

STATE  
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PARKS®

September 2008

# GLACIER BAY NATIONAL PARK AND PRESERVE

A Resource Assessment



National Parks Conservation Association®  
*Protecting Our National Parks for Future Generations*

# STATE ♦ OF THE ♦ PARKS®

## Center for State of the Parks

More than a century ago, Congress established Yellowstone as the world's first national park. That single act was the beginning of a remarkable and ongoing effort to protect this nation's natural, historical, and cultural heritage.

Today, Americans are learning that national park designation alone cannot provide full resource protection. Many parks are compromised by development of adjacent lands, air and water pollution, invasive plants and animals, and rapid increases in motorized recreation. Park officials often lack adequate information on the status of and trends in conditions of critical resources.

The National Parks Conservation Association initiated the State of the Parks® program in 2000 to assess the condition of natural and cultural resources in the parks, and determine how well equipped the National Park Service is to protect the parks—its stewardship capacity. The goal is to provide information that will help policymakers, the public, and the National Park Service improve conditions in national parks, celebrate successes as models for other parks, and ensure a lasting legacy for future generations.

For more information about the methodology and research used in preparing this report and to learn more about the Center for State of the Parks®, visit [www.npca.org/stateoftheparks](http://www.npca.org/stateoftheparks) or contact: NPCA, Center for State of the Parks®, P.O. Box 737, Fort Collins, CO 80522; Phone: 970.493.2545; E-mail: [stateoftheparks@npca.org](mailto:stateoftheparks@npca.org).

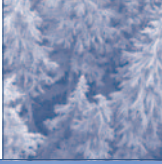
Since 1919, the National Parks Conservation Association has been the leading voice of the American people in protecting and enhancing our National Park System. NPCA, its members, and partners work together to protect the park system and preserve our nation's natural, historical, and cultural heritage for generations to come.

- \* More than 340,000 members
- \* 23 regional and field offices
- \* More than 120,000 activists

A special note of appreciation goes to those whose generous grants and donations made this report possible: MSST Foundation, Dorothy Canter, Ben and Ruth Hammett, and anonymous donors.

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## REPORT SUMMARY



Glacier Bay National Park and Preserve commands a glacier-crowned, maritime wilderness that stretches northward from Alaska's inside passage to the Alsek River, encircling a magnificent saltwater bay. The nearly 3.3 million-acre park derives its name and much of its biological and cultural significance from this great bay, which harbors spectacular tide-water glaciers and a unique assemblage of marine and terrestrial life. To the east and

northeast, the Tongass National Forest borders the park. To the north, it shares an international boundary with Tatshenshini-Alsek Wilderness Provincial Park in British Columbia, Canada. To the south, the waters of Cross Sound and Icy Strait border the park, while the open Pacific Ocean lies to the west. As its name suggests, two main features characterize Glacier Bay National Park and Preserve: marine waters and glacial ice. Glacier Bay itself

Glaciers are primary features of Glacier Bay National Park and Preserve, though glacial ice has been receding for about the last 250 years. Today it covers about 27 percent of the park.



Vegetation such as horsetails (*Equisetum* spp.), club mosses (*Lycopodium* spp.), and true mosses (Bryophyta) carpet the ground in much of the park's dense coniferous forests.

is a large marine fjord, with two main arms that wind more than 60 miles into the heart of the park. Glacial ice covers about 27 percent of the park's area today, though the ice has dramatically receded over the past 250 years. The retreat of the glaciers is striking. When Captain George Vancouver charted adjacent waters of Icy Strait in 1794, he described what we now call Glacier Bay as just a small indent in a gigantic glacier that stretched off to the horizon. Since that time, the bay has undergone one of the fastest large-scale glacial retreats ever recorded, and the face of the closest tidewater glacier is now more than 50 miles from where Vancouver first saw it.

Few places on Earth provide the opportunity to study glacial retreat and associated ecological responses in a setting virtually unaltered by

human activities. President Calvin Coolidge officially recognized the significance of this rapid glacial retreat when he created the 1.16 million-acre Glacier Bay National Monument in 1925. His proclamation establishing the monument specifically identified the key importance of scientific research. In 1939, President Franklin D. Roosevelt further recognized the significance of the area when he more than doubled the size of the national monument.

With the passage of the Alaska National Interest Lands Conservation Act (ANILCA) in 1980, the national monument was redesignated as Glacier Bay National Park and Preserve, and the protected area was expanded to its present size of 3,283,246 acres. About 57,000 acres of this comprises the preserve portion, which lies

to the northwest along the Pacific coast at Dry Bay and is managed differently from Glacier Bay National Park. In the preserve, ANILCA allows subsistence and sport hunting, trapping, commercial fishing, and limited off-road vehicle use. In addition, commercial fishermen are allowed to maintain camps during the fishing season, and there are three permitted lodges that provide opportunities for guided sport fishing and hunting.

The park's clean waters, ample shorelines, steep mountains, and tidewater glaciers combine to create a diversity of habitat types, from estuarine wetland to dense coniferous forest to alpine tundra. These different ecological communities support myriad wildlife species, including bald eagles (*Haliaeetus leucocephalus*), brown bears (*Ursus arctos*), humpback whales (*Megaptera novaeangliae*), horned puffins

(*Fratercula corniculata*), moose (*Alces alces*), wolves (*Canis lupus*), and king salmon (*Oncorhynchus tshawytscha*).

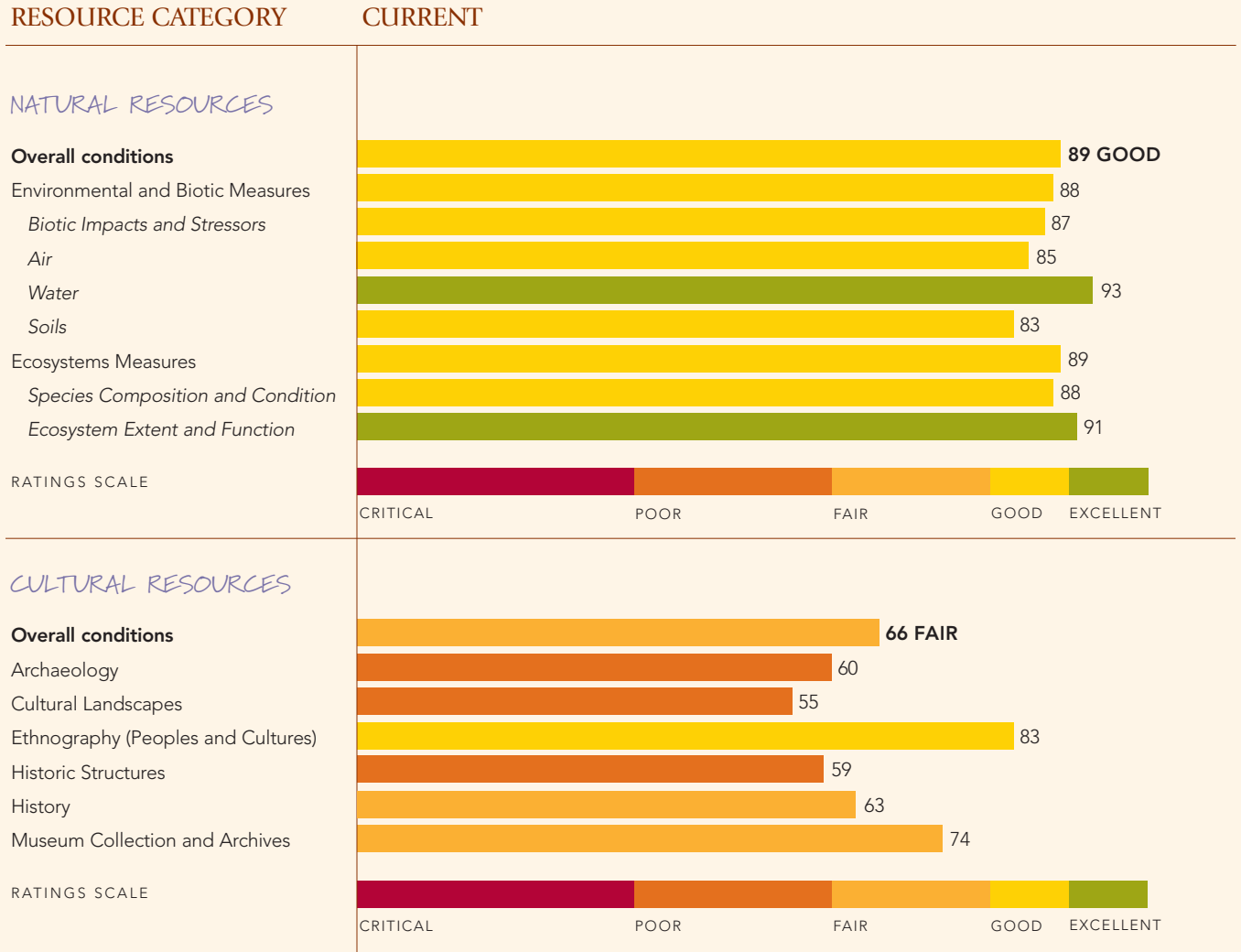
In recent decades, the park has worked to strengthen ties with the Tlingit for whom Glacier Bay is their sacred homeland. Innovative park programs take Tlingit schoolchildren on field trips into the park, which helps foster their connection to tribal elders and their cultural heritage. Members of the Tlingit community are also welcomed into the park to harvest berries, a variety of seafoods, and traditional use items such as spruce roots and mountain goat hair (for weaving traditional blankets). To further recognize Tlingit culture, support its interpretation, and provide a place for cultural events, the park plans to build a Tlingit longhouse near park headquarters.



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Diverse ecosystems at Glacier Bay National Park and Preserve, including the estuarine wetlands shown here, host a wide variety of plants and wildlife.

Note: When interpreting the scores for natural and cultural resource conditions, recognize that critical information upon which the ratings are based is not always available. This limits data interpretation to some extent. For Glacier Bay National Park and Preserve, 87 percent of the natural resource information required by the methodology was available, and 100 percent of the cultural resource information was available.



The findings in this report do not necessarily reflect past or current park management. Many factors that affect resource conditions are a result of both human and natural influences over long periods of time, in many cases before a park was established. The intent of the Center for State of the Parks is to document the present status of park resources and determine which actions can be taken to protect them into the future.

## RATINGS

Current overall conditions of Glacier Bay National Park and Preserve's **natural resources** rated a "good" score of 89 out of 100. Ratings were assigned through an evaluation of park research and monitoring data using NPCA's Center for State of the Parks comprehensive assessment methodology (see "Appendix" on page 56). Glacier Bay received one of the highest scores for natural resources of the 44 parks NPCA has assessed to date.

Glacier Bay National Park and Preserve is comprised largely of untouched wilderness and is relatively pristine compared to other national parks. But there are some natural resource concerns, including the threat of overharvest of halibut, air pollution from Asia, and a few problematic invasive plants that may gain a foothold in the park. Little information is available to comprehensively understand the condition of the park's soils; currently, minor impacts from camping and impacts from off-road vehicle use in limited areas shape the soils rating. Other than these issues, the park faces relatively few known threats to the integrity of its ecosystems. To round out understandings of natural resources, however, the park needs baseline data on land mammals and invertebrates, animal harvests from hunting, and soil quality.

Overall conditions of Glacier Bay's **cultural resources** rated a "fair" score of 66 out of 100. The scores for cultural resources are based on the results of indicator questions that reflect the National Park Service's own *Cultural Resource Management Guideline* and other policies related to cultural and historical resources.

Cultural resource programs receive only 2 percent of the park's budget and are managed primarily by one staff member. More staff are needed to catalog the museum collection and archives and to develop interpretive programs about historic structures, archaeological resources, and cultural landscapes, which currently receive no interpretation. Potentially significant archaeological resources and cultural



landscapes remain undiscovered because the park does not have any staff to complete surveys. One highlight of the cultural resources program is the recent improvement in relations between the park and the Tlingit whose ancestors once lived in the area.

Glacier Bay National Park and Preserve is one of the few places on Earth that provides the opportunity to study ecological responses to glacial retreat.



Glacier Bay National Park and Preserve is comprised of largely untouched wilderness that is a haven for wildlife and adventurous visitors.

## RESOURCE MANAGEMENT HIGHLIGHTS

- Virtually all the land in the park and about 15 percent of the marine waters in Glacier Bay itself are designated wilderness. With the exception of the single road from Gustavus to park headquarters in Bartlett Cove, the park is unmarred by roads, and humans rarely visit vast areas. An off-road vehicle trail network in Glacier Bay National Preserve has the only other vehicle activity outside of Bartlett Cove.
- As most visitors arrive by water, regulating vessel traffic in Glacier Bay is the key resource management strategy to prevent impacts to the park's marine environment. Temporary regulations governing boat traffic were first promulgated in 1980, followed by permanent regulations in 1985 and a major planning effort culminating in a vessel management plan in 1995. A lawsuit brought by NPCA and acts of legislation in the late 1990s led the National Park Service to publish new regulations for vessel management in 2003. These regulations govern boat traffic today (see "Visitors by the Boatful" on page 24).
- In 1999 the Park Service, at the direction of Congress, immediately halted all commercial fishing within the park's designated wilderness waters and began to phase out commercial fishing in Glacier Bay proper. The only people still allowed to fish commercially in Glacier Bay proper are those who have qualified for lifetime nontransferable access permits by demonstrating a sufficient fishing history in the bay. When the last of these fishermen retires or is no longer able to continue fishing, commercial fishing will be completely phased out of Glacier Bay proper. This is estimated to occur around 2050, though it could happen as soon as 2025. When it occurs, the park will contain one of the world's largest high-latitude marine reserve complexes where commercial fishing is not allowed. The U.S. Geological Survey is collecting information on the effects of these closures that could apply to other marine reserves around the world.
- Glacier Bay staff work closely with local schools to take Huna and Yakutat Tlingit



schoolchildren on annual field trips into the park to participate in traditional song, dance, and storytelling with tribal elders. Glacier Bay and the Dry Bay area are an inextricable part of Huna and Yakutat Tlingit culture; these trips help foster connections between the Tlingit and their history, identity, and heritage.

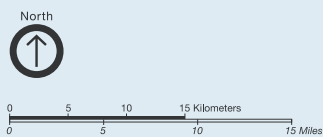
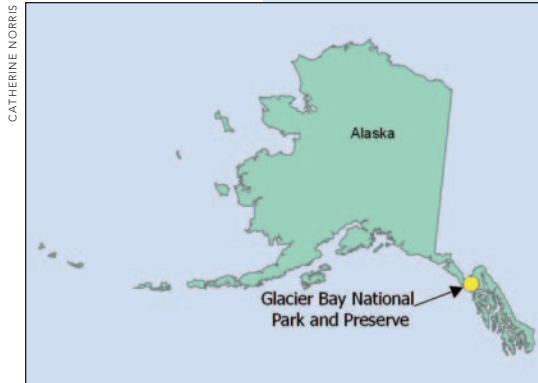
- Providing opportunities for research is central to Glacier Bay's mission. The park serves as an outstanding natural laboratory for academic scientists involved in more than 50 current studies, some of which have been passed down through generations of researchers. Many studies have focused on changes in the landscape and ecosystems related to the glacial retreat that has been occurring for the last two centuries. A number of recent studies, such as the underwater acoustic monitoring program conducted in cooperation with the U.S. Navy, have produced findings applicable well beyond the park's boundaries.
- Researchers have monitored the park's humpback whale populations for 23 consecutive years. The humpback whale is currently listed as endangered under the Endangered Species Act, and the Park Service is an active participant in its mandated recovery plan. Long-term data gathered through this program help guide vessel management activities.
- The park's website is informative and well designed, providing information on both cultural and natural resources. The website is a critical resource because most visitors see the park from the deck of a cruise ship, never setting foot on park land. The website provides information on scientific research, park wildlife, the marine environment, and other topics of interest.

## GLACIER BAY NATIONAL PARK AND PRESERVE AT A GLANCE

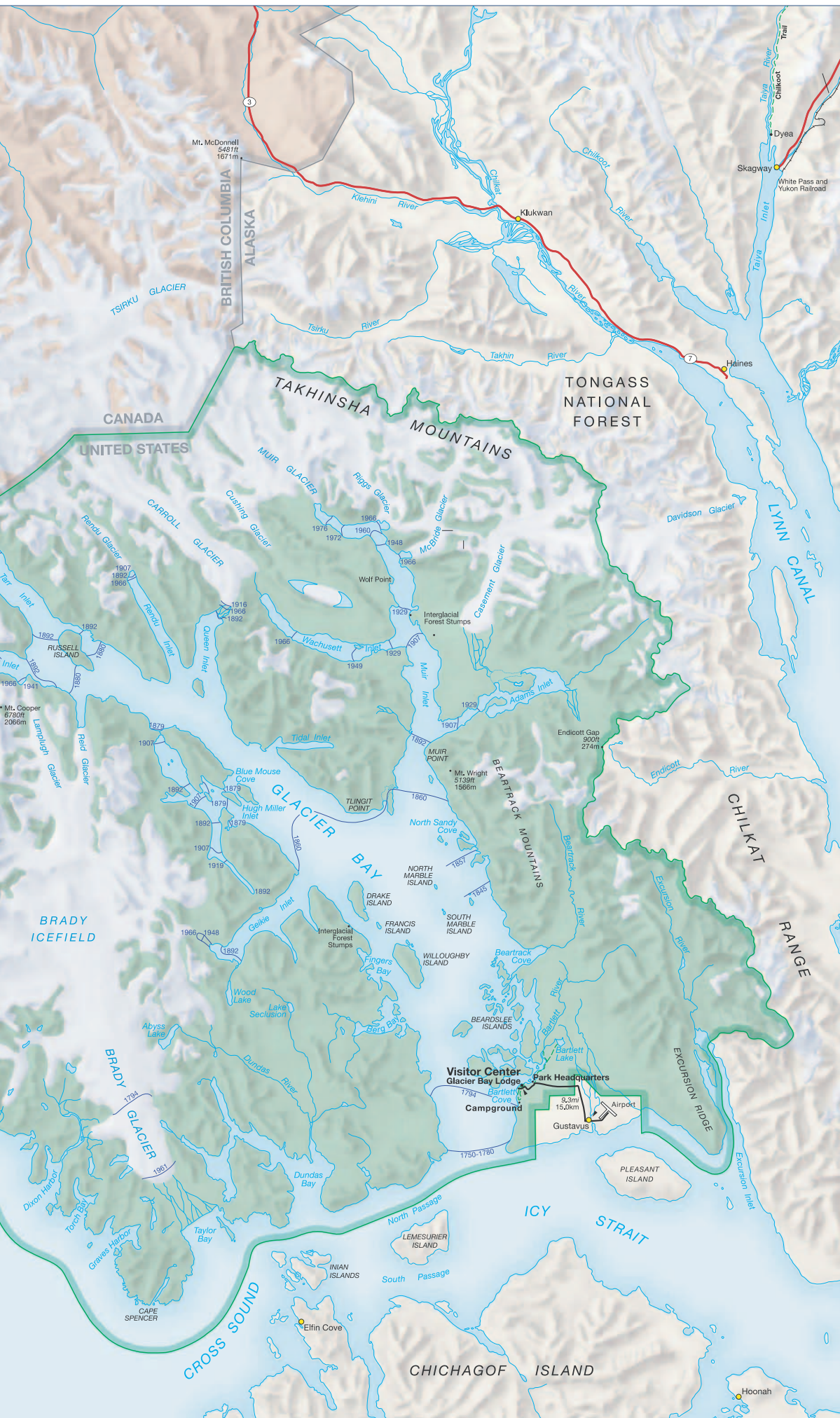
- Glacier Bay National Park and Preserve is located in southeast Alaska and protects nearly 3.3 million acres of high mountains, coniferous forest, and tidewater glaciers as well as more than 600,000 acres of marine waters. It is part of a World Heritage Site that also includes Wrangell-St. Elias National Park and Preserve in Alaska and Kluane National Park and Tatshenshini-Alsek Provincial Park in Canada. This sprawling network of protected lands and waters covers more than 24 million acres and ranks as one of the largest tracts of contiguous protected area anywhere in the world. The United Nations Man and the Biosphere Program also designated Glacier Bay as part of a the Glacier Bay-Admiralty Island biosphere reserve.
- Glacier Bay National Park is the spiritual homeland of the Huna Tlingit, and Glacier Bay National Preserve is the homeland of the Ghunaaxhoo Kwaan unit of the Yakutat Tlingit Tribe. The park has programs in place to connect the Tlingit to their homelands and is working on programs to restore access to plants and animals for traditional uses. Cultural interpretation is increasingly a part of the park's visitor program.
- The park boasts clean air and water, huge tracts of untouched habitat, and the full complement of animal species that were present before the arrival of Europeans. The National Park Service has instituted many regulatory measures to protect habitats and wildlife, such as rules regarding the movement of boats to minimize impacts on marine mammals. Research programs gather information used to protect this marine wilderness.
- Each year more than 400,000 people visit Glacier Bay to admire the stunning mountains and coastline as well as to pursue activities such as boating, whale watching, and kayaking. Ninety-five percent of visitors arrive by water, and most of these on large cruise ships. Rangers board the cruise ships to present park information and answer questions.



Kayaking is a favorite way to explore park waters.



- Glacier Bay National Park
- Glacier Bay National Preserve
- Trail
- 1966 Historic extent of glaciation



## KEY FINDINGS

### Natural Resources

- Natural forces shaped the landscape of Glacier Bay National Park and Preserve, with little human influence. Only limited resource extraction occurred historically on park lands given their remote location and recent ice cover. Threats from development are at a minimum, and while the park has not yet felt extensive impacts from invasive species or pollution, future risks from these stressors are real and should be addressed before they become pervasive.
- Natural ecosystems at Glacier Bay National Park and Preserve are intact and functional, and they could serve as a benchmark for ecosystems within other national parks. But despite a history of productive long-term research programs in the park, baseline data are conspicuously missing on key parameters such as harvested populations of wildlife, invertebrate communities, and soil quality. Gathering this information is critical, particularly as global climate change affects park ecosystems at an accelerating rate.
- Local halibut depletion may be one of the larger resource extraction threats facing Glacier Bay, as halibut play an important role in the food chain and having healthy populations of halibut of all ages is ecologically important. Although commercial fishing in the bay proper is being phased out (lifetime access permit holders will continue fishing until they retire—estimated by ca. 2050), commercial harvests have recently increased to 500,000 pounds annually. Additionally, recreational halibut fishing in Glacier Bay and throughout southeast Alaska is on the rise. Park managers must ensure that the sport fishery does not grow to supplant the commercial harvest as the latter wanes.

Most of Glacier Bay National Park and Preserve's visitors enter park waters on cruise ships and view the park from on board these vessels. The park regulates ship traffic to minimize threats to wildlife.



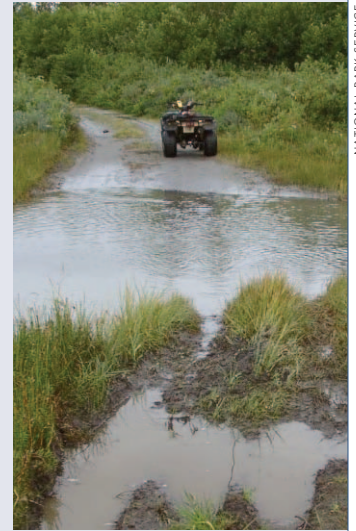
- Hunting and off-road vehicle use are allowed in the preserve portion of Glacier Bay National Park and Preserve. The Park Service faces substantial challenges managing these activities. For example, little information is known about baseline populations of harvested wildlife species—important data that should be used to inform hunting regulations. The extent of off-road vehicle trails has significantly increased since 1980, to the detriment of natural resources. The park’s plan to close some trails and actively manage the remainder will help mitigate damage.
- Seafaring vessels of all sizes and shapes—ranging from commercial fuel barges and cruise ships to tour boats and private vessels—travel the waters in and around Glacier Bay National Park and Preserve, and they present various threats to marine life and visitor experience. These threats include: vessels striking and possibly killing whales and other marine organisms; noise from vessels affecting marine mammals and other organisms that rely on acoustical input to survive; fuel spills from both large and small vessels; and air pollution from vessel emissions. The Park Service works to minimize these threats by limiting the number and type of vessels, implementing vessel course and speed restrictions in some areas to protect whales, and generally limiting vessel behavior, such as approach distances to sensitive resources (e.g., seabird colonies, pinniped haulouts, etc.). Fuel spills from vessels in park waters are a particular concern because there are no known, effective methods to clean up oil from the ice-filled waters of the park’s upper fjords.
- After initially recolonizing Glacier Bay in the early 1990s, sea otters continue to rapidly establish themselves. Aerial

surveys have reported up to 2,400 individuals. At the same time, populations of harbor seals declined significantly between 1992 and 2002 for unknown reasons. Harbor seals are important not only to the park ecosystem but also to the culture of the Huna Tlingit. Historically, the Tlingit harvested seals from areas within the park. This is no longer permitted, but some Huna Tlingit have expressed a desire to renew the harvest of a small number of seals for ceremonial purposes.

- Continued commercial fishing in Icy Strait/Cross Sound and along the Pacific coast, within the boundaries of the park, could significantly affect the long-term population health of various marine species. Although this fishing is permitted, park managers are concerned about the effects of potential overharvest of certain vulnerable species such as rockfish and lingcod. Similarly, bottom trawling for scallops may damage important benthic habitats. Working with the state and other fisheries management agencies to ensure sustainable harvest levels is critical, yet the park’s fisheries funding and number of staff are very limited. In 1999, Congress mandated a cooperative fishery management plan between the State of Alaska and the U.S. Department of the Interior, but funding for this plan has yet to be received.

### Cultural Resources

- The park’s cultural resource program receives just 2 percent of the overall park budget and is primarily managed by a single staff member. Additional employees, such as a full-time cultural resources manager, historian, ethnographer, and archaeologist, are needed to assist with cultural resources management.



Off-road vehicle use is allowed in the preserve. Trail networks have expanded significantly over the last three decades, and park resources are being damaged. The park is preparing a plan to address these problems.

- Important ethnological, archaeological, and historical information is at risk of being lost as Tlingit elders and longtime, non-Tlingit local residents pass away before sharing their knowledge and memories with younger generations. The park needs funds to hire staff to record, transcribe, and translate these oral traditions before the opportunities are lost.
- Staffing is needed to further develop interpretive and outreach projects that focus on Tlingit culture. One example is the Talking Map, an interactive exhibit that allows the public to scroll over a map of the park to see modern and historic photos of sites, hear place names in Tlingit, and learn about the Tlingit culture. Further development would make this resource more broadly accessible online. Funds are also needed to build a traditional Tlingit longhouse near park headquarters to provide space for cultural events, cultural education, and interpretive exhibits.
- The park maintains an important archival collection that includes such items as first-hand accounts from 18th-century explorers Jean François Galaup de La Perouse, James Cook, and George Vancouver. The park also has an invaluable collection of historical documents that pertain to the administrative history of the park. Storage space for the archives is woefully inadequate,

and some documents have not been cataloged and are difficult to access. Moreover, the park does not have any space to accommodate additions to its library or archives.

### Stewardship Capacity

- Staffing and funding shortages make it difficult for the park to provide resources with the level of care they deserve. For example, the Park Service does not have the resources to patrol outer coastal regions of the national park, leading to concerns about the possibility of poaching, resource damage, and unreported wildlife mortality in acts of defense of life or property. Positions that need to be filled on a permanent basis include a cultural resource manager, ethnographer, technical communications specialist, bear biologist, second whale biologist, fish biologist, seal biologist, and research vessel captain.
- To guide interpretation of natural and cultural resources, the park needs to complete a comprehensive interpretive plan. A new plan will articulate the vision for the park's interpretive future and recommend the media and programs best suited for meeting visitor needs, achieving management goals, and telling the park's stories.

The park needs funds to patrol its outer coastal regions to guard against poaching and resource damage.





## THE GLACIER BAY NATIONAL PARK AND PRESERVE ASSESSMENT



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### NATURAL RESOURCES— HEALTHY ECOSYSTEMS FACE FEW IMMEDIATE THREATS

The assessment rated the overall condition of natural resources at Glacier Bay National Park and Preserve a score of 89 out of 100, which ranks park resources at the very high end of “good” condition. Prominent factors influencing the rating include the intact park ecosys-

tems and naturally functioning ecological processes, which have not been disrupted by historical human activities such as resource extraction. Many populations of wildlife appear to be thriving with several exceptions—harbor seals, Kittlitz’s murrelets, and marbled murrelets. Threats from development are at a minimum, and while the park has not yet felt extensive impacts from invasive species or pollution, future risks from these stressors are

Visitors to Glacier Bay often see marine mammals such as orcas (shown here), porpoises, seals, and sea lions.



Glacier Bay National Park and Preserve extends from the Pacific coast to the Takhinsha and Chilkat Mountains, crossing the Fairweather Mountain Range and encompassing the entire Glacier Bay watershed.

real and should be addressed before they become pervasive.

Concerns within Glacier Bay National Park and Preserve include the status of halibut, rockfish, and lingcod fisheries (which are under harvest pressure from both commercial and recreational fishing); brown and black bears (which continue to absorb losses from defense-of-life-and-property kills outside the park); western toads (strong anecdotal evidence of regional declines); some Neotropical migrant songbirds (which may be declining throughout the region due to conditions in their winter habitats far away from the park); and yellow cedar (regional declines are thought to be related to cold winter temperatures combined with thinning covers of root-insulating snow—possibly attributable to climate change). A lack of baseline data for these and other natural resources hampers the ability of park staff to detect changes in resource conditions over time. For example, hunting is allowed in the preserve,

but current hunting policies are developed by state agencies without the benefit of comprehensive data on populations of harvested wildlife species. More information is needed to guide these policies.

Overall, Glacier Bay National Park and Preserve is considered by many to be a crown jewel within the National Park System. It is large, remote, and relatively free of some of the threats facing other national parks. As a result of this status, park managers are challenged to maintain Glacier Bay as one of our nation's best examples of a healthy, intact natural system.

#### GLACIERS AND BAYS— AN INTRODUCTION TO THE LAY OF THE LAND

Glacier Bay National Park and Preserve is comprised of open ocean, protected bays, rugged mountains, tidewater and valley glaciers, and coniferous forest in varying stages of ecological succession. It extends from the Pacific coast in the west to the Takhinsha and Chilkat Mountains in the east, crossing the Fairweather Mountain Range and encompassing the entire watershed of Glacier Bay. Many of the park's mountains exceed 10,000 feet in height, and the tallest, Mount Fairweather, peaks at 15,300 feet, less than 20 miles from the sea.

The marine environment strongly influences the park's climate and keeps the area cooler in the summer, warmer in the winter, and generally wetter than inland Alaska. Storms from the Gulf of Alaska bring plentiful moisture to the park, especially on the outer coast and southern Glacier Bay/Icy Strait. Given the large size of the park and its topographic diversity, weather patterns vary quite a bit from site to site. At sea level, high temperatures in July usually range between 50 to 70 degrees Fahrenheit, while lows in January dip below zero at times but are frequently in the 10 to 30 degree range. The proximity of the sea creates the cool, moist climate with abundant precipitation that enhances glaciation and largely defines the park's biota.



HISTORIC AND CONTEMPORARY LAND USE—PARK LARGELY UNMARRED BY PAST USES; CURRENT THREATS ARE LIMITED

Glacier Bay National Park and Preserve is surrounded by more undeveloped land than any other park in the National Park System. Nearby protected areas include Wrangell-St. Elias National Park and Preserve in Alaska and Kluane National Park and Tatshenshini-Alsek Wilderness Provincial Park in Canada. This sprawling network of protected lands encompasses more than 24 million acres and is one of the largest tracts of contiguous protected land anywhere in the world. It comprises a massive World Heritage Site designated by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), the principal international recognition given to natural and cultural areas of global significance.

To the northwest of Glacier Bay is the northern extension of the Tongass National Forest. Although some timber harvest and other resource extraction occur in this part of the forest, the Yakutat Ranger District adjacent to the park's border is largely designated as roadless.

In the few areas surrounding Glacier Bay that are not conservation units, human population is relatively sparse. Gustavus, the closest town, has only 452 residents and is just a few miles from the park. It is the only town connected by road to the park (but to no other highway system). Other towns in the region include Hoonah, Skagway, Yakutat, Haines, Elfin Cove, and Pelican; all have fewer than 2,000 residents and all are separated from Glacier Bay by water or roadless wilderness. Most of these towns are accessible only by boat or airplane, having no roads to connect them to each other or (with the exception of Haines and Skagway) to the outside world. Juneau, the state capital and the largest city in the region, has a population of about 31,000. Although only 60 miles from Glacier Bay, travel between Juneau and the park also requires a boat or an airplane.

In contrast to the relatively undisturbed state of the lands bordering Glacier Bay, the waters both within and just outside park jurisdiction are subject to intense uses such as commercial and sport fishing. Parts of Glacier Bay have been closed to commercial fishing in recent years. The rest of the bay is being closed gradually (see the "Fisheries" section on page 26), which will in time establish it as one of the world's largest temperate marine reserves where commercial fish harvest does not occur.

Because so much of the area in and around Glacier Bay is remote, roadless, and was covered by ice until relatively recently, it has little history of large-scale resource extraction. (The exception to this is the commercial fishing, which has occurred in the region for about 100 years.) When Captain George Vancouver charted the area in 1794, the wall of ice that covered nearly all of what is now Glacier Bay gave no indication of what would emerge when the ice melted. Although the Tlingits followed the retreating ice front into the bay, their footprint on the land was minimal. It was not until 1879 that John Muir announced the "discovery" of Glacier Bay to the wider world. In the short period between Muir's announcement and the designation of the area as a national monument in 1925, tourists and scientists visited and a few

Though the lands within and surrounding the park are relatively undisturbed by resource extraction, waters within and around the park are subject to intense uses such as commercial fishing. However, some commercial fisheries in Glacier Bay proper have been closed in recent years, and the remainder are being phased out gradually.



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settlers arrived, but no extensive logging or mining operations were established.

Glacier Bay's history contrasts with many other national parks, which include areas previously exploited (often heavily) for resource extraction prior to their protection. For example, throughout California's desert parks—Joshua Tree, Mojave, and Death Valley—there are numerous abandoned mines, some of which present safety risks to visitors. At Hawai'i Volcanoes National Park, staff battle the effects of non-native animals such as goats, hogs, and cattle that were introduced by settlers for agricultural and ranching purposes. These animals have wreaked havoc on native ecosystems that include federally listed endangered species. In addition, land clearing for cattle ranching, logging, agriculture, and forestry (cultivation of non-native species) contributed to the loss of large forest tracts. At Big Thicket National Preserve in Texas, old-growth forests were logged and oil was extracted in large quantities. In contrast, Glacier Bay National Park and Preserve harbors forests that have gone through natural successional processes uninfluenced by human disturbances and thus provides an important case study for scientists.

In addition to limited historical extractive use, there is very little development within the park, unlike some other national parks with extensive visitor facilities. Most of the development is around Bartlett Cove, which contains two docks, a lodge, and Park Service offices, staff housing, and maintenance buildings. A road extends from Gustavus to Bartlett Cove and, in the park, connects the lodge, main dock, and Park Service buildings. Within the preserve, there are three small private lodges used by visitors, some commercial fishing facilities, and off-road vehicle trails.

Today the park faces only minor development pressure. The economy in Gustavus is tied intimately to Glacier Bay National Park and Preserve. Some town residents would like to somehow excise Bartlett Cove from the park so

that it could be developed as Gustavus's port. This would significantly alter the nature of Bartlett Cove by essentially creating an industrial-use zone in the park's primary visitor use area. The Gustavus city government is working to build the new dock in Gustavus, however, rather than in Bartlett Cove.

Other development could occur on the nine privately held parcels within the boundaries of the park. Five of the nine parcels contain valuable salmon runs that could be harmed by development. Of particular concern to the park is development on a 140-acre private plot in Hugh Miller Inlet, one of the park's five designated Wilderness Waters, where there has been ongoing discussion about developing a lodge. Motorized traffic is not allowed in Hugh Miller Inlet from May 1 to September 15, but a lodge could seek year-round motorized access. Any development of a lodge or other tourist facility on a remote parcel in Glacier Bay would increase vessel traffic as guests come and go and recreate while they are there. This increased activity could result in negative effects on marine mammals and nesting and molting birds, increased pressure on sport fisheries, introduction of invasive species, and disruption of the quiet solitude that surrounds areas that are devoid of human habitation. In addition to development on the nine privately held parcels, there is a 400-acre patented mining claim under the Brady Ice Field that could potentially be mined in the future. But given that it is currently covered by ice, the threat is remote. With financial support from the congressionally funded Land and Water Conservation Fund, the Park Service is attempting to purchase inholdings from willing sellers.

#### PLANT COMMUNITIES—NATURAL CONDITIONS DETERMINE DISTRIBUTION, STRUCTURE, AND FUNCTION

Plant communities within Glacier Bay National Park and Preserve vary based on elevation, soil character (including drainage and nutrient

The park's forests have gone through natural successional processes, so they provide an important case study for scientists.





Subalpine meadows are lush with some of the 333 vascular plant species that have been documented in the park.

availability), and successional stage. Generally, the areas nearest the mouth of the bay have been free of ice for 250 to 300 years, with increasingly younger soils as one approaches today's glacial termini. This general pattern, along with the well-documented history of glacial retreat, makes Glacier Bay an outstanding natural laboratory to study plant succession.

The Alaska Natural Heritage Program vascular plant inventories of 2001 and 2003 documented 333 species within the park. General types of plant communities within the park include lowland forest, upland forest, subalpine meadow, alpine tundra, bog and shrub areas, salt marsh, and beach meadow.

Although the park's wet climate encourages trees to grow fairly quickly, most forests of the bay proper are still in relatively early stages of succession, having been established since the retreat of glaciers within the last 250 years. The coastal lowland rainforest of the park outside the bay that escaped the glaciation of the Little

Ice Age is typical of similarly sited forests elsewhere in southeast Alaska—dominated by western hemlock (*Tsuga heterophylla*), Sitka spruce (*Picea sitchensis*), and locally in some areas (e.g., Dundas Bay and the outer coast) yellow cedar (*Chamaecyparis nootkatensis*). Many of these forests have a lush understory of moss, ferns, and shrubs. Mountain hemlock (*Tsuga mertensiana*) dominates the higher elevation forest where the western hemlock is limited by snow and wind. At high-elevation sites in areas free of glaciers, the forest gives way to subalpine meadows at first, and then to alpine tundra at the highest elevations where grasses, sedges, herbs, mosses, lichens, and small shrubs are common.

Scattered throughout the landscape are patches where the forest has been disturbed by avalanches, windthrow (trees blown down by winds), and other natural occurrences. In these areas shrubs such as alder (*Alnus* spp.) and salmonberry (*Rubus spectabilis*) dominate

The melting of glaciers allowed moose to migrate to the park about 50 years ago, and their populations have grown steadily since then.



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until disturbances or natural succession lead to other plant communities. Willows (*Salix* spp.) and alder cover areas of river valleys prone to periodic flooding, and bogs exist in areas that are too wet for trees. Other plant communities include salt marshes with grasses, sedges, and herbs tolerant of salt water, as well as beach meadows dominated by native grasses, wildflowers, mosses, and cow parsnip (*Heracleum maximum*).

#### ANIMAL COMMUNITIES—PARK RETAINS INTACT ASSEMBLAGE OF VERTEBRATES

Unlike parks in the rest of the United States, parks in Alaska still support the full complement of mammal species present before the arrival of Europeans. Glacier Bay National Park and Preserve is no exception. It hosts 30 of the 40 or so land mammals that occur in Alaska. Mammalian predators within the park include black bear (*Ursus americanus*), brown bear

(*Ursus arctos*), Canada lynx (*Lynx canadensis*), coyote (*Canis latrans*), gray wolf (*Canis lupus*), red fox (*Vulpes vulpes*), wolverine (*Gulo gulo*, one of the rarest mammals in North America), and several other members of the weasel family. Herbivores include Sitka black-tailed deer (*Odocoileus hemionus sitkensis*), mountain goats (*Oreamnos americanus*), porcupines (*Erethizon dorsatum*), beavers (*Castor canadensis*), marmots (*Marmota caligata*), and a variety of small mammals. Moose (*Alces alces*) arrived in the park about 50 years ago when the glaciers that had been a barrier to the area melted sufficiently to provide passage. Since then, they have enjoyed steady population growth. Wolf populations may be on the rise, too, likely as a result of the increase in their prey base.

Marine mammal sightings are a regular highlight for visitors to Glacier Bay. Park waters host a number of marine mammals, including five whale species, the most common of which are humpback, killer (*Orcinus orca*), and minke

(*Balaenoptera acutorostrata*). Gray (*Eschrichtius robustus*) and sperm (*Physeter macrocephalus*) whales may be found in the park waters in the Gulf of Alaska. Other marine mammals include Dall's and harbor porpoises (*Phocoenoides dalli* and *Phocoena phocoena*, respectively), northern sea otters (*Enhydra lutris kenyoni*), harbor seals (*Phoca vitulina richardsi*), and Steller and California sea lions (*Eumetopias jubatus* and *Zalophus californianus*, respectively). Two marine mammals—the humpback whale and the Steller sea lion—are currently protected under the Endangered Species Act. Overall, marine mammal populations in the park are stable or increasing, with one exception—the harbor seal. Harbor seals, while common and increasing in other parts of their range, are decreasing in Glacier Bay for reasons still unknown. Scientists are studying this issue extensively.

For 23 consecutive years, scientists have monitored humpback whale populations in park waters, gathering long-term population and behavioral information that helps to guide management decisions dealing mostly with vessel numbers and operating restrictions. Annual counts have totaled between 15 and 111 individual humpback whales in Glacier Bay proper. Each summer, vessel course and speed restrictions are based on the distributions and concentrations of these individual whales.

Beyond mammals, Glacier Bay National Park and Preserve supports about 240 species of birds. Many of them are resident forest species such as the great horned owl (*Bubo virginianus*), northern goshawk (*Accipiter gentiles*), and three-toed woodpecker (*Picoides tridactylus*). Some are colonial seabirds such as the tufted puffin (*Fratercula cirrhata*) and black-legged kittiwake (*Rissa tridactyla*). Open ocean species include several species of shearwaters (*Puffinus* spp.) and storm-petrels (*Oceanodroma* spp.), marbled murrelets (*Brachyramphus marmoratus*), and Kittlitz's murrelets (*Brachyramphus brevirostris*). Both of the latter have declined by more than 75 percent in Glacier Bay since 1991; cause(s)

underlying the declines are not known. The Kittlitz's murrelet was recently listed as a candidate species for protection under the Endangered Species Act. Species such as rock ptarmigan (*Lagopus mutus*) and gray-crowned rosy-finch (*Leucosticte tephrocotis*) are adapted to the alpine tundra, while a host of other birds such as the Canada goose (*Branta canadensis*), varied thrush (*Ixoreus naevius*), and several warblers (e.g., *Vermivora* spp., *Dendroica* spp.) migrate to the park in summer months to breed in a wide variety of habitats.

Alaska is not known for its amphibian and reptile diversity. In fact, only six species of amphibians are native to the state. Of those, three have been found in or near Glacier Bay National Park and Preserve: western toad (*Bufo boreas*), wood frog (*Rana sylvatica*), and north-western salamander (*Ambystoma gracile*). The park's most common amphibian, the western toad, has been the subject of recent study and is thought to be declining regionally. In general, little is known about amphibian populations in the area. With the exception of the rare passing sea turtle, no reptile species are known to occur in the park.

#### WATER RESOURCES—DIVERSITY RANGING FROM RICH INTERTIDAL ZONES TO NEWBORN GLACIAL STREAMS

Glacier Bay National Park and Preserve encompasses an array of marine and freshwater systems, each with its own special features. The park and preserve's marine waters include the sheltered Glacier Bay proper, Dundas Bay, additional small bays and coves, the "semiprotected" Cross Sound and Icy Strait, and the completely open ocean of the park's exposed outer coast. Exceptionally large tides and high productivity characterize the park's marine waters. Tides within the park, which can range vertically up to 25 feet and rank among the highest in the world, contribute to the amazing productivity of its marine ecosystem. Other

The northern sea otter is one of a variety of marine mammal species inhabiting park waters.



Images of the park's outer coast, collected by the ShoreZone program, will be used to document coastline changes that could result from global warming, oil spills, or other natural or human-caused events.



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contributing factors are the cool temperature, strong currents, high volumes of mineral-rich freshwater input from melting glaciers and heavy inland precipitation, and the topography of the ocean's floor. The end product of these combined factors is a water column with just the right amount of stability and stratification to maintain nutrients and phytoplankton near the surface within the influence of sunlight, where they flourish and feed zooplankton. The zooplankton provide a food source for small, schooling fishes (e.g., capelin, sand lance, juvenile pollock, herring), which comprise the primary food source for almost all predatory marine vertebrates, from fishes and seabirds to pinnipeds and whales.

The park's intertidal zones comprise only a small percentage of its total area, but they serve as critical habitat for almost all wildlife due to their high levels of productivity. While intertidal habitats are naturally resilient to disturbance, they can be devastated quickly by oil spills or degraded more slowly by changes in currents

and sedimentation patterns that result from structures such as docks and gravel roads. Recognizing both the importance and the vulnerability of the intertidal zones, the Park Service and U.S. Geological Survey established a monitoring program in 1997 that sampled 25 intertidal areas four times between 1997 and 2001. The Park Service also gathered baseline data on 960 miles of relatively protected coastline as part of the effort to develop a protocol for mapping coastal resources in Alaska parks. ShoreZone, a separate program sponsored by multiple organizations, collected aerial video footage of the exposed outer coast of the park in 2005. All of these efforts will enable scientists to document coastline change in the park, whether gradual as in the case of global warming or sudden as in the case of an oil spill.

In addition to marine resources, Glacier Bay National Park and Preserve hosts numerous lakes, ponds, rivers, streams, and wetlands. Combined with the glaciers and groundwater of the park, these represent an extensive and

diverse array of freshwater resources. Of the estimated 300 streams within the park, about 100 of them were created in the last 250 years, during the course of glacial retreat. Lakes also vary in age, from ten to 10,000 years, and number in the thousands. Five lakes are larger than 1,000 acres. Park wetlands fall into the four categories of estuarine (a mix of marine and fresh water at the coast), riverine (navigable river), palustrine (inland marsh that lacks flowing water), and lacustrine (lake).

The quality of the park's waters is assumed to be high, but water quality is not monitored systematically. A few studies have been conducted at a limited number of sites. The only area where water quality has been tracked across time is the Alsek River. One-time measurements have been made in other streams.

Scientists have noted two main local water-quality concerns in the park: impacts from marine vessels, in particular the threat of fuel spills, and development in and around Gustavus, Bartlett Cove, and Excursion Inlet, which has a fish-processing plant. At this time, available research shows the only impairments to water quality are associated with minimal

contaminants in localized areas. Dog Salmon Creek (Dry Bay area, in the preserve) tested positive for fecal coliform and *Escherichia coli*, and Bartlett Cove groundwater showed some contamination from fuel. A few contaminated areas are associated with historic mining claims. For example, sampling in 1984 revealed high concentrations of lead and cadmium at the site of a former gold mine along Ptarmigan Creek. But mining was never widespread within the park, so this is a limited concern, and sampling has not been conducted more recently. Small amounts of fuel, oil, and wastewater are discharged by all vessels that travel park waters, but threats to park ecosystems from this pollution are so far considered relatively minor.

Atmospheric deposition of contaminants such as mercury, which blows in from Asian power plants, is also of concern because it bioaccumulates in marine fishes, can affect reproductive success, and is passed up the food chain. More research on this topic is needed.

Off-road vehicle use is creating water quality concerns in the Dry Bay region of Glacier Bay Preserve (see "Special Concerns in the Preserve Challenge Resource Managers" on page 33).

All vessels that travel park waters discharge small amounts of fuel, oil, and wastewater. The harmful effects from this pollution are considered to be relatively minor so far; however, planning for accidental large-scale fuel spills from marine vessels is a primary concern because of the potential damage such spills could cause to park ecosystems.



## PARK PROVIDES A NATURAL LABORATORY

In 1916, just two decades after John Muir described Glacier Bay in *The Century* magazine, an ecologist named Dr. William Skinner Cooper arrived in the area from the University of Minnesota to study the plants that first recolonize barren soils after the retreat of glacial ice. His research so excited members of the Ecological Society of America that they eventually helped Dr. Cooper convince President Calvin Coolidge to establish Glacier Bay National Monument in 1925. Considered by many to be the “Father of Glacier Bay National Park,” Dr. Cooper played a critical role in its establishment, and his ecological perspective helped to create a lasting legacy of scientific research in the park.

Today Glacier Bay National Park and Preserve is justifiably proud of its numerous and productive collaborations with academic scientists. From the beginning, the park’s enabling proclamation explicitly recognized the opportunities for research to document the biological succession that occurs in the wake of receding glaciers. Glaciers in the park proliferated during the Little Ice Age about 550 years ago but have been receding for the last 250 years or so. The glacial retreat has created a unique assemblage of ecosystems of varying ages. For example, the lakes in one Glacier Bay study range in age from ten to 10,000 years. The rare combination of natural laboratory and park administrative support has resulted in a wealth of long-term studies in Glacier Bay, some of which have been handed down from professor to student through generations of academic researchers.

In 1997, a team of scientists led by Alexander Milner and Eric Knudsen began studying the physical and biological characteristics of 16 park streams that varied in age from 35 to 1,377 years old. In an effort to

document large-scale colonization patterns, they collected water samples, netted insects, picked leaves, recorded streambed composition, counted species of fish, and detailed a host of other parameters. Analysis of the data collected yielded useful information about the interacting processes that build stream communities. They found that lakes help structure the community by providing flow stability that allows plants to grow in the streambed. The plants enhance colonization by insects and provide cover to the stream. Fish eat the insects and use the habitats created by vegetation to hide from predators. Once salmon establish in the stream, they bring a source of nitrogen and other nutrients from the sea as they return to spawn and die. These inputs fertilize plants and trees that eventually provide woody debris in the stream. Woody debris in turn stabilizes and diversifies the streambed, improving the habitat for juvenile salmon and for riparian vegetation.

The study, published in 2000 in the *Canadian Journal of Fisheries and Aquatic Sciences*, paints a picture of successional processes at work, and it provides information highly relevant to watershed management and the restoration of degraded streams everywhere. It is one example of a research program that took advantage of the unique opportunities provided by Glacier Bay’s dynamic landscape and by the park’s commitment to academic study.

Other recent biological studies include an examination of the long-term effects of spruce beetle (*Dendroctonus rufipennis*) outbreaks on stands of Sitka spruce. Another focuses on the effects of the increasing populations of moose, which arrived in Glacier Bay only within about the last 50 years.

Geologists and hydrologists come to the





park to study phenomena such as isostatic rebound, which is the process by which the surface of the Earth uplifts in response to relieved pressure after glaciers recede. Because of the stiff consistency of the Earth's crust, such rebound happens slowly, often continuing for tens of thousands of years after glacial retreat. In Glacier Bay, uplift rates due to isostatic rebound are estimated at up to 1.2 inches per year. At this rate, the rebound is having significant effects on groundwater levels, flooding frequency, and

rates of sedimentation and erosion. Changes in hydrology result in changes to the plant and animal communities within the park, both on land and in the water.

As global climate change comes to the forefront of public awareness, Glacier Bay's long-term datasets become more relevant than ever. Long-term research conducted in Glacier Bay continues to contribute significantly to scientific knowledge of the ways in which landscapes and communities respond to climatic change.

Glacier Bay National Park and Preserve provides extensive opportunities for research, and data gathered in the park contribute to scientific knowledge of biological succession, ecological responses to climate change, and a host of other topics.

VISITORS BY THE BOATFUL—  
CRUISE SHIPS, CHARTER BOATS,  
AND OTHER VESSELS DELIVER  
PEOPLE TO THE PARK

Glacier Bay National Park and Preserve is unusual in the style of visitation it receives: More than 95 percent of park visitors arrive by cruise ship or other marine vessel and never set foot on park land. Instead, they view the park from the water and listen to rangers who board cruise ships or tour boats to provide interpretive programs. Because most boat visitors never come ashore, impacts to the park depend more on the number and size of vessels than on the number of visitors.

Monitoring and managing vessel impacts is an ongoing challenge for staff at Glacier Bay National Park and Preserve. Temporary regulations governing boat traffic were first promulgated in 1980, followed by permanent regulations in 1985 and a major planning effort culminating in a vessel management plan in 1995. A lawsuit brought by NPCA and acts of legislation in the late 1990s led the National Park Service to publish new regulations for

Despite challenging terrain and heavy brush, hiking offers opportunities to explore parts of the park that are not visible from cruise ships or other vessels.

vessel management in 2003. These regulations govern boat traffic today. From June through August, park regulations do not permit more than two cruise ships, three tour vessels, six charter boats, and 25 private boats into Glacier Bay per day. Although that translates to as many as 184 cruise ships and 2,300 private vessels touring Glacier Bay waters during the summer months, the park limits the number of cruise ships based on current science about the impacts of large ships on marine mammals. As a result, summer cruise ship limits are currently set at 153 ships. And to date, the highest number of private vessels in Glacier Bay during a summer season was 740 in 2007. During the rest of the year, there is no limit on private and charter boats entering Glacier Bay, but the level of visitation is much lower. Entry limits apply only to Glacier Bay proper. There are no limits on the number of private, charter, tour, and cruise vessels visiting other bays and park waters (e.g., Dundas Bay, Taylor Bay, Lituya Bay, and the long stretch of outer coastal waters).

While more than 400,000 people visit the park every year, only about 1,000 to 1,500 of them obtain permits to camp in the backcountry. Some independent visitors opt to stay in Glacier Bay Lodge in Bartlett Cove or in the nearby town of Gustavus, exploring the park through day tours, charter trips, flightseeing trips, kayak trips, and day hikes on the park's limited trail system. Little data are available on the impacts of kayakers and campers on park wildlife, though resource managers are concerned that concentrated human use on certain shorelines affects ground-nesting marine birds, bears, hauled-out Steller sea lions, and harbor seals. Some studies have documented wildlife disturbance to molting seals, nesting birds, and bears. A 2003 study of backcountry conditions found that despite some localized impacts, the overall magnitude of impacts to park resources (e.g., vegetation) from campers appears to be minimal.

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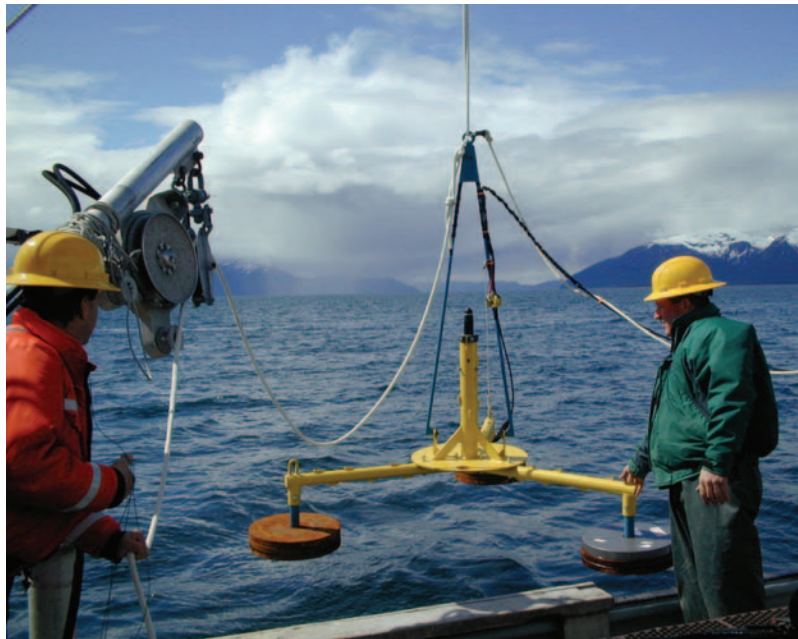


## BOAT TRAFFIC—NOISE IMPACTS STILL IN QUESTION; POTENTIAL FOR OIL SPILLS STILL A CONCERN

When boats travel through any water, there is always the potential for effects on wildlife and their marine habitat. In Glacier Bay, a pregnant humpback whale was struck by a ship and killed in 2001. Additionally, underwater noise from vessels could negatively affect species such as whales that rely on acoustic input. The threat of an oil spill is also ever present as large and small ships continuously move through park waters and nearby areas.

To help minimize the chances of disturbing and possibly killing marine wildlife and to ensure high quality wilderness experiences for visitors, the park has seasonal limits on numbers of each boat type allowed in the park per day (see “Visitors by the Boatful” on page 24). Course and speed restrictions in areas where whales are present and buffer zones to protect seal haul-out areas are some of the measures that are intended to reduce the effects of park visitation on wildlife. Even with these regulations, underwater noise from boats could affect the park’s many species of marine life, including marine mammals, which are known to have sensitive hearing and complicated patterns of vocal communication. Noise from boats could create stress or disrupt their social functions. The park, in conjunction with the U.S. Navy, has been monitoring underwater noise in lower Glacier Bay for seven years.

While questions about the impacts of boat noise on wildlife have fueled study in Glacier Bay, the research to date has been descriptive, rather than addressing specific hypotheses about the effects of noise on whales or other wildlife. The baseline description of underwater noise in Glacier Bay and the calibrated measurements of noise generated by individual ships and smaller vessels are the raw materials for predicting the effects of park management decisions on the acoustic environment. For example, studies in progress are using these



descriptive data to estimate and quantify the acoustic differences between days with different numbers of cruise ships. This information is important because the park superintendent conducts an annual review of the number of ships and decides whether that number should be changed. Similarly, the park has contracted with outside acousticians to use a model that estimates whales’ exposure to vessel noise under various operating scenarios (i.e., different numbers of ships and traveling at various speeds), because the park regularly uses speed limits to protect whales or other species. Judging whether a particular level of acoustic exposure or behavioral disturbance will have a discernable biological effect on an individual whale remains a significant challenge for scientists and managers worldwide.

Additionally, a new study is under way in which Park Service observers record the distances from the ship at which whales surface, in an effort to assess the risk of whale-ship collisions under various conditions. From all of these studies, the park aims to better understand the effects of vessel traffic on whales at both the individual and population levels.

The annual humpback whale monitoring

U.S. Navy acousticians install a hydrophone in Bartlett Cove to monitor underwater sound as part of a collaborative project with the Park Service. Understanding the effects of underwater sound on wildlife, such as whales and other marine mammals, will help park managers determine how best to protect these animals.

Park waters contain at least 160 fish species, including sockeye salmon (shown here), and scientists suspect as many as 160 more fish species also occur in the park.

program at the park has observed increasing numbers of whales in the Glacier Bay area for the past several years, suggesting that reproduction and recruitment have been favorable for this endangered species in the North Pacific in recent years. However, the management of whale-vessel interactions becomes more challenging as the whale population grows.

In addition to collisions with wildlife and underwater noise disturbance, fuel spills are possible from boats traveling both within and outside park boundaries. In 2000, the park commissioned a study to review the different types of vessels using waters in the park's vicinity and to assess the probability of a fuel spill. The study indicated that transit routes and prevailing currents minimize the risks of contamination from oil tankers, but small spills from other vessels are possible. There have been several accidents and vessel groundings within the park, including a tour boat that ran aground in 1999 and another one that hit a rock and almost sank in 1993. Due to the complexities of the bay, no general water circulation model has been constructed to help devise a plan to respond efficiently to spills from these sorts of vessels, though recent studies are beginning to make sense of circulation patterns, which could lead to better oil spill response. In the meantime, the park has devised response strategies to help protect Bartlett Cove and a few other sensitive areas if an oil spill should occur. At this time, there is no reliable method to clean up oil in the ice-filled waters of the park's upper bays.

#### FISHERIES—HIGH PRODUCTIVITY IN PARK WATERS ATTRACTS COMMERCIAL FISHERS

More than 160 fish species have been documented in park waters, and as many as 160 more are thought to occur there. This relatively high species diversity is due, in part, to the great diversity of habitats ranging from shallow marine tide pools to deep benthic habitats (exceeding 230 fathoms or 1,380 feet) and from

small creeks, ponds, and wetlands to larger rivers, including the lower reach of the Alsek River. Many of Glacier Bay's streams support abundant salmon runs, filling with mature adults in the summer and fall months when they return to their birthplaces to spawn and die. Species of salmon breeding in the park include chinook (*Oncorhynchus tshawytscha*)—though populations are likely very small—sockeye (*O. nerka*), pink (*O. gorbuscha*), chum (*O. keta*), and coho (*O. kisutch*). Steelhead (*O. mykiss*) and cutthroat trout (*O. clarkii*), as well as Dolly Varden char (*Salvelinus malma*), also occur in freshwater habitats.

Commercial fishing is allowed in many areas throughout Glacier Bay National Park and Preserve. Park waters of Icy Strait, Cross Sound, and the park's outer coast (to three miles offshore) are open to all commercial fishing; Glacier Bay proper is restricted to Pacific halibut longlining, Tanner crab rings and pots, and winter chinook salmon trolling (mid-October to the end of April).

Pacific halibut (*Hippoglossus stenolepus*), some of which can exceed several hundred pounds in weight, are among the most commercially valuable of the park's species. According to a 2001 publication by the Alaska Science Center of the U.S. Geological Survey (USGS), halibut are currently abundant, but commercial and sport fishing may deplete local populations or skew age, size, and sex structure of the local population. These fish have a life span of 40 years or more, but most fish harvested in the commercial fishery are 11 to 13 years old, on average; females do not achieve reproductive maturity until they reach an average age of 12 years. As a result, overexploitation can have severe consequences for halibut populations.

Other commercially harvested marine animals include several species of rockfish (slow-growing, long-lived fish with low reproductive capacity), lingcod (*Ophiodon elongatus*), three species of king crab (red, *Paralithodes camtschatica*; blue, *P. platypus*; and golden,





While commercial fishing is allowed in many areas throughout Glacier Bay National Park and Preserve, it is being phased out in the bay proper.

*Lithodes aequispina*), Tanner crab (*Chionoecetes bairdi*), weathervane scallop (*Patinopecten caurinus*), Dungeness crab (*Cancer magister*), and five different species of shrimp (pink, *Pandalus borealis*; humpy, *P. goniurus*; sidestripe, *Pandalopsis dispar*; spot, *P. platyceros*; and coon-stripe, *P. hypsinotus*).

A 2001 report by the USGS's Alaska Science Center indicates that between 1970 and 1995, 76,000 to 658,000 pounds of Dungeness crab were harvested annually from Glacier Bay proper and Icy Strait (including areas outside Glacier Bay National Park and Preserve). The commercial Dungeness crab fishery in Glacier Bay proper closed in 1999, but commercial harvest still occurs outside the bay, and a recreational fishery continues within the bay and elsewhere. Moreover, Dungeness crab is also an important prey item to sea otters, which are increasing in abundance. Despite the economic value of these various species and the extent to which they are harvested, little is known about

their population status, or even, in some cases, their basic biology. This lack of knowledge, despite the availability of catch and harvest statistics, is a concern because park managers do not have the information needed to determine if these species are being seriously affected by harvest within park waters.

According to the Alaska Commercial Fisheries Entry Commission, between 429,000 and 498,000 pounds of halibut and Dungeness crab were harvested annually from Glacier Bay proper between 1992 and 1995. Throughout the 1990s, the Park Service was embroiled in discussions with the State of Alaska, commercial fishers, and conservation groups about the extent to which commercial fishing should be allowed in Glacier Bay. The discussions were initiated by a 1990 lawsuit challenging the legitimacy of commercial fishing in park waters. The U.S. District Court for the District of Alaska ruled in 1995 that "there is no statutory ban on commercial fishing in Glacier Bay National Park

provided, however, that commercial fishing is prohibited in that portion of Glacier Bay National Park designated as wilderness area." The district court decision was subsequently upheld by a U.S. court of appeals in 1997.

In 1999, Congress effectively resolved the issue by closing wilderness waters to commercial fishing immediately and instituting a long-term phaseout of commercial fishing in Glacier Bay proper. The 1999 Commercial Fishing Regulations Final Rule also mandated a cooperative fishery management plan between the State of Alaska and the U.S. Department of the Interior. However, the mandate was unfunded and a lawsuit regarding jurisdiction over park waters, initiated by the State of Alaska in 1999, stalled progress on the plan. This question over jurisdiction was resolved in June 2005 when the U.S. Supreme Court ruled that the federal government has jurisdiction over Glacier Bay's waters and submerged lands. Over the years, the park has repeatedly sought funding for developing the cooperative fishery management plan, but has not yet been successful. Management of commercial fishing is a complex and politically sensitive issue involving agencies with differing management mandates, and there is a high degree of public interest in the outcomes. Going forward, the Park Service will need to work together with all affected parties.

The only people who may continue to fish commercially in Glacier Bay proper are those who have qualified for lifetime nontransferable access permits by demonstrating a sufficient fishing history in the bay. When the last of these fishermen retires or is no longer able to continue fishing, commercial fishing will be completely phased out of Glacier Bay proper. This is estimated to occur around 2050, though it could happen as soon as 2025. At that time, Glacier Bay will become a refuge for previously harvested marine species, providing a baseline for comparison with commercially fished areas and the potential to supplement local populations outside the bay through increased produc-

tivity and "spillover" effects. Additional pressure from recreational fishing, however, could affect this process.

Most sport fishing in the region takes place outside of park waters, from charter and private boats based out of Gustavus and Elfin Cove as well as Pelican, Hoonah, and Excursion Inlet. Primary target species are halibut, salmon, rockfish, and lingcod. The Alaska Department of Fish and Game monitors sport fishing through dockside creel surveys in Gustavus and Elfin Cove. Charter operators are also required to participate in a state logbook program. Recreational harvest (including charter and private anglers) is also assessed using a statewide sport harvest mail survey of licensed anglers. The National Park Service, similar to the state program, requires permitted charter concessions to participate in a self-reported logbook survey of fishing activity and harvest within park waters.

Historically, sport fishing has represented a tiny fraction of harvest occurring in park waters but has grown significantly within the last decade. Annual halibut harvest by sport fishers in 2005 was more than five times what it was in 1992. In addition, data from a 2005 report suggest that halibut catch from within the park was underreported by about 19 percent. The National Marine Fisheries Service (NMFS) is currently looking at management options for reducing charter angler halibut harvest throughout southeast Alaska with the ultimate goal of establishing a specific harvest allocation of the halibut resource and a quota share system for the fishery. Park managers must insure that the sport fishery does not grow to supplant the commercial harvest as the latter wanes.

Beginning in September 2005, charter operations shifted the focus of their halibut sport fishing to Glacier Bay proper, likely in response to reduced catch rates and the lack of availability of larger fish in waters they traditionally fished in Icy Strait and Cross Sound. This occurs outside the vessel quota season (which is June

through August) when the Park Service relaxes vessel entry limits. This shift in focus, combined with ongoing and in some locations increasing commercial fishing in park waters, causes park managers to be concerned with local depletion of halibut.

Managers also continue to be concerned about the sustainability of local commercial king crab fisheries, impacts of the outer coast weathervane scallop dredge fishery on benthic habitats and biota, and the effects of recreational and commercial harvest on rockfish and lingcod in the park waters of Cross Sound and along the outer coast. Even basic inventories of fish distribution (including anadromous salmonids) among freshwater habitats in this extremely large and diverse park are lacking. While looming issues regarding the sustainability of specific fish and invertebrates stocks to commercial and recreational harvest are just beginning to be addressed, park resources—including staff and funding—are extremely limited, which hampers efforts to address these complex and politically volatile extractive resource uses.

### INVASIVE SPECIES—A FUTURE THREAT?

Historically, invasive species have not had an easy time establishing themselves in Alaska. The climate is challenging, the landscape is relatively undisturbed and provides few opportunities for gaining a foothold, and there are few avenues for introduction. However, Glacier Bay is slightly more vulnerable to invasive species than most of Alaska, given that it is in the most temperate region of the state and its landscape is changing in response to natural disturbance from receding glaciers. In addition, ships are known transporters of marine invasive species. So far, the impact of non-native species has been minimal when compared to areas within the rest of the United States. Targeting non-native species before they have a chance to establish themselves and spread is key to

protecting native Alaskan ecosystems.

In 2007, invasive plant inventory and control activities were carried out for the fourth consecutive year throughout Glacier Bay National Park and Preserve. To date, nearly 2,600 acres of land that are the most accessible and susceptible to invasive species have been surveyed; of these lands, nearly 1,100 acres were identified as supporting invasive plant species. In total, 51 non-native species have been located, nearly 15 acres of infested land have been treated, and some non-native plant populations have been eradicated.

Most non-native plants in the park, such as pineapple weed (*Matricaria discoidea*) and forget-me-not (*Myosotis scorpioides*), are limited in range and warrant little concern. Two exceptions are the perennial sowthistle (*Sonchus arvensis*) and oxeye daisy (*Leucanthemum vulgare*). Perennial sowthistle has established itself in 2.5 acres of the backcountry on Strawberry Island, on the site of a former fox farm. Other parts of southeast Alaska outside park boundaries also have heavy infestations of the species. Oxeye daisy warrants concern because it, too, is problematic in the larger region. It has been observed in Bartlett Cove,

Non-native oxeye daisies have invaded parts of the park and are a problem in the larger region. They are difficult to control without the use of herbicides.



Dry Bay, Gustavus, and the park's backcountry. Both species are difficult to control without the use of herbicides.

Two other invasive plants with rather wide distributions in the park are common dandelion (*Taraxacum officinale* ssp. *officinale*), which infests coastal meadows and human-disturbed areas park-wide, and bigleaf lupine (*Lupinus polyphyllus*), which is widespread in Dry Bay. One invasive plant in the park, quackgrass (*Elymus repens*), is considered "allelopathic" because it secretes compounds into the soil that are harmful to other plants. Two other allelopathic species have been found in Gustavus and therefore pose a potential threat to Glacier Bay—Canada thistle (*Cirsium arvense*) and orange hawkweed (*Hieracium aurantiacum*). The Park Service is developing an Alaska regionwide Invasive Plant Management Plan Environmental Assessment to address non-native plants.

There has been no documentation of threats by any invasive terrestrial animals, though some non-natives such as European starlings (*Sturnis vulgaris*) and Eurasian collared doves (*Streptopelia decaocto*) do frequent the park. Other animals not found in the park historically are native to other parts of Alaska or North America and are undergoing range expansions for one reason or another. A few examples are barred owls (*Strix varia*), which were historically limited to the eastern United States, Sitka black-tailed deer, a long-time resident of southeast Alaska, and moose, also native to other parts of Alaska but new to Glacier Bay. Invasive terrestrial invertebrates, such as slugs, earthworms, and insects, also may be posing an unknown level of threat to park ecosystems.

Invasive marine species pose a greater threat than their terrestrial counterparts, partly because non-native marine species may be carried to the park in the ballast water or on the hulls of boats. Marine species of particular concern are the green crab (*Carcinus maenas*), Chinese mitten crab (*Eriocheir sinensis*), smooth cordgrass (*Spartina alterniflora*), and several

species of tunicate. While these species have yet to establish themselves in the waters of Glacier Bay, they are abundant and problematic along other parts of the Pacific coast and some are working their way north.

Also of concern are Atlantic salmon farmed in nearby Canadian waters. These fish regularly escape their net pens: More than 450,000 Atlantic salmon are reported to have escaped their pens from these farms between 1991 and 2002. Atlantic salmon pose a threat to the ecosystem for two reasons: They could transfer disease to Pacific salmon or they could establish themselves as an invasive competitor. For these reasons, salmon mariculture is banned in Alaska. Canada, on the other hand, had 127 active salmon farms as of 2005. To date, at least one Atlantic salmon has been reported in Glacier Bay.

#### AIR QUALITY—TWO THREATS LOOM ON THE HORIZON

Air quality is considered high in Glacier Bay, but there is a lack of on-site data to support that assumption. The Park Service conducts widespread air quality monitoring programs focusing on visibility, gaseous pollutants, and wet and dry deposition throughout much of the National Park System, but Park Service monitoring stations were only recently installed at Glacier Bay and no data are yet available. As part of the work of the Park Service's Inventory and Monitoring Program, samplers that measure pollutants in the air and in precipitation are now located in several places throughout the park. These samplers will collect data during parts of 2008 and 2009; follow-up measurements will be taken every five to ten years after the initial measurements are collected. A station that samples mercury in precipitation will be permanently installed at Glacier Bay. Precipitation collected at this station will be analyzed weekly year-round.

Two potential threats to the park's air quality have been identified. The first is the possibility





Marine vessels traveling park waters release hundreds of tons of air pollutants that include nitrogen oxides and sulfur dioxide. Sometimes, haze from cruise ship stack emissions is visible.

that emissions from rapidly developing countries in Asia will deposit pollutants across all of Alaska, including Glacier Bay. There is evidence that levels of mercury and persistent organic pollutants may be high at several remote Alaskan sites, despite the fact that there are no significant local sources of these pollutants. Models of global patterns of atmospheric mercury transport suggest that emissions from China may collect in Alaska. The new mercury monitoring station will help Glacier Bay scientists begin to assess this potential problem.

A recent study on airborne contaminants in a number of western national parks, including Glacier Bay National Park and Preserve, measured more than 100 different semivolatile organic compounds (e.g., pesticides, polychlorinated biphenyls or PCBs, etc.) and found low to moderate concentrations of three historically used pesticides and low concentrations of two currently used pesticides during air sampling at Glacier Bay. Overall, semivolatile organic

compound concentrations at Glacier Bay ranked very low compared to those at other parks that were sampled. Mercury was not measured in air at any park, and lichens sampled from Glacier Bay were not tested for mercury. However, bioaccumulation of mercury and persistent organic pollutants in the food chain is a concern throughout the world. Consuming fish or other animals containing high levels of these pollutants in their tissues has been shown to lead to human health problems.

The second threat to Glacier Bay National Park and Preserve's air quality comes from marine vessels visiting park waters. The total emissions from all motor vessels in Glacier Bay in 2001 was estimated at 401 tons of nitrogen oxides (240 tons came from cruise ships) and 278 tons of sulfur dioxide (252 tons came from cruise ships). Cruise, charter, tour, and private boats also visit other bays in the park and travel along the park's outer coast. No emissions data are available for these areas so the total emis-

sions within the park for any one year are probably higher. Private, charter, and some other small vessels are not inspected by the U.S. Coast Guard, U.S. Environmental Protection Agency, or other entities to check compliance with state or federal air quality standards. They may be contributing to the park's air quality concern more than is currently understood.

Haze from cruise ship stack emissions is visible in the park under some weather conditions. The frequency, persistence, and composition of stack emission haze has not been studied, although park rangers take stack emission opacity readings from each ship at least once a year to determine if state emissions standards are being exceeded. Some cruise line companies report their stack emission compositions to the park voluntarily. There is some hope the situation may improve with pressure on the cruise industry to reduce emissions. The West Coast Collaborative, a public-private partnership working to reduce diesel emissions along the Pacific coast, recently selected a Holland America cruise ship, the *ms Zaandam* (which visits Glacier Bay), to demonstrate a new seawater scrubbing project aimed at reducing emissions of sulfur oxides, nitrogen oxides, and particulate matter. If successful, this technology could be adopted broadly by companies eager to reduce their emissions. Though this technology prevents these pollutants from entering the air, it injects them into seawater. Further study is needed to determine what impacts this could have on the marine environment.

*PARK SOILS—LITTLE IS KNOWN, BUT CAUSES FOR CONCERN APPEAR MINOR*  
Glacier Bay's soil quality has not been the subject of any comprehensive study or monitoring. The park lacks a history of military operations, industry, agriculture, grazing, and resource extraction that has degraded soil qualities in other parts of the country. The primary potential concern is mercury contamination related to emissions from Asia being deposited

in precipitation, as discussed in the "Water Resources" and "Air Quality" sections on pages 19 and 30. Other minor issues involve soil compaction in very limited areas of visitor use.

#### *CLIMATE CHANGE—THREATS ARE DIFFICULT TO CALCULATE*

No place on Earth can escape the inevitable consequences of global climate change. In Glacier Bay, global climate change will likely accelerate processes that have already been at play for centuries and melt the last vestiges of the Little Ice Age. Invasive species may also find it easier to establish themselves. Because of the unique natural processes at work in the park, there is no simple way to separate human-caused changes from natural ones. Surprisingly, the retreat of tidewater glaciers is not necessarily a good indicator of climate change; many other factors are involved and some of the glaciers in the park have *advanced* slightly over the last decades. All that the Park Service can do is monitor the changes while focusing on potential anthropogenic effects, protect the park's natural resiliency, and prepare to adapt to some eventual surprises.

The preliminary results of a relatively recent long-term climate monitoring program in Glacier Bay indicate that average air temperatures increased 3 degrees Fahrenheit from 1999 to 2006. Park waters are currently about 3.6 degrees Fahrenheit warmer than when measurements were first taken in the 1960s. It is much too early to attribute these increases to climate change with any certainty, but if temperatures continue to rise, such will undoubtedly impact ecosystems. That, in turn, will affect the Tlingit cultures that are so closely intertwined with those ecosystems, but the changes they initiate will be difficult to predict. The results of this climate monitoring program further underscore the need for quality baseline data on park resources.



## SPECIAL CONCERNS IN THE PRESERVE CHALLENGE RESOURCE MANAGERS

The Alaska National Interest Lands Conservation Act of 1980 (ANILCA) expanded Glacier Bay National Monument, designated the park's wilderness area, and redesignated the entire area as Glacier Bay National Park and Preserve. Within the 57,000-acre national preserve, activities such as commercial fishing, subsistence and recreational hunting and fishing, operation of concession lodges, and fur trapping are authorized. Off-road vehicles (ORVs) and other motor vehicles are also permitted in support of these uses as long as drivers

conform to certain rules and regulations. Recreational off-trail ORV riding is not permitted. While ANILCA permits certain ORV use, it prohibits "significant expansion" of a trail system on park lands from that present in 1979. The Park Service identified a 25 percent increase over 1979 use levels as "significant."

There is concern because current ORV trails have expanded beyond this 25 percent increase level in the 28 years since passage of ANILCA. The Park Service estimates that 61.1 miles of trails existed in the early 1980s,

Park managers are concerned because ORV trails have expanded significantly since 1979. A 2007 environmental assessment indicates that this expansion has degraded habitats.

and there are 83.5 miles today (a 37 percent increase). About 55 all-terrain vehicles, 12 highway vehicles, and eight heavy vehicles are operated by permittees within the preserve today.

To address the issues associated with expanding ORV use, the Park Service prepared an ORV trails management plan with special regulations. According to the Glacier Bay National Preserve Off-Road Vehicle Use Plan Environmental Assessment published in March 2007, the expansion of the trail network has “degraded habitats by compacting soils, trampling vegetation, increasing erosion, degrading water quality, and altering hydrological regimes.” ORV trails and the vehicles themselves provide opportunities for non-native plants to invade the preserve. The Park Service has found several invasive plants along ORV trails and at campsites. The preferred alternative in the park’s ORV plan closes 20.6 miles of ORV trails, prohibits creation of new trails, and stabilizes two stream crossings to mitigate impacts of ORV traffic on salmon and other native fish. The ORV plan has not been finalized yet.

Hunting is the second issue that primarily affects Glacier Bay National Preserve. Sport hunting and trapping in the preserve, as in most of Alaska, are regulated by the Alaska Department of Fish and Game. Subsistence hunting and trapping are managed by the Federal Subsistence Board, of which the Park Service is a member. In both instances, better population baseline information for those species that are hunted is needed to better inform hunting regulation decisions.

Hunting regulations and bag limits are often developed without the benefit of good population data for harvested wildlife species. For example, the population numbers and trends in populations of bears and wolves in the park and preserve are unknown. Resource managers are only able

to estimate from hunter and trapper tag reports that about six to ten brown bears, one to two black bears, five or six moose, and perhaps a single wolf are taken from the preserve each season. No data on the actual waterfowl harvest exists. The Park Service does not have enough funding or staff to patrol outer coastal park lands adjacent to the preserve boundary. Wildlife poaching within the park and unreported shooting in defense of life or property cannot be estimated. This lack of data prevents both the Alaska Department of Fish and Game and the Park Service from fully understanding these species and developing effective management policies to protect them.

There is also an inherent conflict between the State of Alaska and the Park Service over management of harvested species. The Alaska Department of Fish and Game manages for maximum sustained yield of harvested species under a legal concept of intensive management, while the Park Service is charged with maintaining naturally occurring healthy populations of wildlife on its lands and in its waters. In other areas not under Park Service jurisdiction, the State hopes to support higher moose populations by controlling predators such as wolves and bears through increased bag limits, extended hunting seasons, and incentive programs. On park lands this would conflict with Park Service mandates. While this problem does not seem to be manifesting itself in Glacier Bay National Preserve at present, the State’s desire to manipulate predator populations could become a significant threat in the future.

Resource managers need more data on the population status of bears and other wildlife species. Currently, hunting regulations are often developed without this critical information.





## CULTURAL RESOURCES— IMPROVING RELATIONS WITH THE TLINGIT ENRICH PARK’S LEGACY

Glacier Bay National Park and Preserve scored an overall 66 out of 100 for the condition of cultural resources that include history, historic structures, archaeology, museum collection and archives, cultural landscapes, and ethnography. This score indicates that the resources are in “fair” condition.

The park’s priority is to maintain its spectacular natural resources, and funding is allocated accordingly. Just 2 percent of the park’s budget

is allocated for cultural resource programs, yet these programs comprise 25 percent of the park’s performance goals.

One highlight is Glacier Bay National Park and Preserve’s ethnography program, which fosters good relationships with the Tlingit. Other cultural resources programs suffer—archaeology, historic structures, and cultural landscapes receive little study or interpretation—as a result of staffing and funding shortfalls. Of a total staff of 107 employees, the park has just one senior staff member who is only partially devoted to cultural resources. This is not sufficient to provide resources with the care they deserve.

There is a profound connection between the Huna Tlingit and the lands and waters of Glacier Bay, which they consider sacred.

Berry-picking field trips are one way that the park fosters relationships with Huna Tlingits who have cultural connections with park resources.



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### ETHNOGRAPHY—STRONG TIES CONNECT THE TLINGIT TO GLACIER BAY

In recent years, Glacier Bay's ethnography program has become the top cultural resource priority in the park. Four indigenous groups have historic ties with Glacier Bay: Huna Tlingit, Yakutat Tlingit, Chilkat/Chilkoot Tlingit, and Champaign and Aishinik First Nation (from Yukon, Canada). But park lands are primarily the traditional homelands of just two groups, the Huna Tlingit and the Ghunaaxhoo Kwaan unit of the Yakutat Tlingit Tribe. The Ghunaaxhoo Kwaan are connected to the lands in the national preserve at Dry Bay and on to Lituya Bay. Four clans of Huna Tlingit claim traditional homelands in and around Glacier Bay and the outer coast of the park up to the boundary with Ghunaaxhoo Kwaan, but also including Lituya Bay. Many Huna Tlingit reside in the town of Hoonah, about 25 miles outside the park, and also in Juneau.

The Huna Tlingit traditionally relied on a wide range of terrestrial and marine resources.

They used meat and hides from bears, deer, mountain goats, seals, sea lions, sea otters, and occasionally porpoises. Seaweeds, clams, chitons, octopus, squid, crab, beach greens, eight species of berry, tree bark, salmon, halibut, and other fish species also contributed to the traditional diet. Today, subsistence hunting and gathering is still a way of life for many Huna Tlingit.

There is a profound connection between the Tlingit and the lands and waters of Glacier Bay, which they consider sacred. According to Tlingit oral tradition, a young Huna Tlingit woman commonly referred to as "Woman in the Ice" was left behind to appease the spirits when a glacial advance forced the tribe out of Glacier Bay. Through this sacrifice, Glacier Bay was purchased with Tlingit blood and made sacred in perpetuity. Tlingits believe that the souls of their ancestors still reside in Glacier Bay. The physical place is inextricable from their culture, history, identity, and social structure in a way that also makes it inextricable from their future.

The first decades of Glacier Bay National

Monument's existence were marked by discord between the Tlingit and federal administrators. Park boundaries encompass much of the traditional Huna Tlingit homelands, and with the establishment of the national monument in 1925, federal regulations technically restricted many traditional Tlingit activities in these territories, although the lack of rangers limited the effect. One landmark confrontation involved the 1946 arrest of three Huna men who were fur trapping in the monument.

In the 1950s a territorial bounty was placed on harbor seals in an attempt to bolster the faltering salmon fisheries (seals eat salmon). There was also a robust seal hide market at the time. Bounty and hide hunting, although not truly "traditional" in the realm of Tlingit subsistence practices (the skinless, noseless [bounty] carcasses were routinely discarded), and obviously counter to the Park Service mission, were allowed to continue in the national monument because of their economic importance to the Huna Tlingits. As the practices continued through the 1960s, it became obvious that they were not appropriate in the context of a national monument. Harvest levels were so high as to threaten the seal population, which prompted more legal prohibitions on harvests, and by 1974 hunting was prohibited. Although many Huna Tlingits continued to come into Glacier Bay to fish commercially, termination of seal hunting significantly reduced their interaction with their homelands.

In the 1960s and 1970s, outside the context of seal hunting, many park staff had positive interactions with individual Huna Tlingits. But with staff departures those ties diminished. A substantial effort by the Park Service to reconcile with the Huna Tlingit came in 1987 when Huna elders and carvers were asked to help create a traditional sea otter hunting canoe for display near park headquarters (it is still on display). By 1992, however, the Tlingit had become frustrated that more outreach from the Park Service had not occurred, so they brought a flotilla of

fishing boats into Bartlett Cove and performed a peaceful demonstration on the beach.

Significant change happened in 1995 when the Park Service and the Hoonah Indian Association signed a memorandum of understanding that established a government-to-government relationship, and with increased communication there soon followed a series of positive interactions: a repatriation of human remains under the terms of the Native American Graves and Protection Act, regular semiannual meetings, berry-picking trips, and other outings. In 1997 the Hoonah Indian Association was intimately involved in producing the Bartlett Cove Comprehensive Design Plan, a development plan to guide future growth in Bartlett Cove. The plan calls for the construction of a replica Huna tribal house and a "spirit camp" to teach tribal traditions to Huna children. Although construction has not begun on the longhouse, the plan still remains a park priority and has been put forward in the Centennial Challenge Program. The tribal house concept is also being concurrently developed as part of a larger Hoonah Heritage Center planning process now under way throughout the Tlingit community.

In the late 1990s, the park made important progress in improving relations with the Tlingit

Some Huna Tlingits hunted seals in Glacier Bay National Monument until the 1960s, when the Park Service discontinued the practice. Seal populations were in jeopardy, largely due to a territorial bounty on them set in the 1950s.



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community. Now park managers run innovative programs to foster Tlingit ties to Glacier Bay and to facilitate the transfer of knowledge stored in oral tradition from Tlingit elders to younger generations. They also consult with elders in park decisionmaking. One reason for the high priority given to re-establishing ties between the Tlingit and the lands of Glacier Bay is that available ethnographic information, which may not always be passed down to younger generations, dwindles further with the passing of each Tlingit elder.

One recent success for Glacier Bay's ethnography program is the development of a computer-based education tool called the "Talking Map." This interactive, multimedia database includes Tlingit names for more than 250 places in the park, accompanied by historical and current photographs and explanations of the importance of each place to the Tlingit. Users can access all this information by scrolling over a map of the park and clicking on the featured locations. While currently in draft form, the park hopes to soon make its Talking Map available on compact disk to members of the Huna community and park visitors. Eventually, Glacier Bay will work with the Hoonah Indian Association to explore ways to

make the map accessible to the broader public by hosting it online.

Another park success is the production of *A Time of Gathering: Tlingit Berry Picking in Glacier Bay National Park*. Park staff, Huna elders, and members of the University of Alaska Southeast community collaborated on the documentary. In the film, Huna elders convey messages about the importance of subsistence foods to the native community and about their spiritual ties to the lands of Glacier Bay. Prior to the production of the documentary, Huna members did not feel welcome to pick berries in the park, despite the formal legality of such activity. Now Glacier Bay staff organize annual field trips to bring Huna berry pickers into the park each summer (sometimes several times within a single season). Field trips also provide access for the Huna participants to gather plant and animal foods from the intertidal zone.

Efforts are also under way to explore ways for Huna Tlingits to regain access to harvest glaucous-winged gull eggs (*Larus glaucescens*) in the tradition of previous generations. Toward this end, Park Service staff, staff from the University of Washington, and Tlingit elders collaborated on a 2001 report titled *The Hoonah Tlingit's Traditional Use of Gull Eggs and the Establishment of Glacier Bay National Park*. The report represents the most thorough study of historic Tlingit food-gathering practices within park boundaries to date, and it is also a powerful statement of the cultural importance of egg harvest to the Huna Tlingit. The ethnographic report was used to inform a companion biological study that replicated the effects of the traditional practice on a modern gull colony population, and using those data generated a computer model to predict the effects the practice might have on gull populations if it were allowed to resume in the park. During the course of these studies, Congress became apprised of them and passed legislation directing the Park Service to conduct its ongoing studies and to report back with recommendations if it was determined that the

The eggs of glaucous-winged gulls are a traditional food source for Huna Tlingits. The park is exploring the possibility of restoring the harvest of eggs, as shown in this picture taken outside the park.

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## SCHOOL PROGRAMS REINFORCE TLINGIT CULTURAL HERITAGE

There was a time when the transfer of traditional knowledge from Tlingit elders to subsequent generations came as a matter of course—through storytelling while gathering or preparing food, around fires at night, or through traditional song and dance. Now that the Tlingit have transitioned to a cash-based economy, and younger generations have access to television, movies, and video games, avenues of traditional knowledge transfer are few and far between. Glacier Bay National Park and Preserve is working to re-establish the oral tradition by developing a series of field trip programs with Hoonah and Yakutat schools, the respective tribal governments, and the Hoonah Heritage Foundation.

The various programs take schoolkids into the park to experience traditional stories in their spiritual homeland. They are designed to reach all schoolchildren at least once during the year so that the youngest Tlingit generations can become the culture bearers of the future.

Twice a year, charter vessels take 100 Tlingit elders and schoolchildren on daylong tours of Glacier Bay, stopping at important historic sites. Young and old participate in traditional songs and dances, and they break up into clans to tell clan origin stories. These trips provide a rare opportunity for intergenerational clan interactions. The boat trips culminate at Margerie Glacier, a sacred Tlingit site, where elders lead the group in making offerings to the ancestors.

High school students have been chosen to participate in longer field trips such as two-night stays at ancient village or burial sites or multiday kayak trips in the spring. Class schedules were designed to provide



students with history and culture lessons from elders. Because many participants had never camped before, the groups spent several months learning outdoor skills, and the students also planned their menus and fundraised to cover the cost of supplies and transportation to the site.

The above are examples of some of the programs that have given students a sense of identity and pride in their heritage in recent years. Sometimes an appetite for traditional knowledge is created where none existed before. Many kids return from the field trips much more grounded. Some students who struggled before participating in the kayaking trip returned to school with renewed focus and changed their plans to include college. Program administrators hope that the schoolchildren who participate in these programs will pass along their cultural heritage to their own children, and that the Tlingit connections with Glacier Bay will live on for generations to come.

Excursions for Tlingit elders and schoolchildren offer opportunities for traditional songs, dances, and ceremonies.

practice could resume without affecting the gull population in the park. Currently the Park Service is conducting a Legislative Environmental Impact Statement.

The significance of Glacier Bay's ethnography program has increased in the last decade, not just for park staff but also for members of the Tlingit community. Transition to a cash-based economy has resulted in changes to the lifestyles of the modern Tlingit that limit the traditional avenues of knowledge transfer. Many Tlingit see in the new park programs some potential to counteract this erosion of the traditional knowledge base. In some cases, Glacier Bay National Park and Preserve provides Tlingit cultural opportunities unavailable elsewhere in the modern world.

To better interpret cultural connections with Tlingit groups, to preserve culturally important park resources, and to reverse the trend toward a diminishing Tlingit presence in the park, Glacier Bay National Park and Preserve needs both additional staff and facilities. The park's ethnography program could be better served through the addition of Tlingit to the park's staff and through employing a staff ethnographer. Also, the park should move forward with plans for a traditional tribal house, which would provide a venue for Tlingit interpretation as well as traditional ceremonies, dancing, storytelling, and Tlingit language lessons. Funds are needed to support both additional staff and construction of the Tlingit cultural building.

#### HISTORY—INTERESTING STORIES WAITING TO BE TOLD

Glacier Bay National Park and Preserve has a rich human history that includes contemporary connections to Tlingit groups as well as the long and varied use of regional resources by explorers, fishermen, miners, fur hunters, fox farmers, homesteaders, and scientists. Within the last decade or so, the Park Service has intensified efforts to document the relationship between the lands of Glacier Bay and the Tlingit. This

work is time sensitive, as opportunities to record this information are lost forever with the passing of tribal elders. With limited staff and funding—the park lacks a historian—the park has not been able to devote equal attention to the other historical themes, and the park risks losing information from non-Tlingit elders who have ties to the area. Currently, interpretive materials focusing on Glacier Bay's historical period are either limited in scope, noticeably outdated, or lacking altogether.

On a positive note, the library at Glacier Bay National Park and Preserve contains a wealth of texts that record much of the park's historical period (though the history of the park itself is not as well documented), often as firsthand accounts. Highlights of the collection include journals describing French exploration in 1786, Russian accounts of the fur trade, logs of British explorers, and the adventures of a former frontier soldier who explored Glacier Bay with Tlingit hunters in 1877. John Muir's writings are also represented. His "Discovery of Glacier Bay," published in 1895, is credited with revealing Glacier Bay to the world. That article and his 1915 "Travels in Alaska" prompted tourists, fur trappers, prospectors, commercial fishers, traders, lumbermen, and a stream of scientists to explore the area by steamship. Many of these explorers played a role in the park's subsequent history. While access to library materials needs to be improved (see the "Museum Collection and Archives" section on page 46), these materials will provide future researchers with a rich body of material from which to draw.

Documentation of Glacier Bay National Park and Preserve's history has been sporadic. William S. Cooper was the primary advocate for the creation of the park. His brief account titled *A Contribution to the History of Glacier Bay National Monument* (1956) is the first on a very short list of historical works about the park. It was not until the mid-1990s that historical studies of the park itself were taken up in earnest. Rick S. Krutz's *Glacier Bay National*



Park interpreters present programs on both the park's natural features and its cultural connections, but historical interpretation would be bolstered by new reference materials and educational publications, exhibits, films, and online materials.

*Park and Preserve Historic Resource Study* (1995) begins with a brief discussion of the Tlingit presence in the park and ends with the construction of a military airfield in Gustavus during World War II.

In 1995, Theodore Catton completed a report titled *Land Reborn: A History of Administration and Visitor Use in Glacier Bay National Park and Preserve*, which includes among other themes discussion of relations between the Tlingit and the Park Service from the park's inception. Though this report contributes valuable historical information, it does not adequately address the pivotal issue of commercial fishing in park waters, a controversial component of park history that will affect the park into the future. The park has hired another outside contractor to produce an administrative history of commercial fishing in the park, which will serve as an addendum to the 1995 Catton report. Compiling the history of commercial fishing in Glacier Bay is pressing not only because of its current legal relevance,

but also in order to access the memories and documents of people involved. An administrative history of the relationship between the Park Service and the Tlingit is also needed and should be completed soon to draw from Tlingit elders and retired Park Service personnel before the opportunity is lost. The time sensitivity of these projects should be taken into account when prioritizing research needs.

Glacier Bay's interpretation program focuses on four primary themes relating to the dynamic change, cultural connections, scientific study, and wildness of the park's dramatic glacial landscape. Most park visitors are struck immediately by the splendors of the landscape—the tidewater glaciers, glacially shaped landforms, and impressive biota—and would likely miss the human history if the park did not interpret these stories. Historical interpretation could be strengthened by the production of better reference materials for interpretive park rangers, and publications, exhibits, films, and online material highlighting human history for visitors. The park soon will be

The park has documented Dundas Bay, considered a “Tlingit Homeland,” through a cultural landscape inventory.

distributing a new brochure that includes a focus on the park as the Tlingit homeland, but without additional staff such as a cultural resources manager, archaeologist, or historian, the park will be unable to move forward with additional steps to improve history programs.

#### CULTURAL LANDSCAPES—FUNDS NEEDED FOR TIME-SENSITIVE BASELINE RESEARCH

Cultural landscapes illustrate how humans shape and are shaped by their surroundings. The significance of Glacier Bay National Park and Preserve’s cultural landscapes is based largely upon the spiritual connection of the Huna Tlingit to various locations in the park and the use of the park by Tlingits for food gathering and other subsistence activities. Park managers have gradually identified geological formations and food-gathering places that hold enormous significance to the local Huna Tlingit and have come to recognize the importance of human activities at Glacier Bay. Park managers have identified several areas known as “Tlingit Homelands,” but because of funding constraints only two have been documented

through cultural landscape inventories—Bartlett Cove and Dundas Bay.

Huna oral tradition relates stories of human habitation in Bartlett Cove pre-dating the Little Ice Age that occurred between 1450 and 1750. And the first Europeans and Americans to arrive in Glacier Bay, beginning in 1794 and for more than a century thereafter, encountered Tlingits going about their daily lives. European-American uses of Bartlett Cove and lower Glacier Bay prior to the establishment of the park included commercial fishing operations and homesteading. Abundant salmon streams supported a fish saltery, cannery, and trading post in Bartlett Cove. Fox farming became established in the early 1920s on several of the islands in lower Glacier Bay, but these were all terminated with expansion of the national monument in 1939. The broad forelands at the mouth of Glacier Bay became a popular place to homestead during the early decades of the 20th century, and the community of Strawberry Point—later renamed Gustavus—was born. With the advent of World War II the military built a large airstrip in Gustavus, and following the war the incompatibility of the large airstrip and homesteads prompted removal of Gustavus from the monument by presidential action in 1955. The Park Service established Bartlett Cove as headquarters for its administrative activities and concessions in the early 1950s.

Like Bartlett Cove, Dundas Bay is important for its history of native and European-American habitation. Archaeological remains of two Tlingit villages are situated along the shoreline of the bay, both important for the role they play in modern Huna oral tradition. Stone cairns sit atop White Cap Mountain and Point Dundas, two of the highest points in the area. The cairns are believed to be Tlingit shrines. The remains of the Dundas Bay Cannery and some historic cabins represent European-American presence in the park.

Staff estimate there could be as many as 13





The caretaker's cabin still stands at the site of the Dundas Bay Cannery, which ceased operation in the 1930s. In accordance with its general management plan, the park allows buildings within designated wilderness to deteriorate.

separate Tlingit traditional cultural properties within the park. Completing an ethnographic overview and assessment, left unfinished during the mid-1990s, could help identify these and possibly other cultural landscapes within Glacier Bay National Park and Preserve.

The park risks losing its most important source of information by postponing further cultural landscape inventories. Though there is a collection of taped oral histories of several pioneer Gustavus settlers and early park staff and researchers, additional information available from both Tlingit and non-Tlingit elders dwindles as aging tribal elders and local "old-timers" pass away without sharing their knowledge with younger generations. Managers are aware of this threat and do what they can to document local history, but there is a limit to what can be accomplished without further funding and personnel.

#### ARCHAEOLOGY—LIMITED RESEARCH COMPLETED

Any archaeologist hoping to document sites of cultural significance within Glacier Bay National Park and Preserve quickly encounters considerable obstacles. Repeated glacial advance and retreat have scoured parts of the park's landscape, destroying most physical evidence of human habitation. Sites that escaped damage by the moving glaciers in some areas instead may have been ravaged by the earthquakes of 1899 or 1959, or by their resultant tsunami waves. In addition, the coast is in a continuous state of isostatic rebound, rising in delayed response to pressure relieved by melting surface glaciers. As a result, many older beaches now lie many feet above and many hundreds of feet inland from current sea level, and are covered with "a thick matting of moss, the litter of the forest floor, and in many cases an almost impossible tangle of alder, blueberry, salmonberry and devil's club," according to Robert E. Ackerman.



A spruce tree shows a healed scar indicating it was cut into for its pitch in years past. Culturally modified trees are one of the few remaining physical signs of past habitation by the Huna Tlingit.

Ackerman, a professor of archaeology at Washington State University, and several of his graduate students conducted two archaeological surveys of the park in the 1960s. Ackerman's publications represent the first and only broad-scale archaeological surveys conducted within the boundaries of Glacier Bay National Park and Preserve. The only archaeological work produced in recent years is Charles Mobley's *Culturally Modified Trees in Bartlett Cove, Glacier Bay National Park, Alaska* (1995), a study of the Tlingit use of spruce trees within the park and the signs of that use still visible in trees today. A survey conducted in 1995 by the Smithsonian Institution's Arctic Studies Center on the outer coast and in Dundas Bay still has not been published, but when it is completed, it will provide a better understanding of the relationship of archaeological resources and landscape dynamics.

Perhaps unsurprisingly, Ackerman found more evidence of pre-Little Ice Age human activity in the oral tradition of the Tlingit than he did in any physical remains within Glacier Bay. For example, the Huna Tlingit have many clan origin stories that describe the tribe's occupation of the Bartlett Cove area before the dawn of the Little Ice Age. Ackerman's recommendation to future archaeologists is a "merging of ethnology and archaeology" to improve understanding of human history in the area.

Glacier Bay National Park and Preserve manages 75 archaeological sites; of these sites, 22 are reported in good condition, four are in fair condition, two are in poor condition, and the conditions of the remaining 47 sites are unknown. Most of the park's archaeological sites date to the historic period rather than to prehistoric times. They include one known prehistoric village site and four other possible prehistoric sites, as well as historic cabins, camps, canneries, salmon traps, cemetery sites, houses and other features from World War II activities, fox farms, a lighthouse, a sawmill, and Tlingit settlements. For the most part, park

managers allow documented archaeological sites to weather away naturally without signs or interpretation, a decision made as part of the park's general management planning process. Given the formidable landscape, the inconspicuous appearance of the sites, and the dearth of visitors to Glacier Bay's backcountry, archaeological resources are at little risk of poaching or vandalism.

Archaeological resources are not high profile, largely because they are difficult for visitors to see, and archaeological sites and artifacts are not incorporated into interpretive materials. These resources do contribute to other facets of the park's cultural resources program, however, and they could provide important information to ethnographic projects and to identification of cultural landscapes.

The park does not employ a staff archaeologist, though its acting cultural resources manager is trained in this discipline. Other duties limit the amount of time he can spend on archaeology. Recent cuts in regional archaeological staff have further limited the park's ability to conduct research. Funds are needed to hire additional permanent park staff, including a full-time cultural resource manager and possibly an assistant archaeologist. Having additional permanent staff would enable the park to move forward on completing its draft archaeological overview and assessment, a document that gathers together all known information on archaeological resources and helps prioritize future archaeological work. Archaeological information should also be added to the Talking Map (see page 38 of the "Ethnography" section). Another worthwhile project would be an archaeological survey of the park's outer coast. Such a survey might identify post-Pleistocene landforms that could contain archaeological evidence of the process by which the Americas were first peopled.

## HISTORIC STRUCTURES— INTERPRETATION WOULD ENRICH VISITOR EXPERIENCE

Glacier Bay National Park and Preserve harbors 34 historic structures; 11 are categorized as “backcountry” and are subject to a management policy of “benign neglect” or “passive protection” as outlined in the park’s 1984 general management plan. This means they are photographed, recorded, and marked as necessary, then left to the elements without maintenance or stabilization. No on-site interpretation is provided for backcountry structures. The rationale for this management policy is that preservation and interpretation of backcountry historic structures is “not in the best public interest because of the expense involved and the limited significance of the resources, their deteriorated condition, and their inaccessibility.” Instead, historic sites are managed as “discovery sites,” which allows park visitors who encounter them to decipher history on their own.

The 23 historic structures designated as “frontcountry” include 20 buildings in the Glacier Bay Lodge Complex and three Federal Aviation Administration cottages. Glacier Bay Lodge itself was built in 1966 as part of the Park Service’s Mission 66 program. Mission 66 was the largest improvement program ever undertaken by the Park Service. It introduced visitor centers to national parks and incorporated a bolder, more modern architectural style than the rustic lodges constructed by the Civilian Conservation Corps during the 1930s. Glacier Bay Lodge was cited for an award by the Seattle chapter of the American Institute of Architecture, and it has been determined eligible for listing in the National Register of Historic Places. Today it is one of the only buildings in the park providing accommodations for park visitors (there are also three small hunting lodges in the preserve). The park’s small visitor center is located on its second floor.

The three Federal Aviation Administration

cottages, built at the end of World War II, served a civilian staff at the Gustavus airfield that was built as part of the war effort. The Park Service recently renovated all three buildings, improving their condition from fair to good. Interpretation of the buildings could be made available at the Gustavus airport as part of an exhibit that interprets regional World War II-era activities, but this remains to be done. A fourth building in this compound, the old boiler building, is slated for demolition but that stance is being re-evaluated.

An additional structure is located within park boundaries but is not actively managed by the park, the Cape Spencer Lighthouse. The lighthouse, built in 1924 and listed in the National Register of Historic Places, is owned and used by the U.S. Coast Guard, though in recent years that agency has approached the Park Service with a request to assume ownership and active management. The difficulty with this proposal is that the lighthouse is remote

Glacier Bay Lodge, tucked among trees on the shore of Bartlett Cove, was built in 1966 and is one of the park’s 34 historic structures.



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The Cape Spencer Lighthouse was built in 1924 and is in the National Register of Historic Places. The U.S. Coast Guard has asked the Park Service to own and manage the structure, but the logistics of reaching the remote structure and the costs associated with maintaining it have deterred the Park Service from assuming this role.



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and accessible only by helicopter, so the Park Service has not acted on this request, and for all intents the Cape Spencer Lighthouse is not actively maintained.

Glacier Bay's historic structures face few threats. Although backcountry sites are deteriorating, they are not vandalized or looted, and their gradual decay is in accordance with management policies. Glacier Bay Lodge is maintained largely through funds brought in by the park's contract with its concessionaire, who provides visitor amenities at the lodge. Glacier Bay has a historic preservation specialist on staff with a small portion of his time dedicated to historic structures, and the park consults regularly with the historical architect from the Park Service's Alaska Regional Office.

The Park Service does not interpret any of its historic structures for visitors, which results in a missed opportunity to showcase important cultural resources and enrich visitor experience. Additionally, the park does not have any formal management plans that specifically address historic structures, though there is a loose plan

that discusses their management. Historic structure reports are needed to help guide management of these resources.

The park has an opportunity to further engage the Tlingit and better interpret their history to visitors by building a replica of a traditional Tlingit longhouse near park headquarters, as first outlined in the 1997 Bartlett Cove Comprehensive Design Plan. Funds have not yet been acquired for this project.

#### MUSEUM COLLECTION AND ARCHIVES—MANY ITEMS NEED TO BE CATALOGUED

Glacier Bay's museum collection and archives contain more than 35,000 cataloged items, 30,000 of which are archives such as historical documents, research and wildlife sightings field notes, and photographs. The museum collection includes biological specimens, geological samples, and archaeological artifacts. Archaeological artifacts make up only a small fraction of the museum collection, and they are mostly comprised of objects from the



## IMMERSION PROGRAM HELPS SUSTAIN DISAPPEARING LANGUAGE

In September 2003, 30 people assembled at Glacier Bay Lodge with an ambitious goal: speak and listen to only Tlingit for ten days. Tlingit is an endangered language, spoken fluently by fewer than 200 people, and now considered to be moribund. People interested in keeping the Tlingit language alive have a hard time getting real-world practice. As Roy Mitchell, the immersion program's coordinator, explained, "Unfortunately, there's not a Tlingit-speaking world for us to go to. We're trying to do the next best thing, which is make one ourselves."

The Tlingit language immersion retreat at Glacier Bay was the first of its kind, funded by the federal Administration for Native Americans through a grant to the Sealaska Heritage Institute. When Wayne Howell, Glacier Bay's cultural resource manager, read about the grant in the newspaper, he worked with the institute to make Glacier Bay Lodge the best possible place to hold such a retreat. The Park Service subsequently partnered in the project by provid-

ing logistical support, helping to construct a sweat lodge, and leading food-gathering trips on park beaches.

Most of the program's participants are among the 16,000 living descendants of Tlingit who populated the area hundreds of years ago. Prior to their experience at Glacier Bay, most had never been in a situation where they could speak and hear only Tlingit for even a single day. Some knew only a few words of Tlingit when they arrived and relied on cards bearing simple phrases to help them communicate with other participants.

In addition to language classes and casual conversation, students engaged in traditional basket weaving, carving, and beadwork. They also cooked chitons and other foods gathered from park beaches and sang, drummed, and danced in the evenings. The park would like to participate in additional language and culture programs in the future, but funds are needed to support these kinds of activities.



Tlingit language and cultural programs help foster the transfer of knowledge from elders to youth. The park would like to continue to participate in such programs but needs funds to do so.

The park's museum collection and archive contain a wealth of items, including historical photographs like this one of boys at the Dundas Bay Cannery. Many items have not yet been cataloged, which makes research difficult. Park staff are making strides to address this issue by converting existing library records to a searchable digital format.

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historical period such as buttons, nails, and cooking spoons.

The park's library contains many important primary source documents such as the expedition journals of Jean-François Galaup de La Perouse, who visited the area in 1785. Other important texts include early Russian accounts of the fur trade in southeast Alaska and the journals of James Cook and George Vancouver, who described the outer coast and the mouth of Glacier Bay in 1794, which was then full of glacial ice.

Glacier Bay's archives and library were moved to a new building and thoroughly inventoried in August 2006, but the entire collection is contained in a restricted access facility of only 90 square feet, while the library is allotted just 120 linear feet of shelf space. Archival collections more than fill all available shelf space. Items that should be on the shelves are currently in boxes while they await cataloging. The park recognizes the need for additional space in the museum facility, but the shortfall persists. Until additional space is planned and proposals to procure funding are written, the park's ability to accommodate new collections material will remain impaired.

Access to the archival collection for research purposes is complicated by the serious backlog of items that have not been cataloged and those that have been cataloged without finding aids. On a positive note, park staff are in the process of converting existing library records to an electronic format to make it easier to search for items. Although stored in a restricted access facility, historical photographs are available to staff and to the public by request.

Exhibit space for Glacier Bay's natural history specimens and other museum artifacts is nearly nonexistent. A small space in the park's visitor information center could potentially house limited exhibits, but it lacks climate control. However, because most interpretation takes place aboard cruise ships touring Glacier Bay, the park may not need extensive exhibit space.

Though cataloging backlogs and lack of storage and exhibit space are challenges at Glacier Bay, the region's cool climate discourages the pests, molds, and other biological agents that threaten similar collections in other parts of the country. As at many facilities, fire poses the most significant threat to Glacier Bay's collections, a risk reduced by fireproof safes and the modern sprinkler and alarm systems outfitting the new storage facility.

Management of Glacier Bay's museum collection and archives would be improved through written procedures for monitoring environmental conditions within the storage facility, the addition of a deadbolt and a dehumidifier in the storage facility, and better user access to materials. The most urgent need for the collection, however, is action to reduce the cataloging backlog.



## STEWARDSHIP CAPACITY

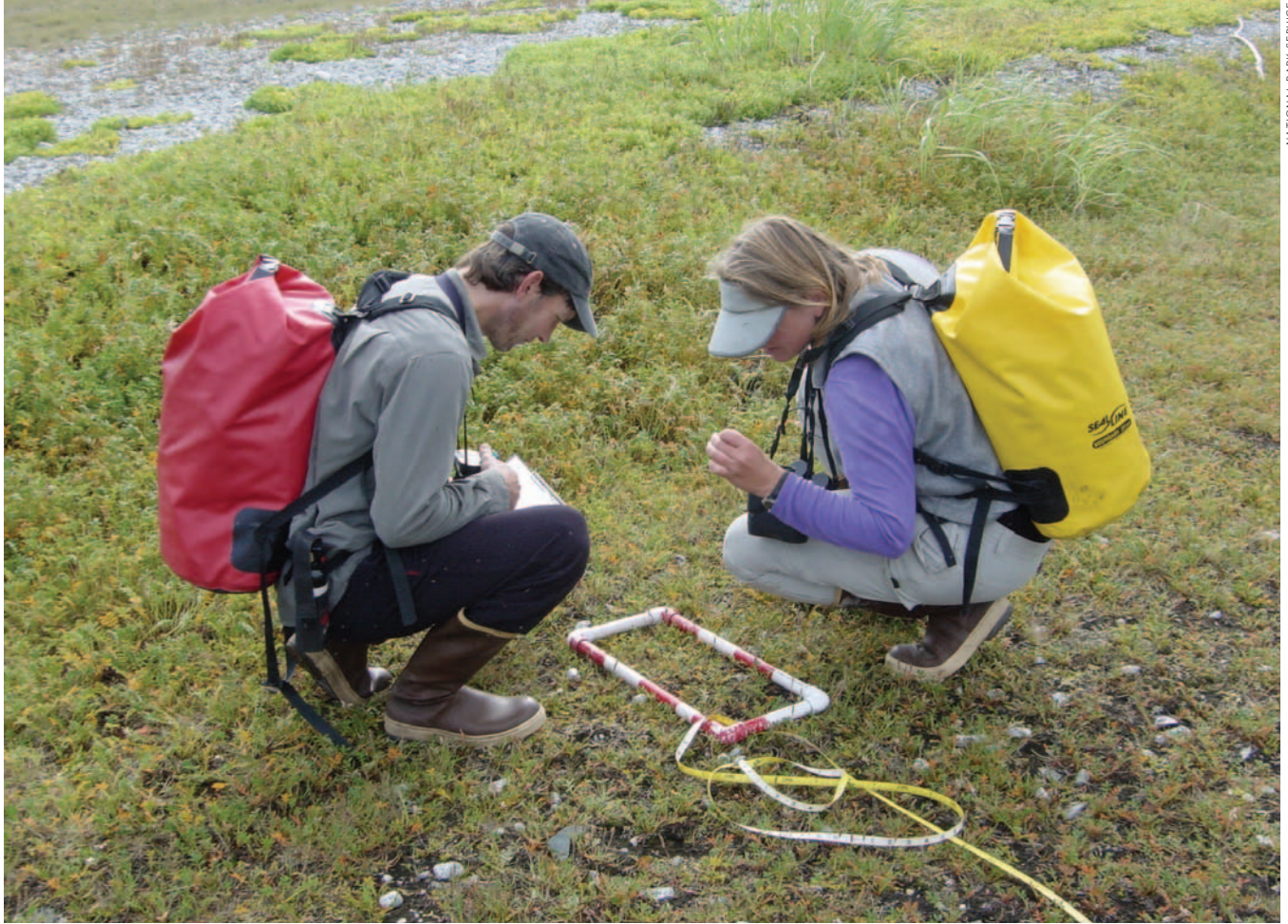
### FUNDING AND STAFFING—SHORTFALLS LEAD TO PROJECT DELAYS AND CHRONIC UNDERSTAFFING

Stewardship capacity details how well equipped the Park Service is to protect the parks. The most significant factor affecting a park's ability to protect its resource is the funding a park receives from Congress and the administration. Over the past few years, the operational base budget for Glacier Bay National Park and Preserve has experienced small increases. Between 2005 to 2006 the budget increased by about 2 percent,

while between 2006 and 2007 it increased just 1.3 percent to about \$3,878,000—that amounts to about \$1.18 to care for each of the park's 3,283,246 acres. The operational budget and these increases have not kept pace with park needs, resulting in chronic understaffing and project delays.

Without funds to hire needed staff, term positions fill in for permanent staff, and several staff positions have not been filled at all. Positions that need to be filled on a permanent basis include a cultural resource manager (funding for this position has been requested in President Bush's fiscal year 2009 budget),

Park staff trap Dolly Varden char, a type of fish, in Falls Creek at the site of a nearly completed hydroelectric facility. Staff are studying the char to determine the facility's effect on fish in the stream system.



Park biologists examine plant species as part of a study to assess bear habitat. The park needs additional funds to support other important resource management projects, such as invasive species control and salmon assessments.

ethnographer, technical communications specialist, bear biologist, second whale biologist, fish biologist, seal biologist, research vessel captain, and law enforcement rangers to patrol outer coastal regions. Employees with term positions that are slated to disappear currently perform most of these duties.

Staffing and funding shortages make it difficult for the park to provide resources with the level of care they deserve. As mentioned previously, the Park Service does not have the resources to patrol outer coastal regions of the national park, leading to concerns about the possibility of poaching, resource damage, and unreported wildlife mortality in acts of defense of life or property.

Staff and funding shortfalls also affect the park's ability to complete resource management

projects. Additional funds are needed for the invasive species management program to ensure that invasive species are kept in check. The program includes conducting inventories, planning and implementing control actions, processing geospatial data, giving outreach programs, and summarizing findings. A permanent invasive species specialist is needed to oversee this program.

Other high-priority projects that need additional funding in order to continue or be implemented include above-water soundscape baseline and monitoring (measuring the amount of noise produced by airplanes and boats, primarily, that can affect wildlife and the visitor experience); a marine debris inventory, assessment, and cleanup; and assessment of coho and sockeye salmon stocks in the Bartlett River.

*PARK PLANS—FUNDS NEEDED TO ADAPT SOME AND COMPLETE OTHERS*

To guide the management of diverse resources, national parks rely on a variety of management plans. The primary overarching planning document at most parks is the general management plan (GMP). The GMP for Glacier Bay National Park and Preserve was completed in 1984 and is outdated. The park's Wilderness Visitor Use Management Plan—important because 75 percent of the park is managed as wilderness—was approved in 1989 and is limited, outdated, and does not address new wilderness use issues the park now faces. Activities such as scientific research, administrative presence, maintenance, and commercial uses affect park wilderness but no plans exist to manage them. Funding shortfalls and low prioritization by the Park Service has stalled work to revise the existing GMP and wilderness management plan. The park is planning to begin work on a commercial services plan in late 2008.

Several other plans are in place to guide

natural resource management and activities within the park, including the Vessel Quotas and Operating Requirements Environmental Impact Statement (Vessel Management Plan, 2005), Alsek River Management Plan (1989), and Bartlett Cove Comprehensive Design Plan (1997). The Glacier Bay National Preserve Off-Road Vehicle Use Environmental Assessment/Finding Of No Significant Impact (FONSI) was completed in August 2007. This plan directs general transportation for the Dry Bay area, including commercial fishing support activity, subsistence and recreational hunting and fishing, and trapping on a network of designated trails and routes. A bear management plan and revisions to the 2000 vegetation management plan are under development. The draft bear management plan, though incomplete, details the most crucial preventative and responsive management protocols needed to protect bears and provide for the safety of visitors. The park has committed funds to complete the plan by September 2008. A cooperative

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Virtually all the land in the park is designated wilderness, but the park's Wilderness Visitor Use Management Plan is outdated and does not address current concerns. A lack of funds is partly responsible for stalling work on a new wilderness management plan.

fishery management plan, mandated by the 1999 Commercial Fisheries Regulations, has never been funded.

Several plans and reports are in place to manage cultural resources, while others are still needed. A museum collection management plan is in place, but it should be updated because the collection was recently moved to a new facility. An archaeological overview and assessment is in draft form and should be completed. An ethnographic overview and assessment is in progress. Historic structures reports would help guide management of the park's 23 frontcountry structures.

#### RESOURCE EDUCATION—PARK REACHES VISITORS IN UNUSUAL WAYS

Resource education programs and interpretive exhibits have the ability to foster appreciation of park resources and engender a sense of resource stewardship in park visitors. Most national parks provide learning experiences through ranger-guided or self-guided tours, interpretive exhibits in visitor centers, or informational brochures and wayside exhibits. Glacier Bay National Park and Preserve faces a somewhat unusual challenge in reaching visitors with educational information because most of the park's visitors enter park waters but do not venture ashore. To reach the 95 percent of visitors who arrive on cruise ships, the park places rangers on board vessels, where they

Park rangers board cruise ships to provide interpretive programs that include children's activities.





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provide interpretive narrative via public address systems, presentations in the ships' theaters, children's programs in the youth centers, and informal interpretive opportunities at portable visitor centers.

People who visit the park's only developed area, Bartlett Cove, may attend ranger-led hikes and formal presentations, while children can participate in the park's Junior Ranger program. But the park currently has little in the way of a visitor center. A makeshift area on the mezzanine of the Glacier Bay Lodge serves as a visitor contact station and includes aging exhibits, an inadequate auditorium, and an information desk, which is staffed only intermittently throughout the day. The park would like to build a multiuse facility to replace the existing visitor center. The proposed facility would

include visitor space for interpretive exhibits, a theater, an information desk, and backcountry and boater orientation; curatorial facilities; dispatch and emergency response functions; a sales area for the Alaska Geographic Association; and work space for the park's interpretive staff. The park has requested funds to move forward with this new facility.

The park hosts education and outreach programs for diverse audiences. It sponsors boat trips, camping trips, hikes, day camps, classroom activities, and formal presentations for local communities, including Hoonah, Yakutat, and Gustavus. Students from around the world participate in the park's electronic field trips on the Internet while other virtual visitors surf the park's website for information on wildlife, park history, and other topics. The park is currently

The park provides ranger-led hikes, formal presentations, and a Junior Ranger program, but the existing visitor center does not adequately serve visitors. The park would like to construct a new multiuse facility and has requested funds for this project.

Teaching children about the park's natural and cultural resources helps to instill a sense of stewardship responsibility.



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working on an interactive map that will allow park and virtual visitors to access information on resources and Tlingit culture online.

To guide interpretation of natural and cultural resources, the park needs to complete a comprehensive interpretive plan (CIP). A decade ago, the park began a long-range interpretive plan, a critical element of a CIP, which developed park themes, visitor experience goals, and implementation strategies. It is now time to take another look at the overall interpretive program and visitor use goals, because during

the last ten years visitation trends, resource knowledge, technology, and park and concession facilities (including cruise ships) have changed significantly. For instance, the number of cruise ship passengers increased by 27 percent in this time period, and the infrastructure of the ships where park staff deliver interpretive programs has changed dramatically. In addition, long-distance technology offers new opportunities to reach underserved audiences. And there is a need to share compelling cultural stories in innovative ways, representing multiple viewpoints. A new comprehensive interpretive plan will articulate the vision for the park's interpretive future and recommend the media and programs best suited for meeting visitor needs, achieving management goals, and telling the park's stories.

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## EXTERNAL SUPPORT—VOLUNTEERS ARE INDISPENSABLE

Many national parks rely on support from volunteers, community groups, and nonprofit organizations to help bridge the gap between the park's needs and what the park can afford. Glacier Bay National Park and Preserve's volunteer coordinator acts as a liaison to help place people where they are most needed. In fiscal year 2007, the park benefited from the contributions of 73 volunteers who eradicated invasive plants, worked as campground and harbor hosts, and assisted with various research projects.

Support from the Friends of Glacier Bay and the Alaska Geographic Association are also critically important. According to its mission, the friends group "is dedicated to ecological integrity, opportunities for solitude, and appropriate research in Glacier Bay National Park and Preserve." The friends group initiated the first Glacier Bay Science Symposium in 1983 and has supported three more since then, the most recent one held in 2004. The friends group also donates time and funds to care for the park's library and is working to record oral histories of Huna Tlingit elders. Alaska Geographic Association runs the park's bookstore, shares park information with visitors on cruise ships and at the Glacier Bay Lodge, coordinates special events, and publishes the park's newspaper.

Relationships with surrounding communities are also important to the resource health and long-term success of Glacier Bay National Park and Preserve. There are three communities closely associated with the park: Gustavus, Hoonah, and Yakutat. Relations with the Tlingit of Hoonah and Yakutat are improving as a result of outreach. Hiring a public information officer would help to further ensure good relationships with surrounding communities, but the park does not currently have funds for this position. Instead, these duties are shared among management staff.

## WHAT YOU CAN DO TO HELP:

- **Participate in park planning efforts:** The public is invited to provide input on all park plans. Visit the park's website ([www.nps.gov/glbsa](http://www.nps.gov/glbsa)) to find out about current planning efforts.
- **Support or become a member of a group helping to protect the park:** Friends of Glacier Bay ([www.fogb.org](http://www.fogb.org)), Alaska Geographic Association ([www.alaskageographic.org](http://www.alaskageographic.org)), or the National Parks Conservation Association ([www.npca.org/support\\_npca](http://www.npca.org/support_npca)).
- **Volunteer in the park.** Glacier Bay National Park and Preserve is looking for dedicated people who can lend a helping hand. To learn about volunteer opportunities, contact the park at 907.697.2230.
- **Become an NPCA member and activist and learn about legislative initiatives and protection projects affecting all parks.** When you join our activist network, you will receive *Park Lines*, a monthly electronic newsletter with the latest park news and ways you can help. To join NPCA or become an activist, visit [www.npca.org](http://www.npca.org).



Volunteers help the park remove invasive non-native oxeye daisies.



## APPENDIX: METHODOLOGY

To determine the condition of known natural and cultural resources at Glacier Bay National Park and Preserve and other national parks, the National Parks Conservation Association developed a resource assessment and ratings process. The assessment methodology can be found online at NPCA's Center for State of the Parks website: [www.npca.org/stateoftheparks](http://www.npca.org/stateoftheparks).

Researchers gather available information from a variety of sources in a number of critical categories. The natural resources rating reflects assessment of more than 120 discrete elements associated with environmental quality, biotic health, and ecosystem integrity. Environmental quality and biotic health measures address air, water, soils, and climatic change conditions as well as their influences and human-related influences on plants and animals. Ecosystems measures address the extent, species composition, and interrelationships of organisms with each other and the physical environment.

The scores for cultural resources are determined based on the results of indicator questions that reflect the National Park Service's own *Cultural Resource Management Guideline* and other Park Service resource management policies.

Stewardship capacity refers to the Park Service's ability to protect park resources, and includes discussion of funding and staffing levels, park planning documents, resource education, and external support.

For this report, researchers collected data and prepared technical documents that summarized the results. The technical documents were used to construct this report, which was reviewed by staff at Glacier Bay National Park and Preserve prior to publication.

NPCA's Center for State of the Parks represents the first time that such assessments have been undertaken for units of the National Park System. Comments on the program's methods are welcome.

Glacier Bay National Park and Preserve offers opportunities for solitude in a spectacular natural setting.



# ACKNOWLEDGMENTS

For more information about the  
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Bryce Canyon National Park (UT)  
Cabrillo National Monument (CA)  
Canyonlands National Park (UT)  
Catoctin Mountain Park (MD)  
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Lewis and Clark National Historical Park (OR)  
Lewis and Clark National Historic Trail (various)  
Little Bighorn Battlefield National Monument (MT)  
Longfellow National Historic Site (MA)  
Missouri National Recreational River (NE)  
Mojave National Preserve (CA)  
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Olympic National Park (WA)  
Pictured Rocks National Lakeshore (MI)  
Point Reyes National Seashore (CA)  
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Saint-Gaudens National Historic Site (NH)  
San Juan Island National Historical Park (WA)  
Santa Monica Mountains National Recreation Area (CA)  
Shenandoah National Park (VA)  
San Antonio Missions National Historical Park (TX)  
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Virgin Islands National Park  
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