

# Ground-Nesting Marine Bird Distribution and Potential for Human Impacts in Glacier Bay

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**Abstract.** With the exception of a few large colonies, the distribution and abundance of ground-nesting marine birds in Glacier Bay National Park is largely unknown. There is growing concern about the potential impact of human activities to breeding birds as visitor use increases in back-country areas of the park. We surveyed the shoreline of Glacier Bay proper to locate ground-nesting marine birds and their nesting areas during the 2003 and 2004 breeding seasons. We determined the nesting distribution of the four most common ground-nesting marine bird species: Arctic Tern, Black Oystercatcher, Mew Gull and Glaucous-winged Gull. We also recorded observations of less abundant species that we encountered including Herring Gull, Semipalmated Plover, Spotted Sandpiper and Parasitic Jaeger. This project comprises the first complete, bay-wide, nesting distribution survey of ground-nesting marine birds in Glacier Bay. This information provides valuable baseline data that may be used to assess potential impacts of human disturbance and to track changes in nesting bird distribution and populations over time.

## Introduction

Glacier Bay National Park and Preserve contains a diverse assemblage of marine birds that use the area for nesting, foraging and molting. The abundance and diversity of marine bird species in Glacier Bay is unmatched in the region, due in part to the geomorphic and successional characteristics that result in a wide array of habitat types (Robards and others, 2003). The opportunity for proactive management of these species is unique in Glacier Bay National Park because much of the suitable marine bird nesting habitat occurs in areas designated as wilderness.

Ground-nesting marine birds are vulnerable to human disturbance wherever visitors can access nest sites during the breeding season. Human disturbance of nest sites can be significant because intense parental care is required for egg and hatchling survival, and repeated disturbance can result in reduced productivity (Leseberg and others, 2000). Temporary nest desertion by breeding birds in disturbed areas can lead to increased predation on eggs and hatchlings by conspecifics or other predators (Bolduc and Guillemette, 2003). Human disturbance of ground-nesting birds may also affect incubation time and adult foraging success, which in turn can alter breeding success (Verhulst and others, 2001). Furthermore, human activity can potentially cause colony failure when disturbance prevents the initiation of nesting (Hatch, 2002).

There is management concern about the susceptibility of breeding birds to disturbance from human activities, but little historical data has been collected on the distribution of ground-nesting marine birds in Glacier Bay. This report summarizes results obtained during two years of a three-year

study to determine the distribution of ground-nesting marine birds in Glacier Bay, and the potential for human disturbance of those nesting birds.

## Methods

We determined the nesting distribution of the four most common ground-nesting bird species in Glacier Bay: Arctic Tern (*Sterna paradisaea*), Black Oystercatcher (*Haematopus bachmani*), Mew Gull (*Larus canus*) and Glaucous-winged Gull (*Larus glaucescens*). We also recorded observations of other ground nesting bird species that we encountered including Herring Gull (*Larus argentatus*), Semipalmated Plover (*Charadrius semipalmatus*), Spotted Sandpiper (*Actitis macularia*) and Parasitic Jaeger (*Stercorarius parasiticus*).

We surveyed for ground-nesting marine birds and their associated nests between June 4 and July 15, 2003 and between May 17 and July 1, 2004. Using National Park Service data that details visitor-use between 1996 and 2002, we determined which coastal areas receive high use by kayakers and campers (fig. 1). We defined "high-use" as sites that received 30 or more overnight visits during the seven years covered by the data set. All areas classed as high-use were surveyed by observers walking the length of the particular coastal segment in order to map nest locations. In areas considered low-use (defined as an area that received fewer than 30 overnight visits) we surveyed the shoreline from a distance of 3-15 m using a skiff in motorized waters, or a kayak in non-motorized waters. When potential nesting behavior was observed (concentrations of birds on shore, defensive behavior by one or more birds, or the presence of paired birds) we landed the vessel and walked the length of the beach. At all survey locations we recorded site and nest positions using hand held GPS units, nest contents (eggs, chicks), adult behavior, general habitat characteristics and evidence of human disturbance. High and low-use areas that had concentrations of nesting birds in 2003 were resurveyed in 2004.

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**Results**

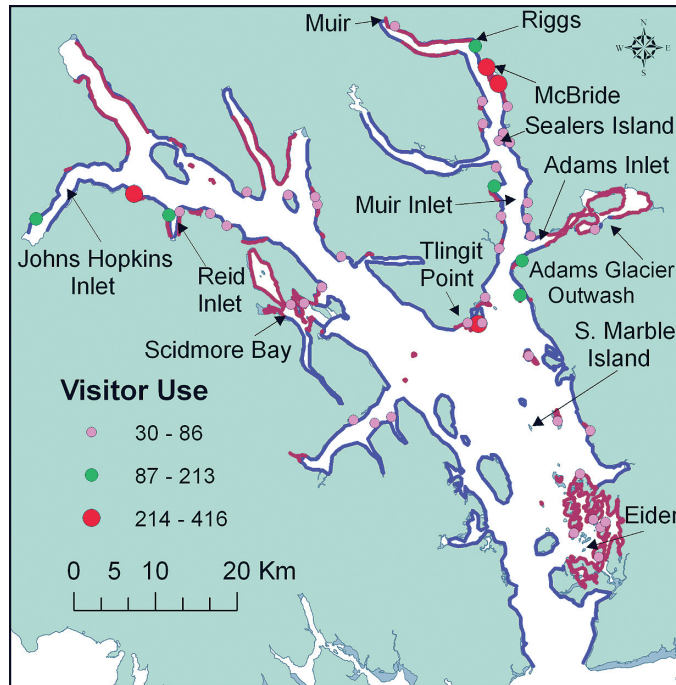
We found 252 active nests along approximately 353 km of shoreline surveyed in 2003, and we found 405 active nests along 692 km of shoreline surveyed in 2004.

We located 43 and 79 Arctic Tern nests in 2003 and 2004, respectively (fig. 2a). Nesting distribution was limited to the upper arms of the bay and one treeless islet in the lower bay. Arctic Terns generally responded to observers in an aggressive manner by diving repeatedly while alarm calling. The highest nesting concentrations were found at the Adams glacier outwash and the islet at the entrance to Scidmore Bay.

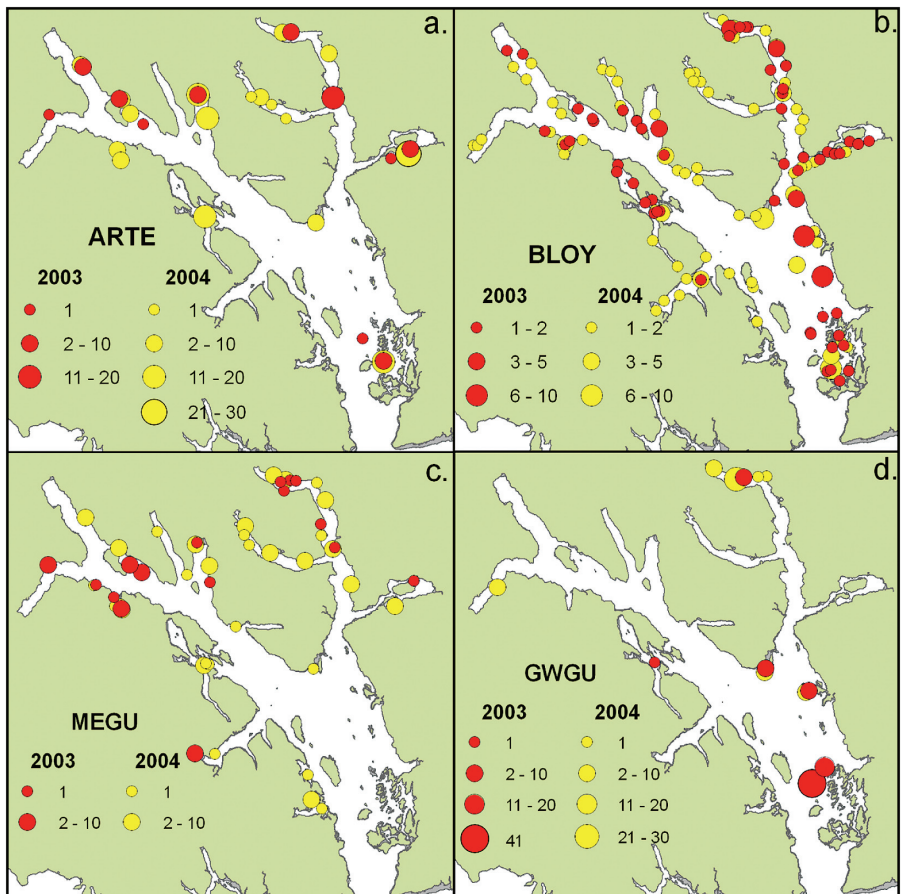
We mapped 90 Black Oystercatcher nests in 2003 and 113 nests in 2004 (fig. 2b). Oystercatchers responded to human presence by apparently leading observers away from the nest, alarm calling and feigning injury. The highest concentration of nests was found at the islet at Tlingit Point in 2004.

There were 20 Mew Gull nests in 2003 and 82 nests in 2004 (fig. 2c). Mew Gull nests were restricted to the more protected areas in the bay including the upper arms and a few bays in the lower part of the fjord. Mew Gulls generally responded to human presence by diving at observers, circling overhead and alarm calling. On several occasions we observed Mew Gull chicks entering the water accompanied by flying adults when humans were near.

We found 81 Glaucous-winged Gull nests in 2003 and 40 nests in 2004 (fig. 2d). Most Glaucous-winged Gull nests were found on protected colonies in the lower bay, although there was a colony along the north shore of Muir Inlet and another concentration nesting high on a cliff in Johns Hopkins Inlet. Glaucous-winged Gulls were less aggressive than other species in defending their nests, circling high overhead while observers were near their nests.



**Figure 1.** Study area, shoreline surveyed in 2003 (red line) and 2004 (blue line), and high-use camping areas and place names mentioned in this report. Circles represent the number of reported overnight camping uses between 1996 and 2002 (National Park Service data).

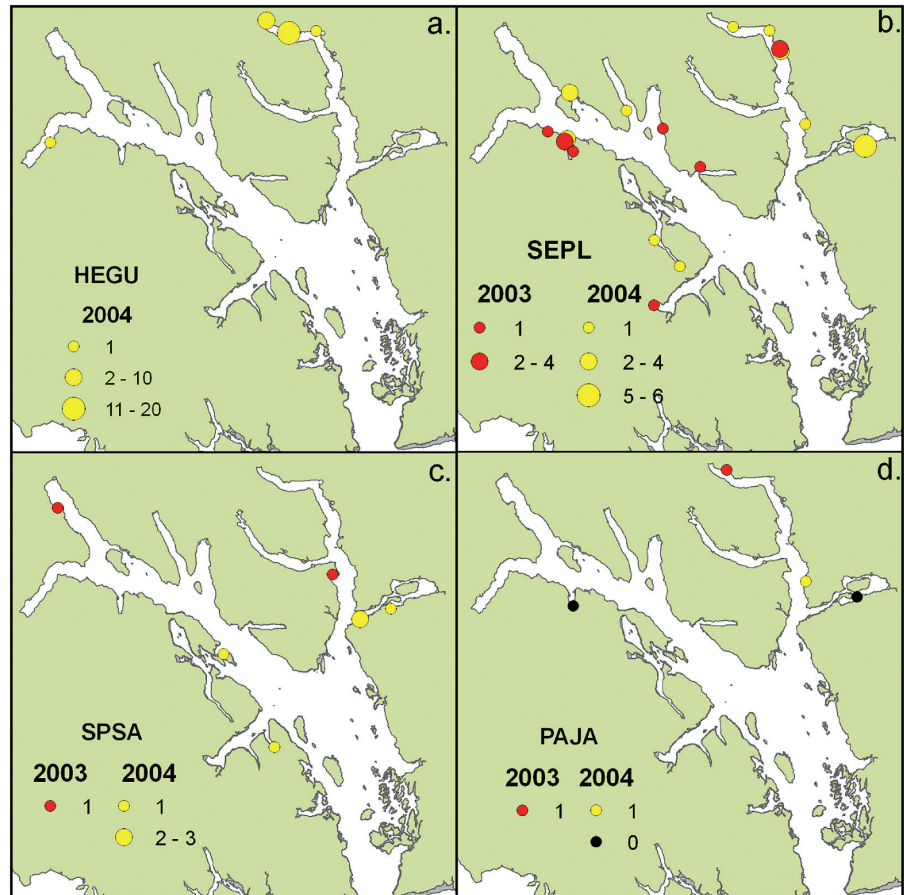


**Figure 2.** Nest distribution by species in 2003 and 2004. a. Arctic Tern (ARTE), b. Black Oystercatcher (BLOY), c. Mew Gull (MEGU), d. Glaucous-winged Gull (GWGU).

In addition to nests of the more abundant species, we also located nests of several other species. We located 18 Herring Gull nests in 2004 (fig. 3a), 13 and 23 Semipalmated Plover nests in 2003 and 2004, respectively (fig. 3b), two Spotted Sandpiper nests in 2003 and 6 nests in 2004 (fig. 3c), one Parasitic Jaeger nest in 2003 and one nest in 2004 (fig. 3d). Herring Gull distribution was limited to the head of the east arm and Johns Hopkins Inlet. Semipalmated Plovers were found on flat sand and gravel shorelines, where they nested near low vegetation. Spotted Sandpipers were usually found within the terrestrial vegetation near the edge of the beach. Parasitic Jaegers laid eggs on bare ground and we noted the presence of pairs flying north of Adams Inlet and near Reid Glacier (fig. 3d).

We surveyed three high-use areas with potential for human disturbance including the north spit at McBride glacier, the west entrance to Reid Inlet and Sealers Island (table 1). During our survey in 2003, Arctic Terns were absent from Reid and McBride inlets. However, in 2004, we found 14 Arctic Tern nests at Reid Inlet between 27 May and 6 June, and 3 Arctic Tern nests on the north spit at McBride Glacier on May 28. By June 26 all Arctic Tern nests at the entrance to Reid Inlet had disappeared. One of those nests was trampled by a visitor on June 20, and this was the only observation of direct human impact on beach-nesting birds during our surveys. We also found 16 Arctic Tern, 1 Glaucous-winged Gull, 1 Mew Gull and 2 Black Oystercatcher nests at Sealers Island on 15 June, 2003. We revisited Sealers Island in 2004 and found 3 Mew Gull, 1 Glaucous-winged Gull and 4 Black Oystercatcher nests. In 2004, we also observed 8-10 defensive Arctic Terns flying and there were recently predated Arctic Tern egg shells near a Northwestern Crow nesting area in the center of Sealers Island.

We also found high concentrations of ground-nesting marine birds at low-use areas including the shoreline between Riggs and Muir glaciers, the islet at Tlingit Point, the islet at the entrance to Scidmore Bay, Adams glacier outwash and the islet northwest of Eider Island (table 1). The north shore between Riggs and Muir glaciers had more nests than any other unprotected area in the bay. The large outwash on the southwest shore of Adam's Inlet and the unnamed islet northwest of Eider Island are notable because of their Arctic Tern aggregations; in 2004 there were approximately 500 and 300 adult Arctic Terns flying over these areas, respectively.



**Figure 3.** Nest distribution by species in 2003 and 2004. a. Herring Gull (HEGU), b. Semipalmated Plover (SEPL), c. Spotted Sandpiper (SPSA), d. Parasitic Jaeger (PAJA).

## Discussion and Conclusions

The preferred nesting habitat for Arctic Terns, cobble outwash areas and rocky outcrops on small islands (Hatch, 2002), is found mostly up-bay in early successional habitats. Their aggressive behavior when humans approach may make their nesting areas less vulnerable to human disturbance, however, individual Arctic Tern nests are inconspicuous and therefore are more likely to be trampled.

Black Oystercatchers prefer to nest on gravel beaches with low-sloping substrates and usually nest near the high tide line (Andres and Falxa, 1995). Oystercatcher nests may be particularly susceptible to disturbance because kayakers tend to use the same beaches for camping. Nests are made of gravel and may be trampled when boats are hauled above the high tide line.

Mew Gulls prefer nesting in areas with little or no vegetation and on gravel banks or beaches, often near freshwater streams (Moskoff and Bevier, 2002). Mew Gull chicks may be susceptible to human disturbance because they usually entered the water when humans approached them.



**Table 1.** Nesting areas with highest potential for human disturbance, human use patterns between 1996 and 2002 (high is  $\geq 30$  camping uses and low is  $< 30$  camping uses), total nest count and species observed. Nest count represents the greatest number of nests found in one year including all species at each location. Species are listed in order of abundance and abbreviations are as follows: Arctic Tern (ARTE), Black Oystercatcher (BLOY), Glaucous-winged Gull (GWGU), Mew Gull (MEGU), Herring Gull (HEGU), Semipalmated Plover (SEPL), Spotted Sandpiper (SPSA) and Parasitic Jaeger (PAJA).

Site Name	Visitor Use	Nest Count	Species
Entrance to Reid	High	16	ARTE, BLOY, SEPL
N. spit at McBride	High	12	BLOY, SEPL, ARTE, MEGU
Sealers Island	High	20	ARTE, BLOY, MEGU, GWGU
North shore Muir Inlet	Low	68	GWGU, HEGU, MEGU, BLOY, ARTE, SEPL, PAJA
Islet at Tlingit Point	Low	21	BLOY, ARTE, GWGU, MEGU
Islet at entrance to Scidmore Bay	Low	29	ARTE, MEGU, BLOY
Adams Glacier outwash	Low	16	ARTE, BLOY, SEPL, PAJA, MEGU
Islet NW of Eider Island	Low	17	ARTE, BLOY

In 1999, 285 Glaucous-winged Gull nests were counted on South Marble Island (Zador and Piatt, 1999), which is currently the largest Glaucous-winged Gull colony in the bay. Although Glaucous-winged Gulls are known to use a wide variety of habitat types for nesting (Verbeek, 1993), in Glacier Bay we found them nesting in areas with low vegetation or on rocky cliffs. Glaucous-winged Gulls place their eggs in conspicuous nest bowls and therefore trampling of nests by humans is less likely than for other ground-nesting bird species.

Hybridization between Herring Gulls and Glaucous-winged Gulls, which commonly occurs in areas where their breeding ranges overlap (Grant, 1986), was documented at North Marble Island by Patten and Weisbrod (1974). We observed signs of hybridization including copulation between a Herring Gull and a Glaucous-winged Gull, an individual from each species attending the same nest and several adults with characteristics intermediate of the two species at the mixed gull colony on the north shore of Muir Inlet.

Semipalmated Plovers, Spotted Sandpipers and Parasitic Jaegers are solitary nesters and have well camouflaged nests. The resolution of our surveys was too coarse to locate the majority of nests for these cryptic species, and our results therefore represent a minimum estimate of pairs and nests for these species.

Although we found unprotected nesting bird concentrations to be generally low in most areas, we found potential for disturbance to nesting birds at high-use areas including the north spit at McBride Glacier, the entrance to Reid Inlet and Sealers Island. These areas have historically supported nesting colonies of Arctic Terns (Wik, 1968; Greg Streveler, pers. comm.) and owing to their close proximity to tidewater glaciers, they are among the most heavily used areas by visitors in the bay.

There was also higher nesting activity in several low-use areas including the north shore of Muir Inlet between Riggs and Muir Glaciers, the islet at Tlingit Point, the islet at the entrance to Scidmore Bay, the Adams glacier outwash and an unnamed islet northwest of Eider Island. The nesting areas on the mainland, including the north shore of Muir Inlet and Adams glacier outwash, may be less susceptible to human disturbance because nesting activity was dispersed over a large area. In contrast, colonies on the smaller islets may be more susceptible to human disturbance because nesting was concentrated over a smaller area.

## Management Implications

Most of the largest seabird nesting areas in Glacier Bay are closed to human use and are therefore largely protected from disturbance by park visitors. Nonetheless, there are areas where significant concentrations of nesting birds gather to breed and human disturbance could affect these breeding activities. Short of closing these areas to visitors, perhaps the simplest way to minimize disturbance to nesting birds is to educate visitors about where they may encounter nesting birds, how to identify nests and nesting bird behavior, and how they should respond when they encroach upon nest sites. This could be accomplished during the mandatory camper/boater orientation and reinforced in the annual regulations publication which is distributed to all visitors.

Baseline data that we have gathered on the distribution and abundance of ground-nesting birds in the park can be used for monitoring changes in breeding bird abundance and distribution over time, whether those changes are due to human disturbance of natural factors (for example, climate change or succession). This project provides a foundation to design and implement a management program that will minimize human disturbance to breeding birds in Glacier Bay.

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