impacts to
wildlife. Additional information is needed on how noise affects whale behavior and
distribution. Also, the EIS lacks inclusion of Figures 3-5 and 3-6 regarding the
32 underwater soundscape (the wrong figures were included).

33 <u>Air Quality</u> – Overall the section was weak and suffers from lack of data. The authors
indicate further documentation is needed on monitoring opacity observations of vessels
as well as additional study to ascertain actual ambient air quality. We agree further study
is necessary and should be part of the detailed science plan and clearly outlined in the
EIS. Conclusions for Wilderness Resources for Alternative 3 indicate that wilderness
34 resources would not be impaired yet the air quality sections indicates that haze may be
visible for extended periods. This contradiction needs to be addressed in the final.

35 <u>Water Quality</u> – Oil spills were not dealt with from the point of view of vessel
36 malfunction or accidents, particularly in the upper icy portions of the bay and this topic
warrants further attention. Given that tour vessels have hit ice and damaged hulls, that oil
spilled in ice is almost impossible to clean-up, and spilled oil will have a significant
impact on the park's resources, the final needs to address more clearly what can be done
to prevent an oil spill, how such a spill would be controlled and cleaned-up, and what the
impacts of a serious fuel would be.

<u>Marine Birds and Raptors</u> – The final EIS should include results of the USGS Biological
37 Resources Division (Robards et al., 2003) study that has recently been published. This report shows profound decline in numbers of Kittlitz's murrelet (60%) and marbled murrelet (75%). These results (which were presented at the 2001 and 2002 spring science meetings in Bartlett Cove), combined with the knowledge of murrelet's susceptibility to disturbance, warrant a cautious assessment of impacts as well as additional study.

38 <u>Socioeconomic Impacts</u> – The assertion that loss of Glacier Bay as a venue would result in loss of revenue to the cruise ship industry and nearby communities is poorly justified and likely unfounded. In August 2001 nine cruise ships were denied entry to Glacier Bay as the result of a court ruling. All nine ships diverted their schedules to other tidewater fjords and apparently suffered little harm by the sudden change. Additionally decreases in vessel traffic to Glacier Bay may actually benefit outlaying areas by increasing ports-of-call to these locations. Or, conversely, as with prior vessel increases in Glacier Bay, it is quite reasonable to expect that ships will go to Glacier Bay and, thus, be diverted from

NUMBER	RESPONSE
OR6-30	Deep benthic environments were found to not be affected by vessel traffic, including potential fuel spills. The rationale is similar to overall conclusions regarding fuel spills. The risks of a major spill are considered very low. The EIS needs to focus on significant impacts.
OR6-31	The effects of vessel noise on threatened and endangered species, marine mammals, and marine birds and raptors are discussed under those sections, and not in the soundscape section. Data regarding soundscape is limited.
OR6-32	These figures were determined to be unnecessary and were removed from the EIS. The placement of figures has been corrected in the FEIS.
OR6-33	Visibility condition observations will be conducted in the summer of 2004 to assess the effect of vessels, particularly cruise ships, on visibility under different meteorological conditions. These observations also should provide information about the presence of haze. Visibility data will be collected using a camera at a strategic location. Meteorological data collected at the same time in the park should provide information to determine the effect of emissions under conditions such as inversions. This information will enable a quantitative evaluation of visibility in the park. Also see general response number 3.
OR6-34	Since the overall character and functioning of the wilderness would remain intact, even when considering cumulative effects, alternative 3 would not impact the Glacier Bay Wilderness resource.
OR6-35 & 36	A major spill (i.e. over 100,000 gallons) would have a major effect. However, the risk of such a spill is very unlikely. The EIS concluded the effects to water quality would be minor, with the exception of a catastrophic oil spill.
OR6-37	The DEIS included the conclusions that effects on murrelets would be moderate, meaning these effects warrant careful consideration and monitoring. Please see general response number 3 for the decision-making framework that would be used to determine if cruise ship entries could be increased.
OR6-38	Our analysis focuses on long-term changes. Common sense dictates that reduced access to the region's premiere attraction may reduce the region's competitive position with respect to other destinations (particularly cross-Gulf destinations, but also destinations outside of Alaska). That is the underlying premise. The Park Service agrees that further refinement of the conclusions about how reduced cruise ship access to Glacier Bay will translate to changes in ports of call in Southeast Alaska communities is warranted. We have analyzed itineraries for each cruise ship scheduled for 2003 to identify patterns between Glacier Bay calls and calls in other Southeast Alaska ports, especially Skagway. The text has been modified to include this new analysis.

other ports (such as Sitka) leading to negative socio-economic impacts to those communities. These differing scenarios need additional analysis and discussion in the final.

39 Finally, while it is admirable to be a good neighbor and understand the impacts of park decisions on neighboring communities, this information should not be a part of the decision making process. Nowhere is it stated in the Organic Act or any other park regulations or policy that the purpose of a national park is to provide economic benefits to neighboring communities. If this happens all the better, but it is certainly not a criteria for making good management decisions.

Include "Science Plan" in EIS outlining future studies

40 Many of our concerns addressed above, including how best to mitigate existing impacts, would be best addressed in a science plan. NPCA recommends the development of a comprehensive science plan to study the many potential impacts to park resources (air, water, wildlife) from vessel use in the bay. We further recommend and urge the inclusion of the science plan in the final EIS. At a minimum, the Final EIS must recognize the need for such a science plan and would strictly tie vessel numbers, especially any proposed cruiseship increase, to the plan's development, implementation and ultimate findings.

We recommend that NPS, its contractors, and the Alaska Science Center work together to develop this plan. The Alaska Science Center already has a working relationship with the park in relation to fisheries research. Applying that research to the vessel issue and outlining data-gaps and timelines will be of great importance in addressing the issues brought up in the EIS. The science plan should address all of the shortcomings outlined in the EIS. For those not reasonably attainable, proxies data options should be explored. We recommend that the science plan be peer reviewed prior to its adoption to establish it as a rigorous response to the questions posed.

Use the Precautionary Principle

41 We realize science is imperfect and cannot answer every question. If the outcome of an activity raises threats of harm even though it is not fully established scientifically, it is prudent to use the "precautionary principle" and err on the side of protection. NPCA does not read the Organic Act as a dual mandate. The language clearly states that protection comes first, and visitor use second. Many resources are showing signs of stress and may be precipitously close to major impacts, possibly even impairment. These signs are cautioning us to proceed carefully. NPCA insists that all future increases should not be considered unless there is overwhelming evidence there will be no harm. NPCA's vision is that 100 years from now Glacier Bay is still predominately ruled by natural processes. That it is a place where humpback whales, harbor seals, and murrelets thrive. The air is pristine, there have never been any oil spills, and some places remain free of the sights and sounds of the motorized world. Our hope is that 100 years from now, Glacier Bay continues to be a place where visitors find a great sense of awe and renewal of the human spirit.

NUMBER	RESPONSE
OR6-39	The Park Service will consider all relevant factors in making a decision about vessel use in Glacier Bay and Dundas Bay, most certainly including the Organic Act.
OR6-40	Please see general response number 3.
OR6-41	Park Service policy states that "when there is a conflict between conserving resources and values and providing for enjoyment of them, conservation is to predominate." When dealing with unknown risks, the Park Service agrees that for any action they should proceed with caution. As an example, under the NPS preferred alternative in the FEIS (alternative 6), cruise ship numbers would be increased only after clear indicators have been established and monitoring systems are in place. Increases would only be made incrementally. Based on current understanding, it is very unlikely that cruise ship numbers would increase to maximum levels for many years, if ever. The NPS preferred alternative allows the superintendent to exercise judgment and caution when considering any increase in cruise ships.

We sincerely thank you for your continued efforts for the best possible stewardship of Glacier Bay National Park. Glacier Bay is one of the most outstanding natural places on earth and must be held to the highest of standards.

Sincerely,

Joan Frankevich

Joan Frankevich
Program Manager-Alaska office

J Stratton

Jim Stratton
Alaska Regional Director

This page intentionally left blank.

National Parks Visitors Alliance

www.npva.net • P.O. Box 1832 • Scottsdale, Arizona 85252

Protecting America's National Parks

Postmarked MAY 14 20

recd MAY 16 20

May 14, 2003

Nancy Swanton
National Park Service
Alaska Support Office
2525 Gambell Street
Anchorage, Alaska 99503

RE: Comments on the Glacier Bay National Park & Preserve March '03 Draft Environmental Impact Statement vessel quotas & operating requirements

1 The National Parks Visitors Alliance ("NPVA") strongly supports and encourages the adoption of Alternative Three contained in the March 2003 Draft Environmental Impact Statement on vessel quotas and operating requirements.

NPVA's position is that Alternative Three allows for the greatest possible number of visitors that the Park's resources can reasonably sustain. Alternative Three is consistent with the National Parks Service's mission under the Organic Act to "*promote and regulate the use of the Federal areas known as national parks .... to conserve the scenery and the natural and historic objects and the wild life 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.*"

Alternative Three provides for conditional future increases of cruise ships from 134 ships up to 184 ships per season. An increase of allowing up to two cruise ships per day translates to an increase of up to an additional 100,000 park visitors each year. It should be noted that cruise ship tours are self-contained and they are the highest revenue/profit producers for the Park. Increasing this mode of visitation poses a negligible to minor impact on Park resources and values. The impact on visitor experience is negligible, given that over the last five years 98% of park visitors use some form of motorized transportation to enjoy the park and that even the 7,600 annual back-country visitors used some form of motorized transportation to gain access to Park.

Increasing the number of Park visitors under Alternative Three would be contingent upon demonstrating that any increases are compatible with park resources (i.e. humpback whales and Steller sea lions). With the amount of study that has already been conducted and since Glacier Bay's past visitation increases have had no significant impact on Park resources, NPS should adopt Alternative Three and immediately begin the process of increasing the opportunities for more Americans to visit and enjoy Glacier Bay National Park.

Respectfully submitted,

R. Lamar Whitmer
Chairman

CONSERVATION • CONSULTATION • PRESERVATION • VISITATION

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR8-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: **5/9/03**

Name: Welch, Edmund

Organization: Passenger Vessel Association

Address: 801 North Quincy Street
Suite 200
Arlington, VA 22203
US

Email: ewelch@vesselalliance.com

DEIS Information: *Chapter:*
Section:
Subsection: US
Page:

Comments: Passenger Vessel Association 801 North Quincy Street, Suite 200 Arlington, VA 22203
Phone: 703-807-0100 Fax: 703-807-0103 Email: PVA@vesselalliance.com
www.passengervessel.com May 9, 2003 Glacier Bay National Park and Preserve Vessel
DEIS C/O Nancy Swanton EIS Project Manager 2525 Gambell Street Anchorage,
Alaska 99503-2892 The Passenger Vessel Association is the national trade association
for U.S.-flag passenger vessels of all types. Included within our membership are
small-ship overnight cruise vessels and day excursion vessels. Most of the companies
holding tour vessel permits for Glacier Bay National Park and Preserve are members of
the Passenger Vessel Association, as are several of the charter vessel permit holders.
We appreciate this opportunity to comment on the Draft Environmental Statement on
Vessel Quotas and Operating Requirement for Glacier Bay National Park and Preserve.
Nearly all visitors to Glacier Bay National Park and Preserve come by some type of
vessel. The DEIS provides little, if any, supportable data that these visitors or the
vessels in which they are conveyed impair the natural resources of the park. In certain
places, the DEIS, through a rather speculative process, attempts to evaluate the
quality of a visitor's experience. It concludes if the number of vessels permitted in the
park was reduced, a minority of visitors might enjoy some degree of qualitative
improvement to their visits. However, the document fails to acknowledge that there
certainly will be a complete degradation of the quality of the park experience for those
1 visitors who will be shut out of the park by the decrease in vessel entries. Any
alternative that reduces the number of permitted entries by tour vessels is
unacceptable. These operators provide an attractive alternative for visitors that prefer
2 not to travel on a large cruise ship. For this reason, Alternative 4 should be rejected.
The tour vessels currently permitted in the park are U.S.-flag vessels. Not only do
these vessels fly the U.S. flag, but their crews are American citizens, their vessels are
built in the United States, their companies pay U.S. and state income taxes, and at
least 75% of their stock is held by U.S. citizens. Since they pay U.S. income taxes (as
do their crew members), they directly support the operations of the National Park
Service. The same can not be said for the foreign-registered, -built, -owned, and -
3 crewed vessels holding the cruise ship permits. National Park Service policies should
support U.S. companies that pay U.S. taxes. In the event that a U.S. company begins
to operate a U.S.-flagged vessel in the cruise ship category, it should be able to obtain
entry permits for Glacier Bay National Park and Monument. Similarly, the Park Service
should adopt no management plan that decreases entry opportunities for U.S.-flagged
vessels in the tour vessel category, and it should contemplate a methodology for
increasing permits for that category if such a demand develops in the future. Thank
you for consideration of the recommendations of the Passenger Vessel Association.
Sincerely, Edmund B. Welch Legislative Director

Grouping:	Organization
Format:	Web Comment

NUMBER	RESPONSE
OR9-1	This issue is addressed under the "Opportunity" portion of the Visitor Experience subsection (4.4.2). Under alternative 4, the EIS states that this alternative would have major effects on the opportunity for cruise and tour vessel passengers to visit Glacier Bay.
OR9-2	The NPS preferred alternative in the FEIS (alternative 6) does not reduce tour or charter vessel entries.
OR9-3	Certain local residents are afforded a statutory preference for providing visitor services in the park and preserve. The nationality of vessel ownership is not an environmental consideration.

Rec'd

MAY 14 2003

Sierra Club Alaska Field Office
201 Barrow Street, Suite 101
Anchorage, Alaska 99501
May 14, 2003

VIA ELECTRONIC MAIL
Nancy Swanton
National Park Service
2525 Gambel Street
Anchorage, Alaska 99503

Re: Draft Vessel Management Plan/DEIS, Glacier Bay National Park and Preserve

Dear Ms. Swanton:

Thank you for the opportunity to submit comments on the draft Vessel Management Plan/DEIS. I am doing so on behalf of the Sierra Club, a national environmental organization of 700,000 members with chapters in every state.

Glacier Bay National Park and Preserve is a very special place for members of the Sierra Club. John Muir, our founder, explored Glacier Bay in the late 1800's. His published accounts of the area's magnificence ultimately led to the establishment of Glacier Bay National Monument. And over the years since the monument's establishment, Sierra Club members have been in the forefront of efforts to achieve the highest degree of protection for the park, as well as to defend it against proposed incompatible uses and commercial resource extraction.

Thus it is disappointing to see the National Park Service identify an "environmentally preferred alternative" 4 that, among the alternatives presented, is the most consistent with Congress's directives for the park, and then reject it in favor of a less protective, commercially oriented, and mediocre Alternative 3.

1 Our recommended alternative is Alternative 4, modified as follows.

2 1. Include commercial fishing vessels in the plan.

Commercial fishing is being phased out of the Bay, but may continue indefinitely in other park waters. Unlike cruise ships, tour boats, and private pleasure craft, commercial fishing vessels are extracting park resources using nets, longlines, pots, and other gear that may ensnare or otherwise interfere with the free movement of marine mammals, especially whales. Commercial fishing vessels also make significant contributions to underwater sound levels, and add to the potential of ship-whale collisions. There is no reason why these vessels should be exempt from the plan.

3 2. Provide days during the visitor season when no cruise ships and tour boats would be present in the Bay.

Grouping:	Organization
Format:	Comment Letter

NUMBER	RESPONSE
OR10-1	Please see general response number 1.
OR10-2	Federal law authorizes commercial fishing in the park. The effects of commercial fishing vessels have been evaluated in the Commercial Fishing Environmental Assessment (NPS 1998). In this EIS, commercial fishing vessel effects are considered in the cumulative effects sections of all resources affected.
OR10-3	Cruise ships provide the means by which over 90% of the visitors to Glacier Bay view and enjoy the park. Currently, cruise ships do not travel into several areas of Glacier Bay, including Whidbey Passage, Berg Bay, Fingers Bay, and Queen Inlet. Cruise ships rarely enter the East Arm. These areas currently provide visitors on tour, charter, and private vessels opportunities to experience Glacier Bay away from cruise ships. Additionally, under the NPS preferred alternative in this FEIS (alternative 6), cruise ships would not be allowed in the Beardslee Entrance and entrance to Adams Inlet in Glacier Bay or in Dundas Bay. Thus, the opportunities that currently exist for visitors on tour, charter, and private vessels would continue and, in fact, be increased with the preferred alternative.

Alternative 4 would allow one cruise ship in the Bay every day of the 92-day visitor season. The Sierra Club recommends that the visitor season be divided equally between cruise ship/tour boat entry days and those days when such vessels would not be present. This division would take the form of one week of cruise ship/tour boat entries, followed by one week of no cruise ship/tour boat entries, and so forth for the duration of the season.

Closed periods could reduce the adverse impacts on park wildlife, especially whales, and also benefit park users seeking a traditional, commercial-free national park experience.

4 3. Restore the existing "whale waters" designations along the lower west side of Glacier Bay proper and elsewhere.

This would benefit vessel operators by reducing uncertainty, and, more importantly, afford protection to the humpback whales that concentrate in these critically important habitats.

5 4. Explicitly preclude the use of Bartlett Cove as a boat harbor for the community of Gustavus.

Alternative 4 appears to accomplish this purpose by proposing to continue the requirement of permits for all private vessels. Alternative 4 as modified would make it entirely clear that all vessels entering the park must have permits, and that Bartlett Cover is not intended to serve as an unofficial boat harbor for the residents of Gustavus or other visitors, particularly in view of the Cove's use by humpback whales.

6 5. Maintain the existing number of small vessels now permitted in Glacier Bay proper.

Given the uncertainties associated with vessel-whale interactions, it is inappropriate to expand the "mosquito fleet" in the absence of further study. The number of whales visiting Glacier Bay have leveled off and there is now a slight but distinct downward trend This should serve as a red flag for park managers, and it suggests that a cautious approach to vessel management is necessary under the circumstances. Alternative 4, modified as recommended above, is the vessel management plan that best expresses such a cautious and conservative approach.

Thank you for considering our views.

Sincerely,

Jack Hession
Senior Regional Representative

NUMBER	RESPONSE
OR10-4	Please see general response number 5.
OR10-5	The "based in Bartlett Cove" exemption would be eliminated under the NPS preferred alternative in the FEIS (alternative 6). Permits would be available to private vessels on short-notice -- within 48 hours of the desired entry to Glacier Bay.
OR10-6	As noted in the DEIS, the additional private vessels under alternative 5 and the NPS preferred alternative in the FEIS, alternative 6, result from the removal of seasonal entry limits. Daily limits would remain at 25. The actual use is anticipated to be lower than the maximum allowable because rarely are maximum use levels achieved. Historically, maximum use occurs only during July. The elimination of the "based in Bartlett Cove" exemption would offset some potential increases in private vessel entries, particularly for traffic in lower Glacier Bay. Overall, private vessel use is expected to be similar to that that would occur under the no-action alternative, alternative 1. The analysis in the EIS acknowledges that private vessels can cause unique adverse effects.

MR. HESSION: Thank you. My name is Jack Hession. I'm here tonight on behalf of the Alaska Chapter of the Sierra Club. My address is here in town, 201 Barrow, Suite 101, Anchorage 99501. I'm still wading through this delightful smorgasbord that you've presented to us and so I will be submitting, and our other members commenting on this, will be submitting detailed comments for the record.

But in the meantime let me say that we're strongly in favor of Alternative 4 and disappointed that the Park Service itself could not find its way through to endorsing the, quote, environmentally-preferred alternative. That's a sad commentary on the current political situation. You will recall that in late 1994 when the Republican parties took both houses of Congress, former Secretary Bruce Babbitt paid a visit to Senator Frank Murkowski and he, in his wry way, said he went on bended knee. The upshot of that was we have what amounts to the Alternative 3, 139 cruise ship visits with the possibility to go to 184. We think that Alternative 4 is vastly superior in terms of protecting Park resources and values. And particular in view of the trend on whale visits to Glacier Bay and Park waters, in general, the last four years the trend is downward. It seems to me given that situation you should err on the side of caution and not even contemplate increasing current quotas but reducing them. Drop it back down and see if that has any effect on whale visits.

Beyond that, one other comment on your alternatives. There is no provision here for a time during the peak visitor season for no cruise ships or large tour vessels in the Bay. The Alternative 4 would call for an average of one ship, one cruise ship, I think even more tour vessels every day of the season, which means on average, of course, there would be times when no cruise ships would be present, but that's hit and miss. There's no formal periods in which the public, those of us who might want to see -- visit the Bay on a day in which there are no large vessels moving up and down would have that opportunity. I'm disappointed in that regard.

Other than that, I'd like to compliment the Park Service for a very thorough and comprehensive analysis and look forward to examining it in detail and providing you with additional comments.

Thank you.

Grouping:	Organization
Format:	Public Hearing Transcript

NUMBER	RESPONSE
OR11-1	Since this letter contained all the comments that you presented at the public hearing, please see the responses to the Sierra Club's letter for responses to these comments.

Comment Date: 5/15/03

Name: Graham, kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*: 4
Section: 6
Subsection:
Page:

Comments: The unavoidable adverse effects are clearly stated as being highest with alt 3, and yet there is no substantial evidence to suggest why that alternative should be selected aside from economic and increased visitor #s, but in conclusion, while we do have national parks for people to enjoy, it seems that the selection of this alternative is not holding true to the commitment to maintain an intact, wild ecosystem, and is sight of the place, and the inhabitants. While lacking data or specific models with which to to
1 obtain data showing that there will be no ill effects seems the choice of selecting the alt. with the the most potential impacts and highest costs to the wilderness incongruent with the mission to ensure continued protection of resources and values and provide high-quality recreatioanal opportunities for visitors. I urge the powers that be to reexamine this DEIS and select a combination of alternatives that imbrace instead of hinder the wildness and wilderness of Glacier Bay. Thank you Kezia Graham

Grouping:	Business
Format:	Web Comment

NUMBER	RESPONSE
B1-1	Please see general response number 1.

Comment Date: **5/15/03**

Name: Graham, kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments:

2 One issue that I do not see addressed anywhere within the document is the overall use of the vessels in the Park. The DEIS states that Native use rights are not considered within the document and are in fact outside of the scope. Nor does this document include the use of park vessels and research permits. Finally, no where do I see any analysis of the potential impact of the total current vessel management plan. There have been a large number of charter entries have gone unused since GB Lodge discontinued its sport fishing program. I strongly feel that there should not be a possible increase when there is not a clear understanding of the impact of the current quotas.

NUMBER	RESPONSE
B1-2	The effects of the current vessel management plan are considered in alternative 1, the no-action alternative. Vessels that are not directly covered under this EIS, such as commercial fishing vessels and administrative vessels, are considered in the cumulative effects sections.

Comment Date: 5/15/03

Name: Graham, Kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*:2
Section: 5
Subsection:
Page:

Comments: 3 I am greatly concerned by the language that allows for the possible increase in cruise ship entries. The language used is vague and ambiguous, and does not offer a clear indication of what studies would need to be conducted for a increase, nor does it offer an explantion of the monitoring systems in place to insure that the increase is in concert with the complete mission of GBNP. With these ambiguities in mind I do not see how this alternative can be preferred and strongly feel that it should be reconsidered. The execuative summary states multiple negative effects of alt. 3, * "Most adverse effects would occur in direct proportion to the number of vessels ... Alternaive 3 could allow an increase of up to 184 cruise ships, which is the highest number being considered ... therefore, alternative 3 has the highest level of effects on the environment" * "alt. 3 would have the highest petential level of risk for whale deaths due to vessel strikes." * "cruise ships produce the hightest point source emission" yet the alt. itself does not offer any exact plan for measuring and mitigating these effects that will come with an increase. It seems that this cannot and should not be chosen as the preferred alternative without clear guidelines for the "studies" which will be conducted in order to protect the park resources that are shown to be at risk in the DEIS document.

NUMBER	RESPONSE
B1-3	Please see general response number 3.

Comment Date: **5/15/03**

Name: Graham, kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*:2
Section:
Subsection:
Page: 2.8

Comments: I question why alternative 3 is the preferred alternative. They state in the document that it "provides for maintaining the current level of visitor use while protecting park resources and value." and continues to claim that "This system has been implemented over the past several years..." If the NPS is attemping to maintain current levels of use then I encourage the preferred selection to do that, maintain, rather possibly increase the use. I would like to draw attention to the fact that while the document states that the system has been in use for the past several years with good results there have been no increases in the vessel traffic since 96. It seems more correct to claim that alternative 1 with no action is the alternative at maintains and appropriately reflects the system that has been in effect for the past several year. Again, I urge the system to reconsider the preferred alternative to reflect what the NPS is claiming to accomplish.

4

NUMBER	RESPONSE
B1-4	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: 5/14/03

Name: Graham, kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*:execucative summary
Section:
Subsection:
Page:

Comments: The execucative summary states that the socioeconomics of Alt. 3 would "benefit local communities and crusie ship ports of call by increasing cruise ship entries." I question
5 this statement, as I do not see any studies at directly show that increasing ships into Glacier Bay would bring more ships into Juneau, Haines or Skagway, and do not see any presentation showing that it would have a direct benefit to Gustavus. If Alt. 3 is attractive for the socioeconomic benefits I wonder why, IF the Bay can handle increased traffic, why it is not distributed among the various vessel types to
6 accomodate local operators and visitors who are looking for a smaller scale experience rather than just the large vessels.

NUMBER	RESPONSE
B1-5	The discussion of the economic effects of each alternative has been expanded in the FEIS.
B1-6	The allocation of entry permits is out of scope of this document. Please contact Dave Nemeth, Chief of Concessions at Glacier Bay National Park for information on concession permit allocations.

Comment Date: **5/14/03**

Name: Graham, kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*:2
Section:
Subsection:
Page:

Comments: 7 The Park mandate is to both protect as well as provide the opportunity for visitor to enjoy this great place. One question I have about the current preferred alternative is the vessel restrictions regarding harbour seals. Although it is clearly shown that the population is on great decline in the park I do not see that concern reflected in the alternatives. It seems that if it is the case that seals are disturbed by boats that there should be restrictions placed on approaching haul outs year round rather than just certain months in the preferred alternative.

NUMBER	RESPONSE
B1-7	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the seasonal timeframe of when vessels must remain greater than 0.25 mile (0.4 kilometer) from harbor seals hauled out on ice in Johns Hopkins Inlet. (The current seasonal restriction is from July 1 through August 31.)

Comment Date: 5/14/03

Name: Graham, kezia

Organization: Alaska Discovery

Address:

,

Email: kezia@akdiscovery.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments:

8 I would like to comment on the issue of the soundscape that was presented in the DEIS. I question the designation of the effects of vessel traffic as not significant. The infromation in chapter 3 shows that there is an large increase during the summer months when there is not underwater sound. The winter months have 90% of no noise and the summer months only 40%. The DEIS clearly states there is a large increase and that this is a resource, which seems to be substantially effected. While one could argue that there is a large percentage of months when there is little noise in the park, it also seems very important to acknowledge that it is during the summer months that the wildlife is most active, as well as presant in greater numbers, and will therefore be significantly more effected. While there are times that there is not underwater noise, there is no supporting research to suggest that the sound that does exist is not adversely effecting the multitude of creatures that the park is protecting and preserving. I also would like to comment on the soundscape above land, and again question the determination that there is not "significant" effects above water. Having speant a great deal of time in the back country in Glacier Bay Proper I would like offer my knowledge of the soundscape in the Bay. As most people know, sound carries incredibly far on calm water, with low fog. These are the conditions that frequently present themselves in GBNP. It is a place that as a visitor you HEAR the wilderness, hear the song of a Kinglet, the breath of a whale, the howl of a wolf. There are few places in the world where that is still possible, and I would like to be heard that those sounds are precious, valuable, and SIGNIFICANTLY effected by vessel traffic. I do not see any studies that were conducted on the effect of the human voice that carries over the PA system for MILES on a calm day and the echo continues to reveberate of the fiord walls or the glacier face. While I do understand and respect the educational component of the boat ride and visit into the bay, I question that it does not have an impact. While the studies have not been done to show the impact and the animals cannot speak, as I human retreating to one of the last protected places I question the designation. Working with Alaska Discovery, a kayak guiding company in the park, we see a great number of people who come to Glacier Bay for the silence. One the the things guides frequently do on the first days of their trips is to have a silent paddle, where guests are asked not to talk. It is astonishing to see what effect that has on the group. The power of the sound of wilderness is overwhelming. Guests comment on such matters, and while they by no means are as well numbered as the experiences of the thousands of people on a large vessel, there needs and desires should be heard. They come here becuase of the silence and the wildness. Please consider that this is one of the few places where that is still possible!

9 I strongly urge you to reconsider the classification of soundscape in the final EIS, and to please give this matter consideration during the final decision of the VQOR. From my experiences and the fact that there are seemingly great impacts from vessel traffic on the soundscape I would request that current preferred alternative not be selected, but rather an alternative that does not provide for furter increases in vessel traffic.

NUMBER	RESPONSE
B1-8	The underwater soundscape is difficult to address for a marine-oriented park. Sound travels much further and can be louder underwater, and with the current vessel levels, human-caused sounds (most notably, vessel noise) are common under water. The NPS preferred alternative in this FEIS, alternative 6, would require that the Park Service (1) measure baseline acoustic conditions, (2) determine which existing or proposed human-made sounds are consistent with park purposes, (3) set acoustic management goals and objectives based on those purposes, and (4) determine which noise sources are impacting the park and need to be addressed by management. The Park Service appreciates the importance of natural quiet as a component of visitor experience, as well as its importance to the kayak guiding operation of Alaska Discovery and your guests, which are also park visitors. The Park Service shares your desire to provide opportunties for solitude, that is why seasonal non-motorized waters were established in 1996. These areas, which can be seen in figure 2-1, include the upper portions of six of Glacier Bay's eight inlets. This provides opportunties for visitors to enjoy the natural sounds described in this comment.
B1-9	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

MAY 16 2003
Postmarked
(fax date)
MAY 14 2003

Alaska Yacht Charters

PO Box 6568
Sitka, AK 99835
(206)780-0822
www.alaskansong.com

May 13, 2003

Nancy Swanton
National Park Service
U.S. Dept. of the Interior

Re: Vessel Management Environmental Impact Statement

Ms. Swanton;

My apologies for not responding sooner and via your website. The website questionnaire would obviously be a more effective means of conveying my broad range of opinions regarding the operation of charter vessels and cruise ships in Glacier Bay National Park and Preserve.

Unfortunately, our season began earlier than expected and I have not been able to take the time to access the questionnaire.

My wife and I are owners of Alaska Yacht Charters and have chartered, first the Viking, and now the Alaskan Song in Alaska for the last fifteen years. For the last ten years, I have been a resident of, first, Juneau and now, Sitka. I have had a guide permit with the U.S. Forest Service for the past ten years and a shoulder season permit with the National Park Service for Glacier Bay for the past two years.

The two most relevant issues I'd like to see addressed in the proposed new regulations are, first, the definitions of 'shoulder season' and second, the apparent exclusion of all vessels from 'charter category' if over 100 tons.

1

1. The shoulder season for Glacier Bay is now limited to include September 30th to May 15th. It would probably be more accurate to call this period a 'non season'. In the past two years, I have visited only in late April and early May, and during three of four visits we've not seen another charter vessel or cruise ship in the bay. My guess is that the same could be said for the remainder of the period from September 30th to May 15th.

   The true shoulder season for Glacier Bay could more accurately be extended to begin on September 1st and end on, perhaps, June 15th. I would estimate that few additional charter yachts and even fewer additional private yachts would enter the bay in this period, even if allowed. Extending the shoulder season would not appear to have any negative environmental effect on the bay and might have the positive effect of taking some of the pressure off of the peak season.

2. I was recently informed by Dave Nemeth that charter vessels allowed to participate in the shoulder season are limited to those

Grouping:	Business
Format:	Comment Letter

NUMBER	RESPONSE
B2-1	Three of the six alternatives, including the NPS preferred alternative, would extend seasonal-use days into May and September for cruise ships only. The option to extend seasonal-use days for cruise ships into May and September is presented in the EIS in consideration of anticipated future demands.

under 100 tons. As you may know, the documented tonnage of a vessel bears little relation to the displacement (weight), or for that matter, even the true volume of a vessel. The rules and exceptions allow for vessels such as those operated by Cruise West to be rated under 100 tons even though they may carry up to 200 passengers, be 200 feet long, and 'weigh' 1000 tons. While the Alaskan Song is 82 feet long, 20 feet wide, and is allowed to carry no more than 12 passengers, 'weighs' 90 tons and is documented at 103 tons.

2 According to Dave Nemeth, the Alaskan Song can currently enter Glacier Bay only as 'cruise ship', while the Spirit of Endeavor, with it's 125 passengers, 200 foot length, and 40 foot beam is considered a charter boat. This is clearly not a rational classification of vessels as related to their environmental impact.

When the U.S. Congress (seven or eight years ago) created the classification of 12-pack uninspected vessels and limited it to vessels of 100 to 200 documented tons, they indicated that unless changed by the U.S. Coast Guard, all rules applying to 6-pack uninspected vessels under 100 ton should also apply to the new 12-pack classification.

I hope that you will give serious consideration to my thoughts on these two issues. I will be in Juneau May 18th and 19th. I will at that time check the website, and if the questionnaire is still available, I will complete it then.

Thank you,

Geoffrey A. Wilson
Alaskan Yacht Charters
P.O. Box 6568
Sitka, AK 99835

NUMBER	RESPONSE
B2-2	Changes to allow uninspected vessels over 100 tons to operate as charter vessels are included in the NPS preferred alternative in the FEIS.

May 8, 2001

Summary of telephone communication between Paul Johnson and Nancy Swanton – Comments on the draft environmental impact statement for vessel quotas and operating requirements in Glacier Bay National Park and Preserve

Paul Johnson
P.O. Box 22
Elfin Cove, AK 99825
Telephone: (907) 697-2720

General information about Mr. Johnson's charter operation in the park
Has a charter concession permit – 6 entries for Glacier Bay proper. In the EIS, he is considered to be one of the two Elfin Cove businesses that have charter vessel permits. Not really true. While his mailing address is Elfin Cove, he does not live there; he resides in Idaho Inlet (see the comment below for a suggested modification to the EIS text to correct this misstatement).

Name of business: Chichikof Charters (www.gullcove.com). Picks most of his clients up in Gustavus; some in Elfin Cove. Some clients fly into Gustavus on the evening jet; some fly out on their own planes. Has a lodge operation as well. Takes groups overnight in Lituya Bay and GLBA proper. Handles groups of up to six people. Day trips from his lodge and Lituya and Glacier Bay proper. He also offers kayaking, sightseeing and photography. Has one motor boat – 38 feet long.

Comments on the Draft EIS

1 Page 3-128, paragraph 5, last sentence. Delete this sentence; it is not true. There will be a fish buyer in Elfin Cove this summer. The Ocean Beauty, a boat/barge, will be operating there.

2 Page 3-129, paragraph 2, sentence 2. This sentence is untrue. Mr. Johnson does indeed market Glacier Bay to his prospective clients (see his website to verify www.gulfcove.com). Mr. Johnson said he extensively uses Glacier Bay in his advertising. He feels he would not be in business without that advertising.

3 Modify the last part of this sentence. As it is now, one can interpret the meaning to be that Incidental Business Permit (IBP) holders are allowed to take clients into Dundas Bay. They are not; only the concession permitees have permission to do this. IBP holders are permitted to take clients along the park's outer coast, including Taylor Bay, but not into Dundas Bay.

4 Page 3-129, paragraph 2, sentence 3. Suggest changing the sentence to read: "Two Elfin Cove *area* businesses . . ." (emphasis added to show the suggested change).

5 Page 3-129, paragraph 2, sentence 5. Suggest adding the following text to the end of this sentence to indicate where IBP holders are allowed to take clients: ". . . along the park's outer coast, with the exception of Dundas Bay."

6 EIS Alternatives – Dundas Bay: The park needs to monitor vessel use in Dundas Bay, particularly if it intends to place restrictions on use. Unless the park intends to monitor the vessels using Dundas Bay, do not place limits on use.

Grouping:	Business
Format:	Comment Letter

NUMBER	RESPONSE
B3-1	The sentence has been deleted.
B3-2	The sentence has been modified to state "Some Elfin Cove Lodges use access to Glacier Bay in marketing their clients. They include sightseeing tours to Taylor Bay."
B3-3	The sentence has been modified to state "Some Elfin Cove Lodges use access to Glacier Bay in marketing their clients. They include sightseeing tours to Taylor Bay."
B3-4	The FEIS has been revised and is consistent with this comment.
B3-5	The FEIS has been revised and is consistent with this comment.
B3-6	The Park Service agrees that vessel use in Dundas Bay should be monitored currently and in the future. The research framework would identify studies for monitoring vessel use and impact to park resources in Dundas Bay.

In 1980, with the passage of the Alaska National Interest Lands Conservation Act, Mr. Johnson said he was locked into the number of entry permits he had at that time for Glacier Bay proper (3 initially, ended up with 6 eventually, which he retains at present). He said he could not make a living on the six entry permits he had for Glacier Bay proper, so he operated charters in Dundas Bay as well. He said he has followed the rules for Dundas Bay. If we limit the charter vessels to three per day in Dundas Bay and the park doesn't enforce the concessions permits in that bay, then it would not be fair for the park to limit charters there. Others are illegally using Dundas Bay now and would continue to do so. He says it would be the legal operators that would be 'nailed' by new limitations.

7

8

Water Quality. Revise the impact analysis for each alternative to more accurately reflect reality (see page 4-78 and other similar text in the EIS). Mr. Johnson's observation, after over 20 years of operating in Glacier Bay, is that resuspension of sediments from natural processes far outweighs any resuspension of sediments due to motor vessels. Heavy rain or a big spring melt account for more sedimentation than all the boats in the bay combined.

NUMBER	RESPONSE
B3-7	While Dundas Bay lacks tidewater glaciers, it provides people with excellent opportunities for wildlife and scenic viewing as well as opportunities for exploration and to experience solitude and natural beauty. The Park Service wishes to maintain these high-quality opportunities provided by Dundas Bay. The NPS preferred alternative in the FEIS, alternative 6, includes a flexible quota system to allow for an average level of use of three charter vessels per day, but with no daily quota. The Park Service feels that this quota level protects the opportunity for solitude of Dundas Bay while not unduly restricting charter vessel operators.
B3-8	A sentence has been added to the FEIS to acknowledge the role of natural processes in the resuspension of sediments.

MR. KREILKAMP: John Kreilkamp. Vice president of operations for Cruise West in Anchorage. After looking through this, this is obviously a huge thing to get your arms around, but having read some of the summary that Karen Cooper in our company had provided for us, would like to at least present our views as to support Alternative No. 3 as the National Park Service's preferred alternative.

We're rather unique amongst the Glacier Bay permit holders because we hold permits not only for one cruise ship but also for four day boats -- or four tour boats that go into Glacier Bay, and because of this we'll probably be -- I'll be giving you some comments that apply to both cruise ships and tour boat entries.

One of the reasons we support No. 3 is it has no change in the current number quotas or in the quota season, from June 1 through August 31, and that covers the time of year when most of the whales are in the Park, and obviously is of interest to us and anybody else that probably goes in there for that manner.

With respect to vessel quotas in cruise ships, the number of cruise ship entries has marginal affect on the whale population we feel. And we feel that it's more affected by what is availability in their food source than it is by the number of vessels that go in and out of the Park. No. 3 also provides for increasing the total number of seasonal entries up to 184, but only what seems reasonable by the NPS for the future. And obviously, there's going to be a lot of demand on the Park in the future and I think we have to be willing to keep an open mind as to where they're going to go, you know, with so many new ships coming on line.

With respect to vessel quotas in tour boats -- tour vessels rather, the number of tour vessels entries and use days would remain unchanged at 276. In the past decades most of these entries have been fully utilized each season. It's anticipated that the pending tour vessel prospectus that is still coming out, I guess, will reallocate or redistribute the entries, but we feel that all the demand, the demand that will be left there will remain at the same level depending on how they reallocate the distribution of them.

1 With respect to vessel quotas in Dundas Bay. Cruise ships haven't asked to go in there, primarily because I don't think a lot of the cruise ships want to go in there because of the depth of the water for safe passage. Our vessels draft, you know, anywhere from six to 13 feet and so it's not a real concern for us in terms of we feel we can operate affectively in those areas, along the way as well. Our largest boat, our largest cruise ship -- well, the only cruise ship we have is the Spirit of Oceanus, it's 295 feet and, again, only drafts 13 and a quarter feel of water, so we feel we could operate in this area and would oppose cruise ships regulations for that reason, into Dundas Bay.

Our tour vessel range from 90 to 217 feet and draft only six to nine feet, a little over nine feet, 9.3 feet, and we would definitely oppose tour boat entries into Dundas Bay as well, because we feel that has, again, the most potential for growth as well in Glacier Bay National Park.

Grouping:	Business
Format:	Public Hearing Transcript

NUMBER	RESPONSE
B4-1	Regarding Dundas Bay, the NPS preferred alternative in this FEIS (alternative 6) establishes limits for tour and charter vessels and prohibits cruise ships. Tour vessels would be limited to one per day during the quota season and would be allowed only in the non-wilderness waters of lower Dundas Bay. Charter vessels would be limited by a seasonal-use day limit but not a daily quota during the quota season.

There's probably some other things that are admirable in Items 4 and 5, but I'll spare you those comments at this point.

REPORTER: Thanks.

MR. KREILKAMP: All right.

This page intentionally left blank.

RECD
MAY 14 2003

CruiseWest

May 13, 2003

Glacier Bay National Park and Preserve Vessel DEIS
C/o Nancy Swanton, EIS Project Manager
2525 Gambell Street
Anchorage, AK 99503-2892

Dear Ms. Swanton:

Cruise West appreciates the challenge of compiling the volumes of information in the Draft Environmental Impact Statement (DEIS) for Glacier Bay National Park and Preserve. We found the draft to be effectively organized and not as daunting as the size would first suggest. The summaries were well prepared and very well supported by appropriate tables, maps, and appendices.

Based on thorough review of the five alternatives and data presented in the DEIS, Cruise West would like to provide the following comments in support of Alternative 3, the NPS Preferred Alternative. We also agree that several of the other alternatives had some points of merit.

DEFINITIONS

Cruise Ship: Cruise West suggests expanding on the current definition of cruise ship to include "over 300 feet in length." The definition would then read "Any motor vessel at or more than *300 feet in length* carrying passengers for hire."

1 Tour Vessel: Cruise West suggests expanding on the current definition of tour vessel to include "300 feet or less in length." The definition would then read "Any motor vessel *300 feet or less in length* that is rated to carry more than 49 passengers, or any smaller vessel that conducts tours into the Park at regularly scheduled times along a regularly schedule route."

Cruise West feels that classifying a cruise ship or tour vessel by length would be more relevant to the Park's purposes. A vessel's tonnage can be subject to manipulation and interpretation. Additionally, the further stipulation of conducting tours "into the Park" moves the Passenger Ferry and Lodge Concession Day Boat from these classes and into a new, more functional classification.

Cruise West is unique among existing Glacier Bay entry permit concessionaires. By current definitions, we have one cruise ship along with our other tour vessels. The *M/V Spirit of Oceanus* at 295 feet is not much larger than the other ships in the Cruise West fleet (*M/V Spirit of Endeavour* is 217 feet) and is much smaller than today's "cruise ships". For example, Holland America Line's smallest vessel, the *Noordam* is 709 feet, carries 1,214 passengers, and is rated

Up-Close, Casual, Personal.

2401 Fourth Avenue, Suite 700 • Seattle, WA • 98121-1438
Tel (206) 441-8687 • Fax (206) 441-4757 • 800-888-9378 • www.cruisewest.com

Grouping:	Business
Format:	Comment Letter

NUMBER	RESPONSE
B5-01	The Park Service agrees that the current 100-ton limit for tour vessels often bears little relationship to the actual displacement of the vessels and is subject to manipulation to the degree allowed under applicable tonnage measurement systems. However, the Park Service feels the current tonnage limit, in being directly related to specific regulatory vessel classes, should remain the distinction between cruise ships and tour vessels. The Park Service notes that vessel operators have the opportunity to use the 2,000-ton International Convention System as an alternative to the U.S. System 100-ton limit. As a side note, NPS records indicate that cruise ships visiting Glacier Bay in 1976 (the vessel quota base year) included vessels 250 feet in length (Lindblad Explorer), so that if a change were contemplated, something less than the proposed 300 feet length would be the logical break-point.

as 33,930 gross tons. By comparison, the *Oceanus* is 295 feet, carries 114 passengers and is rated at 4,200 gross tons.

In modifying the cruise ship and tour vessel definitions as suggested above, NPS would more accurately classify the *Oceanus* and accommodate more technologically advanced tour vessels of the future. As a tour vessel, the *Spirit of Oceanus* is a slightly larger vessel with relatively low visual impact compared to a bigger cruise ship. Passengers still experience Glacier Bay on a close, personal level.

2 Bartlett Cove Passenger Ferry: Cruise West supports clarification of the ferry service as defined in DEIS Alternative 3.

3 Glacier Bay Lodge Concession Day Boat: Cruise West suggests including a redefinition of class for the Glacier Bay Lodge Concession Day Boat. The vessel is based at Bartlett Cove and operates as a function of the Lodge Concession, not a stand-alone tour vessel operation. (See also Vessel Quotas and Operating Requirements sections.)

VESSEL QUOTAS

Vessel Quotas in Glacier Bay

4 Cruise Ships: Cruise West supports Alternative 3 in that it seems logical given the historically safe operation of cruise ships in the Park. Additionally, any increase in the number of cruise ship quotas would be contingent upon studies that would establish compatibility and support of those increases.

Tour Vessels: Cruise West supports Alternative 3 which maintains the current daily quota of three tour vessels. In the past decade most of these entries have been utilized each season. It is anticipated that the pending tour vessel prospectus will reallocate distribution of the entries but that the demand and use will remain at the same level.

5 Charter Vessel and Private Vessel: Cruise West supports the Daily Vessel Quotas and Season Entries for these two vessel classifications as stated in Alternative 2. Reduction of the charter and private vessel Seasonal Entries to 271 and 407 respectively would result in 102 entries available to be placed in a new quota category. This could provide a separate category for the Lodge Concession Day Boat without impacting the total overall vessel entries into Glacier Bay.

The charter and private entries would be revised to their historical use levels (See Seasonal Entries in alternative 2 (Table 2-3) and Table 3-15). The rationale is that it would allow the charter and private entries to continue at historical levels but convert their unused quota allowance to more predictable and lower impact day boat entries.

Bartlett Cove Passenger Ferry: The Ferry service has a legislated function outside the parameters of a stand-alone tour vessel operator. The current practice for the Bartlett Cove

NUMBER	RESPONSE
B5-02	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.
B5-03	The current day boat operation and configuration meets the NPS classification for tour vessels. Where the vessel is based is irrelevant to the vessel classification.
B5-04	The NPS preferred alternative in the FEIS, alternative 6, includes the quotas from alternative 3 for cruise ships and tour vessels.
B5-05	Under alternative 2, a reduction in charter and private vessel numbers would result in a reduction in the total number of allowable entries into Glacier Bay proper and not a reallocation of those entries.

6 Passenger Ferry has been to use either a tour vessel or charter vessel entry, both of which affect the availability of entries by concession tour vessel operators. Cruise West supports identifying the ferry quota as one-trip-per-day vessel allocation that is separate from cruise ship, tour vessel, charter or private vessels.

7 Glacier Bay Lodge Concession Day Boat: Cruise West proposes moving the day boat's allocation of 92 entries from **tour vessel** daily quotas and seasonal use days into a separate category—but without impacting the overall number of vessel entries into Glacier Bay. See discussion in Charter Vessel and Private Vessel quotas above.

OPERATING REQUIREMENTS

8 **Measurement of Vessel Speed**
Cruise West agrees with the DEIS statement for Alternative 1-4: "Measuring vessel speed 'through the water' is a practical method since it allows for variances such as tides, currents, etc. Measuring vessel speed relative to a fixed point on land rather than through the water can create navigational dangers; i.e., if the tidal flow is 8 knots, as it often is around Beardslee, and the ship is traveling with the flow, restricted to 13 knots, would mean a speed of only 5 knots relative to the water. This slow speed through the water would limit vessel maneuverability."

9 **Ferry Vessel Operating Requirements**
As noted in DEIS Table 2-12, "Per Section 127, Public Law 105-83, the ferry is restricted to the sole purpose of accessing the Bartlett Cove dock. The ferry is subject to speed, distance from coastlines, and other operating requirements common to all vessel types." Alterative 4 adds the stipulation that the ferry cannot deviate from a direct course between the mouth of Glacier Bay and Bartlett Cove. It is intended to provide economical transportation and therefore should be thus restricted to prevent interference with other commercial vessels and be predictable to all other types of Glacier Bay visitors.

These operating requirements clearly designate the ferry as a mode of transportation between two points (Juneau and Bartlett Cove). There appears to be no intent of providing additional guest experiences in Glacier Bay, which is left for other permitted vessels or activities. For these reasons and those stated in the "Definitions" and "Vessel Quotas" sections, Cruise West would support clarifying the ferry's class and exempting it from vessel quotas.

Permit exemption for Vessels Based in Bartlett Cove
A permit is currently not required to enter Glacier Bay when a private motor vessel based at Bartlett Cove is transiting between the Cove and waters outside of Glacier Bay, or is operated in the Cove in waters bounded by the public and administrative docks.

10 Cruise West supports extending this exemption to the Lodge Concession Day Boat and the Bartlett Cove Ferry unless the results would be similar to revising the definitions as discussed above.

NUMBER	RESPONSE
B5-06	Under the NPS preferred alternative in this FEIS, alternative 6, the ferry service would be a vessel quota separate from the total allocated to cruise ships, tour, charter, and private vessels.
B5-07	Under alternative 2, a reduction in charter and private vessel numbers would result in a reduction in the total number of allowable entries into Glacier Bay and not a reallocation of those entries.
B5-08	The NPS preferred alternative in the FEIS, alternative 6, maintains the current measurement of speed as "through the water."
B5-09	Under the NPS preferred alternative in this FEIS, alternative 6, the ferry service would be a vessel quota separate from the total allocated to cruise ships, tour, charter, and private vessels.
B5-10	The "based in Bartlett Cove" exemption is eliminated from three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.

EFFECTS BY RESOURCE

The DEIS addresses effects (direct, indirect, and cumulative) that the alternative would have on the existing environments. Thresholds have been given terms of measurement for these effects: negligible, minor, moderate, and major. Cruise West supports Alternative 3 based on the acceptable ranges (negligible to moderate) of these effects' thresholds. No specific additional comments are provided with the exception of Visitor Experience.

Human Environment

Visitor Experience:

11 Adjusting charter and private vessel Seasonal Entries to the levels proposed in Alternative 2 could have a positive impact on visitor experience. The hydrophone study NSWC Glacier Bay Underwater Noise supports not increasing the number of charter and private vessels because it shows that these small vessels, measured as currently operated, are as noisy as medium vessels (louder on average at 96 decibels for small versus 93 for medium, and equal at maximum 126 db for both) and nearly as loud as cruise ships. These more invasive, less predicable craft are likely to disturb wildlife as much or more than the cruise ships and tour vessels which adhere to more regular patterns. They also disturb wilderness seekers more as they cannot be predicted and travel almost everywhere in the bay. It seems logical to suggest that their numbers not be increased without studies similar to those being suggested for the cruise ship increase; i.e., "studies demonstrating that an increase in"..."traffic would be consistent with the protection of the values and purposes of the Park."

Cruise West has safely and effectively operated in Glacier Bay for a number of years. Our vessels and crews have worked in concert with the Park's and Preserve's *General Management Plan*: protection of park resources and provision for visitor use. Alternative 3, we believe, is the most practical balance to achieving those two goals.

Respectfully,

Richard G. West,
Chairman/CEO

NUMBER	RESPONSE
B5-11	The commenter incorrectly interpreted the data on underwater noise. The underwater noise reports discuss the sound levels received at the hydrophone. These data are not appropriate for determining which types of vessels are louder. Some vessels routinely pass closer to the hydrophone than others and therefore have higher recorded sound levels at the hydrophone. These vessels may be quieter than other vessels that do not pass as close to the hydrophone.

RECD MAY 14 2003

GLACIER Guides, Inc.

JIMMIE C. ROSENBRUCH, ALASKA MASTER GUIDE & OUTFITTER
P.O. BOX 460, SANTA CLARA, UTAH 84765 • PHONE/FAX 435-628-0973
P.O. BOX 219, GUSTAVUS, ALASKA 99826 • PHONE/FAX 907-697-2252

May 8, 2003

Glacier Bay National Park and Preserve Vessel DEIS

c/o Nancy Swanton

EIS Project Manager

2525 Gambell Street

Anchorage, Alaska 99503-2892

Dear Ms. Swanton,

It is imperative that all alternatives 1 through 5 or any modification thereof includes under charter vessels the provision:

1 "Charter vessels also include any uninspected vessel of less than 200 tons gross (U.S. Simplified Measurement System) and not more than 24 meters (79 feet) in length engaged in transport of passengers for hire, except when operating as an administrative vessel. (Note: uninspected vessels may not carry more than 12 passengers.)

This would be consistent with recently modified U.S. Coast Guard Regulations that allow uninspected vessels over 100 tons but less than 200 tons to carry up to 12 passengers.

Including this provision in the new Management Plan has no impact on park resources or administration. It offers the public an option of vessel charter that usually has enhanced safety and amenities not offered in smaller uninspected (6 pack) vessels.

Vessels in this category are able to offer a level of service not available in the smaller (6 pack) uninspected charter vessels. This class of vessels reduces impact on park resources with reduced emission (they are deep draft 8-9 knot vessels usually with a single engine), reduced pollution (they have large holding tanks or a waste treatment facility), the slower speed reduces potential collision with marine mammals, and the acoustical level is significantly reduced with a single slower turning propeller.

We are the longest tenure operator in Glacier Bay National Park. Since 1967 we have provided visitor charter boat services into Glacier Bay with our 12 historical entries utilized each season.

I will be pleased to answer any questions.

Sincerely,

Jimmie C. Rosenbruch

Jimmie C. Rosenbruch

● HUNTING ● FISHING ● CHARTERS ● PHOTOGRAPHY

M/V "Alaskan Solitude" *M/V "Alaskan Grandeur"*
M/V "Alaskan Hunter"

Grouping:	Business
Format:	Comment Letter

NUMBER	RESPONSE
B7-1	The NPS preferred alternative in the FEIS, presented in chapter 2, includes this provision.

Rec'd MAY 14 2003

GLACIER Guides, Inc.

JIMMIE C. ROSENBRUCH, ALASKA MASTER GUIDE & OUTFITTER
P.O. BOX 460, SANTA CLARA, UTAH 84765 • PHONE/FAX 435-628-0973
P.O. BOX 219, GUSTAVUS, ALASKA 99826 • PHONE/FAX 907-697-2252

May 9, 2003

Glacier Bay National Park and Preserve
Vessel DEIS
C/O Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, Alaska 99503-2892

Dear Ms. Swanton,

We have been "Home Based" in Bartlett Cove for 36 years, since 1967, during which time we have operated charter and private vessels to and from Bartlett Cove.

The proliferation of Bartlett Cove "Home Based" vessels is a growing problem for park administration.

2 However, eliminating this for historical users under any option is simply unacceptable. In the least measure operators with "historical" use entry permits should be allowed to continue use of Bartlett Cove as "Home Base" without accounting for entry permits.

Perhaps a more liberal "historical" use could be applied for long time legitimate users of Bartlett Cove as "Home Base". Limiting the number of unaccountable entries for "Home Base" use of historical users would be reasonable. Three trips per week with a seasonal cap of 20 would be agreeable.

Simply eliminating the "Home Base" for long time established and historical users is not fair.

Sincerely,

Jimmie C. Rosenbruch

● HUNTING ● FISHING ● CHARTERS ● PHOTOGRAPHY
M/V "Alaskan Solitude" *M/V "Alaskan Grandeur"*
M/V "Alaskan Hunter"

NUMBER	RESPONSE
B7-2	The "based in Bartlett Cove" exemption is eliminated from three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.

Comment Date: 5/12/03

Name: nigro, michael

Organization: gustavus marine charters

Address: box 81

gustavus, alaska 99826
usa

Email: gmc@mars.he.net

DEIS Information: *Chapter*:
Section:
Subsection: usa
Page:

Comments: Glacier Bay National Park and Preserve Draft EIS comments. Your draft EIS is certainly
an imposing document and I can not say I have been able to fully cover the contents.
After reviewing your alternatives I am not sure I understand how you can have a
preferred alternative that requires more study in order to determine the impact on
park resources. You have in effect an EIS that is saying we need an EIS for what we
want to do. Yet you do not detail what studies you think you need to accomplish your
1 ends. Until you have that information and a clearer idea of what is needed I believe
your preferred alternative should be number one, the status quo. Although I do have
reservations there also. Your current whale regulations are too complicated for the
2 average boater visiting the bay. I see people doing the wrong thing all the time and I
believe it is simply confusion rather than a willingness to disregard the regulations.
You would be ahead of the game if you told people how to operate there vessel in
proximity to wildlife rather than creating "whale waters " at different places and at
what appears to the visitor random times. Concerning the ships. One of the most
3 common request I get from my charter clients is " can we stay away from seeing the
cruise ships". That currently is pretty challenging and not always possible, but under
your preferred alternative it would definitely become impossible on any day of the
season. This plan should actually be referred to as the Glacier Bay cruise ship quotas
4 EIS as that is its primary focus. The fact that sixty percent of the money collected
from the ships goes directly to fund Park research represents a a possible conflict to
the people writing the EIS document. A thirty two percent increase in ship entries
represents a substantial increase in funding. I have yet to meet a researcher who was
not obsessed with funding. I also have concerns regarding the fact that no mention
5 was given to the substantial research / administrative fleet, and how it will be required
to operate. Although knowledgeable operators are far less likely to cause problems,
you should have considered the impacts of a vessel fleet that continues to grow. I
understand that politics are involved, pressure from the Alaska delegation and the
tourism industry are great, but cruise ships have a substantial impact on the bay. Air
6 quality, wildlife habitat and wilderness values are all compromised. Any increase in
their numbers would be an unacceptable degradation of the Park and would certainly
do nothing to help keep Glacier Bay "unimpaired for future generations". Thank you
for the opportunity to comment. Michael Nigro Gustavus Marine Charters

Grouping:	Business
Format:	Web Comment

NUMBER	**RESPONSE**
B8-1	
B8-1	Please see general response number 3.
B8-2	The Park Service is aware of the complexity of the whale protection regulations and has incorporated simplifications to the whale waters regulations in the NPS preferred alternative. Please see general response number 5.
B8-3	Cruise ships provide the means by which over 90% of the visitors to Glacier Bay view and enjoy the park. Currently, cruise ships do not travel into several areas of Glacier Bay, including Whidbey Passage, Berg Bay, Fingers Bay, and Queen Inlet. Cruise ships rarely enter the East Arm. These areas currently provide visitors on tour, charter, and private vessels opportunities to experience Glacier Bay away from cruise ships. Additionally, under the NPS preferred alternative in this FEIS (alternative 6), cruise ships would not be allowed in the Beardslee Entrance and entrance to Adams Inlet in Glacier Bay or in Dundas Bay. Thus, the opportunities that currently exist for visitors on tour, charter, and private vessels would continue and, in fact, be increased with the preferred alternative.
B8-4	The Park Service strongly disagrees that managers are motivated to increase cruise ships in the interest of obtaining more fees. Although the funds provided by cruise ships and other fees fund staff positions and projects, the Park Service's motivation is to protect the resources of the park for future generations while allowing the public to enjoy it. Cruise ships provide the means by which the majority of people are able to view and enjoy the park.
B8-5	Please see general response number 4.
B8-6	The numbers of cruise ships would not be increased unless the studies show that the increase would not impair park resources. Ongoing and potential future studies are described in chapter 2, subsection 2.13.3.

Rec'd MAY 14 2003

Holland America Line Inc.

Office of the General Counsel

May 14, 2003

Glacier Bay National Park and Preserve Vessel DEIS
c/o Ms. Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, Alaska 99503-2892

Dear Ms Swanton:

Holland America Line appreciates the opportunity to provide comments on the March, 2003 Glacier Bay National Park and Preserve Vessel Quotas and Operating Requirements Draft Environmental Impact Statement (DEIS).

1 Holland America Line has a long history of operating cruise ships in Glacier Bay. Our ships have provided low impact access to this national treasure for hundreds of thousands of visitors from throughout the world. Over the years we have worked diligently with the National Park Service (NPS) towards the goal of providing public access while still protecting the Park. Towards that end, we have been proactive through such measures as:

- instituting a zero discharge policy in the Park as to black water, gray water and bilge water that has now been copied by other cruise lines.
- developing and funding an oil spill response program in the Park.
- using IFO 180 fuel on all Alaska sailings.

We have also developed other initiatives to improve the visitor experience such as those involving Alaska Native guides and artists-in-residence.

It is in this same spirit that we are providing these comments. We want to do what is necessary to protect the Park while at the same time providing public access.

Initially, we wanted to commend the NPS on the presentation of the DEIS. In our opinion, it was well organized, presented a comprehensive review of the issues, enabled the reader to easily locate referenced documents and provided concise and informative comparisons of the various alternatives.

Holland America Line endorses Alternative 3 - the NPS Preferred Alternative. That Alternative, which essentially implements the 1996 Vessel Management Plan (VMP) for cruise ships, is consistent with the NPS mission to provide visitor access while protecting

300 Elliott Avenue West • Seattle, WA 98119 • 206 • 286-3491 • Fax 206 • 284-8352

Grouping:	Business
Format:	Comment Letter

NUMBER	RESPONSE
B9-01	The Park Service appreciates the standards that Holland America has developed.

the Park resources. The long history of low impact, successful cruise ship operation in the Park clearly supports selection of this Alternative.

Most important, there is nothing showing that the operations to date under the VMP have been detrimental to the environment. The humpback whale population has not been adversely impacted; in fact, the numbers suggest the opposite to be true. The VMP created a flexible regulatory arrangement that enables the NPS to increase or reduce the number of entries, and expand or modify operating restrictions, as required to address whatever environmental situation exists at the time.

2 The adoption of Alternative 3 would not result in an immediate increase in the number of entries. Instead, any increase above the current level of 139 would be conditioned upon further research as to potential environmental impacts. We fully support the idea that "any increase in cruise ship numbers ...be contingent upon completion of studies that demonstrate the increases would be compatible with the protection of Park resources and values."

We do want to comment on the operating restrictions that are referred to in Alternatives 4 and 5. Before doing so, however, we want to stress the fact that current regulations permit the Superintendent of the Park to "establish, designate, implement and enforce restrictions and public use limits and terminate such restrictions and public use limits" at any time. 36 CFR 13.65(b)(3)(ix). That regulation recognizes the "rapidly emerging and changing ecosystems" of the Park. Given this authority (which we fully support), Holland America Line respectfully questions what the justification can be for making further permanent modifications to operating restrictions at this time.

3

Stated another way, the adoption of Alternative 3 will not result in any immediate increase in cruise ship entries. As of this time, there is nothing to indicate that the existing operating restrictions are insufficient to address the environmental impacts of 139 entries during the quota season and up to 2 vessels per day during May and September. If the NPS should decide in some future year to increase the quota season entries above 139, it would be at that time, and on the basis of the reports generated in order to make that decision, that the NPS consider additional operating restrictions.

As to the specific Alternative 4 and Alternative 5 operating restrictions:

- Speed Restrictions

4 Under current policy, speeds are generally restricted to 20 knots. Alternatives 4 and 5 propose reducing this speed to 13 knots in order to "reduce risks of vessel collisions with whales." As to Alternative 5, the speed would be measured "over the ground" rather than "through the water" as is the current practice. Neither the long history of cruise ships operating in Glacier Bay under current policies nor the research cited in the DEIS support

NUMBER	RESPONSE
B9-02	Any future increases in cruise ship numbers would be incremental.
B9-03	The Park Service wishes to revise regulations to reflect the best available information. The regional director, Alaska Region, will carefully weigh the risks and benefits of each operating requirement when making a final decision regarding operating requirements.
B9-04	The Park Service and NOAA Fisheries have determined through consultation under the Endangered Species Act that the 13-knot speed limit is a reasonable and prudent measure to minimize the risk of humpback whale mortality. Studies have shown that vessels greater than 262 feet (80 meters) traveling faster than 13 knots have a greater tendency to strike and kill whales. Under the NPS preferred alternative in this FEIS (alternative 6) vessel speed would be measured "through the water."

making these changes. As shown in Figure 4-2 of the DEIS, the whale population in Glacier Bay has actually increased since 1985.

Slowing cruise ships to an operating speed not to exceed 13 knots throughout Glacier Bay is estimated to add up to 3 hours to the visit. This means that the ships are actually in the Park for longer periods of time. For those who seek to limit cruise ship activity in the Park because of the risk they allege is posed to the environment (such as oil spills), the speed restrictions would necessarily mean that those ships that are allowed in will be there for more time than would otherwise be the case.

This will also mean that the ships must travel faster in waters outside of Glacier Bay to reach ports of call. If higher speeds do pose an increased risk to whales (which we do not believe to be the case), the result of reducing speeds in Glacier Bay would be to increase the danger to whales in Icy Straits, Sitka Sound, Frederick Sound and other known whale waters in which the ships would necessarily have to sail faster in order to compensate for the hours lost in Glacier Bay.

The research paper offered in the DEIS as justification for this speed reduction proposal is "Collisions Between Ships and Whales", D.W. Laist, A. R. Knowlton, J. G. Mead, A. S. Collet and M. Podesta, 2001 Marine Mammal Science 17(1): 35-75. While interesting reading, this paper hardly supports what would be a dramatic change in operating restrictions. Some of the points in that paper which are worth noting:

5

1. On page 50 of the report, the authors conclude that the increase in strikes may be affected by the number and/or speed of the ships. The data on that page seems to strongly imply that the number of ships is the more important factor as the trend in collisions is directly correlated to the number of registered ships. For example, the number of ships more than doubled between 1950 and 1980 which coincided with a sharp increase in the number of collisions with whales. After 1980, there is only a minimal increase in vessels while at the same time, the number of collisions "remained relatively stable or perhaps increased slightly." If anything, this report requires careful consideration be given prior to any increase above 139 entries. It does not justify reducing the speeds for existing vessels.

2. On page 58 of the report, the authors acknowledge that much of their evidence is "anecdotal" and therefore has "significant weaknesses." The report goes on to conclude that further research would be necessary including specifically research on "alternative management actions" such as speed limitations.

3. The report notes at pages 57-58 that vessel collisions appear to be responsible for a very small percentage of whale deaths. The referenced

NUMBER	RESPONSE
B9-05	The EIS represents the best available information. Should new information and/or new technologies be developed, then the Park Service would reevaluate the need for the 13-knot speed restriction.

> Heyning and Dahlheim report, which specifically focused on gray whales stranded between Mexico and Alaska, concluded that less than 1.5% of stranded whales had been involved in a collision with a vessel. Therefore, even if increasing speeds did result in more collisions, this still is not a significant contributor to overall whale mortality.

Furthermore, the suggestion that slower cruise ships will mean reduced underwater sound impacts is of questionable accuracy. The 2002 Naval Surface Warfare Center (NSWC) report referred to in the DEIS, "Southeast Alaska Cruise Ship Underwater Acoustic Noise," Technical Report NSWCCD-71-TR-2002/S74, measured the speed of six different vessels (Figure 22). With the exception of the Norwegian Wind and the Universe Explorer, the noise levels at higher speeds are essentially the same as at lower speeds. The Universe Explorer is a much older ship with an outdated propulsion system.
6 As to the Norwegian Wind, it appears that the ship is not equipped with the more modern diesel-electric engines, as is the case with the other four ships referred to in Figure 22 as well as most of the other cruise ships currently operating in the Park. The similar report for the NPS hydrophone at Bartlett Cove reports cruise ship noise in that part of Glacier Bay under current operating restrictions to be not much louder than that for medium or small vessels: average 98/maximum 129 for cruise ships versus 93/126 and 96/126 for medium and small vessels, respectively.

- Measurement of Vessel Speed

The current practice is to measure ship speed as "speed through the water." Alternative 5 would change this practice so that one would instead measure "speed across the ground." The effect of this would be to reduce the rate of travel in situations where the ship is sailing with the current. Currents in Glacier Bay at Beardslee Island sometimes exceed 8
7 knots and frequently are 5 knots and above.

This could pose a substantial safety risk to vessels as ships are inherently less maneuverable at lower power and stronger currents. In other words, if the ship has to avoid something ahead of it, it is in a much better position to do so if the ship's propulsion system, rather than the current, is what is propelling the ship.

- Whale Water Geographic Locations

We do not believe that extending the whale water designation of lower bay waters to May 1 through September 30 from the current May 15 through August 31 would materially impact cruise ship operations.

- Non-Motorized (Closed) Waters for Cruise Ships

We do not object to making permanent the cruise ship exclusion from Beardslee Entrance, the East Arm and Dundas Bay.

NUMBER	RESPONSE
B9-06	The Park Service agrees that more data on vessel sound production at higher speeds is needed. However, based on the best available information, as presented in chapter 3 under threatened and endangered species, cruise ships traveling at higher speeds produced louder underwater sounds.
B9-07	The NPS preferred alternative in the FEIS, alternative 6, maintains the current measurement of speed as "through the water."

Glacier Bay National Park and Preserve Vessel DEIS
c/o Ms. Nancy Swanton
May 14, 2003
Page 5

- Vessel Routes

8 Defining specific cruise ship routes (track lines) through the joint efforts of the NPS and cruise lines could be a useful measure from the standpoint of all parties. Establishing specific cruise ship routes would further enable those seeking to avoid the large ships a clear map for doing so. It would provide cruise ship predictability. Such a move could also improve safety much like shipping lanes in harbors. Of course, allowance for deviation for safety and to avoid whales and other concentrations of wildlife would be needed.

- Harbor Seal Vessel Approach Distance in Johns Hopkins Inlet

9 We do not agree with extending the current restriction of 0.25 nautical mile distance from seals hauled out on ice from July 1 through August 31 to year round. This could effectively result in cruise ships being kept out of John Hopkins Inlet for the entire season. There is no information to suggest that the existing restriction is insufficient. If it should become an issue, the Superintendent already has authority to address the problem at that time.

- Quota Season

10 Extending the Quota Season for permitted entries of Glacier Bay by cruise ships to May 1 through September 30 from the current June 1 through August 31 has no purpose other than to reduce the number of cruise ship entries. Here again, this is a proposal to fix a system which is not broken. Such a change would mean fewer low impact cruise visitors to the Park.

Thank you again for giving us the opportunity to comment on the Draft Environmental Impact Statement.

Sincerely,

Dan Grausz
Vice President and General Counsel

cc: A. Kirk Lanterman
Stein Kruse

NUMBER	RESPONSE
B9-08	In general, cruise ships stay mid-channel when traveling within the park. Therefore, the Park Service has determined that defining mandatory routes would be unnecessary.
B9-09	The NPS preferred alternative in the FEIS contains this restriction due to the alarming decline in harbor seal populations. The FEIS contains additional information regarding the effects of cruise ships on harbor seals.
B9-10	Three of the six alternatives, including the NPS preferred alternative, would extend seasonal-use days into May and September for cruise ships only. The option to extend seasonal-use days for cruise ships into May and September is presented in the EIS in consideration of anticipated future demands.

MAY 14 2003

PRINCESS CRUISES PRINCESS TOURS

May 13, 2003

Glacier Bay National Park and Preserve Vessel DEIS
C/O Nancy Swanton
EIS Project Manager
2525 Gambell Street
Anchorage, Alaska 99503-2892

Dear Ms. Swanton,

Thank you for considering the following comments on the NPS DEIS for Vessel Quotas and Operating Requirements in Glacier Bay National Park and Preserve, offered on behalf of Princess Cruises, Inc. (Princess)

1 Princess supports Alternative 3, the NPS preferred alternative. This Alternative would leave in place quotas and operating requirements for cruise ships that have been in place since for the past seven years, since 1996. This alternative has provided access for approximately 90% of visitors to Glacier Bay National Park and Preserve without causing impairment to Park resources.

Alternative 3 provides for the Superintendent of the Park to increase the current number of cruise ship entries contingent upon the results of studies demonstrating that an increase would be consistent with the protection of the values and purposes of the park. Under Alternative 3, the daily limit of two cruise ships would be maintained.

There has been continuous advancement in cruise ship environmental systems over the past six years. Many ships currently operating in Glacier Bay have been in operation less than six years. Princess has four ships operating regularly in Glacier Bay. Three ships are new to the Princess fleet since 1996; the fourth was delivered in 1995. All Princess ships observe zero discharge of waste in Glacier Bay, which is common practice for every cruise ship in the park.

2 Princess does not support speed restrictions in Alternatives 4 and 5. Currently, the Park Superintendent has authority to enforce speed reductions to 10 knots. This restriction has been implemented regularly, on an as-needed basis because of whale concentrations. This authority would continue under Alternative 3.

[illegible] Second Avenue, Suite 400, Seattle, Washington 98121-1200 Telephone 206/336-6000 Telefax [illegible]

Grouping:	Business
Format:	Comment Letter

NUMBER	RESPONSE
B10-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.
B10-2	The Park Service and NOAA Fisheries have determined through consultation under the Endangered Species Act that the 13-knot speed limit is a reasonable and prudent measure to minimize the risk of humpback whale mortality. Studies have shown that vessels greater than 262 feet (80 meters) traveling faster than 13 knots have a greater tendency to strike and kill whales. Under the NPS preferred alternative in this FEIS (alternative 6) vessel speed would be measured "through the water."

Ms. Nancy Swanton
EIS Project Manager
GBNP Vessel DEIS
May 13, 2003
Page 2

An arbitrary, park-wide speed restriction would have unintended consequences. Slowing ships will increase the amount of hours cruise ships would be sailing in park waters, forcing changes to ideal itineraries which have been developed after collaboration between the Park Service and cruise ship operators.

Electric diesel propulsion systems may be less efficient at lower speeds, which can result in less efficient fuel combustion, and in more visible smoke emissions over longer periods of time. The extension of time spent in Glacier Bay could force ships to reduce time spent in other ports in Southeast Alaska, to increase speed between Glacier Bay and the next port of call, or both.

The underwater soundscape would not be impaired under Alternative 3. The existing system provides for speed reductions when whale concentrations are identified along the route, or when vessels are inadvertently within one-quarter mile of a humpback whale.

Princess objects to extending the quota system for Glacier Bay cruise ship
3 entries from May 1 through September. This would result in a net decrease in
permits and the opportunity for thousands of visitors to experience the park.

Princess would not object to Superintendent authority to designate whale
4 waters for speed restrictions, including areas in addition to the lower bay waters,
where concentrations of whales are typically found, and speed restrictions
routinely apply.

Princess would not object to Superintendent authority for definition of
5 specific cruise ship routes that conform to the West Arm routes, as shown in
Figure 3-22 of the DEIS.

Thank you for your efforts in preparing the DEIS, and for considering these comments.

Sincerely,

Thomas M. Dow
Vice President, Public Affairs

NUMBER	RESPONSE
B10-3	The NPS preferred alternative in this FEIS, alternative 6, would extend the quota season for cruise ships to protect park resources during May and September. An increasing trend toward vessel use of the park has been observed during these months.
B10-4	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that 'when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.' The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.
B10-5	In general, cruise ships stay mid-channel when traveling within the park. Therefore, the Park Service has determined that defining mandatory routes would be unnecessary.

Comment Date: **5/14/03**

Name: Wrobel, Gordon

Organization: The Cove Lodge

Address: PO Box 17

Elfin Cove, AK 99825

Email: gordywrobel@covelodge.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments:

1 I attended the EIS meeting in Juneau. I was surprised by the lack of participation. I heard from a number of people that they believe the process was geared toward large operators and that many of the decisions about access had already been determined. I know of two people who were in Elfin Cove at the time of the meeting here and chose not to attend. I think this speaks poorly of the process that so few people participated given the impact of the project.

2 I was also concerned that the conclusions of the report did not appear to be generated through an interdisciplinary process. I suspect the results would have been very different had an economist, social scientist, sociologist or a scientist other than a biologist had designed and prepared the report. There are many effects of the decisions being made of which biology is but one. However, the report seems to reflect largely that single perspective.

3 I am also concerned that Dundas Bay charter permits continue to be issued in conjunction with permits in Glacier Bay proper. Dundas Bay has a particular impact on the community of Elfin Cove that was not taken into account in the EIS. Charter services from Elfin Cove can provide a unique experience in the park that is not currently available to any extent. Day travelers from Elfin Cove could experience Dundas Bay for a few hours via a six pack charter boat and have a wilderness solitude experience that is not available through other means. Access to Dundas Bay continues to be underutilized and will continue to be below acceptable environmental levels if the permits continue to be tied to Glacier Bay proper. This will result in lost opportunity for visitors to experience one of the unique features of this great park.

Grouping:	Business
Format:	Web Comment

NUMBER	RESPONSE
B11-1	The Park Service is concerned about the public opinion that a decision has been pre-determined. The NEPA EIS process is based on making a sound decision as determined from the analysis of impacts on the environment. Public involvement is also an important part of the NEPA process in developing the final decision. Please see section 5.1 of the FEIS to review a history of the public involvement for the scoping and development of the DEIS. When assessing the impacts of vessels on park resources the FEIS addresses four categories of vessels (cruise ships and tour, charter, and private vessels). Cruise ships tend to have a greater impact on park resources than the other vessel classes and, therefore, the greatest analysis of impact.
B11-2	The EIS was prepared by an interdisciplinary team of specialists in the fields of study corresponding to the areas of analysis presented in the EIS. See "Chapter 5. Consultation and Coordination" for a list of the EIS consultants and their experience.
B11-3	The Park Service will consider this comment when charter use is re-allocated.

Rec'd 4/21/03

Dear Nancy Swanton: 4-9-03

Its the end of the day in San Jose — my 18 lb cat has been fed and I'm all worn out from swimming laps at the SJSU olympic outdoor pool and its time to drop you a few lines concerning Glacier Bay National Park and Preserve. —

1 I strongly urge you to strictly limit the number of motor vessels in Glacier Bay and Preserve. It seems singular I travel, there is the sound of motors and also the polluted air that goes along with the motors. I recall the stagnant polluted air over the City of Rome two years ago and I recall the polluted air in Washington D.C. It seems to be singular — engines, noise, pollution — Progress?

The further we progress with the Combustion engine, the less peace of mind we attain and more we degrade our environment — our little planet.

The more gas we burn — the greater the Global Warming. I fear all the glaciers are melting, the Antarctic is in a break-down Icebergs falling off that Ice Continent.

Its too bad that we do not have people in Government with ethics and principles and strong Character who could stand up against the Oil and Gas barons and help protect our planet! Its getting late in the game and it seems Planet Earth is on the losing side. Greed and Power and Money rule the Day. They say Venice will be one of the 1st Victims of Global Warming and the Islands of the South Pacific — Oil and Gas are our Idols! Paradise Lost Sincerely Tom Alderete

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I1-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy the park resources. Since 99% of the people who come to Glacier Bay visit the Bay by motorized vessels, eliminating or significantly reducing the number of motor vessels that enter the park would contradict the NPS mandate of providing opportunities for people to enjoy Glacier Bay. To protect park resources the Park Service will limit the amount of vessel use that occurs within the park and mitigate the impact of those vessels on park resources by requiring specific operating requirements

Emails Received

From: "Kimberly Armstrong" <shabubu@hotmail.com>

To: "Nancy Swanton" <glba_vessel_eis@nps.gov>

Date: 4/28/2003 11:02:30 AM

Subject: Alternative 4 comments

Body: Monday, April 28, 2003 Nancy Swanton EIS Project Manager Glacier Bay National Park and Preserve 2525 Gambell Street Anchorage, AK 99503 - 2892 Dear EIS Project Manager Swanton,
1 I strongly support Alternative 4 of the draft Environmental Impact Statement (EIS) on vessel traffic in Glacier Bay National Park. Sincerely, Kimberly Armstrong 6321 N Winthrop Ave Apt 206 Apt/Suite 206 Chicago, IL 60660 - 1541 shabubu@hotmail.com

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I2-1	Please see general response number 1.

MAY 13

5-11-03

Glacier Bay National Park & Preserve Vessel DEIS
c/o Ms. Nancy Swanton
EIS Project Manager
2525 Gambell St.
Anchorage, AK 99503-2892

Dear Ms. Swanton:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement (DEIS) for Vessel Quotas and Operating Requirements in Glacier Bay National Park & Preserve. We are submitting these comments as private local residents and recreational boaters who have lived in the Bartlett Cove/Gustavus community for 11 years.

Having experienced firsthand the variety of uses of Glacier Bay including cruise ships, tour boats,
1 charter boats, private boats, and kayaks, we feel that a balanced quota system as described in Alternative 5, with no more than the current level of cruise ships, is appropriate for protection of park resources and to provide a positive level of visitor experiences in the bay. We strongly believe that given the real and potential environmental impacts of the larger ships in the bay (water and air quality, risks of major fuel spills or marine casualties, sound and visual impacts), there should be some days during the June-Aug. summer season that there would be fewer than 2 cruise ships present. We further agree with the condition in Alt. 5 that restricts cruise ship speed to 13 kts. This would respond to scientific findings that the slower speeds better protect whales from being hit by larger vessels. It would also allow park visitors on cruise ships to spend more time in the park, and allow more time to experience the bay.

As private, recreational boaters in the bay, we feel strongly that our needs should be addressed along with those of the commercial operators. Increasing seasonal use day quotas for private vessels to 2300 would help equalize a current discrepancy that exists which has created an
2 administrative nightmare in allocating daily private boat permits. We also advocate changing the private permit system from differentiating between local and non-local, to short-term and long term. This would make for a system which is more equitable, easier for the public to understand, and easier for the Park Service to administer. Simplification of the permit system, which is addressed in Alternative 5, must be accomplished if the intended result of this DEIS, which is to protect resources and provide for appropriate visitor use, is to be achieved.

We ask that the National Park Service not favor one major use, that of the large commercial vessel operators, over all others, and choose Alternative 5 as the final choice in deciding the future of vessel use in Glacier Bay. Thank you for this opportunity to comment on this DEIS.

Sincerely,

Fawn Bauer Chuck Young

Fawn Bauer and Chuck Young
PO Box 328
Gustavus, AK 99826

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I11-1	The NPS preferred alternative is now alternative 6. This alternative combines elements of alternative 3 with many elements of alternative 5. While this alternative would provide for potential increases in cruise ship numbers (from 139 to 184 over the June through August timeframe), as in alternative 3, it would, as in alternative 5, provide improvements to the existing operating requirements, based on experience with the existing regulations and knowledge gained over the past several years.
I11-2	The NPS preferred alternative adopts the provision of issuing permits to a designated individual for a specific vessel over a specific period of time.

Comment Date: **5/14/03**

Name: Bennett, LeeAnn

Organization: Kansas Biological Survey

Address: 421 Rockfence Place

Lawrence, Kansas 66049-2029
USA

Email: lbennett@ku.edu

DEIS Information: *Chapter:*
Section:
Subsection: USA
Page:

Comments: In my opinion, the Glacier Bay National Park and Preserve, represents the untamed wilderness of Alaska. As such, it deserves protection and demands responsible use. The major concern that I have is that there is a demand by the cruiseline industry to increase the numbers of cruiseliners that visit Glacier Bay. After the incident with a female whale being killed in a collision with such a ship, and after reading reports of raw sewage dumping by a few irresponsible cruiseline companies, as well as learning about environmental violations being committed by several of these companies, I am not inclined to increase numbers of cruiseliners going into Glacier Bay each day. I realize that tourism is an essential part of the economy in and around Glacier Bay, but there are other things to be considered. Mainly, the safety and survival of the resident wildlife. Clearly, the number of routes used by cruiseships must be limited to certain areas so that the wildlife is disturbed as little as possible. Any other restrictions that may need to be instituted to protect the wildlife and the environment they live in, must be developed by biologists in coordination with NPS and the public. At this point,
1 I support the most environmentally sound alternative, Alternative 4. I feel that the interests of the park wildlife must come first.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I3-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: **4/9/03**

Name: Bert, Shawn

Organization:

Address: 14073 La Barca Drive

La Mirada, California 90638
USA

Email: shawn_350@yahoo.com

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments:
1 I could not find on the website a copy of the draft EIS to review, but I would like to state that I believe that the fewest number of vessels allowed in the Park's waters
2 would be most in line with the goal of preserving and maintaining the park in the most natural state possible. Our national parks and forests are the greatest of American treasures, and we should strive to limit human impact as much as possible. Thank you for the opportunity to express my views.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I4-1	The DEIS was available at http://www.nps.gov/glba/ under "News and Events." The Park Service regrets that you were not able to locate it. We tried to design the website to be accessible to all interested parties.
I4-2	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy park resources. Since 99% of the people who come to Glacier Bay visit the Bay by motorized vessels, eliminating or significantly reducing the number of motor vessels that enter the park would contradict the NPS mandate of providing opportunities for people to enjoy Glacier Bay. To protect park resources the Park Service will limit the amount of vessel use that occurs within the park and mitigate the impact of those vessels on park resources by requiring specific operating requirements.

Emails Received

From: "Julie Bond" <juliekaybond@yahoo.com>

To: "Nancy Swanton" <glba_vessel_eis@nps.gov>

Date: 4/22/2003 10:34:52 PM

Subject: Don't Pave the Parks

Body: Wednesday, April 23, 2003 Nancy Swanton EIS Project Manager Glacier Bay National Park and Preserve 2525 Gambell Street Anchorage, AK 99503 - 2892 Dear EIS Project Manager Swanton, I am writing to you today because of a serious threat to our public lands. The Interior Department recently published final regulations intended to facilitate the giveaway of thousands of miles of trails, roads, rivers and streams on our federal lands -- including some in our most precious national parks. I am alarmed by the administration's apparent goal of giving away tens of thousands of unsubstantiated claims for federal rights-of-way under the provisions of an antiquated 1866 Mining Law known as R.S. 2477. This provision, which Congress repealed in 1976, is now being viewed as a loophole for bulldozing thousands of miles of new roads across some of this country's most sacred federal sites and protected areas. These new regulations exclude the ultimate owners of our federal lands -- us, the American people -- from the disclaimer process, and provide no opportunity for advance public notice and comment before a final agency disclaimer decision is made against our interests. I understand that some counties are asserting R.S. 2477 road-building rights-of-way claims for cow paths, horse trails, riverbeds, dirt bike, and off-road vehicle routes, as well as for overgrown and nearly indistinguishable trails long ago abandoned by
1 prospecting miners. In addition, the state of Alaska may assert claims for as many as 22,000 navigable waters under the provision. In light of the potential irreparable damage that could be inflicted under the new disclaimer regulations, I urge you to write Interior Secretary Gale Norton and ask her to suspend indefinitely the processing of any R.S. 2477 claims or claims to lakes and rivers under the disclaimer rule's provisions. For more than a century, this country has created national parks that are the envy of the world. Now is not the time to abandon the protection of these treasured places. Please ask Secretary Norton to stop the reckless giveaway of these precious lands. Sincerely, Julie Bond 375 Liguori Road Edgerton, WI 53534 - 9331 juliekaybond@yahoo.com

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I5-1	Thank you for your concerns about public lands; however, R.S. 2477 is not directly pertinent to vessel management and operating requirements in Glacier Bay National Park and Preserve.

Comment Date: **3/24/03**

Name: Boone, James

Organization:

Address: 254 Independence Rd.

Rochester, WA 98579-8925
USA

Email: BucuzzoBoone@aol.com

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments: Thanks for this opportunity to comment. I am surprised that the "NPS preferred" alternative is different from the "Environmentally preferred" alternative. 1 I would have thought they would be one and the same. Since the primary goal of the National Park System is the preservation of the natural resources of the parks, I think the "Environmentally preferred" option should be chosen.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I6-1	Please see general response number 1.

Comment Date: **3/19/03**

Name: Brennan, Anne

Organization:

Address: 411 N. Colony Dr. 1 C

Saginaw, MI 48603

Email: asbrennan@hotmail.com

DEIS Information: *Chapter:*
Section:
Subsection:
Page:

Comments: As you state on your own website. this is a place for numerous plant species, even pioneer species that are appearing due to glacier melt. A variety of wild and marine life also are there. What kind of motorized vessels are you talking about? A
1 speedboat? or an ocean liner or a tanker? This makes a big difference. If it was up to me it would be left entirely alone, forever and ever. I cannot stress enough the seriousness of the danger that our wildlife faces from greedy people like our President who see nothing wrong with going into a pristime place and just ruining it along with destroying all vegetation, wildlife and any else in their path just for a few % of oil.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I7-2	Cruise ships provide the means by which over 90% of the visitors to Glacier Bay view and enjoy the park. Currently, cruise ships do not travel into several areas of Glacier Bay, including Whidbey Passage, Berg Bay, Fingers Bay, and Queen Inlet. Cruise ships rarely enter the East Arm. These areas currently provide visitors on tour, charter, and private vessels opportunities to experience Glacier Bay away from cruise ships. Additionally, under the NPS preferred alternative in this FEIS (alternative 6), cruise ships would not be allowed in the Beardslee Entrance and entrance to Adams Inlet in Glacier Bay or in Dundas Bay. Thus, the opportunities that currently exist for visitors on tour, charter, and private vessels would continue and, in fact, be increased with the preferred alternative.

Comment Date: **4/15/03**

Name: Brennan, Anne

Organization:

Address: 411 N. Colony Dr.
1 C
Saginaw, MI 48603
USA

Email: asbrennan@hotmail.com

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments: 1 Please do not allow any motorized boats or ships into Glacier bay. If someone wants to canoe or kayak that is ok since there would be no noise or putrid gas and oil smells or leaks. We have to stop somewhere in this world and let some of our land stay the way it is supposed to be before we as humans came along and wrecked everything. Please seriously consider not allowing motorized anything in to Glacier Bay.

NUMBER	RESPONSE
I7-2	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

Comment Date: **4/22/03**

Name: Broz M.D., John

Organization:

Address: 4521 Kanaka court

Buhl, ID 83316
United States

Email: brozj@penn.com

DEIS Information: *Chapter*:
Section:
Subsection: United States
Page:

Comments: Lets preserve Glacier Bay and keep it pristine...Limit the number of tour boats. Thank You JSBrozM.D.

1

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I8-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

Comment Date: **4/8/03**

Name: carey, steve

Organization:

Address: 4021 Bonsall Ave.

Drexel Hill, PA 19026
usa

Email: carey111@comcast.net

DEIS Information: *Chapter*:
Section:
Subsection: usa
Page:

Comments: I'll make this short. On my last visit to the Bay in August. I was shocked to see so
1 nany large vessels in the Bay. I know a whale was struck by one of these ships, and I ilso know, these boats are responsible for alot of pollution in the waters. I agree that here should be tighter vessel quotas!

Grouping:	Individual
Format:	Web Comment

NUMBER	**RESPONSE**
I9-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

MS. CHALLONER-WOOD: My name is Judith Challoner-Wood P.O. Box 276, Gustavus. I am here as a private citizen of the town of Gustavus. Thank you for providing the opportunity for offering our comments on this Draft plan. It is my fervet hope that you will evaluate our comments and give strong consideration to the effects of the Draft-EIS on the socio- economic health of Gustavus, the most affected neighbor coexisting in the great Glacier Bay watershed.

As a caveat to my personal participation in this comment period I would like to state as a
former employee that my concerns are for the equitable consideration of administering a
vessel management plan or VQOR that will benefit both local Icy Strait users and the
1 American public at large. In no way should my comments be construed as a negative
reaction to the Park. In the seven years I worked at the backcountry office it was always
my mission to fairly administer the permit system for the benefit of all.

I applaud the efforts of Park staff in general in doing a job that is challenging and
politically charged. While I celebrate and respect the Tlingit ancestral lifelines to Glacier
Bay, their homeland, I also want to strongly underscore the critical importance of
National Park Service decisions on the people and the environment of this village of
Gustavus. If you are entertaining long-term commitments to outside interests or
manifestly changing how you manage this great Park it would be imperative for you to
partner with Gustavus as you have partnered with the Huna/Tlingit as we, Gustavus, are
2 the critically affected gateway to Glacier Bay. The importance of proceeding with the
gateway conference as promised last summer would help all in bridging the
communication gaps and empower Gustavus leadership in forging decisions for a good
future.

Many of us in the community are promoting activities to build local relationships and the Park has made a good start in some areas but there is more work to be done. We cannot be just your bedroom community. We need other economic outlets to survive and meaningful creative ways to promote a sustainable lifestyle and right livelihood for all.

This preamble is because after reading and reviewing in the short time I've had the Draft, I've only been able to review the executive summary and I am concerned about some of the details and how some factors will impact further our lives here in Gustavus. I will be reviewing the Draft-EIS in detail and submit a comprehensive review of pertinent details and concerns that I have.

3 Immediately I've noticed that the addendum does not contain administrative boat permit
numbers or the charter boat statistics. These are both germane to the quotas and any
changes necessitated by different alternatives. Also lacking is an in-depth review of the
4 recreational boat permit system which after administering for seven years I know
intimately has both loopholes and problems which I had understood would be addressed
in this EIS.

5 I would strongly oppose any increase in cruise ships. I would rather see a maximum of
one cruise ships a day and add another tour boat entry. I feel that aesthetically cruise

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I10-1	The Park Service's goal in the vessel management plan is to protect park resources and provide high quality visitation. The Park Service cannot discriminate between local users and the U.S. public at large, and therefore, has sought to design the NPS preferred alternative to address the local and non-local concerns equitably while protecting park resources.
I10-2	The primary factor to be considered by the regional director, Alaska Region, is protection of park resources. The regional director, Alaska Region, must ensure that park resources would be left unimpaired and within naturally functioning conditions. At the same time, as a responsible member of a greater community and region, the Park Service must take into account the negative as well as the positive impacts that tourism may have on park neighbors. Per Director's Order #17, the Park Service recognizes that cooperation between businesses that operate in the park is essential to providing high quality visitor experiences and opportunities.
I10-3	Please see general response number 4.
I10-4	The "based in Bartlett Cove" exemption would be eliminated under three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.
I10-5	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

ships are an impediment to total visitor use and that they could better be served by coming into the Bay on a smaller boat or boats.

The charter boat entry numbers are fine. They have been under utilized for the last
several years for the most part. A new perspectus for charter boats is long overdue and
6 needs immediate release to accommodate perspective new users while deleting permit
holders who are not using their permits.

In no way should recreational boat entries be diminished. In fact there would be little
7 impact at increasing them to 30 per day during peak season for a limited amount of time
and instituting a limit on where the larger yachts can go, the same limit as tour boats.
Having a short-term permit rather than a local permit is a step in the right direction as
long as the loopholes are closed and the rules are followed equitably. Permits should go
with the operator and the operator requirement should be limited to those people who can
actually operate the boat alone.

8 The boats based in Bartlett Cove consideration largely a privilege constructed to allow
Park personnel to be able to access boat usage when permits aren't available has not
worked very well. The issue of a corridor for Bartlett is a thorny issue and should not
just be available to Park residents and thus needs to be well thought out. This is a
problem due to the need to access Bartlett Cove, also for gas reasons, which is, in my
estimation not a rally good use of the limited recreational permits.

If you are really interested in resource and wildlife impacts you need to more closely
examine and account for limited access in non-motorized waters for research vessels.
9 Kayaks also need to be more closely monitored especially in McBride and other
protected inlets but I assume this will be addressed in the Backcountry EIS. Perhaps
during nesting periods the kayak activities could be curtailed or limited in these critical
habitats.

And it is extremely important and I can't emphasize this too much to simplify the recreational boater permit rules and regulations. The average person just cannot get it.

Again, thank you for letting me testify and I will be presenting more comprehensive written testimony prior to May 14th.

NUMBER	RESPONSE
I10-6	The administration of concession contracts is out of scope of this EIS. Please contact the park's chief of concessions for further information on concession permits.
I10-7	The number of private vessel entries would not diminish under the NPS preferred alternative in the FEIS (alternative 6). Alternative 6 eliminates the seasonal entry quota which allows the same 25 vessels to only be present in any one day. In its place a seasonal-use day would be used which allows a total of 25 vessels to be present in Glacier Bay on any one day; however, they do not have to be the same 25 vessels. This allows more flexibility in the regulations and a greater variety of private vessel visitors to experience the park.
I10-8	Please see general response comment 4.
I10-9	The effects of non-motorized vessels will be assessed in the Backcountry Management Plan and Environmental Impact Statement which is currently under development.

POBox 10159
Fairbanks AK 99710
May 2, 2003

Glacier Bay NP & P, Vessel DEIS
c/o Nancy Swanton
2525 Gambell St.
Anchorage AK 99503-2892

Dear Ms. Swanton,

Several years ago I visited Glacier Bay
(on a cruise ship!) and the scenery was
truly spectacular. An increase in the
number of cruise ships would, however,
both reduce the enjoyment of visitors, and
put more stress on the environment,
from added noise (of engines, etc), air &
water pollution, & also from wakes washing
and eroding the shore. They would be even
more unsettling to marine & other
wildlife than the present motorized
vessels do. So please don't raise the
1 number of vessels in the park - and
reduce it if you can -

Sincerely,

Florence R Collins

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I12-2	Thank you for your comment. Please see general response number 1.
I12-2	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

4-30-03
To: NPS
RE: Draft Plan for Glacier Bay National Park

Good Day,

I am writing to comment on the Glacier Bay draft plan.

Glacier Bay is a beautiful, pristine environment which I enjoy very much. This park should have the utmost protection and the operation of motor vessels, while important, should be
1 carefully monitored and restricted.
Cruise ship speeds should be
2 reduced so marine mammals will not be hit.
3 Non-motorized areas around seal haul-outs should be established and enforced.
The number of vessels allowed should not increase.

4 The second alternative of the draft plan would be the best decision to maintain and protect the wildlife and values of the park for future generations.

Thank you for the opportunity to comment -

Terry Cummings

Ms. Terry Cummings
6740 East 10th
Anchorage, Alaska 99504
(40 year resident)

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I13-1	Please see general response number 1.
I13-2	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
I13-3	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the seasonal timeframe of when vessels must remain greater than 0.25 mile (0.4 kilometer) from harbor seals hauled out on ice in Johns Hopkins Inlet. (The current seasonal restriction is from July 1 through August 31.)
I13-4	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: **3/16/03**

Name: Denison, Mr and Mrs James

Organization:

Address: 6931 E 11 Th St

Long Beach, CA 90815

Email: LAnnD4animals@aol.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments: We are among the fortunate people who have had the inspiring experienceof watching those magnificent giants, the humpback whales, feeding in Glacier Bay from the deck of our ship!So we know how important it is for people to be able to do this. However, we've also enjoyed the opportunity to enjoy whales at their mating and birthing and "nursery" areas up close and natural. So, while we believe that people should be able to enter Glacier Bay for whale viewing, we are also concerned about the disturbance this can cause for the whales, who are storing up fat for that thousnands-of-miles

1 migration they must make. We are concerned that Alternative 4, the "preferred" alternative does not provide enough guaranteed protection of the whales. Therefore, we believe that Alternative 3, "The environmentally preferred alternative should be chosen. Thank you

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I14-1	In the DEIS, alternative 4 is the environmentally preferred alternative and alternative 3 is the agency preferred alternative. For the FEIS, the Park Service has developed a revised NPS preferred alternative (alternative 6) that includes new vessel quotas and some of the operating requirements from alternative 4.

Emails Received

From: "Howard Deutch" <hdeutch1@twcny.rr.com>

To: "Nancy Swanton" <glba_vessel_eis@nps.gov>

Date: 4/23/2003 5:48:32 PM

Subject: Alternative 4 comments

Body: Wednesday, April 23, 2003 Nancy Swanton EIS Project Manager Glacier Bay National Park and Preserve 2525 Gambell Street Anchorage, AK 99503 - 2892 Dear EIS Project Manager Swanton, My wife and I enjoyed our visit to Glacier Bay with Cruise West. We are in favor of preserving this wonder by carefully managing visitation. The draft Environmental Impact Statement will enable the National Park Service to make better decisions about how to manage vessels in Glacier Bay in order to protect the
park's natural resources. The new vessel operating requirements found in Alternative 4, the
1 environmentally preferred alternative, should be implemented regardless of which final alternative you
select for vessel numbers. Thank you for your work in bringing about the possibility to protect and preserve Glacier Bay. Sincerely, Howard Deutch 112 Woodmancy Ln. FAYETTEVILLE, NY 13066 - 1535 hdeutch1@twcny.rr.com

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I15-2	Please see general response number 1.

postmarked
MAY 14 2003
rec'd
MAY 16 20

To U.S. Department of the Interior
National Park Service
Glacier Bay National Park
c/o Nancy Swanton
Re: Glacier Bay National Park + Preserve
Vessel DEIS

My preferred choice is alternative 4. Living nearby as I do, in Pelican, I would suggest that the negative impacts caused by commercial traffic extend beyond the boundaries of the Park. Environmental degradation will affect all of northern SE. 1

While I realize that the Park Service in Glacier Bay receives funding by a head tax on cruise ships, and thus has a vested reason for wanting increased commercial traffic, I can't accept that this is a valid reason for the destruction of the Park. If the Park Service was truly concerned about financial impacts on locals, than perhaps it would have worked harder to allow commercial fishing to continue. 2

Sincerely yours,

David Duffy
P.O. Box 23
Pelican, Ak 99832

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I16-1	Please see general response number 1.
I16-2	The Park Service strongly disagrees that managers are motivated to increase cruise ships in the interest of obtaining more fees. Although the funds provided by cruise ships and other fees fund staff positions and projects, the Park Service's motivation is to protect the resources of the park for future generations while allowing the public to enjoy it. Cruise ships provide the means by which the majority of people are able to view and enjoy the park.

Comment Date: **4/14/03**

Name: Dunn, Ruth Ann

Organization: Flood Brook Union School

Address: 113 Trailside Condos 1-10

Londonderry, VT 05148
USA

Email: dunnru@msu.edu

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments: After reviewing the DEIS, I strongly support Alternative 4. Reasons: It will be the most effective alternative for reducing noise pollution, minimizing adverse effects to the air and water quality of the Glacier Bay area, and minimizing hazardous effects to endangered or threatened species and biologic communities. I have been a visitor to the Alaskan coastline (NOT in a cruise ship!) It is truly worth preserving as untouched as possible. Cruise ships are disgusting - their staff dump garbage into the waters,
1 they belch pollution, and are quite loud. If visitors wish to visit this beautiful area, they should have to do so in an environmentally responsible way. By all means, limit cruise ships to the greatest extent possible. The entrepreneurial spirit will take hold to find an environmentally better way for these folks to see what they want to see. Respectfully, Ruth Ann Dunn

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I17-1	Please see general response number 1.

Comment Date: **4/14/03**

Name: Fischer, John

Organization:

Address: 230 Gorve Acre, #313

Pacific Grove, CA 93950-2342
United States

Email: snowy@ecologyfund.net

DEIS Information: *Chapter*:2
Section: 2.3 &2.4
Subsection: United States
Page:

1 **Comments:** I can support Alternate 1, although my first choice would be Alternate 2. I know that the Environmentally Preferred Alternative is not a winner in any case. Although the addition of some of the small cruise ships like Cruise West might not be too bad, the addition of any large ones is not a good choice until the industry agrees to use ships that are fail safe in the operation of their discharge systems. And I do mean systems that are redundant, have enough storage capacity when a system fails and the companies are willing to pay huge bonds in case of a failure.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I18-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that 'when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.' The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: 3/19/03

Name: fricano, marian

Organization:

Address:

,

Email: mfricano@scu.edu

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

1 **Comments:** Protect this pristine area!

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I19-1	The Park Service is tasked with conserving park resources and values and providing opportunities for people to enjoy these resources and values. To protect park resources the Park Service will limit the amount of vessel use that occurs within the park and mitigate the impact of those vessels on park resources by requiring specific operating requirements.

Comment Date: **4/8/03**

Name: Fricano, Marian

Organization: Michel Orradre Library, Santa Clara University

Address: 500 El Camino Real

Santa Clara, California 95053
U.S.A.

Email: mfricano@scu.edu

DEIS Information: *Chapter*:
Section:
Subsection: U.S.A.
Page:

2 **Comments:** Please consider an alternative to the proposal that is more environmentally sound. Thank you!

NUMBER	RESPONSE
I19-2	Please see general response number 1.

MR. GRANT: My name is Kenneth Grant. My Tlingit name is X'ool'Xaa. My formal Tlingit name is Kaax Ka Took 'aa geh. I'm a Tuk dzia taan, I'm Kagwantan yaadi. And my house comes from Gaa Haax aa hit. I am a decedent of Glacier Bay. I've lived in the area all my life. I've traveled it with my grandparents gathering food, hunting and I traveled it with my father and with other relatives, Jimmy Martin fishing, commercial fishing, king salmon, halibut. And I've grown to really appreciate what we call our ancestral homeland in more ways than one. I've seen it from the cultural side. I've experienced it. It's nourished my body, my family and my ancestors. And now, in today's world I've gotten the opportunity to witness it from the eyes of the newcomers. I've worked on the cruise ships for two seasons. Been up into Glacier Bay every single week on cruise vessels witnessing passengers, people that appreciate the environment and I can see the reaction of the visitors and it's always the same. They have a great awe for the natural wonders that Glacier Bay has, the beauty, the serenity. I believe that when you
1 incorporate a soundscape into the picture, I think you're doing the right thing. I think you should minimize the sound. And I would like to introduce another one which is
2 visualscape, and that's contact with other people, other assets in the Park. I know from my own feeling, when I see someone -- when I'm trying to go through a therapy by, you know, there's a healing in the silence in the natural wonders and then another boat comes in, I know they're entitled to it, too, but you really appreciate that time. And I can't say that I'm really familiar with all of your alternatives so I'm just generally speaking. I think attention should be paid to contact, minimizing it. And I think attention should be paid to the soundscape. And also respect for the land which Wayne alluded to a little while ago. And in final note I'd like to say that I've gone through the full spectrum of emotion with Glacier Bay. We've gone through an adversarial relationship with the Park Service and now we're on the healing phase with the National Park Service with what we're doing -- our tribe is doing with the Park. And I've grown to appreciate the protection that the Park Service has offered for this greatest treasure that we have. I have witnessed it on a daily basis, being up there in the Park, seeing our Park Rangers up there enforcing the speed limits and, you know, even protecting the animal, the habitat and all this. And so I think that what I'm trying to say is I appreciate it and I thank the National Park Service.

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I20-1	The Park Service does consider soundscape in all decisions. This FEIS includes a modified analysis with additional considerations for soundscape.
I20-2	The Park Service thanks you for your suggestion. Viewing vessels is considered in the analysis of visitor experience (subsection 4.4.2). In addition, the wilderness resource section (subsection 4.4.4) evaluates the effects of the presence of vessels on the naturalness dimension of wilderness.

Emails Received

From: "Ravi Grover" <desi666@hindunet.com>

To: "Nancy Swanton" <glba_vessel_eis@nps.gov>

Date: 4/23/2003 3:23:53 AM

Subject: Alternative 4 comments

Body: Wednesday, April 23, 2003 Nancy Swanton EIS Project Manager Glacier Bay National Park and Preserve 2525 Gambell Street Anchorage, AK 99503 - 2892 Dear EIS Project Manager Swanton, Thank you for completing the draft Environmental Impact Statement (EIS) examining alternative levels of vessel traffic and associated impacts in Glacier Bay National Park.
1 The new vessel operating requirements found in Alternative 4, the environmentally preferred alternative, should be implemented regardless of which final alternative you select for vessel numbers. It is the behavior of boats that is potentially one of the most damaging to park resources.
Sincerely, Ravi Grover PO Box 802103 Chicago, IL 60680 - 2103 desi666@hindunet.com

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I21-1	Please see general response number 1.

MS. HEACOX: Hello, I'm Melanie Heacox and my P.O. Box is 359 here in Gustavus and my comments are just as a personal, private citizen.

First, thank you for the opportunity to comment on the Draft environmental impact statement regarding vessel quotas and operating requirements for Glacier Bay National Park and Preserve. The comments I am submitting this evening for the formal record are those of my own, not representing any formalized group, they do represent my association with Glacier Bay which began in 1980.

From 1980 to 1996 I observed, with concern, the increasing level of vessel traffic in Glacier Bay. In 1996 with the advent of the Vessel Management Plan, I was pleased to see quotas set in motion that allowed a moderate level of vessel use to provide access for the visitor, permits for local charter tour operators, conservation measures to protect wildlife and habitats, and at the same time provide opportunities for quality backcountry experiences free from motorized vessels. IT seemed to me then, and does now that the 1996 VMP quotas had arrived at a pretty fair balance of uses. I now have new concerns as I read a preferred alternatives with provisions for up to 184 seasonal use days in the cruise ship category, a 32 percent increase. The best reasons to reject Alternative 3 as the preferred alterative are listed within the pages of the Draft-EIS itself.

The following are all quotes taken directly from the Draft relating to Alternative 3.

1. Would greatly increase the frequency of visible stack emissions
2. Increase associated noise exposure and risk of collisions
3. Eliminate opportunities to undertake traditional activities in the central portions of Glacier Bay without the presence of a cruise ship
4. Charter and private vessel passengers and backcountry visitors could experience a loss of opportunities for solitude due to increase cruise ship traffic
5. Reduce the naturalness of wilderness near the tidewater glaciers
6. Eliminate days when the natural soundscape is not altered by cruise ships during the summer months
7. Have the highest potential level of risk for whale deaths due to vessel strikes
8. Sounds would increase up to two times per day in popular destination inlets of Glacier Bay's West Arm
9. Would likely detract from the quality of experience, including wildlife sightings
10. Increase in the overall risk of fuel spills from cruise ships
11. Increase the number of events during which congestions would occur in inlets
12. Would result in two entries per day every day of the summer season, presenting the worst-case daily emission potential.

Again, these are all quotes, not my own words.

The NPS management policy states that the Park Service will assume "an aggressive role" in promoting and pursuing measures to protect air quality. It seems to me that

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	**RESPONSE**

worst-case scenario and an aggressive role in protecting air quality do not go hand-in-hand.

Although whale 68 was the first documented mortality of a ship struck whale in Glacier Bay National Park, Park records document two other non-fatal whale- vessel collisions since 1985. Again, quoting the EIS, several humpback whales in the Southeast Alaska's photographic catalog have propeller scars or other injuries that clearly indicated collisions with vessels. Collisions with vessels and humpback whales are expected to be rare "yet inevitable."

It occurs to me that any measures we can take to avoid whale/vessel collisions would be worthwhile and an increase in cruise ships is counter productive toward that goal.

The Draft-EIS is not without merit, it offers a tremendous amount of information that will serve as a resource for many years to come. And it includes some excellent provisions I would like to see adopted including:

1 A. Placing limits on cruise ships in May and September
2 B. Prohibiting cruise ships and tour boats from entering Dundas Bay
3 C. Reducing cruise ship speed to 13 knots to reduce likelihood of collisions with whales
4 D. Defining cruise ship routes
5 E. Providing 10 permits for private vessels on a short-notice basis
6 F. Closing the East Arm to tour boats and cruise ships

7 The Organic Act gives the Park Service a mandate to protect resources of National Parks and to make conservation of the environment the leading priority when making management decisions regarding National Parks and, I quote, where a conflict exists between the NPS efforts to conserve resources and values versus those providing for enjoyment of them, conservation takes precedence.

8 I believe that the preferred alternatives written puts the emphasis on visitation and not conservation. I urge a reconsideration of the preferred alternative, leaving vessel use levels as they are at present, with the addition of environmental protections as delineated in Alternative 4, especially with respect to Dundas Bay where according to the EIS, although no vessel quotas currently are established for Dundas Bay, it is expected that charter vessel use of Dundas Bay, over time, will increase by two to three times.

9 Lastly, I would request that administrative travel is addressed in the Final-EIS. A tremendous amount of time and effort and monies have been expended in preparing this document which tackles the pros and cons of changing charter vessels from five to six per day or tour boats from two to three and yet dismisses the administrative use of over 30 NPS vessels. While I agree that administrative use is necessary to conduct Park business, those vessels should be considered along with the others for a comprehensive vessel management plan.

NUMBER	RESPONSE
I22-01	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
I22-02	Regarding Dundas Bay, the NPS preferred alternative in this FEIS (alternative 6) establishes limits for tour and charter vessels and prohibits cruise ships. Tour vessels would be limited to one per day during the quota season and would be allowed only in the non-wilderness waters of lower Dundas Bay. Charter vessels would be limited by a seasonal-use day limit but not a daily quota during the quota season.
I22-03	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
I22-04	In general, cruise ships stay mid-channel when traveling within the park. Therefore, the Park Service has determined that defining mandatory routes would be unnecessary.
I22-05	The "based in Bartlett Cove" exemption would be eliminated under three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.
I22-06	Under the NPS preferred alternative in the FEIS, Adams Inlet would be closed to tour vessels and cruise ships.
I22-07	The NPS preferred alternative has been revised in the FEIS based on public comment. The Park Service believes that the provisions of the NPS preferred alternative, alternative 6, comply with the intent of the Organic Act to protect park resources and conserve the environment.
I22-08	Please see general response number 1.
I22-09	Please see general response number 4.

And one final quote from the EIS states, "More important than its size, Glacier Bay wilderness offers some of the most unique resources in all of the national Wilderness Preservation System. With its calving tidewater glaciers; temperate rainforest, plan diversity and terrestrial marine wildlife, including threatened and endangered species, the Glacier Bay wilderness is an unparalleled intact ecosystem." Please keep it that way. Change the preferred alternative.

Thank you for the opportunity to comment.

This page intentionally left blank.

Comment Date: **3/19/03**

Name: Hill, C

Organization:

Address: POB 441

SHARPES, FL 32959

Email: cynthiapeace@yahoo.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

1 **Comments:** Plain and simple: No destruction of, in and or to the Park should be allowed. When is enough, enough? Thank you for your time, effort, consideration and attention in this matter.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I23-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: **3/19/03**

Name: hooker, betsy

Organization:

Address:

,

Email: thebetsy1@aol.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

1 **Comments:** no ifs ands or buts allowed this time around! just say NO!!! there is no way this can be a benefit to anyone. just another way of polluting our fragile environment. get serious! it's all about oil... much as is the war with iraq!

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I24-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that 'when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.' The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: 4/25/03

Name: Johnson, Roy

Organization:

Address: HC60 Box 145-M

Copper Center, Alaska 99573
USA

Email: roy_1968@msn.com

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments:

1 Dear Good Folks at Glacier Bay National Park, Regarding the issue of motorized vessels within Park boundaries...I feel that at the very least they should be limited. But even better yet, they should not be allowed at all. Glacier Bay is one of the most incredibly beautiful and pristine places in the world...one of the last wondrous places to (mostly) avoid man's selfish on-slaught of "progress". Three very important reasons Glacier Bay has survived from receiving more harmful impact than it has over the years is because of John Muir, Jimmy Carter, and the National Park Service. The National Park Service has a creed to follow...be true to it. I had the opportunity to sea kayak Glacier Bay in 1981. By far and beyond it was one of the very most wonderful places and activities I've ever done in my life and it will be a fond memory I'll never, ever forget. The peacefulness and quietness sang to me with every stroke of my paddle. The only sounds I did hear were the sounds of water dripping off my paddle, water lapping at the sides of my kayak, the wind on the water, the sound of Humpback Whales exhaling as they surfaced, the bawling of harbor seals clustered on the icebergs or rocky islands, the amusing peep, peep, peeping of black oyster catchers scurrying along the shoreline, and the roar of massive slabs of ice breaking off the faces of tidewater glaciers and crashing into the dark, deep water...the droplets of water drip, drip, dripping off the shelf-like, under-cut edges of icebergs that have been afloat for many days or weeks or months...riding the tides in and out and back again into the inlets, again and again. It's so marvelous experiencing nature without the sounds of churning boat engines or paddling through oil, gas, or diesel slicks that float in iridescent blue stains across the water. Keep Glacier Bay a place of beautiful wonderment...a peaceful and quiet sanctity held in it's own natural and subtle sounds...when there's any sound at all. Keep it always guarded for generations beyond our sights. Glacier Bay is a place of Grand Spirit! Save it... preserve it at all cost! Nothing could ever come close to replacing what it always has been. Thanks to you all...past and present who would stand up and protect in nature what there's becoming less and less of in the world. Sincerely, Roy Johnson HC60 Box 145-M Copper Center, AK 99573

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I25-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

Comment Date: **3/18/03**

Name: Koplik, Elaine

Organization:

Address: 20 Stonehenge Lane

Albany, NY 12203

Email: ekoplik@nycap.rr.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

1 **Comments:** Please choose Alternative 4. It's the only option that will protect wildlife from excessive disruptions by vessel traffic.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I26-1	Please see general response number 1.

Comment Date: **3/17/03**

Name: Koplik, Mark

Organization:

Address: 20 Stonehenge Lane
Apt. 19A
Albany, NY 12203

Email: mkoplik@uamail.albany.edu

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

1 **Comments:** Please adopt Alternative 4. It's the best alternative for preserving the health and stability of wildlife populations. The park should be open to visitors, but not a theme park inundated with ship traffic, noise pollution, etc., etc.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I27-1	Please see general response number 1.

MR. KUNNET: My name is Jonish Kunnet, P.O. Box 335, Gustavus, Alaska and I'm representing a family of seven. But I would like to make a comment about the new EIS, the proposal.

Looking at all the charts it's not very difficult to notice there aren't many changes, on the
five proposals there is -- they don't differ very much from the current proposal actually
except one. I would like to make a comment that I would like to see less cruise ships and
1 more charter boat permits available. If we're talking about the environmental impact of
cruise ships you said in your publication there, I can just quote from your book, amount
of nitrogen oxide per day is 4,393 is it pounds or kilograms.

MR. HALL: I think it's tons.

MS. SWANTON: Tons.

MR. KUNNET: No, no that's daily, it doesn't say it's pounds or kilograms.

MR. HALL: Okay.

MR. KUNNET: But comparable to charter vessels 297, pounds or kilograms, per year, it's 240 tons versus seven tons per year. If there is two cruise ships on there per day and six charter vessels per day, for that comparison, I can compare other numbers but that's not the point here.

I think there is more opportunity – there is more room for the charter vessel -- increasing of charter vessel permits. I think it provides better opportunity for visitors to enjoy the Glacier Bay.

And also I would like to stress the need of differentiating the type of motor vessels.
Motor vessels differ very much from one vessel to another vessel. Sailboat is a
completely different vessel. It makes much less impact on the environment than say a
2 catamaran, modern catamaran. And so the type of activities that the motor vessel --
charter motor vessel would be engaged in would be different -- making a different impact
on the environment. For example, a vessel that is doing just sightseeing in Glacier Bay that is going into the glaciers and coming back in one day, it makes a tremendous impact on the environment because the propolsions are on all the time versus a vessel that say is doing sportfishing charter where it's anchored out, most of the time it's idle. Even this close to shore, though, I think the impact on the whales is not even comparable. Because there is opportunities for another vessel -- I'm -- my profession is diving and I don't see any opportunity for diving. I would like to bring tourists to the diving, you know, on the water exploring Glacier Bay and there is not such even -- I'm not even allowed to have that kind of a boat or anything and I would like to see that the Park sees something different, not just as a motor vessel, you know, I'd like to propose -- somebody else would propose sailboat, you know, expedition and that's a -- that's an insignificant impact on the environment, and I think that should be taken into account.

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I28-1	Charter permits will not increase under the NPS preferred alternative, alternative 6. Under the new concessioners prospectus, charter permits will be reallocated, allowing for increased opportunities for charter operators.
I28-2	The Park Service recognizes the different vessels classes; however, when a sailboat is under power it is considered a motor vessel and treated as such by the U.S. Coast Guard. As it is difficult to regulate a vessel that changes from one class to another depending on whether it is using motorized propulsion or not and as the majority of sailboats at some point use motorized propulsion when traveling within Glacier Bay, the Park Service will continue to include sailboats under the private motorized vessel category.

3 And also the cruise ships I would like to see less cruise ships a day. I don't think the Park is in a position to -- it's a little bit conflict of interest when you said, Steve, that the tourists coming on the cruise ships provide jobs for the Park employees. I think the best interest of the Park not to cut the number of cruise ships, and I don't think the -- the money shouldn't go to the Park directly, I think the money for the employees in the Park should come from a different source.

And, yeah, well, I guess, that's it.

NUMBER	RESPONSE
I28-3	The Park Service strongly disagrees that managers are motivated to increase cruise ships in the interest of obtaining more fees. Although the funds provided by cruise ships and other fees fund staff positions and projects, the Park Service's motivation is to protect the resources of the park for future generations while allowing the public to enjoy it. Cruise ships provide the means by which the majority of people are able to view and enjoy the park.

Comment Date: **4/8/03**

Name: Lange, Marlena

Organization:

Address: 23 Royce Ave

Middletown, NY 10940-4708
USA

Email: mar@warwick.net

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments:

1 I believe the total number of vessels allowed to enter the area of Glacier Bay should be pre-1996 levels in order to protect the pristine quality which is what people come to see to begin with.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I29-1	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.

Comment Date: **4/6/03**

Name: Luetkemeyer, Judy

Organization:

Address: P. O. Box 849

Gatlinburg, TN 37738
USA

Email: smokymtngal@webtv.net

DEIS Information: *Chapter*:
Section: Summary
Subsection: USA
Page:

1 **Comments:** In regards to Alternative IV, which is my preferred action, I would like to see restrictions on private vessels.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I30-1	Please see general response number 1.

Comment Date: **3/28/03**

Name: Mattison, Priscilla

Organization:

Address: 351 Hidden River Road

Narberth, PA 19072
USA

Email: smattison@aol.com

DEIS Information: *Chapter*:2
Section:
Subsection: USA
Page:

Comments:
1 I strongly favor Alternative 4 because it will likely have the most beneficial effect on the environment, by limiting the numbers of vessels and where they can go, thus resulting in the least noise and pollution.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I31-1	Please see general response number 1.

Comment Date: **3/18/03**

Name: McMillen, Mimi

Organization: Homo Sapiens

Address: 1621 IndianCreek Loop

Kerrville, TX 78028-1767

Email: grizzly@ktc.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments:

1 I feel Glacier Bay should be free of cruise ships due to reasons of sanitation. This problem becomes ever more catastrophic. However, I know Glacier Bay is important economically. PLEASE strike a balance so as to preserve this gem for ALL of us (sea life, birds & people). Overpopulation threatens to drown the planet. Thank you for providing the opportunity to comment.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I32-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.

Comment Date: **5/14/03**

Name: Morehouse, Carolyn

Organization:

Address:

,

Email: jeffmorehouse@gci.net

DEIS Information: *Chapter*: 3
Section: 2
Subsection:
Page: 4

Comments:
1 The water quality assessment does not include nitrates and phosphates. The NPS may want to include ambient water monitoring if they endorse Alternative 3.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I33-1	Federal law authorizes commercial fishing in the park. The effects of commercial vessels have been evaluated in the Commercial Fishing Environmental Assessment (NPS 1998). In this EIS, commercial fishing vessel effects are considered in the cumulative ef

Comment Date: **5/14/03**

Name: Morehouse, Carolyn

Organization:

Address:

,

Email: jeffmorehouse@gci.net

DEIS Information: *Chapter*:3
Section: 2
Subsection:
Page: 3

Comments:
2
It is unclear from the EIS how the emission facotrs for NOx, CO, PM (is it PM 10 or 2.5), HC and CO2. Since the sulfur is off by 5-8 times once could assume the particulate matter for the CRUISESHIPS is also off. The PM 10 loading is much higher for residual fuel than diesel.

NUMBER	RESPONSE
I33-2	The emission factors for NOX, CO, and PM are calculated using the Marine Engine Emission Factors provided in Table 5-1 of Energy and Environmental Analysis, EPA420-00-002, Analysis of Commercial Marine Vessels Emission and Fuel Consumption Data, Final Report, February 2000. This document instructs the user to use these factors to calculate the emissions of the pollutants listed above, which are determined from existing emission data and vary in relation to work load. The document provides direction to use the sulfur content of the fuel to determine the appropriate sulfur emission factor (see attached spreadsheet). The SO2 emission factor is derived differently, therefore, the error in the assignment of the SO2 factor does not have an impact on the other pollutant emission factors.

Comment Date: **5/14/03**

Name: Morehouse, Carolyn

Organization:

Address:

,

Email: jeffmorehouse@gci.net

DEIS Information: *Chapter*:3
Section: 2
Subsection:
Page: 3

Comments:
3 TOur, CHarter and PRivate boats would all use diesl that ranges .2-.5%. THe 27 lbs/1000 gallons should be OK for those vessels.

NUMBER	RESPONSE
I33-3	The 27 pounds/gallon factor will remain in use for all vessels other than cruise ships.

Comment Date: 5/14/03

Name: Morehouse, Carolyn

Organization:

Address:

,

Email: jeffmorehouse@gci.net

DEIS Information: *Chapter*: 3
Section: 2
Subsection:
Page: 3

Comments:

4 The sulfur emissions are too low. Appendix 6 states an emission factor for sulfur is 27 lbs/gallon. Most large cruiseships burn residual fuel which has a weight of approximately 7.95 lbs per gallon. Backing out of the 27 lbs/gallon emission factor, the sulfur content used for these calculations is 0.3% Sulfur. Residual fuel ranges from 1.4% to 2.1%. The sulfur calculations are 5-8X too low based on my calculations. The emission factor in Appendix 6 is 27 lbs/1000 gallons.

NUMBER	RESPONSE
I33-4	The sulfur content of the fuel used by the cruise ships will be adjusted to 2% to accurately yet conservatively represent the sulfur content of the marine grade fuel used by the cruise ships.

Comment Date: **5/14/03**

Name: Morehouse, Carolyn

Organization:

Address:

/

Email: jeffmorehouse@gci.net

DEIS Information: *Chapter:* Summary
Section:
Subsection:
Page:

Comments:
5 The Alternative 3: NPS Preferred Alternative does not include any statements as to why this is preferred alternative. I would think the NPS would include statements that are deemed more important than the environmentally preferred method. It would be helpful to include the reasons why the NPS choose this alternative even though it will clearly inpact the environment.

NUMBER	RESPONSE
I33-5	After reviewing the public comments, the Park Service has developed a revised NPS preferred alternative in the FEIS - alternative 6. This alternative includes the vessel quotas for cruise ships from alternative 3 and the tour, charter, and private vessel quotas from alternative 5. Operating requirements from alternatives 4 and 5 are included in alternative 6. The rationale for selection of this alternative is presented in section 2.8

Comment Date: **5/14/03**

Name: Morehouse, Carolyn

Organization:

Address: 152 Behrends Avenue

Juneau, AK 99801

Email: jeffmorehouse@gci.net

DEIS Information: *Chapter*:SUmmary
Section:
Subsection:
Page:

Comments:
6 The EIS did not address local impacts to surrounding communities. Such as medical and medivac from Sitka and Juneau. I am not oppose to increase ship traffic but the impacts of local economy includes more than Gustavus.

NUMBER	RESPONSE
I33-6	The socioeconomic impacts were considered for all surrounding communities, not just Gustavus.

RECEIVED
MAY 14

INGRID RUTH NIXON
PO Box 312
Gustavus, AK 99826
907-697-2165
irnixon@hotmail.com

May 12, 2003

Glacier Bay National Park and Preserve
Vessel DEIS
C/o Nancy Swanton
2525 Gambell St.
Anchorage, AK 99503-2892

Dear Ms. Swanton,

I am writing to express my thoughts regarding the DEIS for Glacier Bay National Park.

I live in the Glacier Bay area and consider it a privilege. The bay really is one of our national treasures – from its wilderness qualities to its richness as a habitat for a tremendous variety of wildlife. It those qualities which I think we should seek to protect to the utmost. Therefore, I would urge the National Park Service to
1 implement the Environmentally Preferred Alternative (Alt #4) regardless of which alternative NPS selects for vessel numbers.

2 I think NPS should instigate a speed limit for cruise ships between 10-15 knots for the protection of humpback whales. Whales are here to feed. We should do whatever we can to protect them as they do so. Currently that that 10-knot speed limit is only in effect in certain parts of the bay and only if concentrations of whales are present. However, a slower speed could reduce the chance of collisions between ships and whales, as happened two summers ago. And acoustic monitoring shows that slower ships make less noise, which seems like it would benefit whales that live in a sonic world. This speed restriction might not be popular with cruise ship schedules, but visiting a national park, biosphere reserve and world heritage site should be worth the slight inconvenience.

3 I am also concerned about the harbor seal decline in Johns Hopkins Inlet. And as the cause has not yet been determined, we should look at all disturbances as having potential impacts. NPS should extend the access restriction as currently enforced to cruise ships to all vessels, essentially closing the inlet to all vessel traffic for most of the summer.

I appreciate the opportunity to participate in this process. Thank you for considering these comments.

Sincerely,

Ingrid Nixon

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I34-1	Please see general response number 1.
I34-2	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
I34-3	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the seasonal timeframe of when vessels must remain greater than 0.25 mile (0.4 kilometer) from harbor seals hauled out on ice in Johns Hopkins Inlet. (The current seasonal restriction is from July 1 through August 31.)

MR. OGALVIE: Doug Ogalvie, Box 323 here in Gustavus.

MS. SWANTON: Thank you.

1 MR. OGALVIE: A specific one, in reference to Dundas Bay, in particular, right now the boundary on Dundas Bay is considered headland to headland at the mouth of the Bay and the draw in Dundas Bay is basically the West Arm. There's several reasons why I think that should be -- the boundary should be changed on that. I don't disagree with the need to keep restrictions on the West Arm usage. But the main part of Dundas Bay, the main body of Dundas Bay going back in, there's not much reason to go back in there, into that area unless you're going into the West Arm. It affects me in a couple of different ways.

One, just as a commercial fisherman. And I know the commercial fishermen have been left out of this mix, but I'd like to keep them out of the mix in that right now, too. There's a lot of fishing activity around Point Wimbledon especially in the fall with the trawlers fishing in there and they go in and out of the mouth of the Bay and it's an area that they've traditionally used. It's not likely to increase in the future just because of the nature of the limited entry on the fisheries and so forth. It keeps them out of the mix of that outside portion, actually on the one chart there on the lower right, everything that's in orange, or you could even extend that blue out a little bit to the east from that point and it wouldn't make much difference either. Again, the draw for that is the wilderness water areas in back of there, that's what brings everybody into there.

Anyway, that keeps the fishermen out of that mix in the future in case somebody wants to look at that because they use that area a lot just around the entrance.

And another thing I run into in my business, I run a water taxi business, a lot of it relates to kayakers and so forth and they want to go kayak into Dundas Bay. Well, right now I can't -- I can't take them -- legally can't take them back inside of those headlands for a drop -- safe drop-off if I want to go over there, and that's not just me, it might be Brad on the Taz or some of the other people who run a water taxi service like that. To allow people to access that area of the Bay without having the -- without being under the current quota system that it's on right now would have very little impact on the more sensitive areas in the back of the Bay or probably no impact on the sensitive areas on the back of the Bay. I guess you might call an exception to that would maybe be cruise ships or the mini tour -- mini tour boats that go in that might go into that area and drop off kayakers and then paddle back into there. But that is one thing that just came to mind that could be an effect on that.

But anyway, that's just something I'd like it see changed there is that boundary, because the sensitive area is not the front of the Bay, it's all mud flats out there, everybody goes to the back to look at bears and it's beautiful in the back and it needs to be -- it needs protections back there but the outside areadoesn't -- it's not much of a draw, it's not -- just in my experience.

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I35-1	The NPS preferred alternative (alternative 6) does address the differences between the main and upper parts of Dundas Bay. The NPS preferred alternative in this FEIS (alternative 6) establishes limits for tour and charter vessels and prohibits cruise ships in Dundas Bay. Tour vessels would be limited to one per day during the quota season and would be allowed only in the non-wilderness waters of lower Dundas Bay. Charter vessels would be limited by a seasonal-use day limit but not a daily quota during the quota season. While Dundas Bay lacks tidewater glaciers, it provides people with excellent opportunities for wildlife and scenic viewing as well as opportunities for exploration and to experience solitude and natural beauty. The Park Service wishes to maintain these high-quality opportunities provided by Dundas Bay. The NPS preferred alternative in the FEIS, alternative 6, includes a flexible quota system to allow for an average level of use of three charter vessels per day, but with no daily quota. The Park Service feels that this quota level protects the opportunity for solitude of Dundas Bay while not unduly restricting charter vessel operators.

2 One other thing in reference, I think Alternative 4 extends the VMP season a month on either end. From my past experience here, May and September, unless -- unless that's geared towards the cruise ship industry and the tour boat industry to a smaller extent, but there's not much effort or not much traffic at all in May and September anyway. Everybody's pretty well done then. And if it doesn't need to be extended then don't extend it. Don't make it more difficult for the people who live here when it's not necessary to.

And I've got some other written comments that I'll get together when I look through this thing a little bit more. But those are the only two I wanted to comment on here tonight.

NUMBER	RESPONSE
I35-2	Three of the six alternatives in this FEIS, including the NPS preferred alternative, extend the quota season into May and September for cruise ships only. The NPS preferred alternative does not include a quota season in May and September for tour, charter, or private vessels.

Comment Date: **4/8/03**

Name: oldman, meg

Organization: Illuminations

Address: 263 grande avenue

davis, ca 95616
usa

Email: meg_oldman@yahoo.com

DEIS Information: *Chapter*:
Section:
Subsection: usa
Page:

Comments: Good people, I grew up on a lake in New Hampshire, and I can tell you from first hand
experience, that controlling motorized vessels is absolutely necessary. Fortunately,
this lake has an association that really cares about the pollution levels that have
impacted the lake, and much work has been done to cut back on the number of
vessels putting in for pleasure riding, etc. I am sure, in order to maintain and preserve
1 the beauty of Glacier Bay waters, that keeping motorized vessels to a bare minimum
is a great idea. Why not limit them to organized sightseeing, and prohibit single
crafts? I encourage you to promote kayaks, row boats, and the like. It's good for
2 people to get in a canoe, and really experience the quiet and beauty before them,
much as I did, and stil do on the lake in New Hampshire. It gives people the
opportunity to receive the scents of their natural surroundings, instead of the
overwhelming fumes of oil driven crafts. The current war on Iraq should bring home
the overuse of oil driven vessels for pleasure. A return to people- powered vehicles
brings so much more pleasure, and will help to maintain the existing quality of Glacier
Bay. Thank you for reading my comments. Meg Oldman

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I36-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy these resources and values. Cruise ships provide this opportunity to a large percentage (>90%) of the visitors who travel to Glacier Bay. The elimination or the limiting of cruise ships from Glacier Bay would limit the opportunities for visitors to enjoy the park's resources and values.
I36-2	The Park Service does not promote the use of any specific vessel type. Non-motorized vessel use in Glacier Bay National Park and Preserve will be evaluated in the Backcountry Management Plan and Environmental Impact Statement which is currently under development.

MAY 14

May 13, 2003

Glacier Bay NP&P
Vessel DEIS
c/o Nancy Swanton
2525 Gambell Street
Anchorage, AK 99503-2892

I'm writing to you with comments on the draft plan setting vessel quotas and operating requirements for Glacier Bay National Park. This beautiful place is very important to me personally as my husband and I had the privilege of our first visit last year, and we were completely awed especially having the opportunity to go out in a little boat in Icy Strait and seeing many whales and a herring boil which brought many eagles soaring above our heads. This area needs to be protected from too many cruise ships until extensive scientific studies are completed and rigorously reviewed to
1 assure that the values and purposes of Glacier Bay are protected.

Specifically, the operating requirements found in the Environmentally
2 Preferred Alternative (Alternative 4) should be implemented regardless of
which alternative NPS selects for vessel numbers. These include extending
3 the season for quotas and speed limits for all vessels into May and
4 September (not just June through August); defining mid-channel travel
routes for cruise ships; reducing speed limits for cruise ships from 20 knots
5 to 13 knots to reduce the risk of collision with marine mammals; and
6 establishing additional non-motorized waters to allow wildlife sanctuary,
7 including extending closure in John Hopkins Inlet to year round for seals
hauled-out on ice.

Please protect this uniquely beautiful place.

Sincerely,

Maryellen Oman

Maryellen Oman
12951 Summer Circle
Anchorage, AK 99516-2629

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I37-1	The Park Service will consider all public opinions and concerns when making choices and decisions related to the alternatives. Please see the general response number 3 for a description of the decision-making process for increasing cruise ship quotas.
I37-2	Please see general response number 1.
I37-3	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
I37-4	In general, cruise ships stay mid-channel when traveling within the park. Therefore, the Park Service has determined that defining mandatory routes would be unnecessary.
I37-5	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
I37-6	No new non-motorized waters are being considered in the EIS. However, the alternatives do include closures of certain waters to cruise ships and tour vessels.
I37-7	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the seasonal timeframe of when vessels must remain greater than 0.25 mile (0.4 kilometer) from harbor seals hauled out on ice in Johns Hopkins Inlet. (The current seasonal restriction is from July 1 through August 31.)

postmarked
MAY 14 2003

rec'd
MAY 16 2003

Glacier Bay National Park and Preserve Vessel DEIS

1 Include with Vessel Quotas, no permit is required by the following types of vessels for entry into Glacier Bay: Skiffs launched from a permitted commercial fishing vessel.

2 Under Vessel Operating Requirements, recognize that whales oftentimes approach a transiting vessel. The vessel is complying with operating restrictions even when a whale's migration brings it in close proximity of a vessel in a transiting lane.

3 I support a modified Alternative 3: Current quotas for cruise ships with a provision to increase seasonal quotas for cruise ships. Slightly increase vessel quotas for tour, charter, and private vessels hailing from communities in close proximity to Glacier Bay, specifically Pelican, Elfin Cove, and Hoonah.

4 Pelican, Elfin Cove and Hoonah are economically depressed and are adversely affected by actions taken by the NPS. It is appropriate for the NPS to address and identify the need to increase visitors from these communities. The visitation base needs to be representative of the local population base. Motorized vessels from these communities are disproportionately left out of the vessel quota allocations. The programs, policies, and activities of the NPS on the local and low income community populations are adversely effecting the income of local residents in economic opportunities at Glacier Bay National Park. Allocate specific number of permits for each of the mentioned communities.

5 Keep Dundas Bay open to motorized vessels in Dundas Bay. A daily quota in Dundas Bay from May 1 through September 30 is restrictive and unnecessary.

6 Continue to allow motorized vessels to enter and exit Glacier Bay to moor at Bartlett Cove dock and access the Glacier Bay lodge and road system to Gustavus. These vessels do not count as a daily entry.

7 Local Socioeconomics: It is discriminatory that Gustavus is the only community in close proximity to Glacier Bay National Park to experience an increase in park and preserve revenues. The revenues should be equitably distributed to all neighboring communities. These communities have lower per capita income and more people living at or near the poverty level. Glacier Bay is a remote area and nearby communities involvement should be actively sought after as they are affected by socio-economic impacts.

8 Allow sea otter hunters access to Glacier Bay to harvest sea otters. Sea otters are causing ecosystem imbalance and potential ecosystem destruction.

Thank you for the opportunity to comment.

Patricia Phillips

Patricia Phillips
P.O. Box 33
Pelican, Alaska 99832
May 13, 2003

Comment also sent via www.nps.gov/glba website

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I38-1	The rules with regard to activities associated with commercial fish vessels are not included in this EIS and are found in the Park Service's 1998 Commercial Fishing Compensation Plan and Commercial Fishing Environmental Assessment. The rules for launching skiffs from vessels permitted under this EIS are detailed in 36 CFR 13.65. No permit is required for a motor vessel that is singularly launched from a permitted motor vessel and operated only while the permitted motor vessel remains at anchor, or a motor vessel that is launched and operated in accordance with a concession agreement from a permitted motor vessel while that vessel is not underway.
I38-2	The Park Service recognizes that some marine mammals will approach vessels. However, the current regulation that all vessels must slow to 10 knots or less near humpback whales is in place to reduce the possibility of a collision between whales and vessels.
I38-3	Each alternative considered in this EIS responds to two key purposes common to all national parks: (1) conserving park purposes and values and (2) providing opportunities for people to enjoy park resources. NPS management policies, as well as numerous court cases, clearly state that ‘when there is a conflict between conserving resources and values and providing for the enjoyment of them, conservation is to predominate.’ The alternatives considered in this EIS represent a range of possible actions to achieve these purposes. These key purposes will be carefully considered along with other factors, as required by the National Environmental Policy Act, in the decision to be made regarding vessel quotas and operating requirements.
I38-4	Any changes to permit allocations are being addressed in the concessioner prospectus.
I38-5	While Dundas Bay lacks tidewater glaciers, it provides people with excellent opportunities for wildlife and scenic viewing as well as opportunities for exploration and to experience solitude and natural beauty. The Park Service wishes to maintain these high-quality opportunities provided by Dundas Bay. The NPS preferred alternative in the FEIS, alternative 6, includes a flexible quota system to allow for an average level of use of three charter vessels per day, but with no daily quota. The Park Service feels that this quota level protects the opportunity for solitude of Dundas Bay while not unduly restricting charter vessel operators.
I38-6	The "based in Bartlett Cove" exemption is eliminated from three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.
I38-7	The primary factor to be considered by the regional director, Alaska Region, is protection of park resources. The regional director, Alaska Region, must ensure that park resources would be left unimpaired and within naturally functioning conditions. At the same time, as a responsible member of a greater community and region, the Park Service must take into account the negative as well as the positive impacts that tourism may have on park neighbors. Per Director's Order #17, the Park Service recognizes that cooperation between businesses that operate in the park is essential to providing high quality visitor experiences and opportunities.
I38-8	The issue of sea otter harvesting is out of the scope of this EIS which focuses on vessel quotas and operating requirements.

Comment Date: **3/31/03**

Name: Quick, Nicole

Organization:

Address: 4338 Clovelly Drive

Greensboro, NC 27406
USA

Email: nicolequick@triad.rr.com

DEIS Information: *Chapter*:
Section:
Subsection: USA
Page:

Comments:

1 In order to preserve the beauty of Glacier Bay for the enjoyment of future generations and to protect the wildlife who make the area home, I urge you to select "Alternative 4." The provisions of this alternative, relative to the other options, provide the greatest protections for the environment. We have a moral obligation to preserve the habitat of the species who live in Glacier Bay. In addition to implementing "Alternative

2 4, " I would urge you to provide further protections for the area by prohibiting the dumping of waste, washwater, or other contaminants by any vessel. Also, I would encourage you to require stricter emission controls from the vessels entering the area. While "Alternative 4" is the the best for the environment of the options being considered, it does not do enough to regulate the pollution created by tourist vessels, particularly cruise ships. While I applaud the efforts to maintain the environmental integrity of the area, i would urge you to do more in order to preserve this great natural resource.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I39-1	Please see general response number 1.
I39-2	The Park Service enforces state and federal regulations regarding air emissions and discharges of greywater and blackwater into the marine environment. This is described in detail in subsection 4.2.3.

MR. ROBARDS: Good evening and thank you for letting me provide testimony tonight. I'd like to emphasize that I do have a different hat on today and represent myself. I'd like to commend the preparers of this EIS, they certainly did a mammoth task there pulling together all the information. I'm going to restrict my comments just to two areas.

Firstly, throughout the document in relation to Alternative 3 there's many cases if the
science allows this to happen then we can make an increase to 184, and the essence of my
1 testimony is that that needs to be much better qualified. It's very subjective right now
exactly what that would be. And I'm going to give some ideas firstly about what I think
might be a good idea; would be to come up with a rigorous science plan that has been
peered reviewed and I think the Alaska Science Center would be an appropriate venue for
that. Glacier Bay already has a relationship with him. They have a science plan to study
fisheries-related issues in relation to the marine protected areas and what have you, so
they have a science plan already in place that could be adapted for use, such as this.
There could be a peer review process to come up with indicator or keystone species that
would be studied, and they could be monitored over a period that was peer reviewed and
deemed appropriate in this case to see the effects of cruise vessels on them.

Two of the reasons that make this make sense relate to two little things, and they seem
little and they're mentioned several times in the EIS. The first one is the effects of
increases in cruise ships are expected to be directionally proportional to the number of
vessels. And what it's saying is if you have an increase of one vessel would have an
2 effect of one unit, then if you have 100 more units. And as an ecologist I'd really like that
to be true because it'd make our life very easy but things tend to have these threshold
effects and you'll get to a certain point and then things will happen very quickly and
this leads to a dangerous situation that if we start creeping the vessel numbers up we
might cross a threshold and see a real major impact very quickly and we'll never
really see that real small incremental change ahead of time. So I think that's a really
important reason to come up with some scientifically justified thresholds that can
be used and those would be the basis behind what would drive the science that's
necessary to get to that point where we have an idea of what those thresholds would be
and then those would be the justification to increase vessels.

Also in the EIS, some of the rhetoric, kind of to help justify this, there was a couple of
comments like it would seem unlikely, and I just pulled that out, and I didn't really feel
3 that really emphasized the science. I mean it seemed like it could also be written,
we don't know. And so if the science needs to be done itneeds to be stated and, you
know, we need to do the science to come up with this, this specific science.

4 The second area I'd like to point out and I talked to some economists today about this and
it's the socio-economic impacts, and that section definitely favors the idea that if you take
cruise ships out of Glacier Bay it will impact the entire Southeast Alaska cruise ship
economy. And I really don't see the justification for that in the literature and I think
things might move around but I don't really see necessarily that being the truth. I
don't see the justification for it in the document. But that concludes my comments and
thank you.

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I40-1	The NPS preferred alternative, althernative 6, describes the decision-making framework that would be used should the Park Service consider increasing vessel numbers. If there would be any increases in the cruise ship vessel quota, they would be based on indicators and standards established by the Park Service. The FEIS contains the study framework that would be used to make decisions regarding any changes in vessel quotas. Please also see general response number 3.
I40-2	Ecological threshold effects may exist and all effects will not be proportional to decreases or increases in vessel quotas. However, as we have said, the scientific data is limited. Therefore, as part of the study framework that will be used to determine whether cruise ship vessel quotas will increase, these factors will be considered.
I40-3	The Park Service re-examined the document and has attempted to identify all areas where there are scientific data gaps. These are stated explicitly throughout the document.
I40-4	Our analysis focuses on long-term changes. Common sense dictates that reduced access to the region's premiere attraction may reduce the region's competitive position with respect to other destinations (particularly cross-Gulf destinations, but also destinations outside of Alaska). That is the underlying premise. The Park Service agrees that further refinement of the conclusions about how reduced cruise ship access to Glacier Bay will translate to changes in ports of call in Southeast Alaska communities is warranted. We have analyzed itineraries for each cruise ship scheduled for 2003 to identify patterns between Glacier Bay calls and calls in other Southeast Alaska ports, especially Skagway. The text has been modified to include this new analysis.

Comment Date: **3/19/03**

Name: Seegert, Alan

Organization:

Address: Box 203

Denali Park, AK 99755

Email: zemmo@yahoo.com

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments:
1 I would like to voice my support for alt. 4. This resource should be managed conservatively. The numbers of allowed ships would not have crept up w/o the machinations of the AK Congressional delegation, especially on the Senate side. Thanks, Alan.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I41-1	Please see general response number 1.
I41-2	Increased public demand and the park's mandate to provide opportunities for people to enjoy the resources of the park has led the Park Service to re-evaluate the number of ships allowed into the park.

Comment Date: **3/19/03**

Name: Sklensky, Diane

Organization: Le Moyne College

Address: 166 Sherwood Ave.

Syracuse, NY 13203

Email: sklensde@mail.lemoyne.edu

DEIS Information: *Chapter:*
Section:
Subsection:
Page:

Comments:

1 Sorry, I don't have a specific page to comment on, but I am, in general, in favor of Alternative 4, to both scale back the number of vessels and to impose restrictions on their patterns and speed. These reductions in numbers might be adjustable if there were standards on the noise and pollution produced by the vessels, to encourage cleaner, quieter boats/ships.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I42-1	Please see general response number 1.

Comment Date: **3/19/03**

Name: Stires, Anne

Organization: Voices of Sustainability

Address: 1 Ann Street

Verona, NJ 07044

Email: agstires@earthlink.net

DEIS Information: *Chapter*:
Section:
Subsection:
Page:

Comments:
1 I believe that Alternative 4 should be adopted because it shows the most respect for this incredible area. It is vital that governing organizations not allow borders to be crossed that will lead to the degradation of environment. Stand firm. This is not Disney Land. Now is the time.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I43-1	Please see general response number 1.

Comment Date: 5/13/03

Name: Straley, Jan

Organization:

Address: PO Box 273

Sitka, AK 99835
USA

Email: Jan.Straley@uas.alaska.edu

DEIS Information: *Chapter:* Intro and 4.3.1
Section:
Subsection: USA
Page:

Comments:

1 Comments pertain to humpback whale and Steller sea lion sections: The introduction on humpback whales uses outdated information regarding worldwide current population numbers. If we have 6000-8000 in the North Pacific and current North Atlantic numbers are in the 11000-13000 range this already exceed the worldwide 10000-12000 estimate in the EIS. The section on the various estimates for the North Pacific is confusing. The population estimates for the central stock, southeastern Alaska and Glacier Bay/Icy Strait needs to be clearly stated. Recent (Sept 2002)

2 abundance estimates are available for southeastern Alaska in a NMML contract report that GPNP should have in the library (Straley et al 2002). The average birth interval

3 for humpback whales in the North Pacific is 2-3 years, not 1-2 years. During scoping, collisions with marine mammals were a concern. NPS should listen to those concerns, especially if increasing cruise ship numbers in Glacier Bay is the result of this EIS (and even if it is not, increasing whale numbers park waters should be a management concern). It is evident that if a whale hits a large vessel traveling at 14 knots or greater the collision is likely fatal. I would recommend that the alternative selected by

4 NPS include that vessels over 80 meters reduce speed while in Glacier Bay to 13 knots are less, no matter where they are in the Bay. In the EIS, it is argued that: 1) 90% of the whales are near shore (within 1 mile) and large vessels travel mid channel so risk is minimal. However, sometimes a vessel travels mid channel and is within a mile of shore (any shore, mainland or island) in Glacier Bay and the branching inlets, because

5 some of Glacier Bay and the inlets are less than 2 miles wide, therefore a vessel would be within 1 mile of shore and near 90% of the whales. Essentially, traveling mid

6 channel does not get a vessel away from whales. Also traveling at a reduce speed will reduce underwater ensonification (make those vessels less loud). 2) since cruise ship numbers have increased, whale numbers have increased and because there are more whales there is an erroneous conclusion that all is well and vessels don't need to do anything to reduce impacts to marine mammals (because there are more). This is completely illogical. It is evident that since commercial exploitation of humpbacks in the North Pacific the population is increasing. That is, humpback whales are recovering from very low numbers as a result of commercial whaling. This is true for Glacier Bay as well, humpbacks have increased. However, it seems that an agency such as NPS would want to continue to offer humpback whales protection ESPECIALLY if there are more. If you have more vessels (or even the same number) AND more whales, NPS should be initiating more protection and reduce the factors that they have some control over that could result in mortalities. Reducing the speed of large vessels that, when a collision occurs, would reduce a chance of mortality is the only

7 logical way to think about this issue. Therefore, having more whales in Glacier Bay should have NPS thinking about ways to reduce potential impacts. Reducing the speed of large vessels is one way NPS could offer whales protection in the waters of Glacier Bay. 3) there are no collisions with sea lions because there are no reports as evidence that this occurs. Again, this is illogical thinking. Sea lions are small that when hit likely sink, until they float due to gas buildup. At this point, when they resurface, they would be hard to see and identify (rotting carcass). A sea lion floated ashore this year in Sitka Sound, that, when flensed, had a broken back likely from a collision with a boat. These smaller marine mammals may be even more susceptible to being killed because they may be killed when hit by either a large or smaller vessel. It is unclear how many

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I44-1	Humpback whale numbers have been revised in this FEIS.
I44-2	This change has been made for the FEIS.
I44-3	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
I44-4	The mid-channel course of cruise ships is a factor in determining the likely risk of a cruise ship striking a whale. The EIS did not conclude that a mid-channel course eliminated risk, only that it reduced it.
I44-5	The EIS notes that reducing vessel speed would likely reduce vessel noise.
I44-6	As stated earlier, the NPS preferred alternative in this FEIS (alternative 6) includes a 13-knot speed limit for cruise ships. The EIS also notes that with effects of vessel traffic in Glacier and Dundas Bays, together with other factors, "the population (of humpback whales) is increasing, but probably at a lower rate and with a lower potential peak than if these effects were not occurring."

may be hit and killed (or what the outcome) but it certainly is not logical that just because there is no evidence it is not happening. However, if sea lions are increasing NPS should be thinking of ways under their control that could reduce possible

7 mortalities (such as speed reductions). Missing in the text is the death of a humpback whale in Frederick Sound in Julyt 1999 by the Westerdam. The whale was draped over the bulbous bow of the cruise ship. (NMFS has information and it is in the Laist et al paper). Also, within the last year 4 fin whales were brought into Puget Sound by large vessels. These data need to be included in the EIS. Collisions do happen and they result in deaths of whales when speeds are 14 knots or greater.

NUMBER	RESPONSE
I44-7	The FEIS text includes additional and revised discussion regarding collision risks to marine mammals.

Comment Date: 4/28/03

Name: Streveler, Greg

Organization:

Address: Box 94

Gustavus, AK 99826

Email: grigori@gustavus.ak.us

DEIS Information: *Chapter*: alternatives
Section:
Subsection:
Page:

Comments: Good morning Nancy, Hopefully you are back from your safari to the hinterlands, and
that you received the respectful hearing you deserve. I will see if I can get to the
specificity that you and Steve requested at the Gustavus hearing. A)As I testified, I
1 think the range of alternatives is extrordinarily narrow and virtually assures retention
of the status quo (excepting of course, cruise ships!). Seems to me there are three
defensible ways to broaden the range of alternatives without materially changing the
thrust of Alts 1-4. For the first two, the fundamental idea is to consider ways of
2 shaping boat traffic through means other than entries. 1) construct a new alternative
based on sound. The rationale would be that underwater and abovewater sound are
major impact vectors to both the marine biota and human users. I know that the park
has talked for year about some form of this, and it shouldn't be hard to flesh out the
3 idea. 2) provide more mitigative actions as part of alt 5. This could include a) more
approach restrictions for seal terrestrial haulouts (which are becoming ever more
important as ice-hauling areas decline); b)behavioral restrictions around moulting bird
concentrations (scoters, mergansers, harlequins; mergini ducks in general should be
of considerable management concern, given their problematic status thru much of
their ranges; c)approach restrictions for the few areas of grotto-nesting cormorants
(cormorants appear to be decreasing, and they nest in very few, often very vulnerable
4 places) 3) Some alternative has to include the capping or other means of regulating
admin boat use; otherwise the public has no way to see an analysis of the pros & cons
of this action. Perhaps a limit could be set somewhere above the present level, so that
if the alt were chosen,at least the park would be committed to analyzing their use and
5 finding ways to economize on it as the limit was approached (see below. B)In my
view, an important flaw in the alternatives as a group is their small degree of
attention to seal management. Here is a major species in major decline, and only one
action (more, probably trivial, protection in Hopkins) is contemplated in any
alternative. Given that the park could be culpable from MMPA misfeasance as well as
ignoring years of research documenting the decline, continuing that inaction in this
document strikes me as indefensible. C)After careful reflection, I cannot share an
expressed concern over a potential downside of including admin boats in the mix. It
would stretch credulity that some critical third party could equate some reduction in
that use to a potential increase in a very different vessel class. Seems to me that
portraying that use (which I am assured by local park folks and by personal
observation is a very substantial portion of the whole and the only use class which is
6 increasing)is absolutely essential for the reasons I mentioned orally.
____ I'm not sure where this fits, perhaps
in a concessioner perspectus, but I think Janusz was on to something with his diving
charter idea. The park could encourage such innovations, given that the charter entry
quota is not being met lately. Best to you Nancy. You do good work. Greg Streveler

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I45a-1	Please see general response number 2.
I45a-2	The FEIS has a revised NPS preferred alternative (alternative 6); however, it is not based on soundscape. The Park Service feels that it is not necessary to develop an alternative based specifically on soundscape because the topic of sound and noise is adequately addressed in the soundscape, marine mammals, and threatened and endangered species sections and the effect of all alternatives on the underwater and above water soundscape is moderate.
I45a-3	The Park Service changed their preferred alternative from alternative 3 to alternative 6. This alternative incorporates most of the operating requirements of alternative 5. The Park Service will consider all public opinions with respect to mitigation measures.
I45a-4	Please see general response number 4.
I45a-5	The harbor seal population declines are of great concern, but it is difficult to design vessel regulation measures that will reverse this trend in absence of evidence that links the decline with vessel traffic. Using the precautionary principle, three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend the harbor seal protections in Johns Hopkins Inlet year-round. The Park Service is considering increasing the approach distance to 500 meters.
I45a-6	The Park Service will consider this comment when charter use is reallocated.

MR. STREVELER: Thank you. My name is Greg Streveler, Box 94, Gustavus. These will be personal comments and not from my hat on as Chair of GCA. And I will submit more detailed written comments. I've also just begun looking carefully but I will give you some initial impressions and hopefully fill in the blanks later.

First of all, congratulations on a job well done. I think I recognize a well-crafted EIS when I see one and I think you're to be congratulated for that. There's also some very useful and authoritative resource information here which is very good. I do have some concerns at this point, and one of them I'll start out mirrors something Jonish just said to you.

1 That is I find the range of alternatives extraordinarily narrow. And I think this chart back here shows it about as well as any. But in the EIS as I found most constructive, they give you considerably wider range of choices, even if you don't end up choosing any of the ones out at the ends of the bell curve, they at least give you a chance to more thoroughly analyze what if's, and this one's very narrow and I think could actually endanger the analysis in a sense that it kind of predisposes you toward the status quo and I don't think the Park wants to be placed in that box. I don't think it's wise to be. There's some strong political pressures on the Park right now and I think even if it were not, in fact, done for that purpose making it -- giving that argument weight is not a good idea for the Park at this point.

2 It is mentioned that the status quo would obtain except that and there's one cardinal exception and we all know what it is and we all know kind of the politics that drove that exception. It's mentioned that, of course, there will be studies that predetermine whether this is actuated but unless I missed it in preliminary looking at the document I don't see that these studies are spelled out and I think that's very critical. Because again, I think the Park is going to be under a magnifying glass on that one and you don't want that to just be an empty sort of proforma statement, it better be something you spell out, otherwise it's going to look like a politically driven decision.

3 Another thing that struck me as conceivably inconsistent and certainly on its face so, is that, if, in fact, it makes sense to put in a proposed addition, that says one thing to me, that says that there really is room in Glacier Bay in the view of you analysts for additional human activity and if virtually all of that activity addition is then turned over to one user group that doesn't seem very balanced to me.

The second thing is that if you do that, you end up, how would I put it, I don't have that one well formed in my mind so I'll move along on that.

4 The last thing I'll mention that kind of stuck in my craw was that despite a lot of, at least from Gustavus, public testimony last time when you did scoping, you have chosen to leave administrative vessels out of the analysis. And I honestly -- I feel quite strongly about this, I think that's a considerable mistake and I think it's a mistake for two reasons. One is that it's the only substantial use of the Bay by motorized vessels that I'm aware of that has rapidly increased in the recent decade.

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I45b-1	Please see general response number 2.
I45b-2	Please see general response number 3.
I45b-3	Under the NPS preferred alternative in the FEIS, alternative 6, all user groups will have increased opportunities to experience Glacier and Dundas Bays.
I45b-4	Please see general response number 4.

4 It's also not -- it's not presented -- the magnitude of the use is not presented in the document that I could find in a way that allows us to compare to the non-administrative use so that we could make an informed decision, but just what portion of the, quote, problem or quota that it is, and that, to me, leaves a big piece of error in the equation. I don't know how to look at the whole spectrum of vessel use when a substantial and growing part of that use is simply ignored, I just don't think it works.

The second reason I think that's a mistake is because a lot of people asked for that and a lot of people feel, I believe, I'm afraid I do that it can be construed as the Park Service saying we're going to analyze your impacts but we're above all that. We understand how to handle our impacts and frankly we're not going to tell you about it but we do a pretty good job and that's that. And I don't think that's the kind of posture you want to -- the kind of atmosphere you want to project. I frankly can't see what the Park has to lose by being a little more forthcoming on that subject. It seems to me easy to do and important to allow the analysis to be even-handed.

5 And I'll conclude by saying that I think there's two things as -- as result of the reservations I just mentioned there's two things that the Draft as it's written now are in danger of doing, one, it's in danger of suggesting that local people's concerns are subordinate to higher level, political or economic concerns. That's not good. And the second thing is a reiteration of what I just said, it's conceivable to read into this document that the Park Service has chosen to elevate itself above analysis and impose analysis from above on the rest of us. And, again, I don't think that's a good atmosphere.

So I'll end with that. And I'll write you down some more stuff when I get a chance to look more carefully.

MR. HALL: Your last statement, can you say that again in a different way, I didn't quite -- about how we have elevated?

MR. STREVELER: If the Park chooses not to analyze its own impacts.

MR. HALL: Right.

MR. STREVELER: But chooses to analyze other people's impacts.

MR. HALL: Okay, got that.

MR. STREVELER: But I dare say that a humpback whale can't tell the different between a Park boat and my boat.

MR. HALL: Right.

MR. STREVELER: That's not good. It's not good in terms of allowing the total spectrum of analysis to be cogent and it's not good in terms of the atmosphere it projects, the attitude it projects. I don't think it's a good precedent.

NUMBER	RESPONSE
I45b-5	The Park Service has tried to integrate all public concerns within the framework of NEPA and the goals and purpose of Glacier Bay National Park and Preserve in the development of this EIS. This is demonstrated by the change in the preferred alternative from alternative 3 to alternative 6 in the FEIS. The Park Service believes that alternative 6 contains the best mix of vessel quotas and operating to meet most concerns addressed during the comment period.

MR. HALL: Thank you. I had one thing I wanted -- as far as the, you mentioned the narrowness of the range of alternatives, in your comment, and this goes for everyone, if the more specific you can be, if you're talking about well, I prefer this alternative, it's really nice to know why.

MR. STREVELER: I'll try to get that in my written stuff.

MR. HALL: Yes.

MR. STREVELER: I can tell you one thing that struck me that is a little more specific.
That plan pretty much presupposes that the best way, the most useful tool is manipulating
vessel use limits. An alternative for that that I know has been hashed around quite a bit
or at least a compliment to it is the possibility of using vessel behavior as a principal tool.
Well, Alternative 5 sort of gets into that but there's quite a bit more that could be done
6 within the umbrella of five and frankly I think I should be broken into a couple of
alternatives so that we're not stuck with saying the basic management conception is all
we're going to talk about. It may very well end up that it's still the most cogent thing to
do but I think the analysis is incomplete without that.

And as far as mixing and matching among the alternatives that deal with vessel use limits, I'll try to be a little more forthcoming about that when I look at your analysis. And I say, my first look at it was that you did a nice job on that and I'll try to give you the bene – the dignity of looking it over carefully.

MR. HALL: If you have thoughts about what changes in alternatives that would -- one of the major ways that we – that the Park Service would respond to comments is maybe consider new alternatives, so if you have spe -- rather than saying it's just too narrow, it would be good to say well here's a suggestion that I think might be – would be considered.

MR. STREVELER: Okay, I've given.....

MR. HALL: Again, the overall.....

MR. STREVELER: I've given you one.

MR. HALL: Yes. Yes, you did, and so anyway, I just trying to help, you know, those are the most effective comments.

MR. STREVELER: I understand and I'll try to do that.

NUMBER	RESPONSE
I45b-6	The NPS preferred alternative in the FEIS, alternative 6, integrates the cruise ship quotas from alternative 3 and most of the operating requirements of alternative 5.

Emails Received

From: "Michael Wagner" <nittanymike2@comcast.net>

To: "Nancy Swanton" <glba_vessel_eis@nps.gov>

Date: 4/22/2003 8:13:31 PM

Subject: Don't Pave the Parks

Body: Wednesday, April 23, 2003 Nancy Swanton EIS Project Manager Glacier Bay National Park and Preserve 2525 Gambell Street Anchorage, AK 99503 - 2892 Dear EIS Project Manager Swanton; I am writing to you today because of a serious threat to our public lands. The Interior Department recently published final regulations intended to facilitate the giveaway of thousands of miles of trails, roads, rivers and streams on our federal lands – including some in our most precious national parks. I am alarmed by the administration's apparent goal of giving away tens of thousands of unsubstantiated claims for federal rights-of-way under the provisions of an antiquated 1866 Mining Law known as R.S. 2477. This provision, which Congress repealed in 1976, is now being viewed as a loophole for bulldozing thousands of miles of new roads across some of this country's most sacred federal sites and protected areas. These new regulations exclude the ultimate owners of our federal lands – us, the American people – from the disclaimer process, and provide no opportunity for advance public notice and comment before a final agency disclaimer decision is made against our interests. I understand that some counties are asserting R.S. 2477 road-building rights-of-way claims for cow paths, horse trails, riverbeds, dirt bike, and off-road vehicle routes, as well as for overgrown and nearly indistinguishable trails long ago abandoned by prospecting miners. In addition, the state of Alaska may assert claims for as many as 22,000 navigable
1 waters under the provision. In light of the potential irreparable damage that could be inflicted under the new disclaimer regulations, I urge you to write Interior Secretary Gale Norton and ask her to suspend indefinitely the processing of any R.S. 2477 claims or claims to lakes and rivers under the disclaimer rule's provisions. For more than a century, this country has created national parks that are the envy of the world. Now is not the time to abandon the protection of these treasured places. Please ask Secretary Norton to stop the reckless giveaway of these precious lands. Sincerely, Michael Wagner 804 Stoney Creek Drive Dauphin, PA 1718- - 3961 nittanymike2@comcast.net

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I46-1	The Park Service appreciates your concerns about public lands; however, R.S. 2477 is not directly pertinent to vessel management and operating requirements in Glacier Bay National Park and Preserve.

Rec'd 4/11/03

March 26, 2003

Glacier Bay NP Vessel DEIS
C/o Nancy Swanton, Project Manager
2525 Gambell Street
Anchorage, Alaska 99503-2892

Dear EIS Project Manager:

Thank you for giving me the opportunity to submit my comments on the DEIS for Glacier Bay NP. As a lover of nature deeply interested in the preservation of wilderness in our country, I speak from the heart and therefore my comments may not meet the expectation of "substantive" as requested in your web site, but I hope they will be nevertheless accepted. In the first place, I would like to establish that for the lay person, your web site is extremely difficult to follow and has many glitches that will most surely discourage a not
1 very persistent person. I also think that if your office is seriously interested in comments, the e-mail section should be workable...

I am deeply disappointed at the National Park management that presents #3 as the preferred NPS
2 alternative while reminding the reader that its mandate is "protection of the natural, cultural and historical resources of the park while providing for visitor uses and enjoyment". The American public has been witness to many devastating accidents caused by ships in the last two decades (remember the Exxon Valdez in your state and very recently the tanker that sunk off the coast of Spain?) to accept a proposal by the Park Service to increase the number of quotas for vessels entering magnificent Glacier Bay Park. As the wife of a retired marine engineer I am aware of Coast Guard regulations, but also know that ships enrolled under other flags do very often evade the rules. The public is aware of recent transgressions by Holland America and Royal Caribbean in Alaska as regards illegal dumping in our waters and other violations of air quality standards, as well as incidents that have affected Humpback whales and Stellar sea lions (endangered and threatened species). The waste generated from cruise ships carrying 300,300 (!) visitors into the park every year is often discharged into the ocean (so called graywater at least) and the burden is on the administration of the park to make a sound determination about vessel impacts in the park.

Since an increase in the number of vessels will most surely have a detrimental effect on the park's water and air quality I think that quotas should not exceed those authorized in 1985 for cruise ships, but since
3 your Alt.#2 does not reduce the number of other vessels, **I consider Alternative # 4 the most complete plan.** I also agree that permits should be issued to individuals who are responsible and that vessel speed limits need to be reduced to protect marine wildlife.

I do hope that the administration of Glacier Park is seriously concerned about preserving this magnificent place for future generations and will not give in to political and local pressures, but instead keep focused on the task of "leaving this land even a better land for our descendants than it is for us...", as envisioned by a former president and defender of wild lands.

Very truly yours,
E. G. Wedel

Elizabeth G. Wedel
328 Tacoma St.
New Orleans, LA 70124

Grouping:	Individual
Format:	Comment Letter

NUMBER	RESPONSE
I47-1	The Park Service apologizes for any problems you had in accessing the website or in providing comments.
I47-2	Please see general response number 1.
I47-3	Please see general response number 1.

Comment Date: 4/7/03

Name: Wilcox, Gregory

Organization:

Address: 31 Overlook Drive

Candler, NC 28715
US

Email: gwilcox@charter.net

DEIS Information: *Chapter*:
Section:
Subsection: US
Page:

1 **Comments:** Please do NOT allow motor vessels in Glacier Bay! A national park is a place for peace and quiet, solitude and recreation. Motor vessels are the antithesis of that.

Grouping:	Individual
Format:	Web Comment

NUMBER	RESPONSE
I48-1	The Park Service is tasked with conserving park purposes and values and providing opportunities for people to enjoy park resources. Since 99% of the people who come to Glacier Bay visit the Bay on motorized vessels, eliminating or significantly reducing the number of motor vessels that enter the park would contradict the NPS mandate of providing opportunities for people to enjoy Glacier Bay. To protect park resources the Park Service will limit the amount of vessel use that occurs within the park and mitigate the impact of those vessels on park resources by requiring specific operating requirements.

MR. WROBEL: Gordon Wrobel, and Elfin Cove. We have no street addresses.

MS. SWANTON: General delivery, huh?

MR. WROBEL: That will work, or Post Office Box 17.

1 I guess the comment I would like to make -- and I hope that it falls into one of those categories of either missing information or new alternatives -- in Elfin Cove we have a number of charter operators who have worked successfully for years with the U.S. Forest Service in utilizing streams, estuaries, the forest lands, providing wilderness experiences for people who otherwise wouldn't have transportation to get there. The opportunity to provide that in Dundas Bay is similar, if not identical, to many of the situations -- we are literally seven miles from Dundas Bay. And I guess I'm not seeing the same kind of look at opportunities to have people have access to that resource in Dundas Bay.

In addition, Dundas Bay provides an opportunity to have a wilderness experience, in particular when there is inclement weather on the outer coast and even in Icy Strait.

Those of you who have traversed those waters understand that there are many times when it is not safe to be in those areas. People coming on itineraries where they plan to have some of those kinds of experiences could easily have them in the protected waters of Dundas Bay, whereas there are very limited numbers of people who are allowed to operate in there.

I personally go to Dundas Bay very often, and I guess I have not experienced an impact with any wildlife, and I have not had my wilderness experience disturbed by other people, so I would hope that there would be some careful look at Dundas Bay in particular, uncoupling that with the permitting process in Glacier Bay proper. I don't think the two are the same experiences.

We can access Dundas Bay within -- be in and out within two hours. Most people, I believe, that go to Glacier Bay proper are spending much longer periods of time there. So I think it is a different resource.

In particular, in Elfin Cove, living adjacent to that particular bay, I think we have an opportunity to provide people with an experience there that is substantially different than what happens out of Gustavus or the other parts of Glacier Bay.

Thank you.

Grouping:	Individual
Format:	Public Hearing Transcript

NUMBER	RESPONSE
I49-1	While Dundas Bay lacks tidewater glaciers, it provides people with excellent opportunities for wildlife and scenic viewing as well as opportunities for exploration and to experience solitude and natural beauty. The Park Service wishes to maintain these high-quality opportunities provided by Dundas Bay. The NPS preferred alternative in the FEIS, alternative 6, includes a flexible quota system to allow for an average level of use of three charter vessels per day, but with no daily quota. The Park Service feels that this quota level protects the opportunity for solitude of Dundas Bay while not unduly restricting charter vessel operators.

Nancy Swanton
EIS Project Manager
Glacier Bay National Park and Preserve
2525 Gambell Street
Anchorage, AK 99503 - 2892

Dear EIS Project Manager Swanton,

Thank you for completing the draft Environmental Impact Statement (EIS) examining alternative levels of vessel traffic and associated impacts in Glacier Bay National Park. With the information found in this EIS, the National Park Service will be able to make better decisions about how to manage vessels in Glacier Bay so as to protect the park's many natural resources.

Some of the most important decisions contemplated by the EIS are in vessel operation and
management. The new vessel operating requirements found in Alternative 4, the environmentally
1 preferred alternative, should be implemented regardless of which final alternative you select for
vessel numbers. It is the behavior of boats that is potentially one of the most damaging to park
resources. Specifically, I support:

2 1. Extending the season for quotas and speed limits for all vessels into May and September;

3 2. Placing ALL boats under permit by removing the loophole that allows private boats to be "based in Bartlett Cove," and, therefore, not under any existing permit or limit;

4 3. Defining mid-channel travel routes for cruise ships;

5 4. Reducing speeds from 20 knots to 13 knots for cruise ships to reduce the risk of collision with marine mammals;

6 5. Extending the one-quarter-mile limit for boats approaching seals hauled-out on ice to year around; and

7 6. Establishing additional non-motorized waters.

With implementation of Alternative 4's additional vessel operating requirements, the impacts of
the current daily vessel quota and seasonal-use days limits by commercially operated boats
8 (cruise ships, day-tour boats, and charter boats) should be greatly minimized. If a future increase
in cruise ships is contemplated beyond the status quo, extensive scientific studies must be
completed to assure that the values and purposes of Glacier Bay are protected. Also, any cruise
9 ship increases must be phased in slowly to effectively measure any impacts of the increase and
should not exceed more than two per day.

The National Parks Conservation Association distributed this form letter as an action alert. The Park Service received the same letter from 1,199 individuals via email, by letter or postcard, and by submission of a comment form on the Glacier Bay National Park and Preserve website. Of the total number of form letters, 34 letters contained additional comments. The additional comments either repeated comments contained in the form letter or were not considered substative comments.

Grouping:	Form Letter
Format:	Form Letter

NUMBER	RESPONSE
IF1-1	Please see general response number 1.
IF1-2	The NPS preferred alternative in the FEIS, alternative 6, would extend the June through August levels for cruise ships into May and September. Visitation by other vessel types does not warrant extension of the season for these other vessel categories.
IF1-3	The "based in Bartlett Cove" exemption would be eliminated under three of the six alternative in the FEIS, including the NPS preferred alternative. Short-notice permits would be issued for anyone who makes a reservation 48 hours in advance.
IF1-4	In general, cruise ships stay mid-channel when traveling within the park. Therefore, the Park Service has determined that defining mandatory routes would be unnecessary.
IF1-5	Three of the six alternatives, including the NPS preferred alternative, include a 13-knot speed limit for large vessels throughout Glacier Bay. Studies have shown the potential and severity of collisions between vessels 262 feet (80 meters) or larger and humpback whales is significantly reduced when the vessel is traveling at speeds 13 knots or less. This also would reduce air emissions from existing conditions. Please see chapter 2 for a description of the NPS preferred alternative, alternative 6.
IF1-6	Three of the six alternatives in this FEIS, including the NPS preferred alternative, would extend to year-round the seasonal timeframe of when vessels must remain greater than 0.25 mile (0.4 kilometer) from harbor seals hauled out on ice in Johns Hopkins Inlet. (The current seasonal restriction is from July 1 through August 31.)
IF1-7	No new non-motorized waters are being considered in the EIS. However, the alternatives do include closures of certain waters to cruise ships and tour vessels.
IF1-8	The NPS preferred alternative in the FEIS, alternative 6, includes more information regarding the basis for increasing cruise ship numbers and study needs. Please see general response number 3.
IF1-9	Any future increases in cruise ship numbers would be incremental.

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Kevin Clement
Carolyn Nickles
Martha Waltman
Jonathan Lotz
Thomas Walker
Wendy Malmid
David Lien
Tamara Lischka
Michael Kelly
Noelle Peterson
Ashley Perez
Benjiman Reckahn
Toshihide Hanazak
Michael Carey
Carrie Barcom
Mike Barcom
Sharon Lee
Lisa M. Bach
Becky Jones
Unreadable Name
Jennifer P. Johnson
Nicole Stone
Lori Johnston
Joyce Smith
Jill Vourkas
Sarah Vandervort
Shareen Siegrist
Denise Finch
Ellen Maling
Anna Giampaoli
Iris Prophet
Jessica Diaz
Carol R. Dee
Ayvozie Drones
Gerald Huber
Joyanna Gersher
Dale Evan, Sr.
C. Martin
Rayette Martin
Angie Szarenski
Rosalin Gonzales
Jennifer
James Harding
Darren Don
Aaron Weeks
Kara Simon
Debra McKay
Elayne Hunter
May Ellen Ashton
Lisa Jamieson
Deborah Greene
Jeanine Schaaf & Robert Werner
Mary Hayes-Siegrist
Joanne Kuntz
Craig Baumann
Jennifer Wetzel
David Meyers
Noel Nelson
James Byrnes
Roswitha Van Hemert
Scott Petrunic
Michael O'Rourke
Melody Davis
Joel Bach
Stacey Kellerman
Carol Gebauer
Randy Steen
Lois Epstein
Donna Baldwin
Lynn M. Ledgerwood
Robert Janusko
Kerry Burkhardt
Greg Bernucca
Rhiamon Shae
Thomas Mulligan
Stephen Kilpatrick
Craig Conn
Lisa Marshall
Resham Shirsat
Taryn Clapper
Shirley Davis
Tammy Minion
Kimberly Peterson
Lisa Y. Guerra
Doug and Lee Buckmaster
Michelle Mink
Bill Jones
Darby Bennett
Elena Maria F. Muratori
Brenda Kennedy
Cyndi Torelli
Tammy Woody
Erica Ryan
Bryan Wyberg
Thomas Gardner
Doreen Curtin
John J. Strauss
Glenda Puhek
Shanno Reed
David Addison
Ashley Gronek
James Stevenson
Dale & Sheree Kesler
Harrison P. Bertram
Betty Jean Herner
Phyl Morello
Edward Hamlin
P. D. Barbuto
Donna Chelman
Kirsten Buell
Mark Buell
Amy Yager
Dick
Paul Williams
Dianne Beal
Kim Duve
Diana Martz
Steven Sievers
Hans Westenburg
Gerald J Dalton
Craig Conn
Marie Mark
Robert Owens
Shelley White
Patricia J. Jennings
Louis Rhodes
Maura O'Connor
Kate Spoont
Nevin Grossnickle
Kathy Byers
Allen Smith
Carrie Tate
Stephen Reynolds
Angela Yau
Raj Shah
J. Jeffries
Raphael Mazor
Richard Spotts
Jim Lunsford
Julie Bond
Gail Gitlitz
John Broz
Pat LeBaron
Martin Baskin
Lisa DeVaney
Christopher Mull
Richard Leonard
Elvira Floran-Bernier
James Davidson

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Alison Rasch
Lark Kirkwood
David Cann
Sequoiah Wachenheim
Sharon Lu
Mha Atma S. Khalsa
Robert Holder
James Boone
Tracey Perriello
Lynne Harrison
Paul Chuberka
John Kline, Jr.
Kerry Burkhardt
Pamela Dugan
Eric Spielman
David Williamson
William Berry
Robert Edwards
Lila Rogers
Cathie Brettman
David Randall
Mark Buchsbaum
James Pitkow
Ferdinand Kutheis
Wendy Read Wertz
Fred Mann
Maria Papi
James M. Nordlund
Ero Lippold
Kate Manning
Courtney Gartin
Lori Carter
Lynn Ledgerwood
Jeffrey Rapp
Tracey Allen
Heather Dennis
Mark Bender
Gary Thompson
Laura Herndon
Rene Valladares
George Dorman
Juanita Montano
Charmaine Oakley
Scott Cowan
C. Johnson
Wendy Walker
Kimberly Schrader
Kathleen Haggerty
Mark Carroll
Tina Littleman
Rochelle Willis
Cheryl Reid
Gloria Diggle
Nancy Donker
Connie Adamski
Jim Derzon
Karen Stelma
Jerry Hutchinson
Steve Green
Pandora Rose
Deanna Wenstrup
Kelly Hanlon
Norman Kopecky
Michael Kelly
Lynn Dodson
Matthew Cozzi
Carla Quinn
Agnes Jung Biro Mihly
Holy Holian
Mark Giordani
Gerald Meslar
Gail Harmon
Emily Morganstein
Dinda Evans
Suzanne Olbricht
Allain Hale
Roland A. Press
Kesha Ram
George Zuk
Margaret Rydant
Lauren Verruni
Sherida Tutor
Terri Mungle
Kimberly Peterson
Hiroko Jones
Sarah Piechuta
Lawrence Hooker
Timothy Lewis
Roy Bingham, Jr.
Ellen Kolasky
Justin Ferber
Brian J McGrath
Lisa Jo Frech
Steven Joel Koscheski
John Buchanan
Helena Miel
Matt Moore
James Pluta
Theresa Terhark
Linda Burianek
D. A. Randall
Wendy Taylor
Lindsay Johnson
Patricia Hopkins
Sally Sheumaker
Joseph Bail
Jason J. Green
Trisha Jachlewski
Barney McComas
Ruthann Roka
Rachel Scott
Christopher Lish
Betty J. Van Wicklen
Michael Brown
Kelli Howerin
Susan Dzienius
Barbara Rudio
Marc Robinson
Nanci McGonigal
Lee Howard
Carrie Tate
Jonathan Lotz
Jeffri Frontz
Shoeb Amin
Nanette Oggiono
George Alderson
Martha Glenn
Jayeson Vance
Lisa Marshall
Fritz Clark
Clyde Jones
Lynn Harrigan
Annette Gill
Neal Halloran
Lisha Doucet
Betty Smith
Scott Sanders
Carolyn Faulkner
Mary Kline
Valerie Schmidt
Cheryl Zang
Lisa Peterson
Dan Puetz
Jennifer Humowiecki
Mika Suzuki
Katharine Zeimis
Jon Clark
Stacie Grassano
Martha Galan
L. Emerson

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Kimberly Schrader
Logadia Hennigar
MaryJane Hammel
Kimberly Schrader
Robert Owens
Christine Moreno
Kristine Jordan
Christine Moreno
Kai Chan
Amy M. Elbert
Michael Letendre
Joseph Stubblefield
Courtney Laves-Mearini
Brian Barnes
Celine Foy
Azel Beckner
Kathleen Snow
Madeline Yamate
Deborah Smith
Gary Dzik
Gary Fishman
Lillian Hanahan
David Lauder
Robert Zinn
Alanna Louin
Gideon Derr
James Lindsay II
Anthony DelGreco
Linda A. Leblang
Francine Brown
Catherine Hardison
David Thompson
Denise DeGeare
Stacy Palik
Rick Neighbarger
Grace Cormons
Joan Bresko
Joanne Linden
Robin van Tine
Linda York
Charles Laun
Joseph Bail
James Williams
Laura Traynham
Deb Cohn
Ryan Little
Kimberly Armstrong
Gregory Esteve
Christy George
Charlotte Samuels
Carol Anne Gordon
Jeminie Shell
Deidra Currie
Michael Garvin
Juli Ames-Curtis
David Wick
Ryszard Decowski
Chaminade
Mark Roberts
Joshua Valencia
Margaret Clay
Christina Mansell
Janice VanDusen
Ann Allain
Mary Halligan
Jan Clark
Thomas & Kristin
Bowling-Schaff
Rosalie Hewitt
Tammy Robinson
Linda C. Fowler
Robert Puca
Theresa Perenich
Wendy Sera
Jim Lynch
Tammy Plante
Susan Poverchuk
Toni Sokoloski
Marcia Cooperman
Christine Radau
Tom Boughan
Nandita Shah
Anna Moomaw
Steven McGaffin
Ashley Stephen
Patricia Rowe
Carl
Elizabeth Brill
Mitch Cholewa
Steve Tyler
Donna Marcialis
Pamela Ohman
Melisa Holman
Carle Brown
Ida Sheriff
John Bowe
Hilda Kidwell
Jill Quilici
Michael Dillman
Linda Norelli
Loretta Richards
Kitrina Lisiewski
Dennis German
Jan Ingle
John Stevenson
Cheryl Pruitt
Bridgett Tadel
Virginia L. Waltermire
Eva Blake
Rhonda Foster-Staber
Elizabeth May
Dorothy Hanes
Lisa Griffith
Desi Nagyfy
William Freeto
Charles Sanderson
Kathleen Colburn
John J. Strauss
Deanna Wenstrup
Devon Cohen
Carol Blaney
Hazel Landa
William Hildner
Julian Kesterson
Greg Bernucca
Debbie Horan
Julie Starr
Maureen Gagnon
Nancy Hoecherl
Sheila Ward Condominio
Montebello
Emil Ippolito
Mike Wingate
Stefan Furst
Kathy Hamill
Harriette Frank
Ruth Stambaugh
Suzanne Koehler
Kathleen Haggerty
Marcia Peterson
M.L. Heller
Deborah Santone
James Ward
Mary Cherry
Mildred Felder
Sarah Piechuta
Stephen Dickson
Ann R. Jacobson
Steven Joel Koscheski
Adam Kilborn

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

V. Bostock
Lia Friedman
Kathy Hanson
David Surplus
Concetta Edwards
Patricia Bereczki
Patricia Coffey
Cathleene George
glenda mayeaux
Jean Melom
Robert LieBerman
Betty Jean Herner
Amy Lindsey
Robert Hammond
Viola Henning
Maria Lynn Therese
Barbara Horning
Claire Perricelli
Marilyn Cox
Nikki Jordan
Eric Spielman
James Murphy
Lee D. Winslow
Sally Berger
Sheron Schaeferle
Norman Kopecky
Elaine White
Jason Bean
Judith Embry
Melissa Mutter
Joannna Rotkin
Elaine Sartoris
Phoebe Blanchford
Nancy Stevens
Gavin Kramer
Charlotte Stahl
Gib Chase
John and Nancy Arnold
Kimberly Kennard
Katie McCarthy
Barbara Feijo
Mike Wingate
Shannon Taylor
Janet Walsh
Barbara Harrison
Karen Baker
Marilyn Johnson
Ken Olson
Nina Keefer
Bettina Bickel
Claudia Lucas
John Petersen
Kathy Byers
Erica Mitchell
Kelli Howerin
Kevin Corcino
Alicia Kern
Diana Allard
Kenn Goldman
Judy Dietel
Anne Malone
Marc Rayburn
Keith Shannon
Linda Leblang
Eileen Murray
Jo Vandiver
Jacqueline French
Dorothy Russell
Douglas Adolphsen
Jeremy Sohn
Bruce Blum
Robert Zai III
Tony Prato
Tanya Shersnow
Melissa Bishop
John Randolph
Sandra Merrell
Erlene Jackson
Janet Ackerman
Laura Ellenwood
Regina Bowie
Starr Hurst
Betsy Vozary
Thomas Amundrud
Sharon Tebben
Larry Chriss
Saskia Santos
Michael Gross
Janeen Faulk
Judy Redding
Scottie Baugh
Michael S. Lewis
Kenneth Gourley
Barbara Ann Dembek
Christine Severson
Barry Friedman
Lisa Haugen
Bill Commins
Wendy Walker
Suzanne Olbricht
Adele Myers
Adela De La Santos
Jennifer Serrano
Scott Diehl
Patty Nill
Juanita Loudermilk
Tam Bui
Raymond T. Bissonnette
Janet Holly Romine
Robert Sventy
Robert Janusko
Scott Rosecrans
Chad Fordham
Dorothy Schwartz
David Randall
Nick Nichols
Dolores C. Pino, Esq.
Maria Papazian
Maria Difiore
Christina Borra
Sierra Biehle
Demelza Costa
Constance Rodman
Mandy Merritt
Wendy Powers
Linda Young
Judith Holstein
Phil McPherson & Cindy Pardee
Patti Bell
Florence Thompson
Matthew Geisert
Deborah Smith
Nita McCuller
White Bear
Janine Taulman
Brent Larsen
Don Smith
Evan Silberstein
Art Zernis
Amanda Lane
Carol Sulanke
Stephen Williams
William Berry
Mary Hogan
Rochelle Garnes
Bridgit Roeth
Tim Reede
Lauren Brown
Carolyn Bourassa

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Jacqueline Lasahn
Betty J. Van Wicklen
Bernard Wasserman
Diana Dexter
Lisa Hedge
Carina Barnett-Loro
James M. Nordlund
Kelly Hanlon
David Anderson
Kathy Galligan
Matt Moore
Nora Reed
James Boone
Mary Gill
Craig Bredeson
Connie Boitano
Katherine Hamilton
Sara Kube
Kathleen Jannusch
Kate Marks
Michael Larson
Margaret Rydant
Robert Anthony
Andrea Kruse
Kathy Ross
Lesley Urasky
Charles Kalina
Carol Waldner
Joseph Waldner
Roberta D. Smolenski
John Mueller
Lawrence Farris
Mary Ann Hansen
Elaine Fischer
Michele Heinbaugh
Mark Carroll
Jordan Moore
Brenda Bussell
John Will
Bridget LaNoir
Mark Buchsbaum
Deborah Jutz
Zona Hays
Rene Turner
Mary Yep
Karen Ziomek
Rhiannon Chandler
Natasha & Noah Brenner
Rita Hickey
Ethan Finkelstein
Walter J. Lee IV
Kristy Fruth
Marilyn Edlund
Georgia Evans
Donna Calvao
Mary Shockley
Carrie Watson
Niki Pestel
Mary Lu Kelley
Anne Duffy
Wendy Taylor
Fletcher Rogers
Daniel Kelly
Nancy Hamilton
Jessica Joseph
Albert Utzig
Ralph Bocchetti
Anthony Donnici
Ulla Besch
Ed Lickey
Nicole Groeber
Kate Krader
Heather Sousa
Nick Urban
Kristin Hannum
James Davidson
Bruce Combs
Kendra Haggerty
Denise Lytle
Judith A. Cartisano
Julie Rodgers
Erica Ryan
Charlene Rush
Debbie Feldman
Sharon Posey
Arlene Epperson
Carolyn Zinns
Lottie Jenvey
Mary Pease
Nori Hayes
Beverly Drucker
Laura Homeyer
Nathan Miller
Bonnie S. Mandell-Rice
Edna Rankine
Jennifer Clark
Kirsta Skaff
Mercy Drake
Jamie Przybylski
Shaindel Beers-Finley
Margaret Kerr
Tom Chancler
Emily Rieber
Scott Cowan
Helen Mckay
John Newton
Louis Rhodes
Joan Breiding
LeeAnn Young
Debbie Slack
Michael Lance
Patrick Kilbane
Marcia Cooperman
Louis Rhodes
Jess Stewart
Bobbie Peter
Briana McElfish
Jonathan Fernsler
Lori Hyder
Lisa Uchno
Julia Johns
Beverly Flores
Michael Allen
Ariele Faulkner
William Clemons
Alan Christy
David M. Felix
Brian Scott
Darlene Wolf
Patricia Maddox
Barbara Christensen
Jane Hart
Sheri Mitchell
Sanford Higginbotham
Diane Brown
Alex Herrera
Jennifer Morgan
Howard Deutch
Bill & Marilyn Voorhies
Eleanor Burian-Mohr
Kevin Armitage
LeeAnn Bennett
Constance Anderson
Agnes Jung Biro Mihly
Carolyn Ganus
Heather Rorer
Heather Payne
Russell Bezette
Myra MacDonald
Elaine & William Barney

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Robert Rutkowski
Greg Garrison
Margaret Welke
Jim Lunsford
Adam Savett
Tristan Raymond
Ana Velasco
Michelle Mink
Dana Steeples
Shannon Holmes
Marian Simmons
Wood Lee
Danny Tangorra
Dottie Moseley
Florence Sullivan
Melanie Maloney-Richardson
John Mueller
Charles Simms
Marian Simmons
Aurora Kushner
Deborah Crews
Fred Mann
Kendall Dinwiddie
Cathy Stahmer
Alessandro Drius
Chuck Johnson
Billie Whittaker
Karen Hardin
Martin Baskin
Kathy McElwain
James Nimmo
Cory Golden
Bob Schneider
Carmen Blakely
Lisa Broxson
Scott Hills
Margaret Feinberg
Larry Johnson
Ronald Champany
Heather Busse
Jamie Tietjen
John Fairfield
James Andelin
Edward LeVieux
Dean Ruscoe
Elyse Friedman
Grace Busch
Clark Andelin
Lenore Rubino
Betty Dean
KayLee Witt
Renee Davis-Born
Kathrin Dodds
T. B. Boorn
Karen Munro
Marvin Orndoff
Sharon Jabs
Nelson Siler
Pamela Raya-Carlton
Deborah Brush
Jenni Kovich
Rachel Roffman
Mr. & Mrs. Donald Wood
Gregory Kelly
Claire Stuart
Keith Cubbon
Patricia Hopkins
Jim Derzon
Jamie Mierau
Holly Eaton
Elizabeth Petersen
Leslie Ruby
Timothy Gilbert
Cheryl Morris
Cheryl Reid
Melissa Chisena
Alison Megger
Harry Schueler Jr.
Mia Knight Nichols
Lois Solomon
Gersldine Fox
Richard Sleator
Shelley White
Virginia Manley
Marie Macaluso
Jayleen Hatmaker
Kevin Kruse
Gene Reimer
Christine Crawford
Courtney Lyons-Garcia
Alison Burrows
Linda Leimbach
J.M. Gordon-Omelka
Nicole Loerzel
Annie King
David Fox
Robert Kruschwitz
Allyson de Groat
Mary Ann McFarland
Annie Blackmer
Jim Walters
Susan Poverchuk
Paul Buechler
Liz Clements
Kenneth Ohnemus
Don Blanton
Anita Lutz
Karen Stelma
Heather Randall
Shanna Rozelle
Karen Robbins
Robert Edwards
Karen Robbins
Martha Coyne
Lynn Harrigan
Kim Mazik
Jay & Sandy Lynch
Jenny Wilson
Karen Ognian
Neil Milani
Mary Kinnick
Robert Hill
Joan Bueter
Holly Dyer
Marlena Lange
Alison McGinty
Missy Correlle
Pam Jaeger
Mary Dyer
Mayra Lopez
Michael Kelly
Colleen Woods-Esposito
Mark and Mary McGrath
Mack Grubb
Bernie Stein
Sandi Beale
Marsha Brofka-Berends
Phyl Morello
Derek Brown
Susan Murray
Lynn Dodson
Greg Gillis
Gloria Diggle
Julie Ford
John Kavanagh
Matthew Cozzi
Jim Mosser
James Hood
Robert Gartner

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Holly Dyer
Frank Willard
Deborah Hardin
Karen Becker
Melissa Judge
Andy Lynn
Kelly Wilford
Lucy Moore
Matt Hols
Stephanie Hunt-Brinkmann
Susan Schlessinger
Gina Lopez
Bonnie Mc Cune
James Hembree
Shirley Davis
Christine Georgiou
Chrisley Pickens
Johnnie Prosperie
Danny Dillow
Anatole Besman
Kevin and Tracy Burgess
J. K. Fort-Strietzel
Angela Burgess
Glenn Friedman
Catherine Menke
Barre Simmons
Marilyn Chestnut
Sister Philothea
Wendy Porter
Shannon Cummins
Sarah Emmerson
David Sawaya
Claire Watson
Donna Mo
Sheri Archey
Jennifer Gale
Paula van de Werken
George Imrie
Ellen Ramsdale
Juanita Montano
Alex Stavis
Mark Holt
Thomas Conroy
Doris Cassidy
Jack and Karen Bashor
Mark Giordani
Karen Lampke
Lauren Jonik
Miriam Dyak
Suzanne Moran
Diane la Chusa
Jane Drews
Jim Steitz
Jennifer Lee
Douglas Estes
Celine Nahas
Gail Harmon
Barbara Geist
Hal Rodgers
Roland A. Press
Pamela Abramson
Ulla Sarmiento
Tami DeNoel
Dinda Evans
Ellen Kolasky
Jeanette Kaufman
Vicki O'Riley
William Koeppen
Ravi Grover
Raphael Mazor
Robert Davis
Edward Hamlin
Thomas Mulligan
Mark Bender
Jody Conrad
Theresa Terhark
Stacy Bruno Lovra
Kathy Watt
Arthur Moss
Matt Hicks
Sandra Sekelsky
Mary Anne Vestal
Marcia Z. Dunetz
Sharon Morris
Mha Atma S. Khalsa
Harlan Solomon
Kay Corriher
Yolanda Garcia
Doris Dickens
Terri Mungle
Lois White
Mary Anna Coulter
Urmila Padmanabhan
Lucy Joyce
Richard Sanders
Dorothy Chiu
Weldon H. Jackson
Rae Newman
Susanna Isbell
Nikki Hiza
Audrey Johnson
Barbara Bernhart
Dawn Stanzione
Doris Gagnon
Clyde Jones
Timothy Lewis
Joanne Johnson
Patricia J. Jennings
Kimberly Hurley-Shoaf
Jesse Gore
Connie Gilmore
Bruce Hoegh
William A. Richey
James H. Fitch
Laura Thayer
Lisa Butch
Brian Stewart
Rebekah Roberts
Kerry Burkhardt
David Burton
David Wexstein
Emily Heinlen
Jacqueline Robertson
Maria Prokopowycz
Kristin Kirby
Lee VanderWeyden
Deborah L. Steinmetz
K. Finch
Timothy Johnston
August & Judith Mirabella
Melody Torrey
Sarah Ives
Thomas Porter
Marlo Hill
Clark Hiestand
Misti Jancosek
Stan Logan
Jean Strickler
Swami Shraddhananda
Ray Vickers
Janette Stoner
Kathryn Miller
Alfred Papillon
Joe Zillner
Terry Proeger
Kathryn Santana
Mary Lupton
Courtney Gartin
Earl Lane

Names of the Senders of the National Parks Conservation Association
Action Alert Form Letter

Michael Keepper
Kimberly Peterson
Cindy Gawne
Davydd Contarino
Julie Bond
Heather Williams
Kate Spoont
Johnny Fink
Glen Zorn
Linda Sotis
Sheri Millard
Lauryn Slotnick
Richard Spotts
James A. Knight
Thomas Zissu
John Marchese
Charlene Root
John Dukes
Randolph Schoedler
Susan Montague
Marie Jacobs
Martha Waltman
LaVerne Smith
Jill Forman
William Berry
Courtney Gartin
Marie Slater
Chris Norbury
Kathy Rapp
David Kibitlewski
Carl Paulie
Ted Boyce
Carl Paulie
Jason Russ
David Loomis
Charlotte Girard
Martin Wimmer
Henneth Bozek
Marie Slater
Judy Desreuisseau
Jennifer Rosenberg
Philip Komdat
Michael Wagner
Lisa Frey
Linda Mack
Sheila Balch
Bob Aegerter
Freya Harris
Thornton Long
Ferdinand Kutheis
Patricia McCain
Marie Gutkowski
Traci Hamilton
Patricia Patterson
Davis McGlathery
Patrick Stoddard
Elaine Costeas
Jonathan Lotz
Patricia Clements
Tom Dancer
Patricia Mackura
Nichole Lorusso
Judy Krach
Kathleen Steele
Sabrina Corbaci
Robert Holder
Andrew Freeman
Michael Gill
Seth Silverman
JoEllen Kuszmaul
Gerald J. Dalton
John Yarber
Jennifer Johnston
Lois Evron
Gail Lee Van Heel
Adam Moyer
Deby Murphy
Robyn Reichert
Steven Dawes
Charles Alvarez
Kenneth Albers
Linda Carpenter
Tara Holmes
Marion Davis
Satu Hummasti
Marvin George
Amy R. Prisco
Ingrid Leypoldt
Marcella Hammond
Sharon Lu
Jason J. Green
Barbara Kridner
Dorothy Foster
Pandora Rose
Alice Bartholomew
Angela Nichols
Anne Snyder
Linda Beliveau
Kelly Eyler
Amanda Nelson
Sandra Schachat
Laura Tregoning
Keegan Roberson
Donald Chelman
Stephen Bickel
John Buchanan
Bryan Strickland
John Buchanan
Laura Herndon
Diana Wittenbreder
Stephen Reynolds
Amanda Petel
Paul Szymanowski
Mary-Carol Madison
D. A. Randall
Robert A. Vanderkamp
Pamela Jiranek
Wayne Bessette
Donna Chelman
C. Johnson
Diane Baptista
Kirsten Buell
Mark Buell
Hiroko Jones
Stefanie Collins
Julia Benedetti
Vanessa Pesec
Stephen Bickel
Jo Ellen Young
Eugene Kiver
Jack Saylor
Marti McKenna
Frances Cone
Chris Hudock
Barry Klein
Dana Wullenwaber
Gabriella Turek

The National Park Service cares for special places
saved by the American people
so that all may experience our heritage.

EXPERIENCE YOUR AMERICA.

October 2003





UNITED STATES DEPARTMENT OF THE INTERIOR • NATIONAL PARK SERVICE