

Wilderness Camp Impacts: Assessment of Human Effects On the Shoreline of Glacier Bay

Final Report



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INTRODUCTION

Glacier Bay National Park encompasses a vast wilderness of 3.2 million acres, but the majority of backcountry use occurs along the shoreline within Glacier Bay proper. Most visitors to Glacier Bay's backcountry travel by sea kayak and do most of their camping, cooking, and hiking in the relatively narrow belt of terrain between the ocean and dense upland vegetation. Because most camping is limited to this beach fringe inside Glacier Bay proper, kayakers have a high likelihood of coming in contact with other campers or seeing evidence of past camping activity. While there are no official campgrounds or campsites in the backcountry of Glacier Bay, there are many established campsites which kayakers tend to use as they make their way to the glaciers. Since most visitors come to Glacier Bay to view tidewater glaciers, shoreline areas between the locations where the tour boat drops kayakers off and the tidewater glaciers have a high potential for paddlers to converge and impacts to intensify. There are also additional sites dotted throughout the length of the bay where campers tend to congregate. Virtually all of these camping sites are attractive for ease of access for kayaks, flat areas for camping, and often a readily available stream or other water source.

Just as it provides most camper needs, the shoreline of Glacier Bay also supports the park's most productive biological communities and most active wildlife zone. Indeed, the same wide beaches and flat open meadows that are most attractive to campers are also prime foraging and travel habitat for many animals and birds. The shoreline generally is the principal travel corridor for large mammals, including black and brown bears, moose, wolves, and coyotes, and provides important foraging habitat for these species during specific periods of the year. River otters and mink require secluded areas close to the marine water to den and feed. Shorelines also serve as haul-out habitat for harbor seals as well as nesting areas for both colonial nesting birds, (e.g. gull species, arctic tern) and solitary nesting species (e.g. black oystercatcher, semipalmated plover, spotted sandpiper, parasitic jaeger). In addition, marine waters directly adjacent to shorelines often serve as resting areas for molting sea ducks, and virtually all bald eagle nests in the bay are found in tall trees near the shore.

The park has committed to preparing a Backcountry Management Plan, to ensure that human disturbance to wildlife is minimized as well as to promote a feeling of solitude and wilderness for those who have journeyed into the backcountry of this large wilderness park. To accomplish this task, it is necessary to identify actual and potential social and ecological impacts that result from human recreation in Glacier Bay's backcountry. For the purposes of this study, we defined social impacts as physical evidence of human use that people notice when they visit, such as fire pits, trampled vegetation and trash. Social impacts are usually site specific and may be somewhat subjective, based on the individual's needs, expectations and perspectives. However, social impacts can directly contribute to the quality of the backcountry journey. Consequently, while acceptable levels of social impacts may be difficult to determine, they are an extremely important factor in designing a plan to manage Glacier Bay's backcountry.

Ecological impacts are disturbances to the natural landscape or biota of the ecosystem as a result of human activity (Hammit and Cole, 1998). These impacts can range from the site-specific, such as a bird egg crushed by a hiking boot, to landscape-wide impacts such as the introduction of an invasive species. Increasingly in recent decades, land managers have defined ecological impacts in terms of disturbance, often disturbance or interruption of life-sustaining activities of wildlife such as breeding and feeding. The effects of such disturbance on the health of a population, however, are difficult to ascertain without a tightly focused scientific investigation of the species in question.

In this study we attempted to assess the current state of human impacts on the shoreline of Glacier Bay's backcountry by examining site-specific human impacts in areas of suspected use. We identified campsites, recorded social impacts according to a set protocol, and assigned each campsite a rating based on the intensity of these social impacts. We also noted potential ecological impacts from campers at those campsites. While we attempted to assess both ecological and social impacts, social impacts were much more apparent and consequently were documented more thoroughly. Many of the potential ecological impacts will require more detailed species or site specific research to evaluate. Such studies on some selected species (shoreline nesting birds, harbor seals) are currently ongoing in Glacier Bay, and the results will further inform this backcountry management process.

METHODS

Survey Area Selection and Boundaries

We used ArcView GIS® analysis of an existing camper database to determine where sampling efforts should be focused within the bay. Since 1996, Glacier Bay National Park has requested that campers identify locations of their campsites on a visitor survey which, though voluntary, as been met with acceptance and a high rate of compliance (>90%). Consequently, more than 8,000 campsite locations are in the camper database. In order to rank camping areas by use intensity, 100 m buffers were placed around each reported camp, boundaries dissolved, and the number of camps within resulting polygons analyzed. (Figure 1) With a few exceptions, all polygons containing 10 or more camps were sampled. Importantly, we not only surveyed the highest use camps but rather the entire area within which the camp exists, which we defined as a "survey area."

Crews walked the beach surrounding high-use areas and determined the boundaries of the survey areas. Boundaries were often delimited by geographical constraints such as sheer walls, talus, or dense vegetation. If geographical constraints were not present, crew members arbitrarily created survey area boundaries surrounding what appeared to be the center of human use. Survey area limits were established as the crew walked the beach to: 1) establish precise locations for the high use campsite(s) identified in the camper database, 2) identify other campsites for assessment, and 3) record signs of animal and human activity in the area.

While walking the survey area, crews recorded sign of humans including footprints, trash, trails, etc; observations and signs of animals including tracks, scat, nests, etc; and campsite locations. Observations and campsite locations were recorded on plastic laminated aerial photos (ranging in scale from 1:2000 to 1:6000). The precise locations of survey area boundaries, campsites, and nests and dens were determined with global positioning system units (GPS).

Campsite Selection and Boundaries

For the purposes of this project, the term “campsite” is defined as a location where people are known or suspected to have camped. Sites showing evidence of human use are considered “established” (Figure 2) and sites showing no evidence of human use are considered “not established.” In 2002, field crews measured human impacts in at least one campsite per survey area. In 2003, crews attempted to measure impacts on all established campsites within each survey area. If no evidence of camping was found within a survey area, a campsite was chosen that seemed the most likely to be used by campers within the survey area. If more established sites were found in a survey area than the crew had time to measure, we simply took GPS locations and a few quick notes on these campsites.

Camp Locations, Glacier Bay Backcountry Survey, 1996-2000

National Park Service
U.S. Department of the Interior

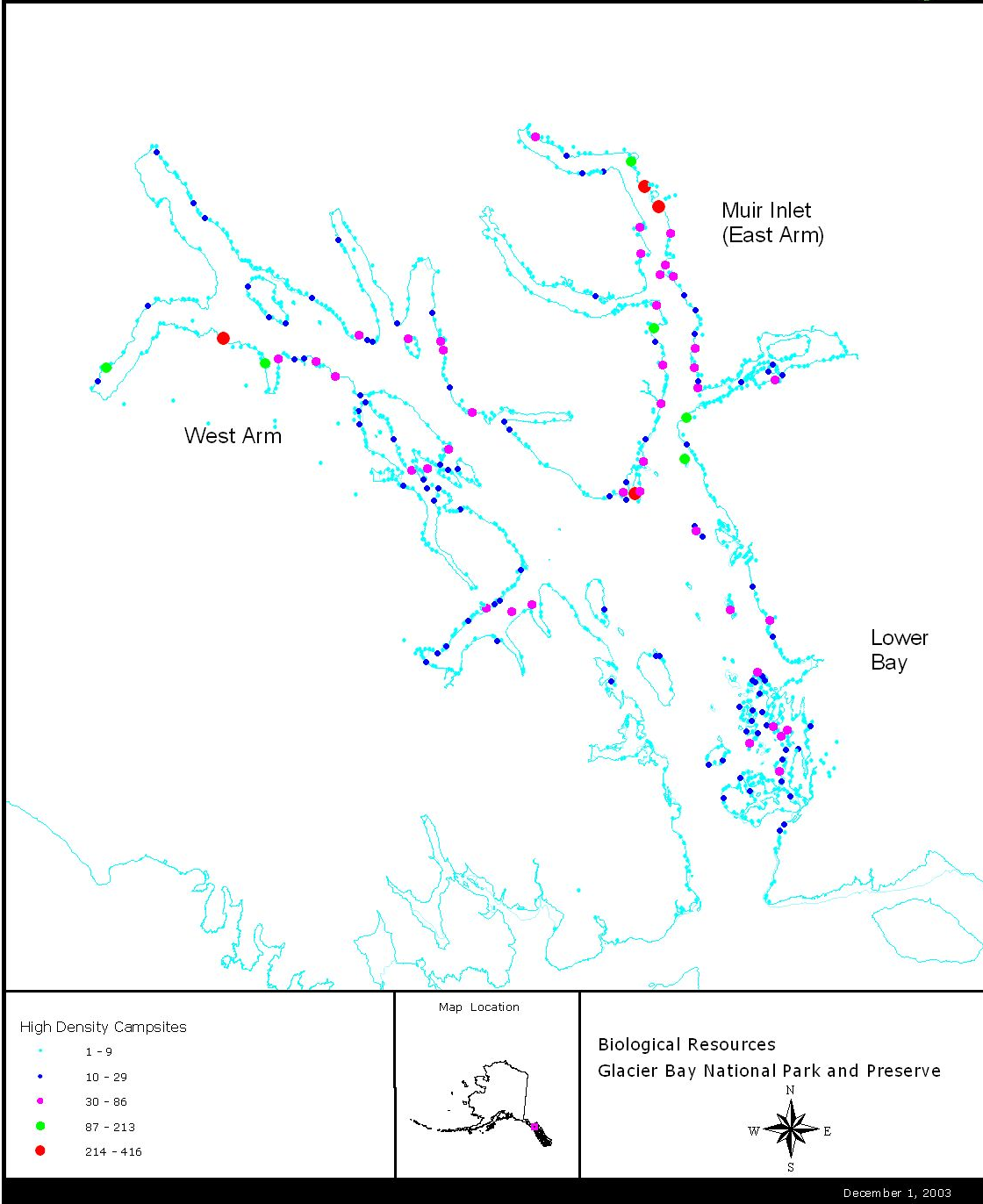


Figure 1: Reported camp locations from backcountry survey, 1996-2000.



Figure 2: Established Campsite, McBride Glacier Inlet.

At each chosen campsite, we determined a center point from which to conduct the survey and from which to record a GPS position. Some campsites contained a main site and “satellites,” defined as smaller camp areas associated with a main site. If the campsite had multiple areas of use or satellites, we chose for the center point the area showing the greatest evidence of use or the central area if all showed equal use. Campsites and satellites were drawn in a sketch and the length and width of each was measured and recorded. It was sometimes necessary to determine if an impacted area was a single site with satellites or multiple sites. Factors such as distance between the areas of use, trails joining them, and terrain obstacles between them were considered. Reasons for these determinations were documented.

We initially attempted to measure and evaluate campsites in accordance with a standard protocol as described by Jeffrey Marion (Marion, 1991) and currently used in Prince William Sound by Paul Twardock of Alaska Pacific University to monitor ongoing backcountry impacts (P.Twardock, perscomm). This protocol requires that an exact boundary of the site be defined, marked and measured. We soon found that in the majority of camp areas in Glacier Bay we could not discern the exact boundary of a campsite due to surrounding sparse vegetation and bare open gravel patches. Furthermore, some of the impact parameters used in the standardized condition/class rating such as root exposure and erosion, did not seem to apply in the open, recently deglaciated northern portions of Glacier Bay, where much of the human use occurs. We therefore revised the standardized protocol and rating system to fit the unique environment of Glacier Bay. This revised protocol and associated datasheet can be found in Appendix I.

Impact Parameters

Social Impacts

1) Vegetation: Impacts to vegetation were rated by observers on a scale of 0-5 using comparisons between vegetation in the campsite versus vegetation outside the campsite. Off-site vegetation was considered to be natural and thus the control. These ratings, which we called “observer ratings,” were assigned in the field while observing the campsite. The observer rating classification was:

0 = Campsite barely distinguishable: none or minimal disturbance of vegetation and/or organic litter. May be a possible/likely camping location, an old campsite that has not seen recent use, or a location of recent one-time use with no signs of permanent damage. May find evidence of a rock tent ring.

1 = Obvious vegetation difference between campsite and “control” areas indicate impacts of repeated use. Impacts may be subtle such as smaller, more durable species growing within site while taller more sensitive species growing outside of site. Campsite shape may indicate the cause of this difference in vegetation to be from human use instead of natural causes. May find evidence of a rock tent ring.

2 = Ground vegetation worn away from around center of activity. If vegetation is sparse or non-existent in campsite and control area, soil is compressed at center of activity.

3 = Ground vegetation lost (compared to control) on greater than half of the campsite, but humus and litter (if applicable) still present in all but a few areas.

4 = Bare mineral soil obvious (if control is vegetated). Tree roots exposed on the surface.

5 = Soil erosion obvious. Trees reduced in vigor or dead.

2) Size: Campsite areas were measured and categorized as small or large. A small site is less than 250 square meters in size with two or less satellites. A large campsite is ≥ 250 square meters and/or has three or more satellite. The area of the campsite included all satellites.

3) Long-lived impacts: Impacts that will endure season to season and include the following:

- Trailing: Trails made or used primarily by people rather than wildlife (Figure 3). Examples include a trail from a beach to a campsite and trails connecting main sites to satellite sites.
- Supratidal Fire pit: A fire pit above the high tide line (Figure 4). For this analysis, a fire pit is defined as the location of a campfire. Usually, this was apparent even if the campfire occurred in previous years due to charcoal and burnt wood. A single piece of burned wood above the intertidal was not considered a fire pit.



Figure 3: Trailing, Johns Hopkins Inlet



Figure 4: Supratidal Fire pit, Garforth Is.

4) Short-lived Impacts: Impacts that can be easily erased or will disappear naturally in a short time, including:

- Rock Rings: Rocks used by campers to anchor tents (Figure 5). They are usually left in circles or strewn about where people have camped. Evidence that rocks were left by campers include the pattern in which the rocks are found, live or recently dead vegetation under the rocks indicating they were placed there recently, and the size of the rocks.



Figure 5: Site Containing Rock Ring, Upper Muir Inlet.

- Intertidal Fire pit: A campfire below the high tide line. Burned wood that was not at a campfire location was not counted, as this travels with the tide and accumulates at different locations.
- Trash: Human artifacts left by campers or hikers. Trash that washed up with the tide and/or believed to be carried inland by bears or wolves was not counted (bears especially like to chew on Styrofoam and plastic). Relics such as mining debris, old shacks, and survey markers with wires and spikes were noted but not counted in analysis. All other trash, no matter how minute, was included.
- Human Waste: Feces and/or piles of toilet paper found above mean high tide line. Human waste below the high tide line was not included
- Firewood: Piles of collected firewood. This includes piles of sticks. It does not include burned wood scattered on the beach.
- Structures: These are structures made by campers from natural materials (Figure 6). Examples are rock cairns, driftwood arranged for seating or a windbreak, etc. This does not include relics such as shacks, mining debris, or old cairns. It also does not include cairns at camper drop-off locations built by park concessionaires.



Figure 6: Human Structure, Hunter Cove

- Footprints: Human tracks.

Final Social Impact Rating

A final social impact rating was determined for each measured site by calculating an additive score of these impacts, including the site's observer (vegetation) rating, size, long-lived impacts, and short-lived impacts. Final social impact ratings were calculated after the field season had commenced as a way to best summarize social impacts. These impact rating categories are: "none, low, medium, and high." Ecological impacts such as plant species and sensitive animal species were not included in final impact ratings. The

formula used to determine final social impact rating was (the detailed protocol can be found in Appendix II):

$$\text{Final Social Impact Rating} = \text{Observers' Rating} + \text{Size} + \text{Long-lived Impacts} + \text{Short-lived Impacts}$$

Observers' Rating: Enter the Observers' rating assigned to the site (0-5).

Size: Enter 0 for a small campsite or 2 for a large campsite. A small campsite is less than 250 square meters in size with 2 or less satellites. A large campsite is ≥ 250 square meters and/or has 3 or more satellites. To determine the square meter size of a site include the main campsite and all satellites.

Long-lived Impacts: Enter 0 if no long-lived impacts are present. Enter 1 if one or more long-lived impacts are present. Long-lived impacts are fire pits above the intertidal and social trailing. Do not include missing or worn vegetation as this is already accounted for in the Observers' Rating.

Short-lived Impacts: Enter 0 if there are three or fewer short-lived impacts. Enter 1 if there are four or more short-lived impacts, including rock rings, campfires below the intertidal, trash, human waste, firewood, structures or footprints.

0 = None
0-2 = Low**
3-5 = Medium
 ≥ 6 = High

** A site that shows evidence of camping with an Impacts Rating of 0 = Low. A site that shows no evidence of camping with an Impacts Rating of 0 = None.

Ecological Impacts

Observations of dominant plant species in the site and in the control area, and potentially sensitive animal species in the vicinity of campsites were recorded. Descriptions of sensitive species near camping locations are described in the discussion and summarized by survey area in Appendix III. A complete list of plant species can be found in Appendix IV. Animals considered sensitive to human disturbance include:
Birds: nesting birds, molting birds, shore birds, birds with young, cormorants, and scoters
Mammals: harbor seals, river otters, mink, wolves, coyotes, bears, and wolverines, or any other mammal with a den
Amphibians: boreal toads
Fish: spawning salmon

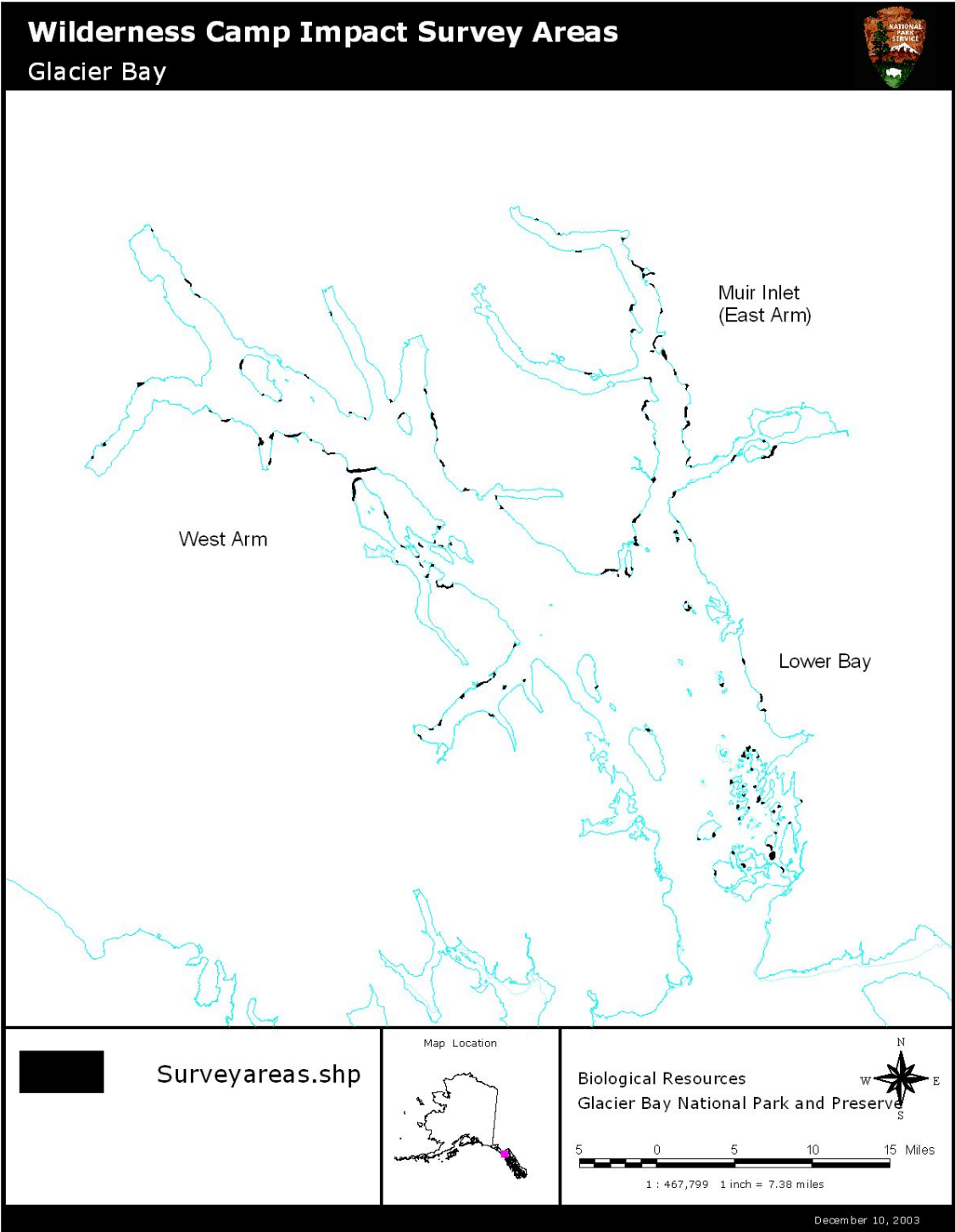


Figure 7: Survey Areas identified in the present study.

RESULTS

Survey areas

One hundred and thirty-six survey areas were identified (Figure 7). Of these, 134 were surveyed completely and 2 were not. Of the 134 surveyed areas, 105 (78%) contained one or more established campsites. In 29 survey areas (22%), no established campsites were found. Evidence of potentially sensitive species was observed in 134 survey areas (100%). Location maps and a complete summary of each survey area; including human impacts, attractive features, and sensitive species; can be found in Appendix III.

Campsites

Two hundred and sixty-eight campsites were identified and of these, 257 were measured and rated (Figure 9). Almost half (48%) of the measured sites were given an observer (vegetation) rating of 0, indicating no difference between on-site and off-site vegetation. Twenty-five percent were rated 1, 18% rated 2, and only 9% rated 3 (Table 1 and Figure 10). The majority of the sites were categorized as small (81%) while 19% were large (Table 2 and Figure 11). Seventy-four percent of the sites contained rock rings, 28% had footprints, 22% had trash, 16% had trailing, 9% had supratidal fire pits, while 5% or less sites contained intertidal fire pits, human waste, structures or firewood (Table 3 and Figure 12). Fourteen percent of the measured sites showed no sign of human impact and thus a final social impact rating of “none.” Fifty-nine percent of the sites received a final social impact rating of “low,” 23% “medium,” and 4% “high” (Table 4 and Figures 13 and 14).



Figure 8: Large campsite, Reid Inlet

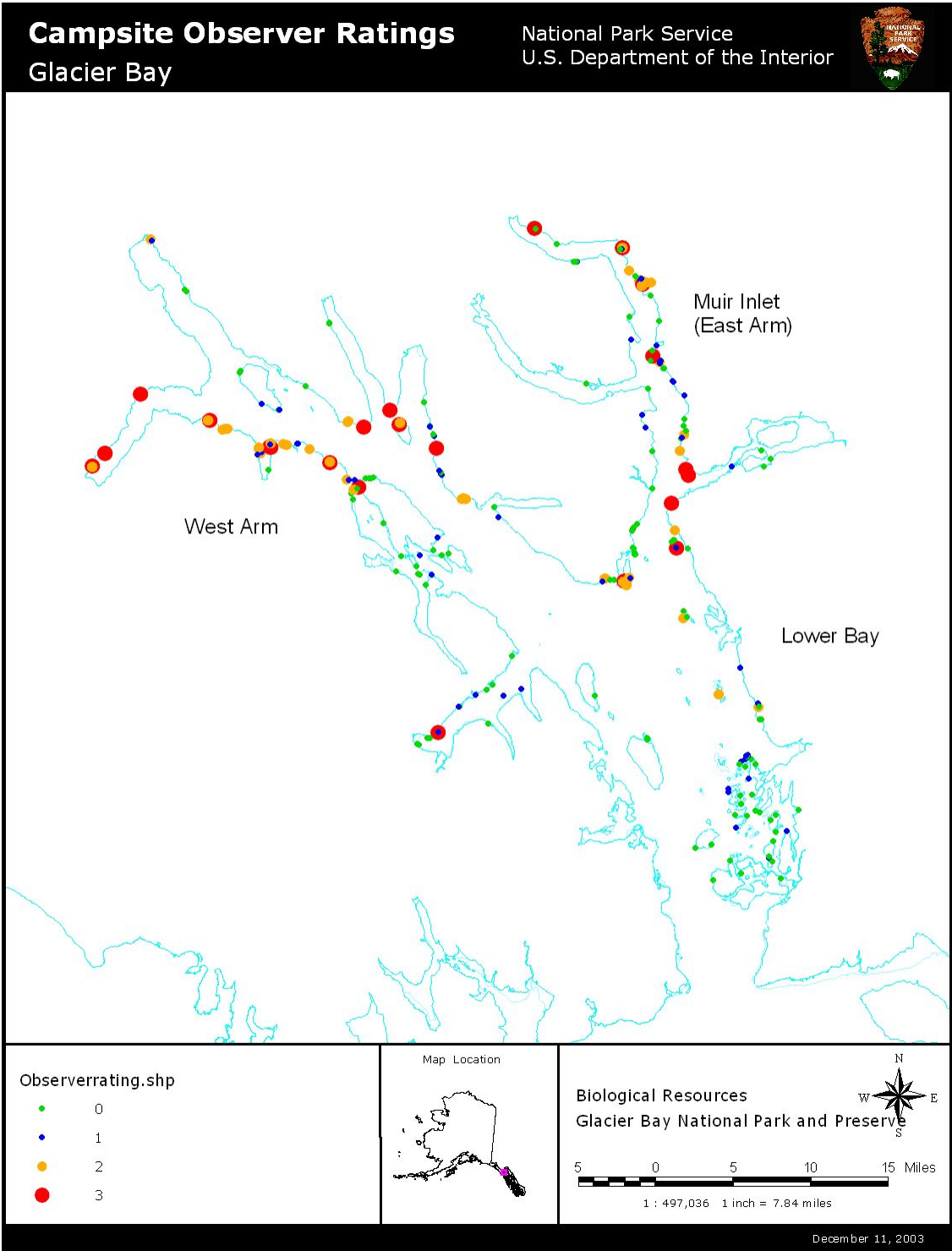


Figure 9: Observer ratings (vegetation impacts) of measured campsites.

Observer Rating	Number of Sites (n=257)	Percentage of Sites
0	123	48%
1	64	25%
2	47	18%
3	23	9%

Table 1. Number of sites and percentage of sites in each observer (vegetation) rating category.

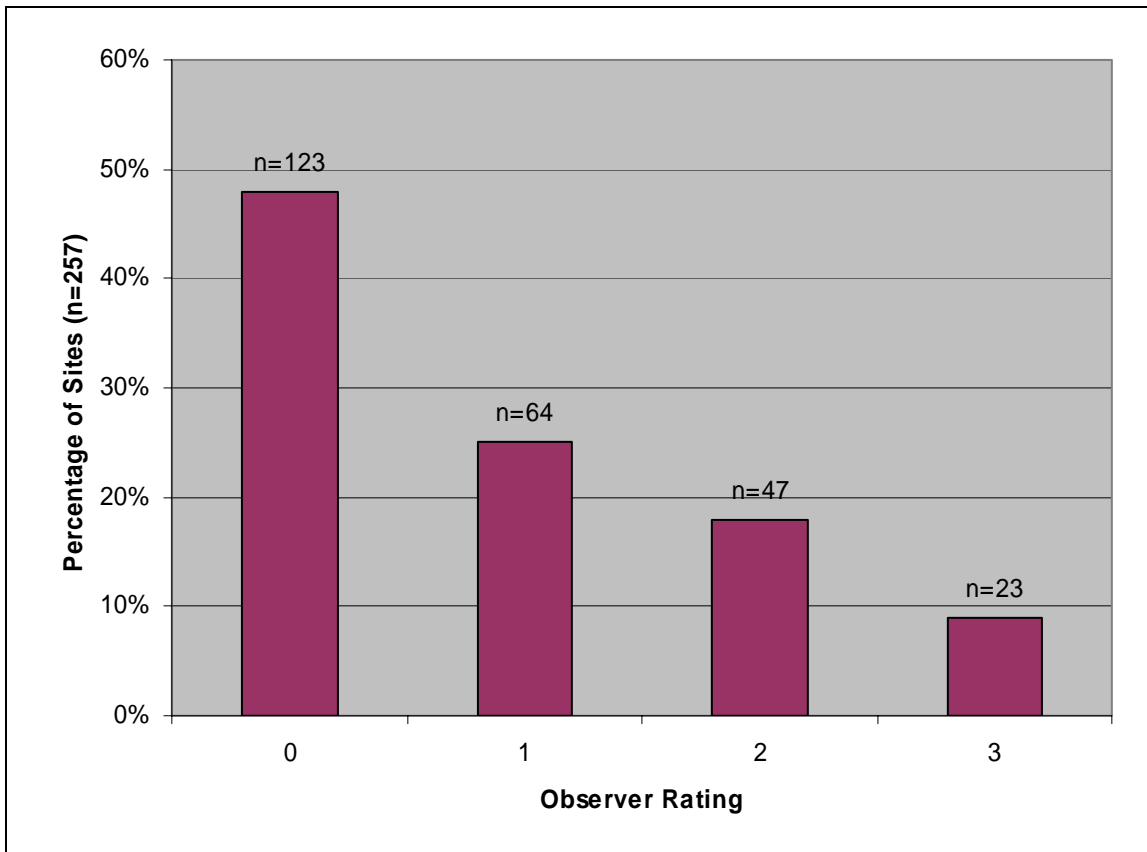


Figure 10: Percentage of sites in each observer (vegetation) rating category.

Size	Number of Sites (n=257)	Percentage of Sites
Small	208	81%
Large	49	19%

Table 2: Number of sites and percentage of sites in each size category.

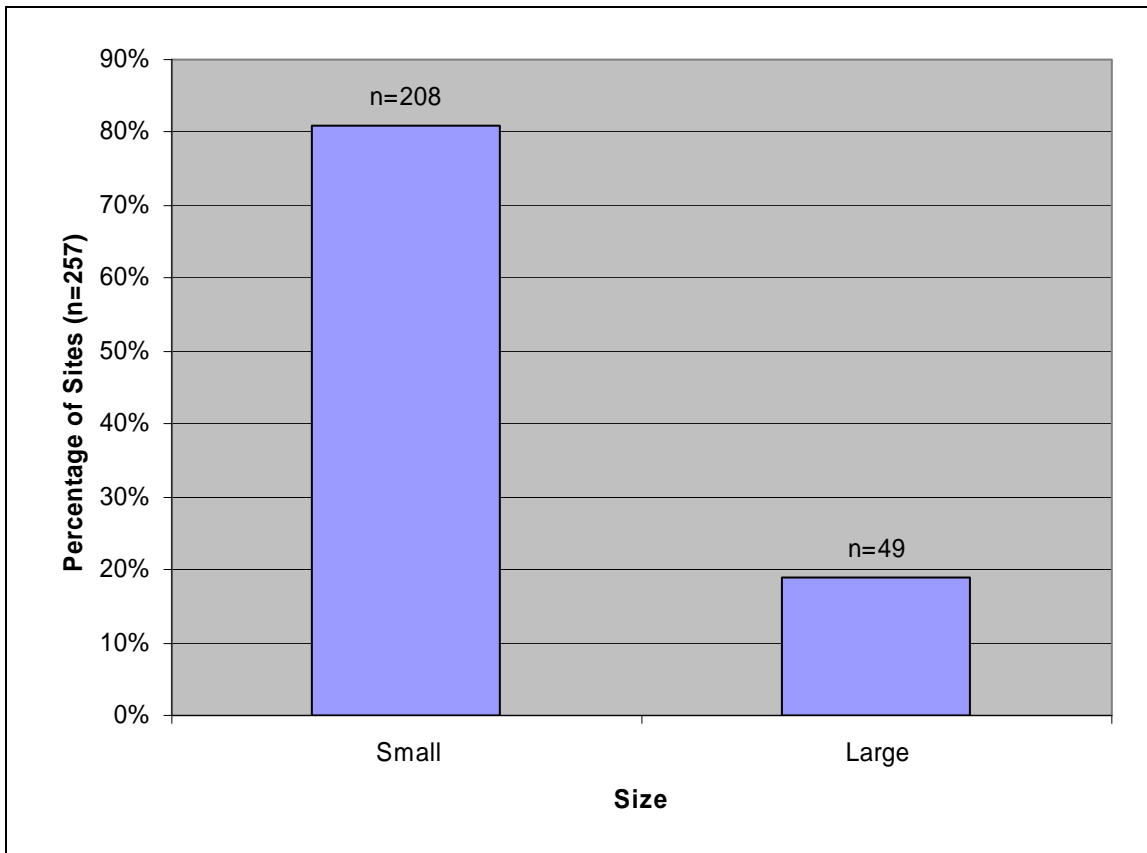


Figure 11. Percentage of sites in each size category.

Long-lived Impacts	Number of Sites (n=257)	Percentage of Sites
Trailing	41	16%
Supratidal Fire pits	22	9%
Short-lived Impacts		
Rock Rings	191	74%
Footprints	72	28%
Trash	57	22%
Intertidal Fire pits	14	5%
Human Waste	12	5%
Structures	11	4%
Firewood	8	3%

Table 3. Number of sites and percentage of sites containing long-lived and short-lived human impacts.

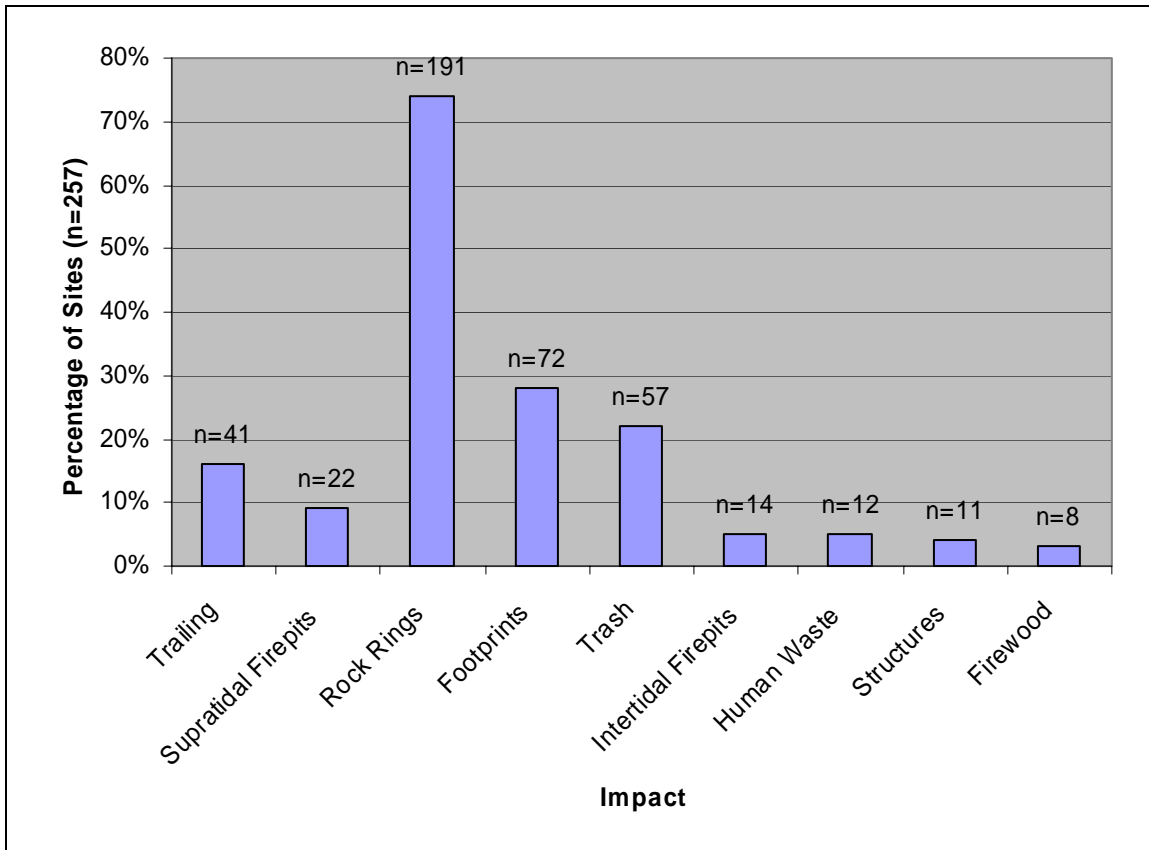


Figure 12: Percentage of sites containing human impacts.

Final Social Impact Rating	Number of Sites (n=257)	Percentage of Sites
None	36	14%
Low	152	59%
Medium	60	23%
High	9	4%

Table 4. Number of sites and percentage of sites in each final social impact rating category.

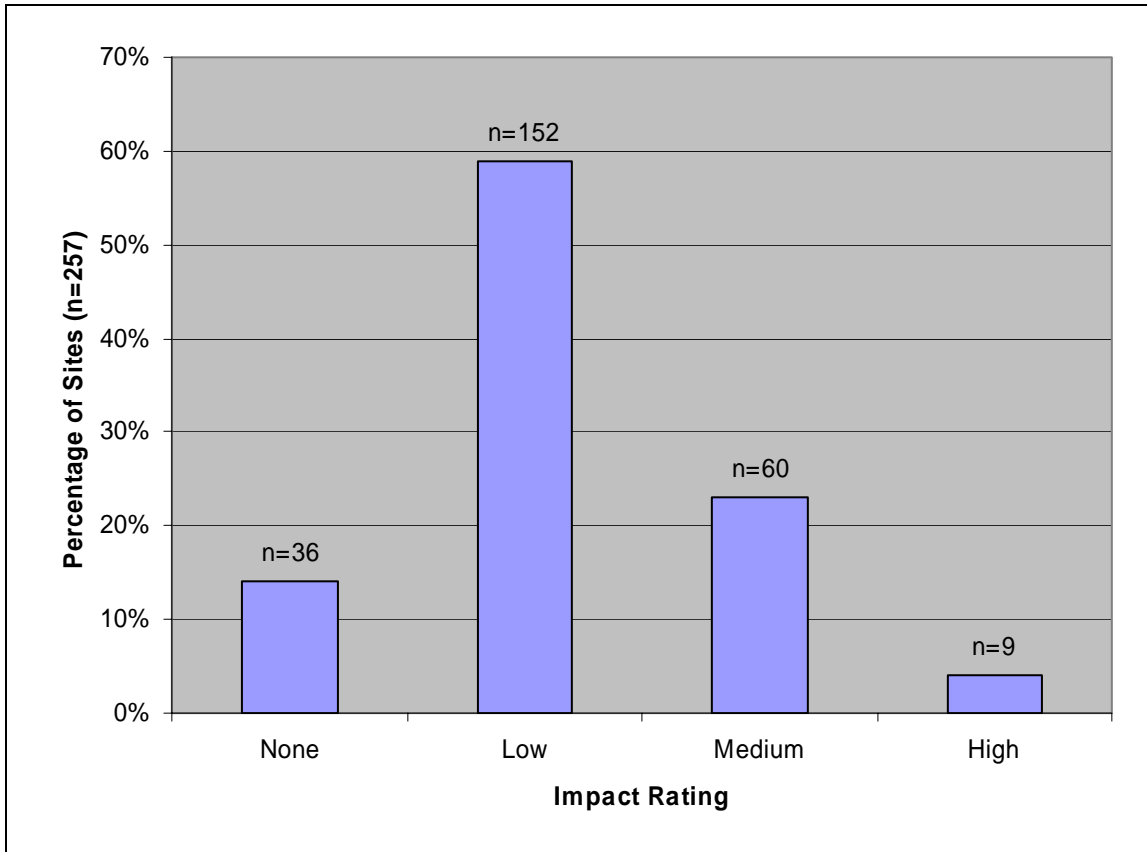


Figure 13: Percentage of sites in each final social impact rating category.

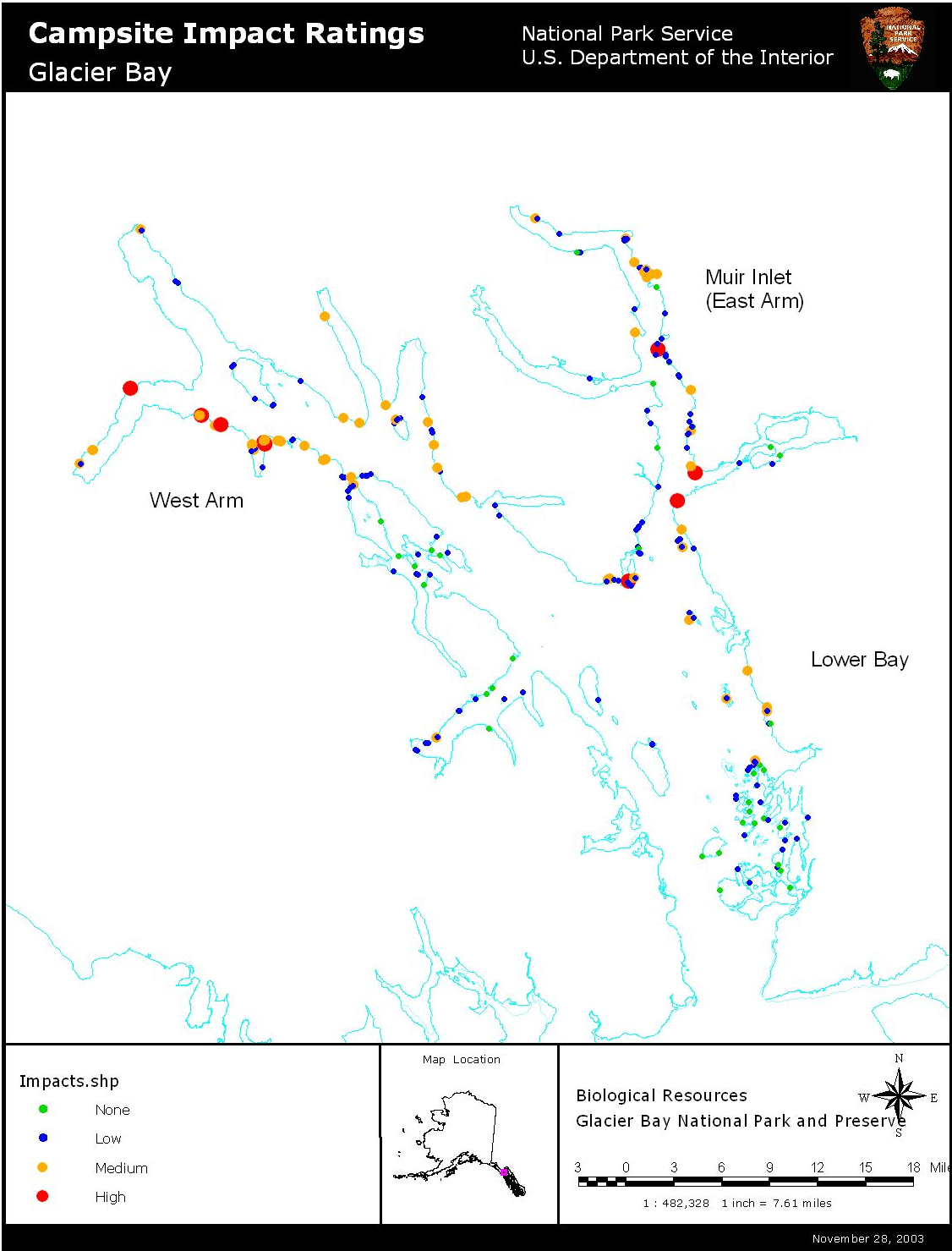


Figure 14: Final Social Impact Ratings of measured campsites.

DISCUSSION

Impact and Use Patterns

Given that the tidewater glaciers are a big draw for visitors and that most kayakers begin their trips at one of the camper drop-off locations (Appendix V), it is understandable that most of the heavily impacted sites were found between the drop-off locations and the glaciers. The geography of Glacier Bay also plays a large role in the prevailing use patterns and subsequent human impacts. Areas of the bay with steep shorelines concentrate use and impacts in those areas that are flat enough to camp in. An example of steep shoreline concentrating use is the area from Reid Glacier into Johns Hopkins Inlet in the west arm. Nearly all of the campsites in this area were rated as medium or high social impacts. Conversely, in areas where the shoreline is not steep and there are many possible camping areas, such as the Beardslee Islands, most sites received an impact rating of none or low. Some areas get repeated use because they are natural stopping locations on well-traveled routes. Two examples are York Creek and the southern tip of Leland Island. Both are desirable camping locations located just south of a long section of shoreline closed to camping. Some areas concentrate use, and therefore impacts, because of access to tidal channels in which campers often must wait for high tide to get through. Examples of these locations include the northern-most tip of the Beardslee Islands and the Scidmore Cut.

Substrate plays an important role in determining which areas retain lasting social impacts from humans. Areas with organic soil tend to have lush vegetation that is prone to trampling, but grows over and conceals impacts seasonally. The most commonly observed long-term vegetative impact in these areas was a decrease in species diversity. Areas with organic soil also hold tent stakes, so rock rings are not used as often and left as human evidence. Areas with loose mineral substrates are more prone to disturbance from campers. While plants such as dryas and alder are resilient to wear, lichens growing on sand or gravel tend to be easily disturbed, even in a single use. Rock rings are often used to secure tent flies. Areas with cobble substrates tend to have less vegetation than areas with organic soil or loose mineral substrates. Vegetative impacts may be less evident in cobble substrate but compression, rock rings, and other impacts were often found.

Social Impact Parameters

The land in Glacier Bay is rising over an inch per year from glacial rebound. The shoreline is in a constant state of renewal as new shoreline emerges and old shoreline recedes from the tide, often being consumed by encroaching willows and alders. This process plays a major role in camper impacts in Glacier Bay. Campsites that were once on beach meadows and cobble terraces are now overgrown. Similarly, people are now camping on beach meadows and cobble terraces that were once under water or subject to tidal inundation. Camper destinations also change as glaciers retreat, beaches rise, and tidal channels go dry and become unnavigable. In short, favored campsite locations continually change over time in Glacier Bay. Because of this, camper impacts to

vegetation and substrates may be less obvious in Glacier Bay than in more static environments.

The observer ratings were largely based on vegetation differences inside versus outside the campsite. Because the focus of this rating was on vegetation, we did not feel that this rating adequately described all of our campsites because it did not take into account long-lived vs. short-lived impacts and size of the site. The final social impact ratings factor all of these impacts in and are a better description of the overall condition of Glacier Bay's backcountry. The observer ratings do tell us something about the overall visual impact of human-caused changes to vegetation, Almost 3/4 of the campsites we surveyed showed minimal to no vegetative disturbance (0-1 rating). The remaining 1/4 campsites showed moderate to extreme vegetation loss.

Campsite size was difficult to calculate because the boundaries of the campsites were usually impossible to discern, and because in places sites were so close together it was hard to distinguish between one large campsite and a smaller campsite with several satellites. In an effort to standardize our data, we measured the areas of clear vegetative impacts and used a rough calculation to determine if a site was small or large. The overwhelming majority of sites in Glacier Bay were rated as small. The few large sites most often contained more severe vegetative disturbance and other impacts, presumably due to the nature of use by large or multiple groups.

Long-lived impacts persist over time, and therefore were weighed more heavily than short-lived impacts in the final social impact rating. Trailing was found in 41 sites. Trails were most commonly seen between main campsites and satellites, and from the intertidal zone to heavily used campsites. The most worn trails occurred in the northern portions of the bay near the glacier and outwash areas, such as McBride Glacier Inlet, Topeka Outwash and Johns Hopkins Inlet. Fire pits above the intertidal zone were found in 22 sites, which is only a small proportion of the campsites, but is still surprising considering that backcountry visitors are asked to build fires only in the intertidal zone to reduce impacts to the terrestrial zone and so that tidal action can wash away the fire evidence.

The most common short-lived impacts observed were rock rings, footprints, and trash. Rock rings were found in the majority of the campsites surveyed, and often were the leading indicator of human use in a site. Rock rings were much more common in the northern portions of the bay than the southern. In many areas, such as campsites at the mouth of Reid Inlet and Ptarmigan Creek, multiple rocks rings were strewn about over a large area. Footprints were observed in over 1/4 of the campsites, and we found trash at nearly 1/4 of the campsites we surveyed. Most often the trash appeared to be items left unintentionally such as tent stakes, bits of string, bits of foil or plastic, articles of clothing, and pieces of equipment. Occasionally we found trash that we believe was left intentionally in fire pits. The field crews for this project dispersed many rock rings and picked up trash throughout Glacier Bay over the duration of this project. The number of structures built and left in the backcountry was surprising, as was the number of campsites near which we found human waste above the intertidal zone. The human

waste was most often found in areas of high use and/or near large campsites. We suspect that some people are wary of defecating out in the open when there may be other people around, and will instead go to a brushy or otherwise covered area for privacy.

Almost 3/4 of the sites surveyed in Glacier Bay were given a final social impact rating of “none” or “low.” Most of these sites occur in the Beardslee Islands, Geikie Inlet, and Hugh Miller Inlet, with some spread out through the West and East Arms as well. The sites given a “medium” impacts rating were mostly in the West Arm north of Tidal Inlet and along the east side of the bay from the lower bay through Muir Inlet. Of the nine sites that were given an impact rating of “high,” five were found between the eastern side of Reid Inlet and Topeka Outwash. The remaining four were found between Sebree Island and Nunatak Cove. It is important to note that, in an ecological context, the number of sites in an area may be more important to consider than the rating of each site. For example, the cumulative impacts of the eight sites rated “low” and “medium” on the south spit of McBride Glacier may be the same or greater than the one site rated “high” at Muir Point.

Overall, the social impacts along the shoreline of Glacier Bay are minimal. This is probably due to the relatively small number of camper nights per year, the resilient and continually changing landscape, and the fact that campers are encouraged to find their own camp locations and thus tend to spread out along the shoreline. There are, however, places of aggregation that warrant management concern. The areas of high camper use and medium to high social impacts will likely continue to draw campers to them and thus intensify these impacts over the coming years.

Ecological Impacts

One of the most difficult aspects of this project was attempting to determine the ecological impact of campers on the plants and animals of Glacier Bay. Given the scope of this project, we did not attempt to make any conclusions about the number of species or individuals that campers disturb, or about the extent of those impacts. Instead we present observations and descriptions of potential ecological impacts that we observed on certain species in specific locations.

Plants

From a landscape viewpoint, the impacts from campers on the flora of Glacier Bay appear to be minor. Even in sites where ground vegetation has been lost on greater than half of the site, the proportion of ground cover lost compared to the surrounding landscape is negligible. We did, however, observe the invasive plant species dandelion (*Taraxicum spp.*) in many parts of the bay. We also observed several plant species that are sensitive to disturbance and could potentially be eliminated from areas by human trampling. Examples of such locations include the northern Beardslee Islands and Willoughby Island where several orchids (*Platanthera* and *Cypripedium spp.*) were observed near campsites (Figure 15).

Our field crew was not specifically trained in botany so further investigations into the ecological effects of campers on plants in Glacier Bay is required.



Figure 15: *Lady's slipper orchid (Cypripedium montanum)* observed near campsites in the northern Beardslee Islands.

Birds

Because backcountry visitors in Glacier Bay tend to camp and walk in areas along the shoreline, birds that nest on the ground along Glacier Bay's shorelines are subject to disturbance from backcountry visitors. Nests of these birds can be almost impossible to see and may be stepped on. Adult birds sometimes go to great lengths to drive off or distract people from the nests or young they are tending. This can result in expenditure of precious energy on the adult bird's part, distraction from predators, separation of adults from young, reduced time spent feeding young, stress to adults and young, time off the nest causing adverse temperatures to eggs or young, and nest abandonment. Birds observed nesting on the ground along the shoreline included: black oystercatcher, spotted sandpiper, semipalmated plover (Figure 16), least sandpiper, mew gull, arctic tern, glaucous-winged gull, herring gull, orange-crowned warbler, golden-crowned sparrow, savannah sparrow, song sparrow, and fox sparrow.

The majority of the shore-nesting birds were found on small islands or in the rocky open peri-glacial outwash areas. Many treeless islands are closed to humans to protect nesting areas, but we found several islands that are not closed to have abundant nesting activity. For example, at Sealer's Island in Muir Inlet we observed nesting arctic terns, glaucous-winged gulls, mew gulls and oystercatchers. The small island near the mouth of Charpentier Inlet and the tiny island south of Tlingit Point also had abundant bird activity including indications of ground nesting birds. We also found nesting birds throughout

the upper portions of Glacier Bay where the glaciers have recently receded. We observed the greatest nesting bird activity at Scidmore Glacier outwash, Topeka outwash, Riggs Glacier outwash, Adams Glacier outwash, Grand Pacific Glacier outwash, the east and west side of Reid Inlet, the north shore of upper Muir Inlet, both spits of McBride Inlet, all of our survey areas in Tarr Inlet and Queen Inlet, and several outwash areas in Muir Inlet.



Figure 16: Semipalmated plover nest hidden within a large campsite area, Riggs Glacier

The birds most commonly observed nesting on these rocky outwash areas were mew gulls, herring gulls, glaucous-winged gulls, arctic terns, semipalmated plovers, black oystercatchers and spotted sandpipers. Not only are campers potentially a problem in these areas, but people hiking in the outwashes can be very disruptive to nesting birds.

Just as birds are especially prone to disturbance when nesting, several species of birds in Glacier Bay become flightless every year during their molt. While many of these birds stay on water during this time and may not be affected by campers on the land, kayakers on the water can disturb large flocks of these birds. We observed this disturbance in areas such as Adams and Hugh Miller Inlets where calm waters and abundance of prey attract rafts of molting scoters and harlequin ducks. Kayakers passing such rafts can displace birds for hundreds of meters, even miles. There are areas of land that we observed molting birds resting where campers in that area could disturb them. We noted these areas in the survey area summary (Appendix III). We also noted all survey areas with species of scoter and cormorant in or near them as these species appear to be declining in Glacier Bay (Greg Streveler, personal communication).

Nesting eagles can also be sensitive to disturbance. Eagle nests were observed in six of the survey areas, including heavily used beaches such as the west spit of Reid Glacier and the beach east of Lamplugh Glacier.

Mammals

The most abundant animal sign observed along the areas of shoreline that we surveyed was from moose, bears and river otter. We found moose sign throughout the bay with the exception of the ends of the glacial fjords. We do not believe that moose are especially sensitive to human disturbance because of their abundant willow and alder forage allows them to dwell inland as well as on the shoreline. Bear sign was found everywhere except for upper Muir Inlet and a few islands in the lower bay. Bear foods tend to be concentrated along the shoreline of the bay, particularly in the upper bay where rock, scrub and ice dominate the land. Bears and people seem to be attracted to the same lush, flat meadows in the upper bay that are in short supply in the steeper portions of the bay. Because brown bears tend to inhabit the upper portion of the bay while black bears inhabit the lower portions, brown bears are especially susceptible to human disturbance, and while many bears seem to have become habituated to human presence, some degree of displacement of bears from key food resources is likely in areas of high camper use. Several bear dens were located in the northern portion of the Beardslee Islands. Although bears den in the winter and human use occurs in the summer, bears at these den sites face possible disturbance in the spring. River otter sign was observed as far up bay as Lamplugh Glacier in the west arm and McBride Glacier in the east arm. Many survey areas in the Beardslee Islands were so covered with river otter sign that human sign was almost impossible to distinguish. River otters seem especially prone to human disturbance and displacement because of the areas that they like to inhabit; flat mossy areas, open forest, and scenic rock outcroppings; all equally desirable to campers. Several suspected river otter dens were found during this study, none of which appeared to be actively in use. River otters usually den relatively close to the water and are therefore highly susceptible to disturbance from campers at their den sites.

We observed wolf sign sporadically throughout the bay, and observed four wolves, one in Adams, one in Hugh Miller Inlet, and two in Queen Inlet. Coyote sign was very abundant in the lower bay reaching into Geikie Inlet on the west side and as far as McBride inlet on the east side. Coyotes were observed repeatedly in the Beardslee Islands. Both species probably move a great deal, both on the shoreline and inland, and do not seem especially prone to human disturbance except at their den sites. No definite coyote or wolf den sites were found in this study, but one or more of the bear dens found in the northern Beardslee Islands are suspected to have historically been used by coyotes (Greg Streveler, pers. com.).

We found mink sign in one location in Hugh Miller Inlet and observed wolverine in Geikie Inlet and at Scidmore cut (Figure 17). We observed denning marmots in three areas between Scidmore cut and Lamplugh Glacier. Potential camper impacts on these animals cannot be surmised from our limited observations.



Figure 17: Wolverine at Scidmore Cut

Harbor seals are extremely susceptible to human disturbance when hauled out on land or ice during their pupping and molting times. Harbor seal numbers have been declining in Glacier Bay for at least 10 years and thus human disturbance of harbor seals is a great management concern. We found potential for disturbance from campers in several sites in the Beardslee Island, the southern tip of Leland Island, and at all sites within McBride Glacier Inlet.

Other Animals

We observed boreal toads in several locations including east of Lamplugh Glacier, southeast of Gloomy Knob, Ptarmigan Creek, Composite Island, and in the Beardslee Islands. Boreal toads and other amphibians are declining in the region and throughout the world. It is unlikely that campers contribute to this decline. Spawning salmon were observed in 11 survey areas. Not only are spawning salmon sensitive to disturbance by people walking in the creek bed, these areas also attract bears, wolves and other predators and thus indicate valuable resource to be protected.

Recommendations

Further research

We recommend that specific sites be periodically monitored for camper impacts using this study as a baseline. A random selection of sites of differing impact ratings in different portions of the bay should be repeatedly examined as indicators of the relative condition of the backcountry.

We also recommend that further studies be conducted on the distribution and abundance of several sensitive species as well as the effects on human disturbance on these species.

Of special concern are shore-nesting birds, harbor seals, cormorants, scoters, harlequins, brown bears, and den sites of river otter, wolves and coyotes. Currently studies are under way examining the effects of human disturbance on several species of shore-nesting birds, and evaluating habitat and bear activity in several areas of concern in the bay. The results of these studies will be helpful in evaluating the ecological impacts of campers on these sensitive species.

Seasonal Closures

We recommend that in the future, areas of concern be considered for seasonal closures to protect shore-nesting birds, harbor seal haul-out areas, important bear habitat, and den sites of terrestrial predators such as river otter, wolves and coyotes.

With colonial nesting birds such as gulls and arctic terns, it is possible to identify areas of high nesting density that can be closed seasonally to people, thus including a high percentage of these birds' nests in the bay in the closures. For birds such as black oystercatchers, semipalmated plovers, spotted sandpipers, sparrows, and orange-crowned warblers with individual nests scattered over wide areas, closures are likely to protect only a small percentage of these birds' nests in the bay. Although it is possible that some birds, such as black oystercatchers, may actually benefit from the presence of people which tend to ward off predators such as canines and bears, it can be assumed that most or all ground-nesting birds would benefit from reduced people traffic in the areas that they are nesting. Closures during the nesting season in areas of concentrated nests are an obvious solution to nesting disturbance from people for some birds. Seasonal closures at glacial outwashes should be considered pending results of the current shore-nesting bird study. If additional closures should become a management priority, we would recommend the following islands as candidates for closure from May-July due to high levels of nesting activity we observed:

- Sealers Island
- The small unnamed island south of Tlingit Point
- The unnamed island at the mouth of Charpentier Inlet.

We would also recommend seasonal closures be considered in the following areas due to high numbers of hauled out seals during pupping (June) and molting (August) times.

- Southern tip of Leland Island
- McBride Inlet
- Active haul-outs areas in the Beardslee Islands

Likewise areas of high quality bear forage and suspected or known denning areas of other terrestrial predators should be considered for closures to reduce the negative impacts of campers on the ecosystem, pending further studies.



Spotted sandpiper emerging from its egg, near Scidmore cut

Education

Continuing education in “no trace” camping ethics will help keep human impacts in Glacier Bay low. Educating backcountry users on bird nesting behavior, nesting habitat, and the importance of avoiding nesting birds would help reduce nesting disturbance for birds. We also recommend expanding the current camper education to include detailed information of animal sign and key habitats to watch for when selecting campsites in order to minimize impacts on animals. It is important to include boaters, as well as kayakers, in this education effort, as people from boats often go to shore for the day without the benefit of the extensive backcountry orientation that is given to kayakers who will be camping.

Acknowledgements

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Twardock, Paul. Director and Assistant Professor of Outdoor Studies. Alaska Pacific University, 4101 University Drive, Alaska, 99508-4672.

Appendix I

Field Protocol And Data Collection Sheet

Survey Areas

ArcView GIS® was used to determine where sampling efforts should be focused within the bay. Since 1996, GLBA management has requested campers identify locations of their campsites. Consequently, more than 8,000 campsite locations are in GLBA's 'camper database'. In order to rank camping areas by use intensity, 100 m buffers were placed around each reported camp, boundaries dissolved and the number of sites within resulting polygons analyzed. Polygons containing 10 or more camps within them will be sampled. Importantly, crews will not only assess the highest use sites but rather the entire area within which the site exists, also called a survey area.

Crews walk the beach surrounding high use areas and determine the boundaries of the survey areas. Boundaries are delimited by geographical constraints such as sheer walls, talus, or dense vegetation. If geographical constraints are not present, crew members arbitrarily create survey area boundaries surrounding what appeared to be the center of human use. Survey area limits are established as the crew walks the beach to: 1) establish precise locations for the high use site(s) identified in the camper database, 2) identify other campsites for assessment, and 3) record signs of animal and human activity in the area.

While walking the survey area, crews record; sign of humans, including footprints, trash, trails, etc; observations and signs of animals including tracks, scat, nests, etc; and campsite locations. Observations and campsite locations are recorded on plastic laminated aerial photos (ranging in scale from 1:2000 to 1:6000). The precise locations of survey area boundaries, campsites, and nests and dens are determined with global positioning system units (GPS). Opportunistic bear hair samples will also be collected and GPS waypoints taken.

Site Selection and Boundaries

Attempt to assess/measure Wilderness Camp Impacts on ALL established sites within each survey area. These will be the sites showing any evidence of use or, if no sites show

evidence of use, choose a site that you think is the most likely to be used by campers within the survey area.

Determine a center point from which to conduct the survey and from which to take a waypoint. If the site has multiple areas of use or “satellite sites,” choose the area showing the greatest evidence of use or the central area if all show equal use. Include the satellite sites in the sketch and measure the length and width of each and record this under Other Observations at Site or in the sketch. It will be necessary here to decide if this is one site made up of a main area and its satellites or if it is multiple sites. Factors such as distance between the areas of use, trails joining them, and terrain obstacles between them should be considered. Give reasons for your decision in the Other Observations at Site section.

Overall Site Information

Observers: ND BH TL

Circle the initials of the people conducting the research at the given site. (Nat Drumheller, Bonnie Harris, Tania Lewis)

Date: 2003_____

Enter the date for the day the data sheet is being filled out. Enter the date in the following form: Year, Month, Day. Ex) **2003** 06 29

Time:

Enter the time of day at which you begin to enter data onto the data sheet. Use military time. Examples: 10:40, 14:20.

Site Name:

Assign a name to the site being assessed and enter it here. The name should correspond to land or water features relevant to the site. Examples: East Beartrack Cove, Spit west of Blue Mouse, southern site Scidmore Cut.

GPS:

Unit A (GBNP Trimble GeoExplorer) or B (KLG0 Trimble GeoExplorer) or C (Garmin3). In 2003 we will most likely be using Unit A exclusively.

File#:

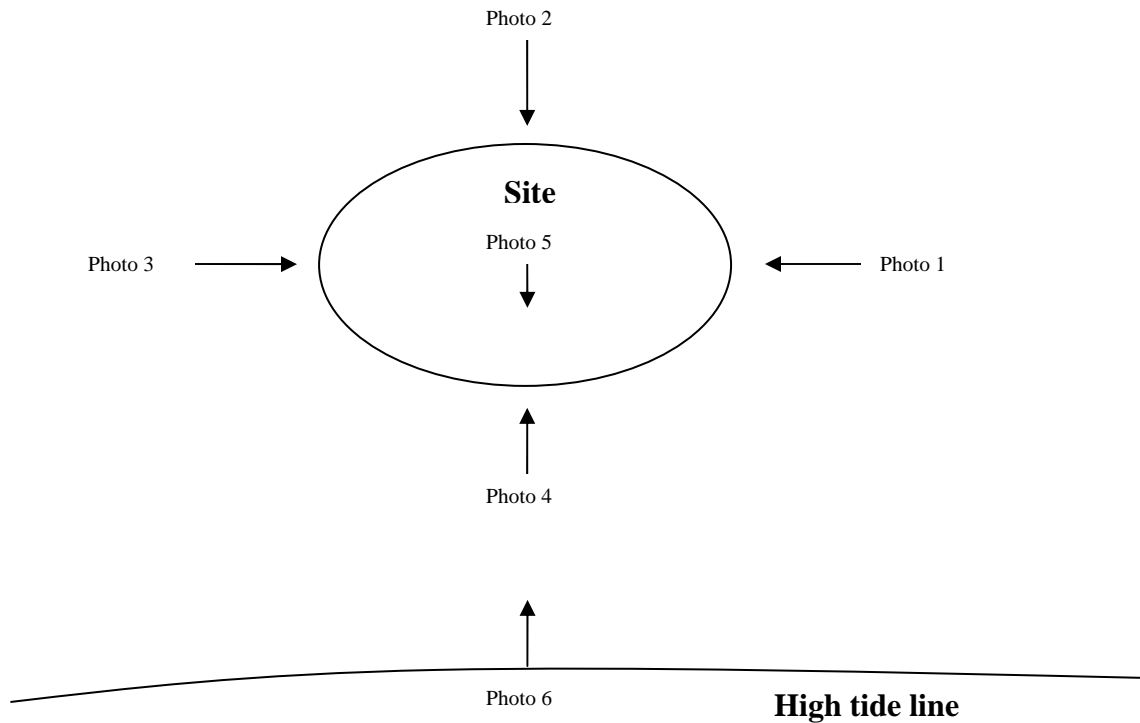
Write down the rover file number if using a Trimble GeoExplorer GPS unit. A new rover file will be started each day and should be written on each data sheet. If the Garmin3 is used, disregard rover file number.

Photo#s:

At least six photos should be taken of each site following the protocol below. Deviate from the protocol only if the circumstances of the site do not allow the protocol to be

followed. Take more photos if necessary to clearly show the entire site, satellite sites, and corresponding impact features. All people and gear should be out of the site for the photo with the exception of a single colored dry bag and the GPS unit placed at the designated center point so that it is visibly marked in the photos.

Take 4 photos from the outside of the site looking in, beginning on the right side of the site (when looking at it from the waterline) and rotating back, left, and then from the front. Then take photo from the center of the site looking at the water, and then go to the high tide line and take a photo looking back toward the site.



Record photo numbers as follows: **Year-Trip number-S- Frame number- A, B, C or D.** S stands for Sony and A, B, C, or D correspond to the letter of the memory card used. In the space for the frame numbers, enter all frame numbers shot separated by commas or a dash. Example: 2003-2-S-34,35-A.

Any additional photos taken and/or deviations from the above protocol should be marked on the site map and explained photo by photo in Other Observations at Site.

Waypoint:

Take the waypoint at the site center point. Enter the data waypoint number taken at the site. Example: 5.

Lat:

Enter the latitude in decimal degree format taken from the GPS unit for the site waypoint. Example: 58.45091.

Long:

Enter the longitude in decimal degree format taken from the GPS unit for the site waypoint. Example: 135.89290

Bear Site?:

If you suspect that a Bear Campsite Assessment survey was conducted in 2001 at the given site, circle **yes** and later we will enter the corresponding site number from the Campsite Assessment data (Bear Project). If you do not think there was a BCA survey conducted here, circle **no**.

BCA sites are numbered as follows: map number-site number (from the bear data.)

Examples: 11a-1, 2c-3.

Site Location:

Using local geographic features, write a brief description of the location of the site within the survey area. This is intended as an aid to someone trying to relocate the site. When reasonable, give distance measurements to reference objects such as rocks, cliffs, and trees. Example: This site is on the southern tip of the peninsula separating Rendu Inlet from Queen Inlet. It is just above the high tide line on a narrow shelf between a large rock outcropping 90m to the east and a steep slope 25m to the west.

Nests/dens:

Describe any observed or suspected birds nesting or animal dens in the vicinity of the site.

Survey Area Information

#Established sites in survey area:

Enter the number of established sites observed within the survey area. An established site is any site that shows evidence of past human use even if it is rated as a condition class 0.

Sites measured in survey area:

Enter the number of sites actually assessed within the survey area. This is every site for which a Wilderness Impact Data Sheet has been completed. Each site should be assessed (measured), but if for some reason time prevents this, a waypoint should be taken for each established site and its location with the corresponding waypoint number indicated on the survey area map. Keep separate notes on each non-measured established site including: the waypoint number, map number, the length and width

dimensions, evidence of human use/impact, observers' condition class rating, and photo numbers.

Map#:

Enter the number of the map being drawn for the area. These are usually aerial photos with numbers sequentially assigned before entering the field. Example: 112a

Inventory Parameters

Substrate of landing area: B C S O

The landing area is defined as the tidal beach area directly below the site. The letters correspond to boulders, cobble, sand, and organic. Circle the substrate that best describes the landing area. Two substrates may be circled if one does not dominate the landing area. This information is taken as an aid in identifying the site.

B=boulders(larger than fist-sized, includes bedrock.)

C=cobble(larger than sand, fist-sized or smaller)

S=sand

O=soil(includes clays to loamy soils in which there is a mixture of minerals and organic matter)

Substrate of campsite: B C S O

Circle the letter of the corresponding substrate using the definitions above that best describes the site being assessed. Two substrates may be circled if one does not dominate.

Aspect:

This is a compass reading using *magnetic north* (do not correct for declination). Stand with your back to the site, face out towards the tidal beach area directly below the site, and take a reading. Enter this reading. Example: 178. This is intended as an aid to relocating the site.

Predominant veg IN site:

Enter the vegetation type that best describes the vegetation within the site boundaries.

Use the following broad categories:

Sparse herbaceous* – Less than 80% ground coverage

Dense herbaceous* – Greater than 80% ground coverage

Open scrub – Easily penetrated bushes such as alder, willow or soapberry

Dense scrub – Alder, willow or soapberry that is difficult to walk through

Forest – Large trees such as spruce, hemlock or cottonwood

Graminoid – Grasses, sedges, or rushes

Dryas mat – predominantly *Dryas drummondii*

Other – describe

*Herbaceous here includes all non-woody vegetation (even moss). If the majority of the vegetation groundcover is graminoid or Dryas, choose one of those categories.

Predominant veg OFF site:

Enter the vegetation type (See above) that best describes the vegetation outside of the site boundaries within the “control” area. When selecting the control area, attempt to choose an area that is similar to the IN site area. For instance, if the site is on herbaceous beach meadow, the control area should be the herbaceous beach meadow to either side of the site and not in scrub above the site or on halophytic herbs below the site.

Observers’ Rating:

Assign the site a condition class using the following definitions:

0 = Campsite barely distinguishable: no or minimal disturbance of vegetation and/or organic litter. May be a possible/likely camping location, an old campsite that has not seen recent use, or a location of recent one-time use with no signs of permanent damage. May find evidence of a rock tent ring.

1 = Obvious vegetation difference between site and “control” areas indicate impacts of repeated use. Impacts may be subtle such as smaller “tougher” vegetation growing within site while taller more sensitive species growing outside of site. Site shape may indicate the cause of this difference in vegetation to be from human use as opposed to natural causes. May find evidence of a rock tent ring.

2 = Ground vegetation worn away from around center of activity. If vegetation is sparse or non-existent in site and control area, soil is compressed at center of activity.

3 = Ground vegetation lost (compared to control) on greater than half of the site, but humus and litter (if applicable) still present in all but a few areas.

4 = Bare mineral soil obvious (if control is vegetated). Tree roots exposed on the surface.

5 = Soil erosion obvious. Trees reduced in vigor or dead.

Write additional comments and draw a detailed sketch of the site, using the tape measure and range finders to measure distances of suspected impact and record them on the site sketch.

Site Dimensions:

Measure in meters the length and width of the site and enter it here. Example: 6 x 3.5

Other Observations at Site:

This field is for written descriptions or explanations of procedures, observations, difficulties, etc. that are not captured in the data collected and might be of relevance.

Signs human use/impact: Ex) trash, footprints, trailing, damage to trees, soil compaction, fire evidence, human artifacts (toilet paper, rock rings from tents, benches, etc.). Did you change/improve the site? (Pick up trash, bury human waste, scatter a fire ring, etc.).

Dominant plant species IN and Off site: List most predominant 3-5 species both in and off site. If there is a difference between the two that appears to be non-human caused, please explain.

Sensitive species: Describe any potential sensitive plant and animal species in the area that may be affected by campers at this site.

Site suitability for long-term monitoring: Describe factors that might make this site good for long-term monitoring. Examples include heavy human impacts, presence of sensitive species, particular attractions at site for campers such as view or proximity to drop-off, etc.

Other thoughts or observations: This is a space to list any impressions or anecdotal information about the site or surrounding area that may be relevant to this study. This is also the place to list frame numbers of and describe additional or alternate photos taken.

Site Map:

Draw a map of the site showing the center point, a rough site perimeter, natural features and objects that will aid in relocating the site and the center point, trails, and the points from which any additional or alternate photos were taken. Indicate true north on the map. Record all distances. Show the sea or beach, streams, dens or nests, the woods, etc.

Be sure to mark site (with associated waypoint number) on the data collection aerial photo of the survey area.

Wilderness Impact Data Form				SiteID#:
Observers:	Date:	Site Name:	Time:	
GPS:	File#	Photos: 2003 - - S -	A B C D	
Waypoint:	Lat:	Long:	Bear Site? yes no	
Site Location:				
Nests/dens:				
Survey Area Info				
# established sites in survey area:		# sites measured in SA:	Map #:	
Inventory Parameters				
Substrate of landing area: B C S O		Substrate of campsite:	Aspect:	
Predominant veg IN site:		Predominant veg OFF site:		
Observers' rating: 0 1 2 3 4 5		Site Dimensions:		
OTHER OBSERVATIONS AT SITE:				
Human Use/ Impacts: note trash, footprints, trailing, damage to trees				
Dominant plants IN and Off site:				
Sensitive species observed or suspected:				
Is site suitable for long-term monitoring, why?				

Other thoughts or observations of site or survey area:

SITE MAP - include direction of true north and record distances when possible

Appendix II

Final Impact Rating Formula

Observers' Rating + Size + Long-lived Impacts + Short-lived Impacts = Impacts Rating

Corresponding values of the resulting Impacts Ratings: (0-2 = Low**), (3-5 = Medium), (≥ 6 = High)

**If a site has an Impacts Rating of 0, it is necessary to determine whether the value for the site is None or Low. A site that shows evidence of camping with an Impacts Rating of 0 = Low. A site that shows no evidence of camping with an Impacts Rating of 0 = None. A site shows evidence of camping if one or more of the short-lived impacts boxes is checked or if the observers describe evidence of use in the site observations. If none of the short-lived impacts boxes are checked, the observers give no evidence of use, and the Impacts Rating = 0, then the Impacts Rating value is None (enter N.)

Below are instructions for coming up with the numbers to plug into the formula.

Observers' Rating: Enter the Observers' rating assigned to the site (0-5).

Size: Enter 0 for a small site or 2 for a large site. A small site is less than 250 square meters in size with 2 or less satellite sites. A large site is ≥ 250 square meters and/or has 3 or more satellite sites. To determine the square meter size of a site include the main site and all satellite sites.

Long-lived Impacts: Enter 0 if no long-lived impacts are present. Enter 1 if one or more long-lived impacts are present. Long-lived impacts are fire pits above the intertidal and social trailing. Do not include missing or worn vegetation as this is already accounted for in the Observers' Rating. (Note: burned wood above the intertidal that is not associated with the remains of a fire does not count as a long-lived impact.)

Short-lived Impacts: Enter 0 if there are three or fewer short-lived impacts. Enter 1 if there are four or more short-lived impacts. The following is a list of short-lived impacts.

- Rock rings -This includes any evidence of rock rings.
- Campfires below the intertidal -This refers to fire pits or evidence of the remains of a fire. Burned wood does not count, since it could have washed up from another location.

- Trash -This includes trace trash, micro-trash, tent stakes, nails, hand-held radios, ear plugs, etc.
- Human waste -This refers to human waste or piles of toilet paper found above the intertidal.
- Firewood piles -This refers to sticks or other wood gathered or piled as if to be used for fuel.
- Footprints
- Structures such as cairns and driftwood benches. -These are objects made or arranged by campers from natural materials. This does not include Camper Drop-off cairns, old cabins, or other relics.

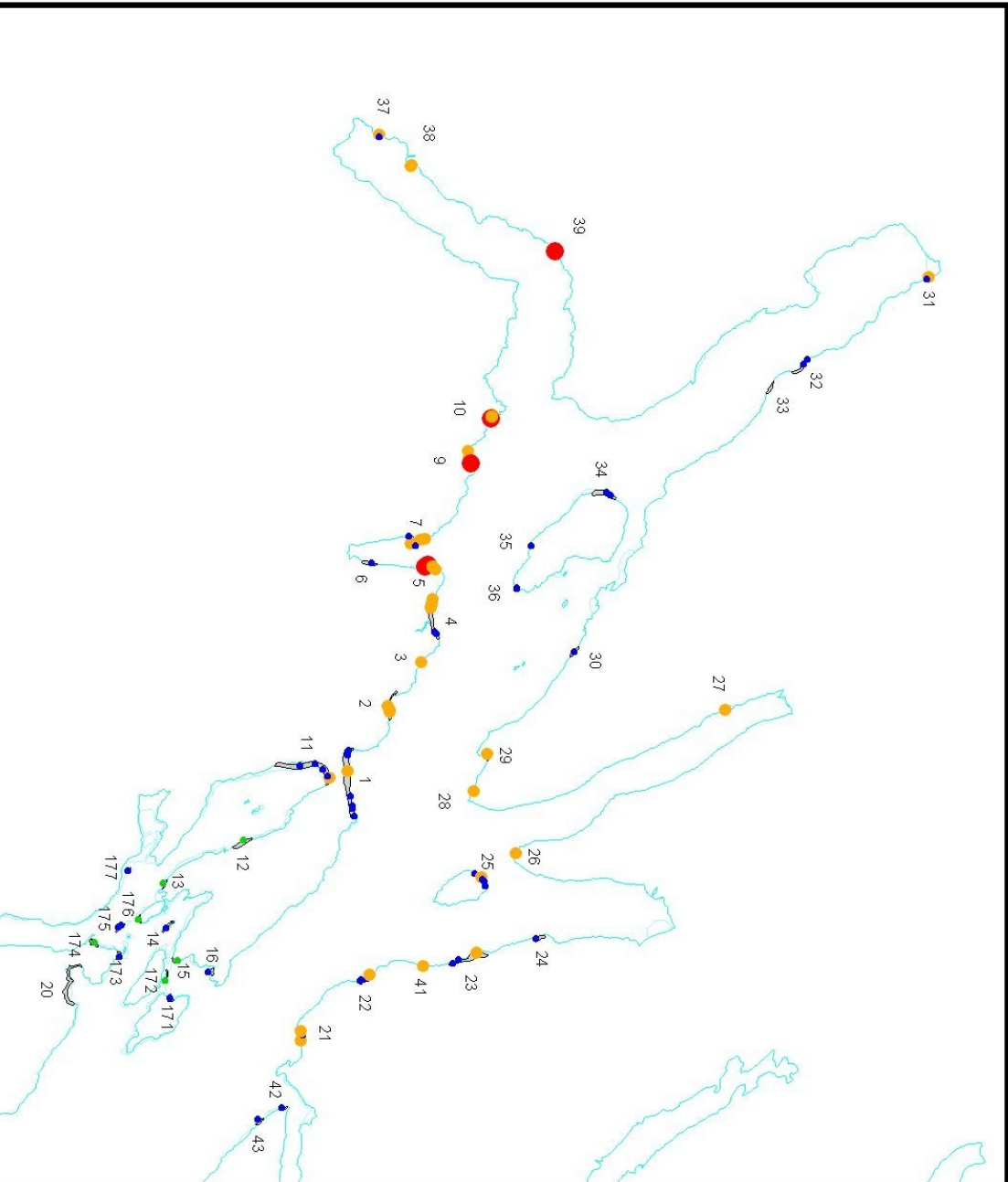
Appendix III

Survey Area Maps and Summaries

Survey Areas and Campsites with Impact Ratings

Lower Bay, Glacier Bay

National Park Service
U.S. Department of the Interior



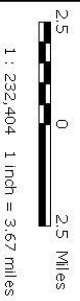
Impacts.shp

- None
- Low
- Medium
- High

Map Location



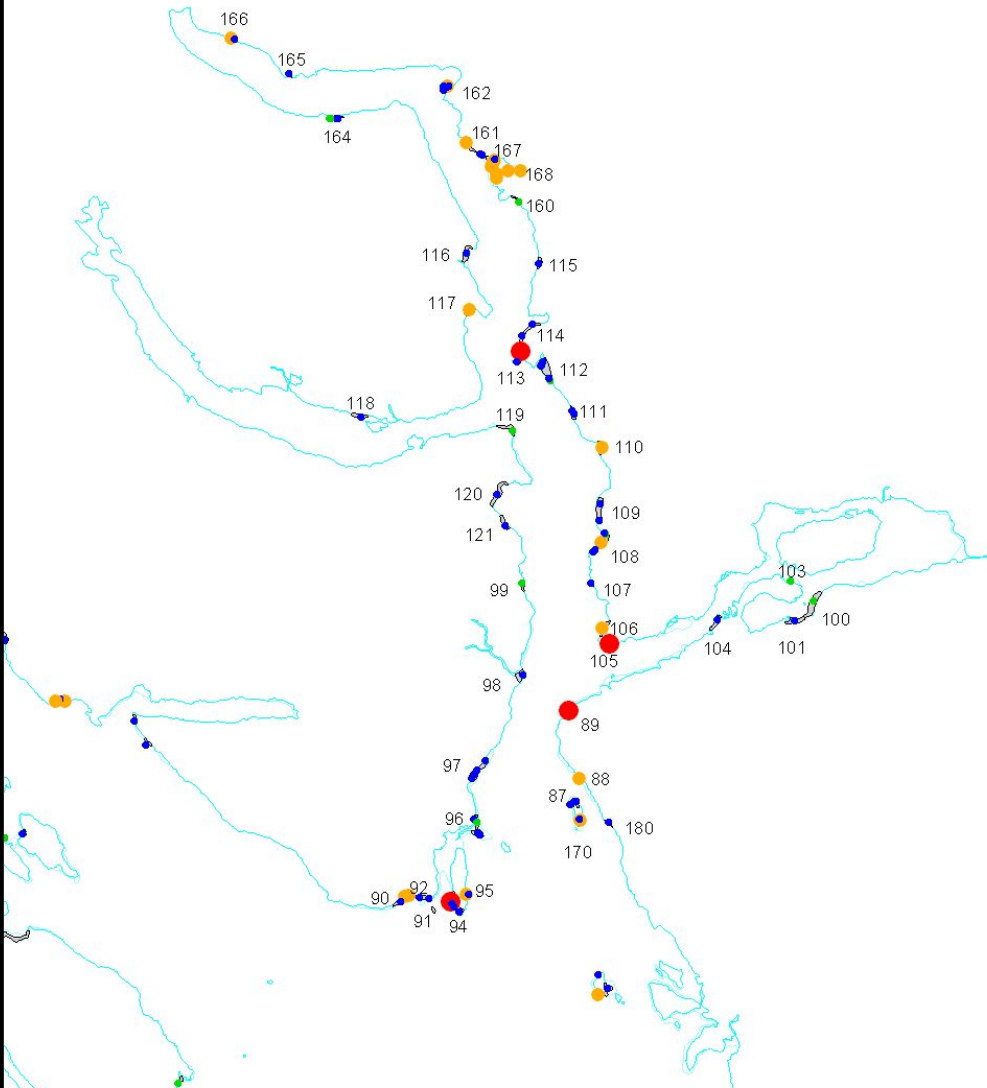
Biological Resources
Glacier Bay National Park
and Preserve



December 10, 2003

Survey Areas and Campsites with Impact Ratings

Muir Inlet, Glacier Bay



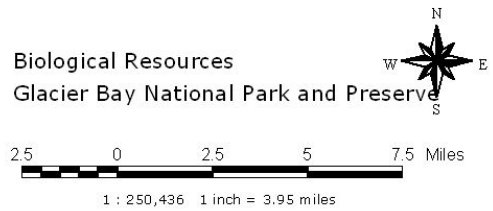
Impacts.shp

- None
- Low
- Medium
- High

Map Location



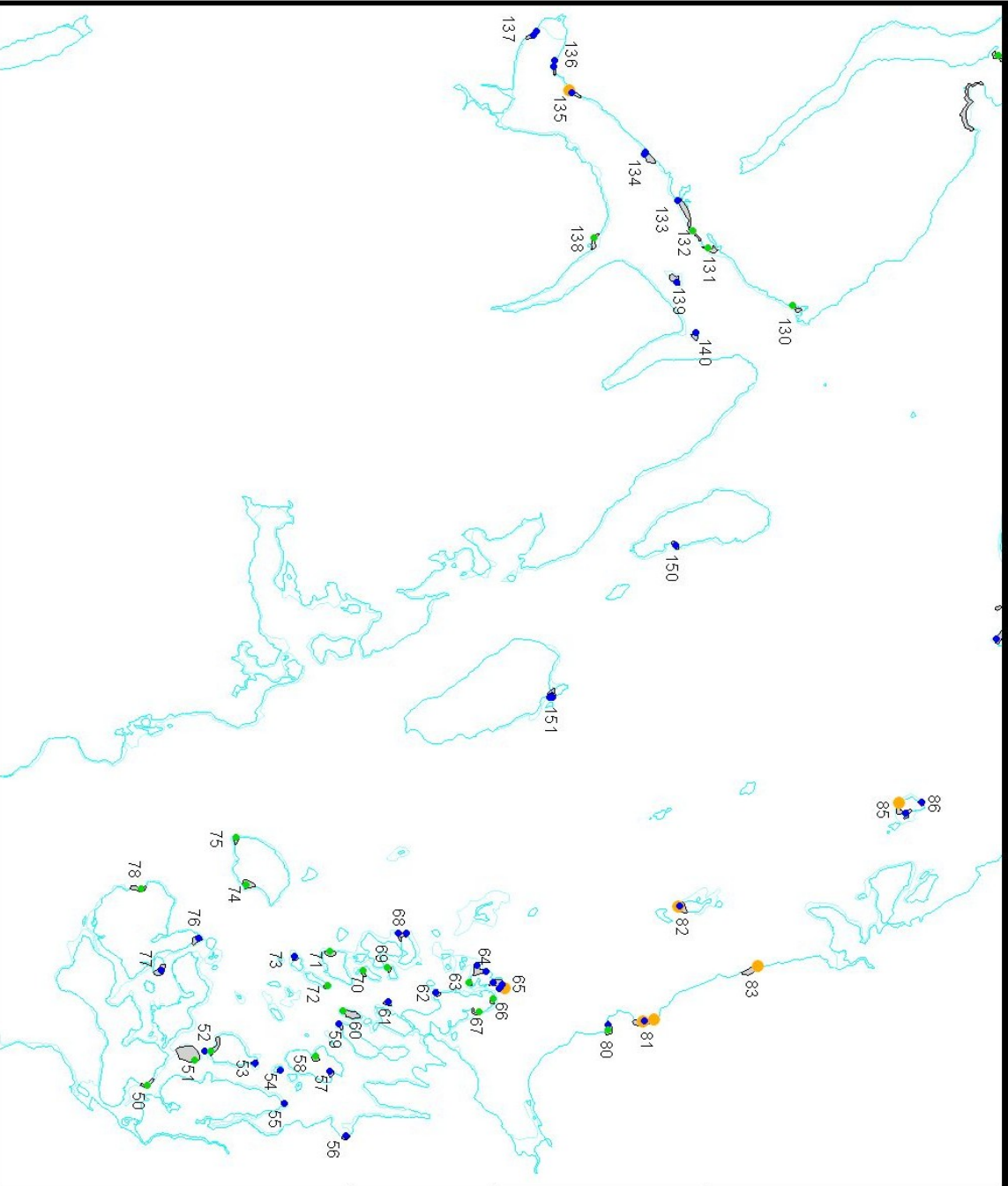
Biological Resources Glacier Bay National Park and Preserve



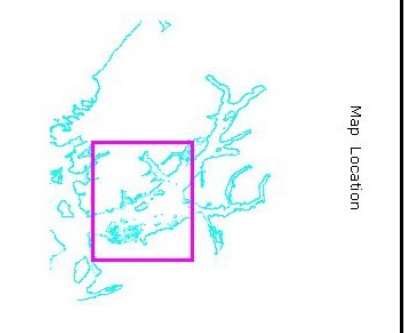
December 10, 2003

Survey Areas and Campsites with Impact Ratings Lower Bay, Glacier Bay

National Park Service
U.S. Department of the Interior



- Impacts.shp
- None
 - Low
 - Medium
 - High



Biological Resources
Glacier Bay National Park
and Preserve

1 : 252,765 1 inch = 3.99 miles

November 28, 2003

1 Scidmore Cut Beach

Eight established sites, Impact Rating: 7 sites - Low, 1 site - Medium. 8 sites with rock rings and 2 with supratidal fire pits. Trace trash found between sites. Area is attractive to kayakers who are waiting to get through the high-tide cut into Scidmore Bay, and the western end of the survey area has historically been used as a camper drop-off location. Sensitive species observed include nesting semi-palmated plovers, nesting spotted sandpipers, oystercatchers, wolverine, river otter sign and abundant bear foods and sign.

2 First Cove Northwest of Scidmore Cut

Three established sites: Impact Rating: 3 sites - Medium. 3 sites with rock rings, 2 with trash, 1 with human waste, and 1 with footprints. Area is attractive to campers en route from the camper drop-off to the glaciers of the West Arm. Sensitive species observed include nesting spotted sandpipers, nesting oystercatchers, wolf sign and brown bear with cubs.

3 Small Beach East of Long Beach East of Ibach Point

One established site, Impact Rating: Medium. Site contained rock ring, human waste, and footprints. Area is attractive to campers en route from the camper drop-off to the glaciers of the West Arm. Sensitive species observed include nesting oystercatchers, nesting ptarmigan, river otter sign, possibly denning marmot, and abundant bear sign.

4 Long Beach East of Ibach Point

Six established sites, Impact Rating: 3 sites - Low, 3 sites - Medium. 6 sites with rock rings, 3 with trash, 1 with footprints. Very little human evidence east of the central creek. Area is attractive to campers en route from the camper drop-off to the glaciers of the West Arm. Sensitive species observed include nesting oystercatchers, nesting mew gulls, nesting ptarmigan, nesting sparrows, denning marmots, river otter sign, small salmonids, and abundant bear foods and sign.

5 Reid Inlet, Ibach Point

Four established sites: Impact Rating: 2 sites - Medium, 2 sites - High. 2 sites with supratidal fire pits, 4 with rock rings, 2 with trash, 1 with human waste, 1 with structures, and 3 with footprints. This area is very attractive to campers as it offers views of Reid Glacier, and receives day-use from people off of boats anchored in Reid Inlet. Sensitive species observed include nesting oystercatchers, nesting ptarmigan, nesting sparrows, arctic terns, mew gulls, pelagic cormorants, spotted sandpipers, scoters offshore, river otter sign, wolf sign, and abundant bear foods and sign.

6 Head of Reid Inlet, East Side

One established site, Impact Rating: Low. Site contained rock rings and footprints. This area has potential to be attractive to campers as it is directly adjacent to Reid Glacier, and receives day-use from people off of boats anchored in Reid Inlet. Sensitive species observed include nesting mew gulls, parasitic jaegers, oystercatcher nest, and bear sign.

7 Reid Inlet, Western Side of Mouth

Five established sites, Impact Rating: 2 sites - Low, 3 sites - Medium. 2 sites with supratidal fire pits, 5 with rock rings, 2 with trash, 1 with structures, and 5 with footprints. This area is very attractive to campers as it offers views of Reid Glacier and contains the historic Ibach Cabin remains. For these reasons the area also receives day-use from people off of boats anchored in Reid Inlet. Sensitive species observed include nesting ptarmigan, nesting least sandpipers, nesting semi-palmated plovers, nesting spotted sandpipers, nesting oystercatchers, nesting sparrows, nesting bald eagles, possibly nesting arctic terns, spawning pink salmon, river otters, and abundant bear sign.

9 Ptarmigan Creek

Three established sites, Impact Rating: 2 sites - Medium, 1 site - High. 1 site with trailing, 1 site with supratidal fire pit, 3 sites with rock rings, 1 site with intertidal fire pit, 2 sites with trash, 1 site with human waste, 1 site with firewood, and 3 sites with footprints. Cut branches found near 1 site. This area is attractive to campers because it is the last large campable area with fresh water before turning into Johns Hopkins Inlet. Sensitive species observed include nesting oystercatchers, nesting mew gulls, suspected nesting semi-palmated plovers and spotted sandpipers, nesting bank swallows, river otters, and brown bear.

10 Mary's Beach, East of Lamplugh Glacier

Three established sites, Impact Rating: 2 sites - Medium, 1 site - High. 3 sites with trailing, 3 sites with rock rings, 1 site with intertidal fire pit, 1 site with trash, 1 site with human waste, and 1 site with footprints. A trail along the beach berm heads up the valley to the west, eventually reaching an overview of Lamplugh Glacier. This area is attractive because of this access to a view of Lamplugh Glacier and also because it is the last easily campable beach before turning into Johns Hopkins Inlet. Sensitive species observed include nesting oystercatchers, denning marmots, nesting barn swallows, nesting sparrows and warblers, nesting bald eagles, nesting spotted sandpipers, boreal toads, river otter sign, and bear sign.

11 Scidmore Bay, Northern End

Six established sites, Impact Rating: 5 sites - Low, 1 site - Medium. 1 site with supratidal fire pit, 6 with rock rings, 2 with trash, and 2 with footprints. This area is attractive to kayakers waiting to get through the high-tide cut from Scidmore Bay to the West Arm. Sensitive species observed include nesting arctic terns, nesting semi-palmated plovers, nesting mew gulls, nesting spotted sandpipers, nesting ptarmigan, wolf, black bear and brown bear. Common mergansers, harlequin ducks, and white-winged scoters in, or near, Scidmore Glacier outwash on southern end of survey area.

12 Scidmore Bay, East Side

No established sites found, only trace trash and intertidal burnt wood in this survey area. This area holds no particular attraction to campers other than it is a long open beach in the middle of Scidmore Bay. Evidence of sensitive species observed include wolf and bear sign.

13 Entrance to Scidmore Bay, Eastern Shore

No established sites found in this survey area. This area holds no particular attraction to campers other than it is a scenic point overlooking the mouth of Scidmore Bay. Evidence of sensitive species observed was bear sign.

14 Small Island in Hugh Miller West of Blue Mouse Cove

One established site, Impact Rating - Low. Site contained trailing, trash and footprints. This area holds no particular attraction to campers but offers scenic island camping in Hugh Miller Inlet. Sensitive species observed include oystercatchers, river otter sign, and bear sign.

15 West Blue Mouse Cove - North of Cut to Hugh Miller

No established sites and no evidence of human use found in this survey area. This area holds no particular attraction to campers except as a place to camp while waiting to get through the tidal cut from Blue Mouse Cove into Hugh Miller Inlet. Evidence of sensitive species observed was bear sign.

16 Blue Mouse Cove

One established site, Impact Rating - Low. Cut branches at site and trace trash found in survey area. This area holds no particular attraction except for years when it is used as a camper drop-off location. It is also very close to the Blue Mouse Cove floating ranger station, which may be an attraction to some campers and a deterrent to others. Sensitive species observed include spawning pink salmon, oystercatchers, spotted sandpipers, and bear sign.

20 Sundew Cove

This survey area was not surveyed for the Wilderness Camp Impact project. Surveys during the Bear Campsite Assessment project, however, found several established sites containing trampled vegetation, footprints, and an intertidal fire pit. This area is attractive to campers during years that it is used as a camper drop-off. Sensitive species observed include oystercatchers with chicks, common mergansers with chicks, spawning pink salmon, wolf sign and bear sign.

21 Southeast of Gloomy Knob

Three established sites, Impact Rating: 1 site - Low, 2 sites - Medium. 1 site with trailing, 3 sites with rock rings, 1 site with human waste, 1 site with firewood, 3 sites with footprints. This area is attractive to campers who want to climb Gloomy Knob or hike to Vivid Lake. Sensitive species observed include spawning pink and sockeye salmon, boreal toads, wolf sign, river otter sign, mountain goat sign, and bear sign.

22 Northwest of Gloomy Knob

Four established sites, Impact Rating: 3 sites - Low, 1 site - Medium. 4 sites with rock rings, 2 with footprints. One attraction of this area may be a hiking route to Vivid Lake. Sensitive species observed include nesting oystercatchers, spawning pink and sockeye salmon, semi-palmated plover, spotted sandpiper, river otter sign, and bear sign.

23 Queen Inlet, 2nd Drainage South of Carroll Glacier

Four established sites, Impact Ratings: 3 sites - Low, 1 site - Medium. 2 sites with supratidal fire pits, 4 sites with rock rings, 2 sites with trash, and 1 site with footprints. This area is especially attractive to campers when the camper drop-off is located about 1 mile to the south and this is the nearest campable meadow. Sensitive species observed include mew gulls and arctic terns with young, nesting oystercatchers, spawning pink salmon, spotted sandpipers, wolves and a brown bear.

24 Queen Inlet, 1st Drainage South of Carroll Glacier

One established site, Impact Rating - Low. Site contained rock rings and footprints. This area offers no particular attraction except that it is relatively close to the Queen Inlet camper drop-off. Sensitive species observed include oystercatchers, wolf sign, a brown bear, and a large number of scoters just offshore.

25 Composite Island, North End

Six established sites, Impact Rating: 5 sites - Low, 1 site - Medium. 5 sites with rock rings. This area is attractive to campers who are en route from the Queen Inlet drop-off to Rendu Inlet or north to the glaciers. Sensitive species observed include possible nesting oystercatchers, merlin with young, warblers and sparrows with young, river otter sign, and bear sign.

26 Mouth of Rendu Inlet, Eastern Shore

One established site, Impact Rating: Medium. Site contained rock ring and trash. This area is somewhat out of the way and probably only gets use from kayakers exploring Queen and Rendu Inlets. Sensitive species observed include nesting oystercatchers, river otter sign, and a brown bear.

27 Rendu Inlet, Romer Glacier Outwash

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. 1 site with supratidal fire pit, 2 with rock rings, 1 with trash, and 2 with footprints. This area is one of the few suitable camping areas near the head of Rendu Inlet. Sensitive species observed include nesting oystercatchers, wolf sign, river otter sign, brown bears and bear cub sign.

28 First Beach West of Mouth of Rendu Inlet

One established site, Impact Rating: Medium. Site contained rock rings, firewood and footprints. This area is near the Rendu camper drop-off location. Sensitive species observed include oystercatchers, river otter sign and bear sign.

29 Rendu Camper Drop-off

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. 1 site with trailing, 2 sites with rock rings, 1 site with intertidal fire pit, 2 sites with footprints. Remains of cairn in area, possibly from camper drop-off. This area is used most heavily in years when the camper drop-off location is here. Sensitive species observed include nesting spotted sandpipers, oystercatchers, river otter sign and bear sign.

30 Mainland North of SE Tip of Russell Island

One established site, Impact Rating: Low. Site contained rock ring. This area offers no particular attraction to campers. Sensitive species observed include nesting spotted sandpipers, possible eagle nest inland from beach, river otter sign, bear sign.

31 Northeast Tarr Inlet

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. 1 site with trailing, 1 site with rock rings, 1 site with trash, 1 site with human waste, and 1 site with footprints. Survey area contains a trail up a knoll with the remains of a rock cairn on it. This area's greatest attraction is spectacular views of Marjorie and Grand Pacific Glaciers. Sensitive species observed include nesting spotted sandpipers and bear sign.

32 Mid-Tarr Inlet, Beach NW of Large Outwash on East Side

Two established sites, Impact Rating: 2 sites - Low. Both sites with rock rings and 1 with trash. This area would likely only be used by kayakers heading up Tarr Inlet. Sensitive species observed include oystercatchers, spotted sandpipers, least sandpipers, wolf sign and a brown bear.

33 Mid-Tarr Inlet, Large outwash on East Side

No established sites found in this survey area. This area would likely only be used by kayakers heading up Tarr Inlet. Sensitive species observed include ptarmigan with young, oystercatchers with young, possibly nesting spotted sandpipers, common redpolls with young, mew gulls, arctic terns, river otter sign, wolf sign, and bear sign.

34 Northwest Russell Island

Two established sites, Impact Rating: 2 sites - Low. Both sites with rock rings, and 1 with trash. This area hold no particular attraction to campers except for scenic views of the West Arm. Sensitive species observed include nesting spotted sandpipers, oystercatchers, warblers and sparrows with young, ptarmigan with young, river otter sign, and bear sign.

35 Southwest Russell Island

One established site, Impact Rating - Low. Site contained rock rings. This area hold no particular attraction to campers except for scenic views of the West Arm. Evidence of sensitive species observed include abundant river otter sign and bear sign.

36 Southeast Russell Island

Two established sites, Impact Rating: 2 sites - Low. Both sites contained rock rings. This area hold no particular attraction to campers except for scenic views of the West Arm. Sensitive species observed include warblers with young, scoters off shore, river otter sign, and bear sign.

37 Johns Hopkins Head, West Shore

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. Both sites with rock rings, 1 site with trash and 1 site with human waste. This area is the closest possible campsite to Johns Hopkins Glacier and offers a spectacular view. It is, however, difficult to get to at times of heavy ice and questionable in safety due to calving induced waves. Sensitive species observed include harbor seals hauled out on icebergs, kittiwakes, glaucous-winged and mew gulls.

38 Johns Hopkins, Chocolate Falls (Seal Camp)

Two established sites, Impact Rating: 2 sites - Medium. Both sites with trailing and rock rings, 1 site with trash, and 1 site with footprints. The area has worn trails up a rocky knoll and erosion from human use is evident. This area is very close to Johns Hopkins Glacier and offers a spectacular view. It is also difficult to get to at times of heavy ice. The area has been used as a harbor seal research camp for several weeks per summer from 1991-2002. Sensitive species observed include harbor seals hauled out on icebergs, nesting oystercatchers, and bear sign.

39 Topeka Outwash

Two established sites, Impact Rating: 1 site - Medium, 1 site - High. 1 site with trailing, 2 with rock rings, 1 with trash, and 2 with footprints. This area has been closed to camping since the early 1990s due to bear problems. The exception to this rule is Alaska Discovery, the Park guided kayaking concessionaire, has been allowed to camp there since year 2000. If this area were to open to the general public for camping, the attraction would be a large open campable area at the mouth of Johns Hopkins inlet with spectacular views and access into the inlet. Sensitive species observed include mew gulls with young, oystercatchers and arctic terns with suspected young, spotted sandpiper nests, ptarmigan with young, and bear sign.

41 Queen Inlet, Camper Drop-off

One established site, Impact Rating: Medium. Site contained trailing, rock ring, trash, firewood, structures, and footprints. Two rock cairns are present on beach, probably from drop-off. Area is likely only attractive to campers when it is a drop-off location because there is little campable terrain and there is a high danger of rocks falling onto this area. Sensitive species observed include nesting oystercatchers, spotted sandpipers with young, and bear sign.

42 Point at the Mouth of Tidal Inlet, South Shore

One established site, Impact Rating: Low. Site contained rock rings. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include nesting eagles, oystercatchers with young, river otter sign and bear sign.

43 Tiny Peninsula 1 Mile South of Tidal Inlet

One established site, Impact Rating: Low. Site contained rock rings, intertidal fire pit, and footprints. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include nesting oystercatchers, spotted sandpipers, wolf sign, river otter sign and bear sign.

50 Northeast Lester Island

No established sites found in area and no other evidence of human use. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter and bear sign.

51 Island North of Lester

No established sites found in area and no other evidence of human use. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include blue grouse with young, coyote sign, river otter sign and bear sign.

52 South Tip of Island South of Kidney Island

One established site, Impact Rating - Low. Site contained rock ring. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include blue grouse with young, nesting crows, oystercatchers, river otter sign and bear sign.

53 North End of Island South of Kidney Island.

One established site, Impact Rating - Low. Site contained trailing and rock rings. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter sign, coyote sign, and bear sign.

54 South Kidney Stone Island

One established site, Impact Rating - Low. Site contained rock rings, trash, and human waste. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter sign and bear sign.

55 South Hutchins Bay, Mainland peninsula East of Kidney island

One established site, Impact Rating - Low. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include nesting ravens and river otter sign.

56 Hutchins Bay

One established site, Impact Rating - Low. Site contained supratidal fire pit. This area is one of the few places in the Beardslee Islands that has a consistent supply of fresh water. Evidence of sensitive species observed include river otter sign and bear sign.

57 Northeast Kidney Island

One established site, Impact Rating - Low. Site contained rock rings and firewood. Rock cairn in survey area. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter sign, coyote sign and bear sign.

58 Northwest Kidney Island

No established sites found in area and no evidence of human use except for a dilapidated small shack in woods. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include spotted sandpiper, river otter sign and bear sign.

59 Southern tip of Link Island

One established site, Impact Rating - Low. Site contained rock rings. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include nesting oystercatchers, nesting warblers, river otter sign, coyote sign, and a black bear. Survey area is near seal haulout.

60 Small Island West of South Tip of Link Island

No established sites found in area and no other definitive evidence of human use. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include nesting oystercatchers, semi-palmated plovers suspected nesting, river otter sign and a black bear with bear sign including den.

61 Tiny Island with SPIDER Geo-marker

One established site, Impact Rating - Low. Site contained trash. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter and bear sign.

62 Peninsula Due North of SPIDER Geo-marker

One established site, Impact Rating - Low. Site contained trailing. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include boreal toad, river otter sign and a black bear.

63 South End of Northern-most Island in the Beardslees.

No established sites found in area and no other definitive evidence of human use, but area contains abundant campable meadows. Area holds no particular attraction to campers unless they were passing by except for a possible waiting area for access through the high-tide cut into Beartrack Cove. Evidence of sensitive species observed include river otter sign and bear sign, including sign of cubs.

64 Southwest Corner of Northern-most Beardslee Island

Two established sites, Impact Rating: Both sites - Low. Both sites had rock rings and one had a structure. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include oystercatchers, river otter sign and bear sign.

65 Northern-most Tip of the Beardslees

Five established sites, Impact Rating: 4 sites - Low, 1 site - Medium. 1 site with trailing, 3 with rock rings, and 3 with trash. Survey area is at the northernmost tip of the Beardslee Islands in Beartrack Cove and is a natural stopping point for kayakers waiting to access the Beardslees through a high-tide cut. Sensitive Species observed include nesting oystercatchers, semipalmated plovers, spotted sandpipers, nesting sparrows, lady slipper orchid, river otter sign and bear sign including an old den and sign of cubs.

66 North Tip of Mainland, Beardslees

No established sites found in area and no other definitive evidence of human use. Area holds no particular attraction to campers unless they were passing by except for a possible waiting area for access through the high-tide cut into the Beardslee Islands. Sensitive species observed include raft of over 500 common mergansers off shore, sign of small weasel including den, sign of bear including den.

67 East Side of Peninsula West of Beartrack Cove

No established sites found in area and no other definitive evidence of human use. Area holds no particular attraction to campers unless they were passing by except for a possible waiting area for access through the high-tide cut into the Beardslee Islands. Evidence of sensitive species observed river otter sign, and sign of bear including den.

68 Island Due East of Boulder Island, West Side.

Two established sites, Impact Rating: both sites - Low. 1 site with supratidal fire pits, 2 with rock rings, and 1 with firewood. Area holds no particular attraction to campers unless they were passing by. Sensitive Species observed include a large flock (120) of oystercatchers, coyotes, and bear sign including possible den.

69 Island Due West of Tiny Island with SPIDER Geo-Marker.

No established sites found in area and no other definitive evidence of human use. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter sign including possible den, and bear sign.

70 Island Southwest of Spider Geo-marker, South Tip

No established sites found in area and no other definitive evidence of human use. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include oystercatcher nest, nesting hairy woodpecker, spotted sandpiper, nesting sparrows, river otter sign, black bear and a dug up den, possible coyote or river otter.

71 Island North of White crow Island with SOCK Geo-marker.

No established sites found in area and no other definitive evidence of human use except for historic wood and nail structure. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include river otter sign with possible den and a black bear .

72 Linear Island Northeast of White crow

No established sites found in area and no other definitive evidence of human use. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include river otter sign and black bears.

73 West White Crow Island

One established site, Impact Rating - Low. Site contains trailing and rock rings. Area holds no particular attraction to campers except for being on a southwest facing point at the southern end of the Beardslee Islands. This site receives use from harbor seal researchers 1-3 weeks per year. Sensitive species observed include nesting oystercatchers, coyote, river otter sign, bear sign. Nearby reefs are used by arctic terns, gulls, oystercatchers harlequin ducks and harbor seals that may be impacted by kayakers in this area.

74 Southeast Strawberry Island

No established sites found in area and no other evidence of human use except for a partially buried wooden crate in woods. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include river otter sign and bear sign.

75 Southwest Strawberry Island

No established sites found in area and no other evidence of human use. Area holds no particular attraction to campers unless they were passing by except for being the westernmost point of Strawberry Island and a natural stopping point for kayakers traveling through the northern part of Sitakaday Narrows. Sensitive species observed include oystercatchers, black turnstones, river otter sign and bear sign.

76 Northern Tip Young Island

One established site, Impact Rating: Low. Site contained trailing and trash. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include nesting sparrows, river otter sign and bear sign.

77 East Side of Island in Secret Bay

One established site, Impact Rating: Low. Area holds no particular attraction to campers unless they were passing by. The only sensitive species observed was a black bear.

78 Cove West Side Young Island

No established sites found in area and no other evidence of human use. Area holds no particular attraction to campers except for kayakers traveling through Sitakaday Narrows. Sensitive species observed include oystercatchers, river otter sign and bear sign.

80 First Cove South of York Creek

One established site, Impact Rating: Low. Site contained rock rings. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include wolf sign, river otter sign, and bear sign.

81 York Creek

Three established sites, Impact Rating: 1 site - Low, 2 sites - Medium. 1 site with trailing, 3 sites with rock rings, 3 sites with trash, and 3 sites with footprints. This area is a natural stopover for kayakers traveling up the east side of the bay as it offers level campable terrain and fresh water. Evidence of sensitive species observed include river otter sign and bear sign.

82 South Leland Island

Three established sites, Impact Rating: 1 site - Low, 1 site - Medium, 1 site - not rated. 1 site with trailing, 2 sites with rock rings, and 1 with trash. This area is very attractive to kayakers traveling up or down the east side of the bay because the "island hopping" route is the most direct and the rest of Leland Island is closed to camping. Sensitive species observed include nesting oystercatchers, nesting gulls of unknown species, and river otter sign. A nearby harbor seal haulout is extremely susceptible to disturbance from kayakers entering or leaving this area.

83 1st Drainage S. of Spokane Cove

One established site in survey area, Impact Rating: Medium. Site contained supratidal fire pit and rock rings. Human waste was found in the intertidal. The main attraction of this area is probably that it is the last campable area at the southern end of a long beach camping closure and has freshwater available. Evidence of sensitive species include river otter sign, coyote sign, and bear sign.

85 South Sturgess Island

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. Both sites with rock rings, 1 with trash, 1 with structures, and 1 with footprints. This area is very attractive to kayakers traveling up or down the east side of the bay because the "island hopping" route is the most direct and the adjacent mainland is closed to camping. The only evidence of sensitive species was river otter sign.

86 North Sturgess Island

One established site, Impact Rating: Low. Site contained rock rings. This area is very attractive to kayakers traveling up or down the east side of the bay because the "island hopping" route is the most direct and the adjacent mainland is closed to camping. Sensitive species observed include oystercatchers, nesting crows, and river otter sign.

87 North Garforth Island

Four established sites, Impact Rating: 3 sites - Low, 1 site - not rated. 2 sites with trailing, 2 with supratidal fire pits, 2 with rock rings, 1 with trash, 1 with firewood, and 1 with footprints. This area is particularly attractive to campers when the camper drop-off is located nearby at Mt. Wright. Evidence of sensitive species include river otter and bear sign.

88 Mount Wright

One established site, Impact Rating: Medium. Site contained trailing, rock ring, intertidal fire pit, trash, human waste, and footprints. This area is particularly attractive to campers when the camper drop-off is located nearby at Mt. Wright. Evidence of sensitive species was bear sign.

89 Muir Point

One established site, Impact Rating: High. Site contained trailing, rock rings, trash, structures and footprints. This area has been used as a camper drop-off location and is also close to the Mt. Wright camper drop-off. It is also attractive in its location at the southern mouth of Adams Inlet. Sensitive species include oystercatchers with young, river otters and a black bear.

90 Creek West of Tlingit Point

Four established sites, Impact Rating: 2 sites - Low, 2 sites - Medium. 4 sites with rock rings, 4 with intertidal fire pits, 2 with trash, and 3 with footprints. This area is especially attractive when the camper drop-off location is at nearby Sebree Island and because of its freshwater creek. Sensitive species observed include eagle nest, spawning salmon, wolf sign, otter sign and bear sign.

91 Small Island south of Tlingit Point

This survey area was not surveyed completely due to lack of time, but 1 established site was noted with flattened vegetation and trailing. This area is probably attractive when the camper drop-off location is at nearby Sebree Island. Sensitive species observed include over 260 oystercatchers, arctic terns, a large raft of scoters, several cormorants and mew and glaucous-winged gulls.

92 Tlingit Point

Two established sites, Impact Rating: both sites - Low. 1 site contained rock rings. This area is probably attractive when the camper drop-off location is at nearby Sebree Island, but beach terrace appears to be eroding and past evidence of use may have been erased. Sensitive species observed include oystercatchers, nesting crows, river otter sign and bear sign.

94 SW Sebree Island

Four established sites, Impact Rating: 3 sites - Low, 1 site - High. 1 site with trailing, 1 with supratidal fire pit, 4 with rock rings, 1 with trash, 1 with a structure, and 1 with footprints. Trace trash, footprints, and piles of firewood were found between sites. This area is often the location of a camper drop-off and is most likely used more heavily during those times. Evidence of sensitive species observed include river otter sign and bear sign.

95 SE Sebree Island

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. Both sites with trailing, 1 with supratidal fire pit, 1 with rock rings, and 1 with trash. This area is probably attractive when the camper drop-off location is nearby on the southwest side of Sebree Island. Evidence of sensitive species observed include river otter sign and bear sign.

96 Caroline Point

Four established sites, Impact Rating: 4 sites - Low. 2 sites with trailing, 1 with rock rings, and 1 with trash. This area is attractive to campers traveling up and down Muir Inlet, particularly when the camper drop-off is at Sebree Island. Sensitive species observed include arctic terns, oystercatchers, scoters off shore, river otter sign and bear sign.

97 Shore North of Ice Valley Outflow

Four established sites, Impact Rating: 4 sites - Low. 4 sites with rock rings, and 1 with trash. This area may be attractive to campers traveling up and down Muir Inlet but holds no other significant attractions. Sensitive species observed include spotted sandpipers suspected nesting, harlequin ducks with young, and bear sign.

98 Morse Glacier Outwash

One established site, Impact Rating: Low. Site contained footprints. No obvious sign of human use in survey area. This area may be attractive to campers traveling up and down Muir Inlet but holds no other significant attractions other than freshwater. Sensitive species observed include oystercatcher with young, arctic terns, semipalmated plovers and spotted sandpipers acting defensively, sparrows and warblers with young, wolf sign, coyote sign, and bear sign.

99 Creek across Muir Arm from Klotz Hills

No established sites or evidence of human use found in survey area. This area may be attractive to campers traveling up and down Muir Inlet but holds no other significant attractions other than freshwater. Evidence of sensitive species include wolf sign, river otter sign and bear sign.

100 Adams Glacier Outwash

No established sites or evidence of human use found in survey area except for sporadic footprints. This area may be attractive to campers who wish to hike the outwash. Evidence of sensitive species include semipalmated plovers, oystercatchers, arctic terns, wolf sign, and bear sign.

101 Southwest of Adams Glacier Outwash

Three established sites, Impact Rating: 1 site - Low, 2 sites - not measured. Measured site contained trailing and trash. No specific attractions in this survey area. Sensitive species observed include spotted sandpipers, oystercatchers, and bear sign.

103 South of Casement Glacier Outwash across Adams Inlet

No established sites or evidence of human use found in survey area except for possible old fire pit and rock ring. No specific attractions in this survey area. Evidence of sensitive species include wolf sign and bear sign.

104 Mid-Adams Inlet, South side

Three established sites, Impact Rating: 1 site - Low, 2 sites - not measured. No specific attractions in this survey area except as a mid-point in Adams Inlet. Sensitive species observed include nesting juncos, wolf sign, and bear sign.

105 Point George

One established site, Impact Rating: High. Site contained trailing, rock rings, trash, and footprints. The main attraction of this area is its location at the northern mouth of Adams Inlet. Sensitive species observed include oystercatchers and bear sign.

106 Maquina Cove

Two established sites, Impact Rating: 1 site - Medium, 1 site - not measured. Measured site contained trailing and cut branches. No specific attractions in this survey area. Evidence of sensitive species was bear sign.

107 South Klotz Hills

One established site, Impact Rating: Low. Site contained rock rings and footprints. No specific attractions in this survey area. No sensitive species observed in survey area.

108 First Cove North of Klotz Hills

Four established sites, Impact Rating: 3 sites - Low, 1 site - Medium. 2 sites with trailing, 3 with rock rings. No specific attractions associated with this survey area. Sensitive species observed include suspected nesting spotted sandpipers and semipalmated plovers, oystercatcher, river otter sign, brown bear.

109 Large Former River Fan, South of Forest Creek.

Two established sites, Impact Rating: 2 sites - Low. Both sites with rock rings. No specific attractions associated with this survey area. Sensitive species observed include oystercatchers, parasitic jaegers, and bear sign.

110 Center of Small Cove at South End of Forest Creek Fan

One established site, Impact Rating: Medium. Site contained rock ring and footprints. No specific attractions associated with this survey area. Evidence of sensitive species observed include river otter sign, wolf sign and bear sign.

111 North End of Forest Creek Fan

Two established sites, Impact Rating: 2 sites - Low. Both sites with rock rings. No specific attractions associated with this survey area. Evidence of sensitive species observed include wolf sign and bear sign.

112 Goose Cove

Five established sites, Impact Rating: 5 sites - Low. 3 sites with rock rings, 3 with trash, and 2 with footprints. The attraction of this area is a small tidal lagoon and freshwater stream. Sensitive species observed include defensive oystercatchers, wolf sign and bear sign. Stream is believed to contain spawning salmon.

113 Sealer's Island

One established site, Impact Rating: Low. There is little attraction for camping in this area except that it is an island with great views. Sensitive species observed include nesting arctic terns, nesting mew gulls, nesting oystercatchers, nesting glaucous-winged gulls, nesting crows, river otter sign, and a brown bear.

114 Rounded Peninsula between Nunatak and Goose Coves.

Three established sites, Impact Rating: 2 sites Low, 1 site - High. 1 site contained trailing, 1 with supratidal fire pit, 3 with rock rings, 1 with structures, and 1 with footprints. No specific attraction in this area except that it offers extensive camping possibilities. Sensitive species observed include defensive oystercatchers, nesting warblers, and bear sign.

115 Nunatak (1st cove North of Nunatak)

One established site, Impact Rating: Low. Site contained rock rings. No specific attractions in this survey area. Evidence of sensitive species was bear sign.

116 Wolf Point

Two established sites, Impact Rating: 1 site - Low, 1 site - not measured. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include defensive semipalmated plovers, mew gulls, oystercatchers, and bear sign.

117 Stump Cove

One established site, Impact Rating: Medium. Site contained rock rings. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include defensive oystercatchers and bear sign.

118 North Side Wachusett Inlet

One established site, Impact Rating: Low. Site contained rock rings. No specific attractions in this survey area. Sensitive species observed include nesting sparrows and bear sign.

119 Rowlee Point

No established sites and no evidence of human use except for footprints. This area's main attraction is its location at the southern mouth of Wachusett Inlet. Sensitive species observed include defensive spotted sandpipers, oystercatchers, coyote sign and bear sign.

120	Hunter Cove North	One established site, Impact Rating: Low. Site contained a structure. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include defensive semipalmated plovers and spotted sandpipers, oystercatchers, coyote sign, and a brown bear.
121	Hunter Cove South	One established site, Impact Rating: Low. Site contained rock rings. No specific attractions in this survey area except for freshwater stream. Evidence of sensitive species include river otter sign, wolf sign, and bear sign.
130	Mouth of Geikie, North Shore	One established site, Impact Rating: not measured. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include oystercatchers, spawning pink and chum salmon, river otter sign, a wolverine, and black bears and a brown bear.
131	North shore Geikie with ARCH Geomarker	No established sites or evidence of human use in this survey area. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include oystercatchers, spawning pink salmon, coyote sign, river otter sign, and a blue color phase black bear (glacier bear).
132	First Site East of Charpentier Valley	No established sites or evidence of human use in this survey area. No specific attractions in this survey area except for freshwater stream. Evidence of sensitive species observed include river otter sign and bear sign.
133	Valley From Charpentier Inlet	One established site, Impact Rating: Low. Site contained rock rings. No specific attractions in this survey area except for freshwater stream. Sensitive species include common mergansers with young, oystercatchers and bear sign.
134	Mid North Shore, Geikie Inlet	Two established site, Impact Rating: 2 sites - Low. 1 site with supratidal fire pit, 2 with rock rings, and 1 with intertidal fire pit. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include a black bear.
135	Stream Off of South Mt. Bulky, Geikie Inlet	Two established site, Impact Rating: 1 site - Low, 1 site - Medium. 2 sites with rock rings, and 1 with trash. Rock cairn in survey area likely from camper drop-off. This area was used as a drop-off location for at least one year. Otherwise, no specific attractions in this survey area except for freshwater stream. Sensitive species observed include brown bears.
136	North Shore Geikie, about 1 mile from the head.	Two established site, Impact Rating: 2 sites - Low. 2 sites with rock rings. No specific attractions in this survey area except for access to Geikie Glacier Outwash. Evidence of sensitive species was bear sign.
137	Head of Geikie Inlet, South Shore	Two established site, Impact Rating: 2 sites - Low. 2 sites with rock rings. No specific attractions in this survey area except for access to Geikie Glacier Outwash and freshwater stream. Evidence of sensitive species was bear sign.
138	Mouth of Tyndall Inlet, West shore	No established sites or evidence of human use in this survey area. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include black turnstones, wolf sign and bear sign.
139	West island of the two islands in Geikie Inlet	One established site, Impact Rating: Low. No specific attractions in this survey area except for being an island with scenic views. Sensitive species observed include black turnstones, oystercatchers and bear sign.
140	Island at Mouth of Shag Cove, Geikie Inlet	

One established site, Impact Rating: Low. Site contained trailing, rock rings, and firewood. No specific attractions in this survey area except for being an island with scenic views. Sensitive species observed nesting bald eagles, river otter sign and bear sign.

150 East Drake Island

One established site, Impact Rating: Low. Site contained rock rings. No specific attractions in this survey area except for being on an island with scenic views. Evidence of sensitive species observed river otter sign and bear sign.

151 Johnson Cove, Willoughby Island

Two established sites, Impact Rating: 2 sites - Low. 2 sites with rock rings and 1 with trash. Historic structure remnants were found in survey area. This area is attractive because it is located within a protected cove on the outside of Willoughby Island, and thus a natural stopover for kayakers passing by. Sensitive species observed include several species of orchids, river otter sign and bear sign.

160 Large cove south of McBride Inlet

No established sites or evidence of human use in this survey area except for supratidal human waste. No specific attractions in this survey area except for freshwater stream. Sensitive species observed include oystercatchers, wolf sign and bear sign.

161 Long beach north of McBride Inlet

Four established sites, Impact Rating: 2 sites - Low, 1 site - Medium, 1 site - not rated. 2 sites with rock rings, 1 with intertidal fire pit, 1 with trash, 1 with human waste, and 3 with footprints. Trash, supratidal human waste, and footprints found in survey area. This area is attractive to campers because of its proximity to McBride Glacier and access to freshwater. Many Alaska Discovery guided kayaking trips begin or end in this location. Sensitive species observed include river otter, defensive oystercatcher, semipalmated plovers, coyote and bear sign.

162 Riggs Glacier

Six established sites, Impact Rating: 5 sites - Low, 1 site - Medium. 6 sites with rock rings, 2 with intertidal fire pits, 1 with trash, 1 with a structure, and 4 with footprints. This area is attractive to campers because of the spectacular views of Riggs Glacier. Sensitive species observed include nesting semipalmated sandpipers, spotted sandpipers, oystercatchers, finches with young, coyote, wolf and bear sign. Nesting arctic terns and mew gulls in vicinity that could be impacted by campers in this area.

164 South Shore, Mid Upper Muir Inlet

Two established sites, Impact Rating: 2 sites - Low. Both sites contained rock rings. This area is attractive to campers traveling in upper Muir Inlet because it is one of the few campable areas, and may be an access point for hiking up White Thunder Ridge. Sensitive species observed include nesting oystercatchers, suspected nesting spotted sandpipers, nesting swallows, wolf sign and bear sign.

165 North Shore, Mid Upper Muir Inlet

One established site, Impact Rating: Low. Site contained rock rings. This area is attractive to campers traveling in upper Muir Inlet because it is one of the few campable areas and has freshwater. Sensitive species observed include nesting arctic terns, mew gulls with young, oystercatchers with young, nesting semipalmated plovers, nesting glaucous-winged gulls, nesting herring gulls, and a spotted sandpiper. Boreal toad tadpoles were later reported at this site.

166 North Shore, West End of Muir Inlet

Two established sites in area, Impact Rating: 1 site - Low, 1 site - Medium. 2 sites with rock rings, 1 with intertidal fire pit. This area is attractive to campers traveling in upper Muir Inlet because it is one of the few campable areas and has freshwater. Sensitive species observed include nesting mew gulls with young, nesting oystercatchers, nesting glaucous-winged gulls, defensive spotted sandpipers, semipalmated plovers, and American pipits.

167 North spit McBride Inlet

Six established sites in area, Impact Rating: 2 sites - Low, 4 sites - Medium. 1 site with trailing, 6 with rock rings, and 5 with footprints. Trailing, broken branches, trash, intertidal fire pits and footprints observed in survey area. This area is very attractive to campers because of the spectacular views of McBride Glacier. Sensitive species observed include nesting oystercatchers, nesting gulls of unknown species, defensive semipalmated plovers, coyote sign, bear sign, and wolf sign including evidence of pups. Harbor seals pupping and molting in fjord would potentially be disturbed by campers in this area. Arctic terns have been observed nesting in area in past, but no evidence of nesting was observed in 2002 or 2003.

168 South spit McBride Inlet

Eight established sites, Impact Rating: 4 sites - Low, 4 sites - Medium. 3 sites with trailing, 2 with supratidal fire pit, 8 with rock rings, 1 with trash, 1 with human waste, and 5 with footprints. Extensive trailing, broken branches, and footprints in survey area. This area is very attractive to campers because of the spectacular views of McBride Glacier. Sensitive species observed include oystercatchers with nests, semipalmated plovers, spotted sandpipers, wolf sign, bear sign, and possible river otter sign. Harbor seals pupping and molting in fjord would potentially be disturbed by campers in this area.

170 Garforth Island, South End

Two established sites, Impact Rating: 1 site - Low, 1 site - Medium. 2 sites with trailing, 1 with rock rings, 2 with trash. Cut wood found in survey area. This area is probably most attractive to campers when the camper drop-off is nearby at Mt. Wright. Sensitive species observed include oystercatchers, river otter sign and bear sign.

171 Blue Mouse Cove, Southeast

One established site, Impact Rating - Low. Site contained rock ring. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed include river otter sign and bear sign.

172 Small Island in South Blue Mouse Cove

No established sites or evidence of human use. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed was bear sign.

173 North tip of Mainland Peninsula in Mid-Hugh Miller Inlet

One established site, Impact Rating - Low. Site contained rock ring. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include oystercatchers, a black bear and river otter sign.

174 Northeast Mouth of Charpentier Inlet

No established sites or evidence of human use. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include young spotted sandpipers, river otter sign, and bear sign.

175 Small Island at Mouth of Charpentier Inlet

Two established sites, Impact Rating: 2 sites - Low. Both sites contained rock rings. Area holds no particular attraction to campers except for being an island with scenic views. Sensitive species observed include mew gulls with young, oystercatchers with young, arctic terns, dowitchers, black turnstones, crow nest, and bear sign.

176 South Tip of Island off Southeast Tip of Gilbert Peninsula

No established sites or evidence of human use. Area holds no particular attraction to campers unless they were passing by. Evidence of sensitive species observed was river otter sign, mink sign, and bear sign including evidence of cubs.

177 South of Entrance to Weird Bay, mouth of Scidmore Bay

One established site, Impact Rating: Low. Site contained rock rings. Area holds no particular attraction to campers unless they were passing by. Sensitive species observed include oystercatchers, glaucous-winged gulls and molting harlequin ducks.

180 Mt. Wright Drop-off

One established site, Impact Rating: Low. Site contained rock rings. Rock cairn, probably from drop-off, found in survey area. This area is sometimes the location of a camper drop-off and probably receives most of its use during these times. The potential for falling rocks makes this area hazardous for camping. Evidence of sensitive species was river otter sign and bear sign.

Appendix IV
Plant Species List

WCI PLANTS

Note: Plant identifications were not confirmed by a botanist and names may be inaccurate.

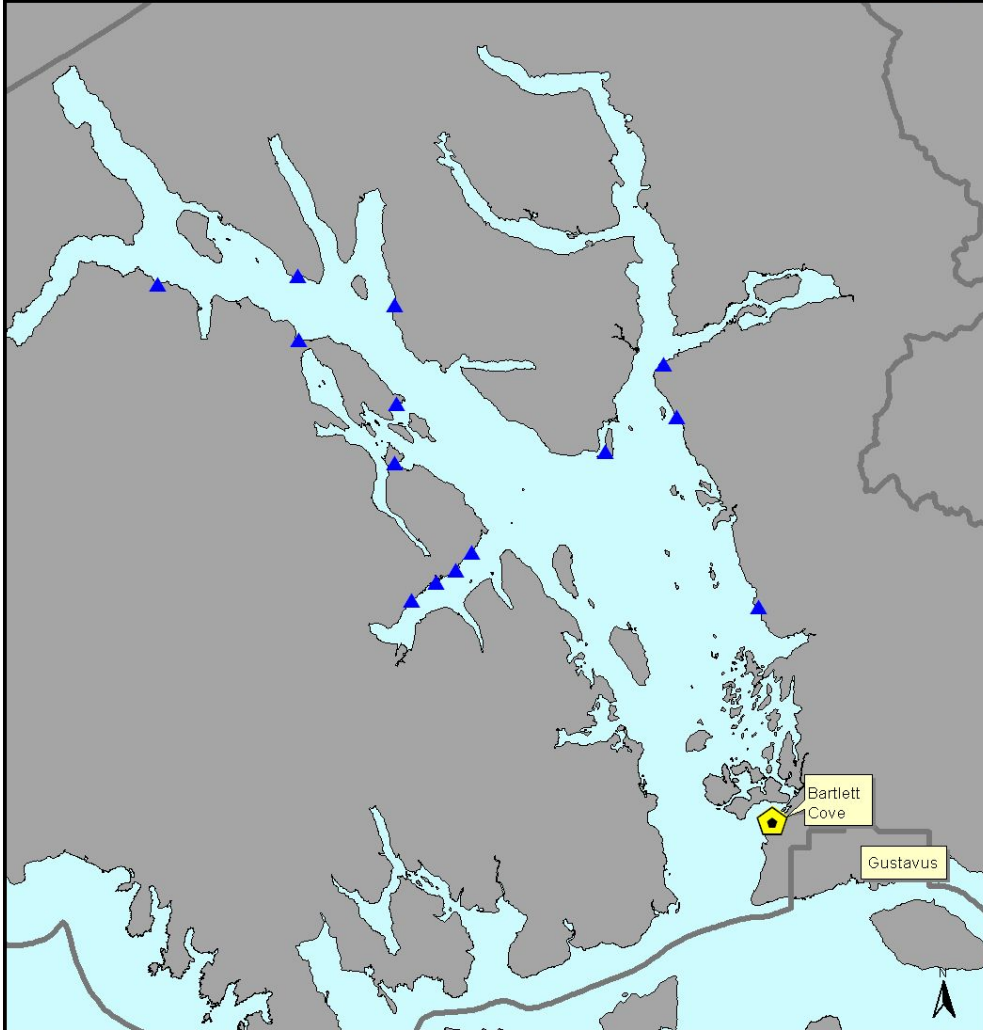
COMMON NAME	GENUS SPECIES	ALSO KNOWN AS
alder	<i>Alnus crispa</i>	Sitka alder
alkali grass	<i>Puccinellia</i> spp.	Alaska alkali grass
angelica	<i>Angelica lucida</i>	sea watch
aster	<i>Aster</i> spp.	
astragalus	<i>Astragalus</i> spp.	milk-vetch
beach greens	<i>Honkenya peploides</i>	seabeach sandwort
beach pea	<i>Lathyrus maritimus</i>	<i>Lathyrus japonicus</i>
bedstraw	<i>Galium</i> spp.	cleavers
black lilly	<i>Fritillaria camschatcensis</i>	northern rice root, chocolate lilly
carex	<i>Carex</i> spp.	sedge
conioselinum	<i>Conioselinum chinense</i>	pacific hemlock-parsley
cottonwood	<i>Populus balsamifera</i>	black cottonwood
cow-parsnip	<i>Heracleum lanatum</i>	
dandelion	<i>Taraxacum</i> spp.	
dryas	<i>Dryas drummondii</i>	yellow mountain-avens
elymus	<i>Elymus arenarius</i>	rye grass
eyebright	<i>Euphrasia arctica</i>	arctic eyebright
fireweed	<i>Epilobium angustifolium</i>	
goose-tongue	<i>Plantago maritima</i>	sea plantain
grass	?	unidentified grasses
horsetail	<i>Equisetum</i> spp.	field horsetail, scouring rush
kinnikinnick	<i>Arctostaphylos uva-ursi</i>	common bearberry
lady fern	<i>Athyrium filix-femina</i>	
large-leaved avens	<i>Geum macrophyllum</i>	geum
lichen	?	
lovage	<i>Ligustichum hultenii</i>	beach lovage
lupine	<i>Lupinus nootkatensis</i>	nootka lupine
nagoonberry	<i>Rubas arcticus</i>	dwarf nagoonberry
moss	?	
oysterleaf	<i>Mertensia maritima</i>	sea bluebells
paintbrush	<i>Castilleja</i> spp.	indian paintbrush
rattlebox	<i>Rhinanthus minor</i>	yellow rattle
river beauty	<i>Epilobium latifolium</i>	dwarf fireweed
silverweed	<i>Potentilla egedii</i>	<i>Potentilla anserina</i>
soapberry	<i>Shepherdia canadensis</i>	soopolallie
spruce	<i>Picea sitchensis</i>	Sitka spruce
strawberry	<i>Fragaria chiloensis</i>	coastal strawberry
sweet-cicely	<i>Osmorhiza</i> spp.	blunt-fruited sweet-cicely, etc.
umbels	<i>Apiaceae</i> spp.	members of the carrot family
willow	<i>Salix</i> spp.	
winter cress	<i>Barbarea orthoceras</i>	american winter cress
wintergreen	<i>Pyrola</i> spp.	pink and one-sided wintergreens
yarrow	<i>Achillea millefolium</i>	<i>Achillea borealis</i>

Appendix V

Camper Drop-off Locations

Camper Drop-offs and Pick-ups

Glacier Bay National Park and Preserve
National Park Service
U.S. Department of the Interior



▲ Drop-offs and pick-ups
mid May - early Sept.

▭ Park Boundary

3 0 3 6 9 Miles

This map shows camper drop-off and pick-up locations used over the past 10 years. Generally, only 2-3 locations were used each year and were spread evenly throughout the Bay. Drop-off locations were often rotated within and between seasons.