

**Integrated Bird Monitoring in Harriman Fiord,
Prince William Sound, Alaska**

2000 Progress Report

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INTRODUCTION

Marine waters of Harriman Fiord and northern Barry Arm in Prince William Sound, Alaska, are known to support moderate to high densities of breeding and summering waterbirds. Among the numerous species reported from Harriman Fiord, recent surveys have documented substantial use by breeding Kittlitz's murrelets (*Brachyramphus brevirostris*), breeding black oystercatchers (*Haematopus bachmani*), and summering scoters (*Melanitta* spp.) all of which are species of concern in Alaska. The impressive scenery and calm waters of Harriman Fiord make it a popular destination for a variety of recreational users. Recreational pressure in eastern Prince William Sound will likely increase with the completion of the road to Whittier and conflicts between wildlife and recreational users will likely intensify.

Terrestrial habitats found in the fiord probably support a diverse array of breeding landbirds. Monitoring efforts for landbirds in coastal habitats of southcentral Alaska need to be expanded to adequately track populations in the region. Because of the importance of Harriman Fiord to waterbirds, the potential for increased recreational use, and the interest in developing integrated bird monitoring programs, we initiated a multiple species, multiple habitat, bird monitoring program for Harriman Fiord and northern Barry Arm.

STUDY AREA AND METHODS

Study Area and General Methods

Harriman Fiord and northern Barry Arm (hereafter Harriman Fiord) are located in northwestern Prince William Sound, Alaska. Numerous tidewater glaciers and often calm surface water conditions in the fiord make it a popular destination for kayakers and tour boats. Shoreline are generally steep and rocky but are punctuated by beaches formed of glacial cobble and gravel and rocky debris of avalanches. Several submerged and emergent glacial moraines provide foraging and nesting habitat for waterbirds and foraging habitat for marine mammals. Most of the upland areas of Harriman Fiord are managed by the USDA Forest Service as part of the Chugach National Forest.

We conducted surveys from 5-8 June and 11-12 July 2000. Black oystercatcher, waterbird, seabird colony, and landbird surveys were all made during the June visit. The July visit was used to determine the fate of oystercatcher and seabird colony nests and to delineate landbird survey routes. Daily checklists of bird and mammal species were made on both visits. Scientific names of all bird and mammal species are provided in Appendix 1.

Black Oystercatchers

To detect potential breeding black oystercatcher pairs, the entire shoreline of Harriman Fiord was searched at a slow rate of speed, by small inflatable boats, in June and July. When black oystercatchers were detected, observers went ashore and to determine breeding status. Status

was assigned as single, flock, pair, or reproductive pair. A reproductive pair was defined by the presence of eggs or chicks or behaviors such as nest-building and copulation. Locations of confirmed and potentially breeding pairs were mapped and were used to estimate linear pair density. The number of eggs or chicks were recorded at each location, and all sites were re-visited in July to determine their reproductive fate.

Waterbirds

We generally followed the methods of Klosiewski and Laing (1994) to conduct offshore and shoreline surveys for marine birds; we also recorded observations of marine mammals. Except for a few areas where solid ice prohibited access, the entire shoreline of Harriman Fiord was surveyed by a 4-person crew in a 4.3-m inflatable boat. Shoreline and offshore waterbird surveys were made independently from oystercatcher surveys. Data were recorded by subsection of the shoreline to examine spatial patterns of abundance. Subsections were delineated to match divisions used by Day and Nigro (1999). We used a 12.8-m boat to survey offshore areas. Two observers counted all birds and mammals detected in a sampling window 100 m on either side of the vessel, 100 m ahead, and 100 m overhead of the vessel. Observers reviewed and practiced identification of Kittlitz's and marbled murrelets prior to the survey. An additional person operated the boat and the other crew member recorded data. When surveying the shoreline, observers also recorded birds and mammals sighted on land within 100 m of shore. Observers scanned continuously and used binoculars to aid in species identification. All transects were surveyed when wave height was <30 cm. A GPS and nautical compass were used to navigate offshore transect lines. The shoreline was surveyed between 0800 h and 1600 h ADT, and offshore transects were surveyed between 0830 h and 1600 h ADT.

Due to ice conditions, not all planned offshore transects could be surveyed. We did sample 23 offshore transects, generally placed to bisect the fiord, that were spaced at approximate 1-km intervals (Figure 1). This resulted in a total surveyed area of 9.9 km². The combined area of shoreline and offshore transects sampled about 35% of the marine waters of Harriman Fiord. All but 4 of the sampled offshore transects had <10% ice cover (#6 - 75%, #16 - 40%, #17 - 10%, #27 - 10%). Offshore transect locations, headings, and lengths are given in Appendix 2.

Population estimates of bird species were calculated by estimating density for the area surveyed and extrapolating to the total area of Harriman Fiord. We assume that areas with 100% ice cover did not have any birds. We used a simple random sample estimator to determine the variance of the population size estimates. Estimates of variance included only variability in counts on offshore transects because the shoreline was completely surveyed. We only calculated estimates for waterbird species and marine mammals (not for shorebirds and landbirds). We divided Harriman Fiord into 6 sections to examine spatial patterns of distribution (Table 1). Boundaries of regions were delineated by oceanographic features and partially dictated by endpoints of transects (Figure 2).

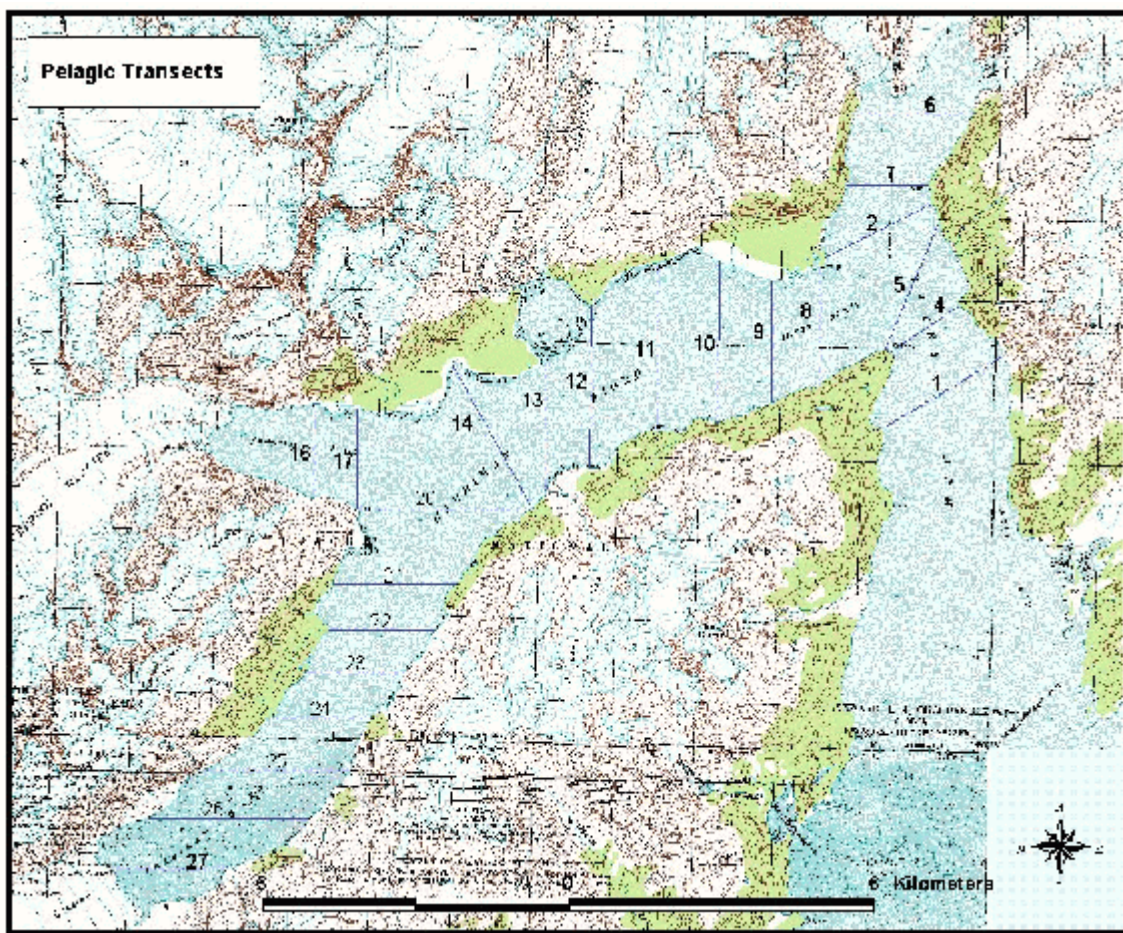


Figure 1. Locations of offshore transects in Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska, surveyed for waterbirds and marine mammals during June 2000.

Table 1. Survey effort for waterbirds in regions of Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska - June 2000.

	Offshore area		Shoreline		total area (km ²)	total surveyed (km ²)
	no. of transects	km ² surveyed	km	km ²		
Upper Harriman	3	1.29	12.6	2.53	9.84	3.82
Mid Harriman	4	1.36	10.6	2.13	9.24	3.49
Surprise Inlet	2	0.55	8.08	1.62	5.9	2.17
Lower Harriman	5	3.24	15.0	3.00	18.4	6.24
Doran Strait	7	2.85	16.4	3.28	20.2	6.13
Barry Arm	2	0.60	9.90	1.98	6.34	2.58
All areas	23	9.89	72.6	14.5	69.9	24.4

Seabird Colonies

During oystercatcher searching in June, we also surveyed previously known seabird colonies and searched for new tern colonies. For cliff-nesting species, individual birds and nests were counted from the boat 50-100 meters offshore; tern colonies were counted from the nesting island. All birds were identified to species, and timing of counts occurred between egg-laying and hatching. Colonies were re-visited in July to assess reproductive success. Surveys of the Barry/Cox Glacier kittiwake colony were made by other U. S. Fish and Wildlife Service personnel. We did not count nests or individuals of glaucous-winged gulls or mew gulls.

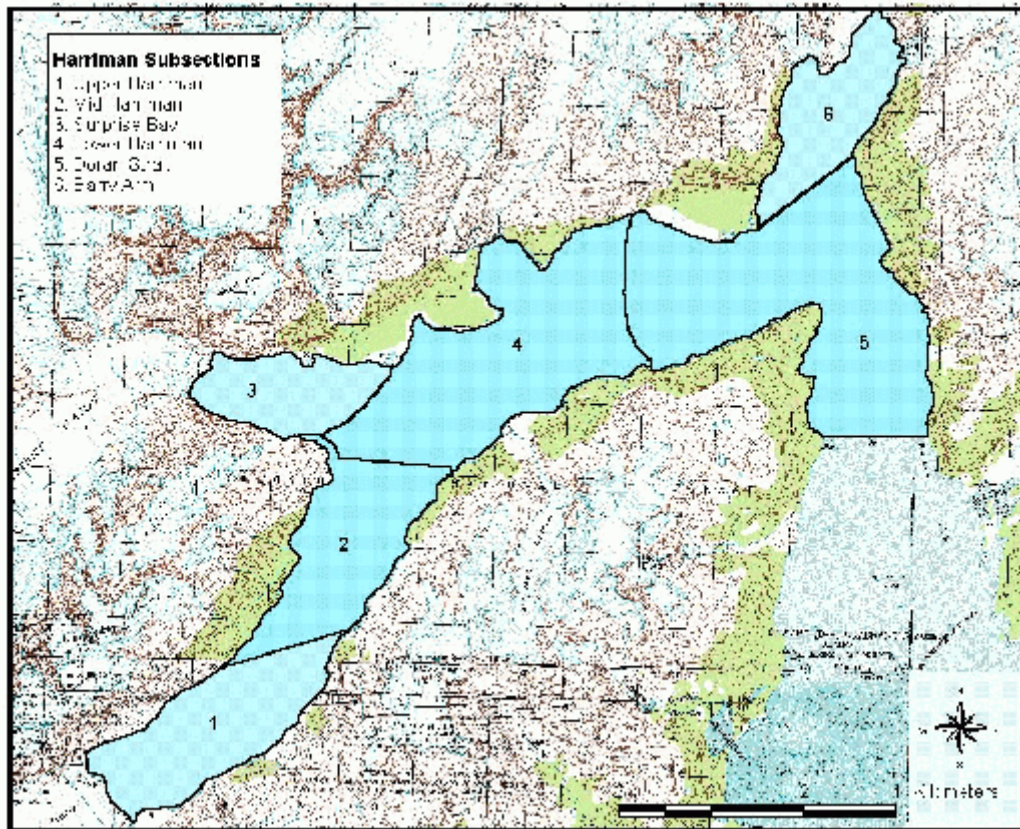


Figure 2. Areas used to examine spatial patterns of abundance of waterbirds and marine mammals in Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska - June 2000.

Landbirds

To increase landbird monitoring efforts in western Prince William Sound, 3 off-road point count routes were established in Harriman Fiord. Prior to route placement, the western Sound was divided into 54 sample units, each being a 4-township conglomerate (373 km²). The long-term landbird monitoring plan of the Glacier Ranger District is to establish clusters of 3 off-road point count routes within a subset of these units. Routes in Harriman Fiord were established primarily in needleleaf forests. Because ease of access was a major concern for these remote routes, they were placed near the shoreline.

We followed the Boreal Partners in Flight standard for off-road point count routes and established routes that contained 12 points spaced at ≥ 250 -m intervals. The observer recorded all birds seen or heard in a 5-min period. Individuals observed in the first 3 min were recorded separately from those recorded in the last 2 min. Individual detections were placed into 2 distance classes, ≤ 50 m or >50 m from each point. Care was taken not to count birds at >1 point. Each route was surveyed beginning at approximately 0430 h on 6 and 7 June. Andres surveyed the Doran Strait routes and Poe surveyed the Toboggan Glacier and Serpentine Cove routes (Figure 3).

We used a 4.3-m inflatable boat to survey the Toboggan route. Points were designated near a recognizable landmark on the shoreline; all points sampled needleleaf forests. Points were located 400-500 m apart, and each point was surveyed from the water ≤ 25 m of the shoreline. Distance to detected birds were estimated as if the observer were standing on the shoreline at the center of each point. The terrain in this section of Harriman Fiord is steep and rocky with hemlock-spruce covered cliffs and would be impossible to survey on foot. The Doran Strait and Serpentine Cove routes were surveyed by foot. Because routes were placed on the shoreline, open water contributed 50% of the cover of some of the points. Locations and vegetative cover of points are provided in Appendix 3. Data collected from all 3 routes were sent to the Alaska Biological Science Center to be included in the statewide off-road point count database.

RESULTS

Checklist

We recorded 66 species of birds during work in Harriman Fiord (Appendix 1). Numerous species of dabbling, diving, and sea ducks were present in the fiord in June. A flock of 5 cinnamon teal was observed on 11 July in Serpentine Cove. All 5 species of shorebirds encountered in the fiord were suspected of breeding (semipalmated plover, black oystercatcher, wandering tattler, spotted sandpiper, and common snipe). Spruce forests and shrubby avalanche chutes provide for a diverse landbird fauna in Harriman Fiord. Several species (e.g., Townsend's warbler and blackpoll warbler) are rarely found on islands of Prince William Sound (Andres, pers. obs.).

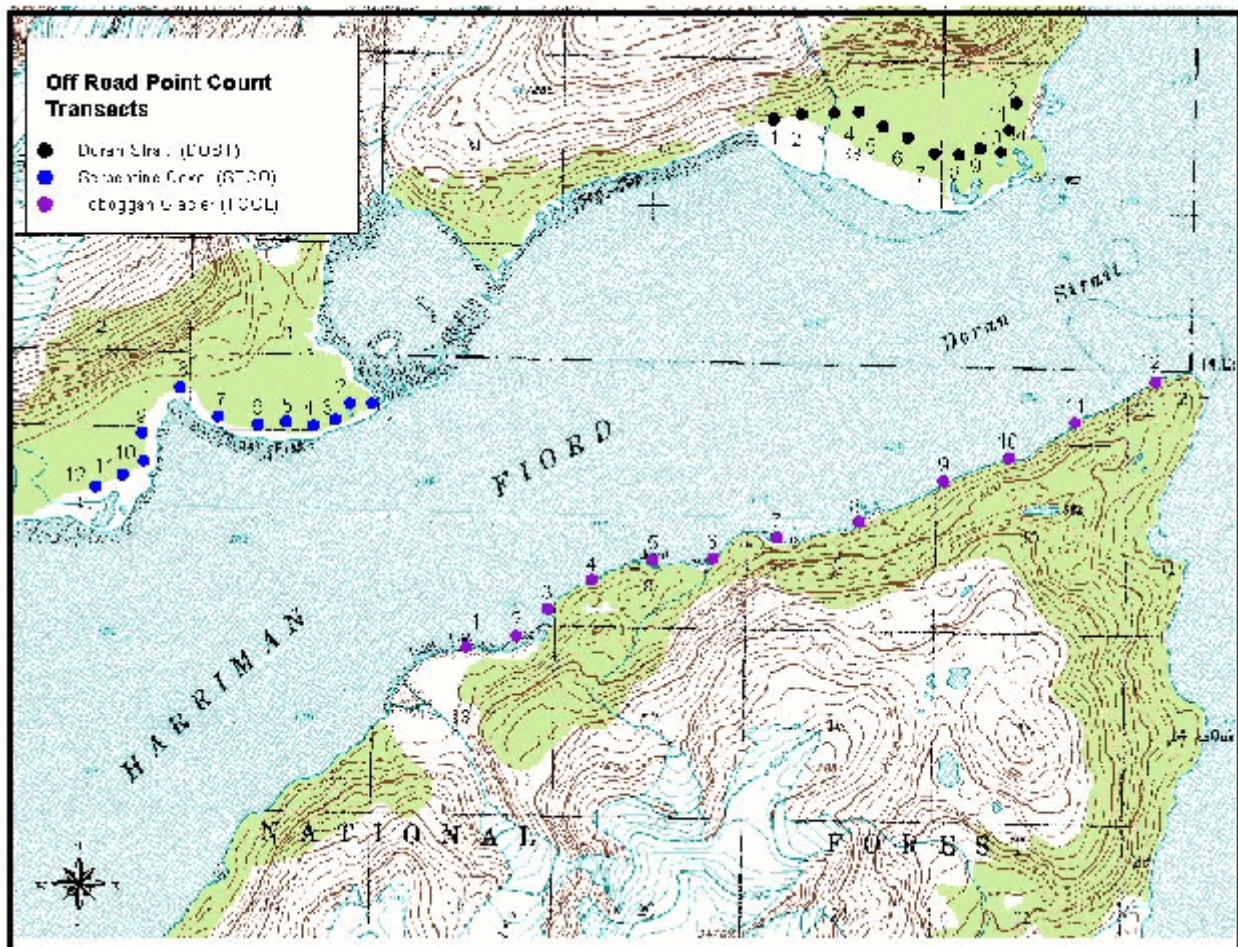


Figure 3. Locations of off-road point count routes established for landbird surveys in Harriman Fjord, Prince William Sound, Alaska - June 2000.

Black Oystercatchers

We located 21 pairs of Black Oystercatchers in Harriman Fiord. Pairs were distributed throughout the area (Figure 4), and overall density was 0.3 pairs/km. We found evidence of breeding (eggs, chicks, nest-building) for 15 pairs (71%). Fourteen nests were located on avalanche alluvia or glacial moraines; 3 nests were placed on large boulders. Shoreline density in Harriman Fiord was similar to that found in Russell Fiord, Yakutat, Alaska – also an area where avalanche alluvia supported most nesting pairs of oystercatchers (Stephensen and Andres 2001). Pair density in Harriman Fiord was higher than Knight Island (0.09 pairs/km), lower than Green Island (0.80 pairs/km), and similar to Montague Island (0.45 pairs/km). Observation of young chicks on the June survey indicates that some nests were initiated as early as 10 May in Harriman Fiord. On the July survey, we found only 4 pairs that had produced chicks (all 6 chicks were fledging age), and 2 nests still contained eggs. No 3-chick broods were observed. Productivity in Harriman (0.29 - 0.32 chicks/pair) was similar to Knight Island (0.29 chicks/pair) but was lower than Green Island (1.3 chicks/pair) and Montague Island (0.6 chicks/pair).

A concentration of 5 pairs nested with terns and mew gulls on a 600-meter circumference island in Serpentine Cove. Other high densities of nesting pairs associated with tern colonies have been observed on Channel Island in eastern Prince William Sound (Andres and Falxa 1995) and in Russell Fiord, Yakutat (Stephensen and Andres 2001). Several pairs nesting on this island placed their nests in patches of beachgrass (*Elymus*). Of >350 oystercatcher nests found by Andres in southcentral Alaska, these were the first 2 that were constructed completely in standing vegetation. Water levels during high tide were observed to reach the vegetation line on the moraine; nests placed more usually on beach gravel would have been washed away.

Waterbirds

We recorded 32 species of waterbirds on shoreline and offshore surveys; waterfowl, larids, and alcids were most prevalent (Table 2). All waterfowl were encountered along the shoreline, whereas densities of alcids and larids were generally higher on offshore transects. The marbled murrelet was the most abundant species and numbered about 1,500 individuals. Our estimate of the number of Kittlitz's murrelets was lower than the average June estimate (≈ 600 individuals) provided by Day and Nigro (1999). However, they found significant seasonal variation in counts. We expended extra effort to identify all murrelets to species.

Harlequin ducks and surf scoters were the most abundant waterfowl in Harriman Fiord and represented 68% of all waterfowl observations (Table 2). The observation of a flock of about 1,800 scoters in Doran Strait in July exceeded our population estimate for scoters. Opportunistic counts of flock counts made in June (about 600 individuals) also exceeded our transect-based population estimate.

Waterbirds were not evenly distributed throughout Harriman Fiord. Scoters were densest in Doran Strait, whereas harlequin ducks and other waterfowl were densest in Surprise Inlet and upper Harriman Fiord (Table 3). Scoter flocks appeared to move between moraine foraging sites

at Serpentine Cove and Doran Strait. Density of murrelets was the lowest where ice cover was greatest (Barry Arm and Surprise Inlet), whereas pigeon guillemots were densest in Doran Strait and Surprise Inlet. Patterns of distribution of Kittlitz's murrelets differed from those reported by Day and Nigro (1999); they recorded the greatest early summer densities of murrelets in Barry Arm and Doran Strait. Surprise Inlet, Barry Arm, and Doran Strait receive the greatest amounts of tour boat traffic in Harriman Fiord.

We recorded 4 species of marine mammals on shoreline and offshore surveys. Sea otters were fairly evenly distributed throughout Harriman Fiord with the exception of ice-choked Surprise Inlet (Table 4). In contrast, harbor seals were densest in Surprise Inlet and were mostly observed ≤ 200 m of the glacier front.

Seabird Colonies

We surveyed 4 colonies of seabirds in Harriman Fiord; 2 arctic tern colonies and 2 black-legged kittiwake colonies (Table 5). Mew gulls were present at the Serpentine Cove colony and a small colony ≤ 10 pairs was present at Hinge survey marker. Productivity at all colonies was poor. Only a single mew gull chick was found at the Serpentine Cove colony on 11 July. Terns were completely absent until 2200 h when 30 pairs arrived and began engaging in courtship behaviors; no juvenile terns were observed. The Joint colony did not produce any tern chicks and the Harriman Glacier kittiwake colonies were abandoned except for 4 nesting pairs by the July survey. Numerous glaucous-winged gulls nested on the cliffs between Surprise Inlet and Harriman Glacier.

Landbirds

We detected 27 bird species on 3 off-road point count routes of which 23 species were hummingbirds or passerines (Table 6). Of these 23 species, >4 individuals were recorded on all routes combined for 16 species (70%). The orange-crowned warbler and hermit thrush were the most abundant species encountered followed by the varied thrush and Wilson's warbler. Abundance and richness of small landbirds was highest on the Serpentine Cove and Doran Strait routes (Table 6). Although the sampled area was reduced on the boat-based Toboggan route, habitats were also less diverse on this route.

Boreal Partners in Flight (1999) has identified 7 species that depend on the coastal forests of the Chugach for priority monitoring efforts (rufous hummingbird, Steller's jay, northwestern crow, chestnut-backed chickadee, golden-crowned kinglet, varied thrush, and Townsend's warbler). Five of these species (not the jay or the kinglet) were detected on off-road point count routes in Harriman Fiord.

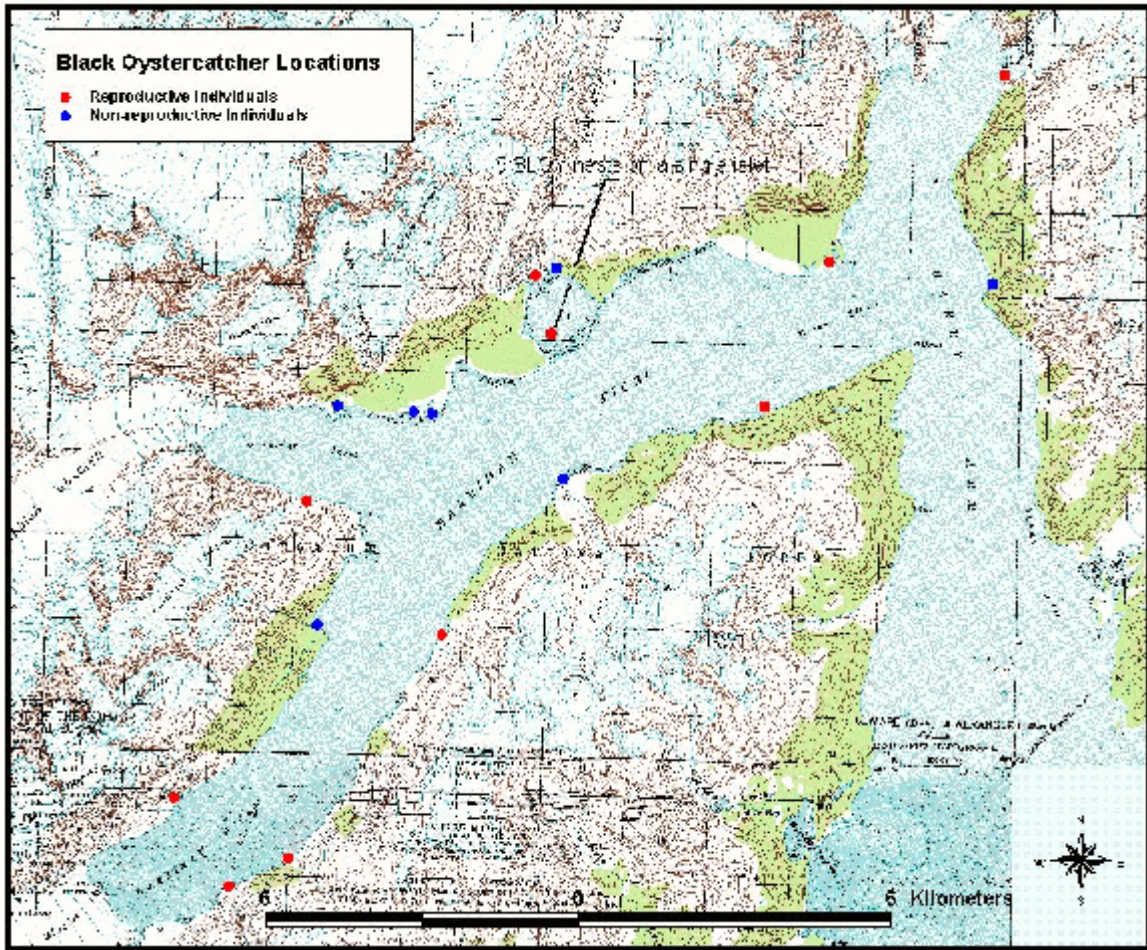


Figure 4. Locations of black oystercatcher pairs breeding in Harriman Fiord, Prince William Sound, Alaska - 2000.

Table 2. Density and population sizes of waterbirds and marine mammals recorded on transects in Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska - June 2000.

	Species	Individuals per km ²		Population size
		shoreline	offshore	
Birds				
	Red-throated Loon	0.02	-	2
	Horned Grebe	0.01	-	1
	Red-necked Grebe	0.03	-	3
	Double-crested Cormorant	0.01	-	1
	Gadwall	0.03	-	3
	American Wigeon	0.03	-	4
	Mallard	0.31	-	36
	Northern Shoveler	0.29	-	33
	Northern Pintail	0.07	-	8
	Green-winged Teal	0.10	-	11
	Canvasback	0.02	-	2
	Greater Scaup	0.23	-	26
	Harlequin Duck	2.81	-	322
	Surf Scoter	3.67	-	420
	White-winged Scoter	0.13	-	15
	Black Scoter	0.02	-	2
	Long-tailed Duck	0.16	-	18
	Barrow's Goldeneye	0.72	-	82
	Common Merganser	0.83	-	95
	Red-breasted Merganser	0.03	-	3
	Bald Eagle	0.08	-	9
	Wandering Tattler	0.02	-	2
	Spotted Sandpiper	0.03	-	3
	Mew Gull	0.80	0.08	98 ± 6
	Herring Gull	0.02	-	2
	Glaucous-winged Gull	1.16	1.23	219 ± 49
	Black-legged Kittiwake	1.03	3.09	334 ± 62
	Arctic Tern	0.03	3.48	247 ± 94

	Species	Individuals per km ²		Population size
		shoreline	offshore	
	Long-tailed Jaeger	-	0.10	7 ± 7
	Pigeon Guillemot	0.32	1.45	138 ± 81
	Marbled Murrelet	0.79	20.2	1502 ± 273
	Kittlitz's Murrelet	0.09	3.60	262 ± 76
Mammals				
	Sea Otter	0.27	8.61	633 ± 146
	River Otter	0.01	-	1
	Steller Sea Lion	0.01	-	1
	Harbor Seal	0.43	0.10	56 ± 7

Table 3. Densities of birds (per km²) recorded on shoreline and pelagic transects of Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska - June 2000.

	Harlequin Duck	Scoters	Waterfowl ¹	Marbled Murrelet	Kittlitz's Murrelet	Pigeon Guillemot
Barry Arm	0.00	0.00	0.00	0.00	0.00	0.00
Doran Strait	8.16	66.9	6.36	9.62	0.16	3.92
Lower Harriman	6.89	3.21	7.85	23.6	3.04	1.28
Mid Harriman	3.44	2.01	12.0	15.5	3.44	1.72
Upper Harriman	0.00	0.00	28.5	9.95	5.50	0.00
Surprise Inlet	102	0.00	37.8	0.92	0.92	6.45

¹ waterfowl species other than harlequin duck and scoters.

Table 4. Densities of sea otters and harbor seals recorded on shoreline and pelagic transects of Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska - June 2000.

	Sea Otter	Harbor Seal
Barry Arm	6.59	0.00
Doran Strait	3.92	0.00
Lower Harriman	6.41	0.16
Mid Harriman	4.58	0.29
Upper Harriman	3.93	0.00
Surprise Bay	0.00	22.1

Table 5. Numbers of birds and nests at colonies in Harriman Fiord, Prince William Sound, Alaska - June 2000.

Species	Joint Rock		Serpentine Island		N. Harriman Glacier		S. Harriman Glacier	
	birds	nests	birds	nests	birds	nests	birds	nests
Black-legged Kittiwake					23	13	56	33
Mew Gull			16	6				
Arctic Tern	40	5	90	39				

Table 6. Numbers and percentage of points of birds recorded off-road point count routes (12 stops) in Harriman Fiord, Prince William Sound, Alaska - June 2000.

Species	Number of individuals recorded on routes				% of points present (<i>n</i> = 36)
	Toboggan Glacier	Doran Strait	Serpentine Cove	all routes	
Bald Eagle	1	0	4	5	14
Black Oystercatcher	1	0	2	3	6
Wandering Tattler	0	0	1	1	3
Spotted Sandpiper	0	2	1	3	8
Rufous Hummingbird	1	1	6	8	17
Alder Flycatcher	0	2	3	5	11
Northwestern Crow	3	0	0	3	3
Tree Swallow	0	1	2	3	6
Chestnut-backed Chickadee	0	2	0	2	6
Winter Wren	0	1	0	1	3
Ruby-crowned Kinglet	0	7	1	8	22
Hermit Thrush	12	17	18	47	81
Varied Thrush	6	8	8	22	39
Orange-crowned Warbler	33	16	11	60	86
Yellow Warbler	0	4	3	7	11
Yellow-rumped Warbler	0	2	2	4	11
Townsend's Warbler	0	3	1	4	11
Blackpoll Warbler	0	1	0	1	3
Northern Waterthrush	0	2	2	4	8
Wilson's Warbler	8	12	8	28	64
Savannah Sparrow	0	5	1	6	11
Fox Sparrow	2	1	8	11	25
Song Sparrow	10	0	0	10	22
Lincoln Sparrow	0	7	6	13	31
Pine Grosbeak	1	0	0	1	3
Common Redpoll	1	5	11	17	17
Pine Siskin	0	2	0	2	3
Unidentified sparrow	0	0	2	2	6
Unidentified finch	0	0	2	2	6
All species	79	101	103	283	

MANAGEMENT RECOMMENDATIONS AND SURVEY IMPROVEMENTS

General Approach

In 2000, we demonstrated that a multi-taxa survey for waterbirds, shorebirds, landbirds, and marine mammals could be accomplished efficiently and effectively in Harriman Fiord. Total survey effort only amounted to 4 days in June and 2 days in July. The work summarized in this report represents the efforts of a mutually beneficial partnership between the Chugach National Forest and Migratory Bird Management division of the U. S. Fish and Wildlife Service. The U. S. Fish and Wildlife Service has had a long interest and vast experience with waterfowl, seabirds, and shorebirds of Prince William Sound. Additionally, they are charged with the management of the nation's landbirds. Their experience with managing these species has been invaluable in establishing landbird projects on the Chugach National Forest in the past. Managers on the Chugach National Forest have the responsibility for managing terrestrial habitats surrounding the Prince William Sound. Our integrated bird monitoring project for Harriman Fiord will help answer management questions regarding the effects of recreational use on waterfowl, seabirds, and shorebird populations. Information on landbirds will contribute to regional monitoring programs. All these monitoring efforts require a multi-year commitment to be useful. Repeat visits in July are useful to determine productivity of black oystercatchers and seabird colonies.

To understand the effects of increased recreational use, a reliable survey of motorized and non-motorized boat use of Harriman Fiord should be conducted. This survey could be part of a larger effort to determine increases in use of the western Prince William Sound. Foraging flocks of scoters and murrelets responded negatively to the approach of motorized, particularly large, boats. Large tour boats tend to follow the southern shoreline of the Fiord when traveling between the mouth of Barry Arm and Serpentine Cove. This allows for a disturbance refugium for scoter flocks along the shallower north shore. Murrelets were also most abundant in this area. More directed work toward understanding the effects that boat disturbance has on murrelets, particularly Kittlitz's murrelets, is immediately needed. Our population estimate for this species suggests that they may be continuing to decline.

The largest, vegetated island in the mouth of Serpentine Cove provides important nesting habitat for black oystercatchers, wandering tattlers (perhaps), arctic terns, and mew gulls. Intertidal moraines in this area provide important foraging habitat for sea ducks. We suggest that this seabird/shorebird nesting island be closed to landings between 15 May and 15 July.

Black Oystercatchers

The early nesting of several pairs of oystercatchers (about 10 May) and their use of avalanche debris for nest sites that may reduce the potential for conflict with recreational users. Many of the nest sites we found were not placed on beaches where recreational users would camp; about 5 of 21 pairs were located on beaches where conflicts could exist. We suggest that oystercatcher occupancy and productivity continue to be monitored and that this information be interpreted with respect to recreational beach use.

In a broader scale, we suggest that other shorelines of northern and western Prince William Sound be surveyed to locate and map densities and concentrations of breeding pairs. Besides Harriman Fiord, shoreline pair surveys have been conducted the Knight Island and Green Island area, on a portion of northwestern Montague Island, and in the northeastern Sound from Hawkins Island to Port Gravina.

Pair occupancy and nesting of other shorebird species should be recorded with greater care during oystercatcher surveys.

Waterbirds and Marine Mammals

Precision of population estimates of common bird species are similar to other surveys of this type (Lance et al. 1999) but could possibly be improved by stratification of Harriman Fiord. Further surveys are needed to determine if spatial patterns of distribution of waterbirds are similar among years. As mentioned above, concern about possible declines in Kittlitz's murrelet populations has recently been raised (Lance 1999), and a more thorough survey for this species should be undertaken. Because of significant seasonal, inter-annual, and spatial variability, several surveys may need to be conducted throughout the season (Day and Nigro 1999). Identification of foraging sites important to murrelets would be useful for managing human recreation, including tour boats, in the fiord.

We believe that an adaptive sampling approach would yield a better estimate of the population of scoters in Harriman Fiord. Because scoters tend to congregate in large flocks, we suggest that entire flocks be counted any time they are encountered during waterbird surveys or oystercatcher pair surveys. Maximum counts from June and July surveys should be used track populations in Harriman Fiord. We also suggest that colony counts be used to monitor populations of terns and gulls. The overall waterbird survey would be improved by the use a standardized platform for conducting shoreline and offshore surveys (i.e. 7.6-m [25'] boat).

Productivity of sea otter populations could be gathered by counting pups along with adults. This would not add much additional effort to the survey.

Seabird Colonies

More attention should be paid to enumerating small arctic tern colonies encountered during oystercatcher pair searches. Mew gull colonies could also be counted at this time. We did not count glaucous-winged gulls nesting along the northwestern shore between Surprise Inlet and Harriman Glacier, but suggest counting these birds in future years. Increases in large gull populations could be important for interpreting changes in kittiwake and oystercatcher populations.

Landbirds

Efforts for landbirds in Prince William Sound are important for filling a monitoring void in the coastal forests of southcentral Alaska (Boreal Partners in Flight Working Group 1999). Reasonable detections of a number of priority landbird species indicates that routes in Harriman Fiord are worth continuing. The use of boat-based methods should be expanded to other areas of the Sound. Besides providing information to track populations, off-road point count routes in Harriman Fiord can contribute to broader efforts to understand habitat relationships of landbirds on the Chugach National Forest and in coastal forests of Southcentral Alaska.

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LITERATURE CITED

- Andres, B. A., and G. A. Falxa. 1995. Black oystercatcher (*Haematopus bachmani*). In *The birds of North America* (A. Poole and F. Gill, Eds.). Philadelphia: Academy of Natural Sciences; Washington, D. C.: The American Ornithologists' Union. 20pp.
- Boreal Partners in Flight Working Group. 1999. Landbird conservation plan for Alaska biogeographic regions, version 1. Unpubl. Rep, U. S. Fish Wildl. Serv., Anchorage, Alas. 144pp.
- Day, R. H., and D. A. Nigro. 1999. Status and ecology of Kittlitz's murrelet in Prince William Sound, 1996-1998. *Exxon Valdez Oil Spill Restor. Proj. Final Rep.* (Restor. Proj. 98159), ABR, Inc., Fairbanks, Alas. 207pp.
- Klosiewski, S. P., and K. K. Laing. 1994. Marine bird populations of Prince William Sound, Alaska, before and after the *Exxon Valdez* oil spill. *Nat. Resour. Damage Assessment Bird Study Number 2*. Unpubl. rep., U. S. Fish Wildl. Serv., Anchorage, Alas. 85pp.
- Lance, B. K., D. B. Irons, S. J. Kendall, and L. L. McDonald. 1999. Marine bird and sea otter population abundance of Prince William Sound, Alaska: trends following the *T/V Exxon Valdez* oil spill, 1989-98. *Exxon Valdez Oil Spill Restor. Proj. Annu. Rep.* (Restor. Proj. 98159), U. S. Fish Wildl. Serv., Anchorage, Alas. 117pp.
- Stephensen, S. W., and B. A. Andres. 2001. Marine bird and mammal survey of Yakutat Bay, Disenchantment Bay, Russell Fiord, and Nunatak Fiord, Alaska. Unpubl. rep., U. S. Fish Wildlife Serv., Anchorage, Alas. 26pp.

APPENDICES

Appendix 1. Common and scientific names of bird species observed in Harriman Fiord and Barry Arm in June and July 2000.

Birds	
Red-throated Loon	<i>Gavia stellata</i>
Pacific Loon	<i>Gavia pacifica</i>
Horned Grebe	<i>Podiceps auritus</i>
Red-necked Grebe	<i>Podiceps grisegena</i>
Double-crested Cormorant	<i>Phalacrocorax auritus</i>
Gadwall	<i>Anas strepera</i>
American Wigeon	<i>Anas americana</i>
Mallard	<i>Anas platyrhynchos</i>
Cinnamon Teal	<i>Anas cyanoptera</i>
Northern Shoveler	<i>Anas clypeata</i>
Northern Pintail	<i>Anas acuta</i>
Green-winged Teal	<i>Anas crecca</i>
Canvasback	<i>Aythya valisineria</i>
Greater Scaup	<i>Aythya marila</i>
Harlequin Duck	<i>Histrionicus histrionicus</i>
Surf Scoter	<i>Melanitta perspicillata</i>
White-winged Scoter	<i>Melanitta fusca</i>
Black Scoter	<i>Melanitta nigra</i>
Long-tailed Duck	<i>Clangula hyemalis</i>
Barrow's Goldeneye	<i>Bucephala islandica</i>
Common Merganser	<i>Mergus merganser</i>
Red-breasted Merganser	<i>Mergus serrator</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Willow Ptarmigan	<i>Lagopus lagopus</i>
Semipalmated Plover	<i>Charadrius semipalmatus</i>
Black Oystercatcher	<i>Haematopus bachmani</i>
Wandering Tattler	<i>Heteroscelus incanus</i>
Spotted Sandpiper	<i>Actitis macularia</i>
Common Snipe	<i>Gallinago gallinago</i>
Long-tailed Jaeger	<i>Stercorarius longicaudus</i>
Mew Gull	<i>Larus canus</i>
Herring Gull	<i>Larus argentatus</i>
Glaucous-winged Gull	<i>Larus glaucescens</i>
Black-legged Kittiwake	<i>Rissa tridactyla</i>
Arctic Tern	<i>Sterna paradisaea</i>
Pigeon Guillemot	<i>Cephus columba</i>
Marbled Murrelet	<i>Brachyramphus marmoratus</i>
Kittlitz's Murrelet	<i>Brachyramphus brevirostris</i>

Rufous Hummingbird	<i>Selasphorus rufus</i>
Belted Kingfisher	<i>Ceryle alcyon</i>
Alder Flycatcher	<i>Empidonax alnorum</i>
Northwestern Crow	<i>Corvus caurinus</i>
Common Raven	<i>Corvus corax</i>
Tree Swallow	<i>Tachycineta bicolor</i>
Chestnut-backed Chickadee	<i>Poecile rufescens</i>
Winter Wren	<i>Troglodytes troglodytes</i>
Ruby-crowned Kinglet	<i>Regulus calendula</i>
Gray-cheeked Thrush	<i>Catharus minimus</i>
Hermit Thrush	<i>Catharus guttatus</i>
Varied Thrush	<i>Ixoreus naevius</i>
American Pipit	<i>Anthus rubescens</i>
Bohemian Waxwing	<i>Bombycilla garrulus</i>
Orange-crowned Warbler	<i>Vermivora celata</i>
Yellow Warbler	<i>Dendroica petechia</i>
Yellow-rumped Warbler	<i>Dendroica coronata</i>
Townsend's Warbler	<i>Dendroica townsendi</i>
Blackpoll Warbler	<i>Dendroica striata</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Wilson's Warbler	<i>Wilsonia pusilla</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Fox Sparrow	<i>Passerella iliaca</i>
Song Sparrow	<i>Melospiza melodia</i>
Lincoln's Sparrow	<i>Melospiza lincolni</i>
Pine Grosbeak	<i>Pinicola enucleator</i>
Common Redpoll	<i>Carduelis flammea</i>
Pine Siskin	<i>Carduelis pinus</i>
Mammals	
Sea Otter	<i>Enhydra lutris</i>
River Otter	<i>Lontra canadensis</i>
Steller Sea Lion	<i>Eumetopias jubatus</i>
Harbor Seal	<i>Phoca vitulina</i>
Black Bear	<i>Ursus americanus</i>

Appendix 2. Starting locations, headings, and lengths of offshore transects surveyed for waterbirds and marine mammals in Harriman Fiord and northern Barry Arm, Prince William Sound, Alaska - June 2000.

Transect	Area	Latitude	Longitude	Heading (°)	Length (km)
1	Doran Strait	61°03.40'	148°10.10'	36	2.35
2	Doran Strait	61°05.90'	148°09.10'	210	1.70
4	Doran Strait	61°04.80'	148°09.10'	33	1.25
5	Doran Strait	61°04.30'	148°10.10'	182	2.25
8	Doran Strait	61°03.80'	148°11.50'	340	1.90
9	Doran Strait	61°03.60'	148°12.70'	160	2.10
10	Doran Strait	61°03.48'	148°13.90'	335	2.70
6	Barry Arm	61°06.05'	148°08.20'	248	1.85
7	Barry Arm	60°05.90'	148°11.00'	65	1.15
11	Lower Harriman	61°05.20'	148°00.00'	158	2.85
12	Lower Harriman	61°02.85'	148°16.50'	335	2.70
13	Lower Harriman	61°02.60'	148°17.60'	160	2.20
14	Lower Harriman	61°02.40'	148°18.00'	310	2.75
20	Lower Harriman	61°02.48'	148°21.70'	68	2.85
16	Surprise Inlet	61°03.50'	148°22.50'	158	1.25
17	Surprise Inlet	61°02.48'	148°21.70'	338	1.50
21	Mid Harriman	61°01.62'	148°19.45'	248	2.05
22	Mid Harriman	61°01.10'	148°20.00'	66	1.75
23	Mid Harriman	61°00.70'	148°19.45'	248	1.50
24	Mid Harriman	61°20.30'	148°24.20'	68	1.50
25	Upper Harriman	60°59.58'	148°21.30'	248	1.95
26	Upper Harriman	60°59.35'	148°25.50'	66	2.90
27	Upper Harriman	60°58.55'	148°24.50'	248	1.60

Appendix 3. Locations and characteristics of off-road point count routes established for landbird surveys in Harriman Fiord, Prince William Sound, Alaska - June 2000.

	Point	% Vegetated	Tree height (m)	Utm1	Utm2
Doran Strait					
	1	50	12	0429892	6771570
	2	50	10	0433901	6773291
	3	100	12	0434138	6773275
	4	100	10	0434331	6773270
	5	100	10	0434543	6773154
	6	100	9	0434750	6773057
	7	100	10	0434994	6772920
	8	100	10	0435195	6772938
	9	50	10	0435285	6772795
	10	50	10	0435487	6772883
	11	100	9	0435517	6773069
	12	50	9	0435636	6773388
Toboggan Glacier					
	1	50	7	430984	6768664
	2	50	9	431415	6768729
	3	50	8	430984	6768664
	4	50	8	431698	6768931
	5	50	9	432588	6769521
	6	50	8	433099	6769486
	7	50	9	433097	6769493
	8	50	8	434285	6769832
	9	50	9	435019	6770206
	10	50	9	435573	6770371
	11	50	7	436165	6770660
	12	50	9	436829	6771003
Serpentine Cove					
	1	100	8	430186	6770789
	2	100	9	429998	6770807
	3	100	8	429917	6770654
	4	50	8	429711	6770545
	5	50	8	429476	6770649
	6	50	8	429230	6770630
	7	25	8	428878	6770726
	8	50	4	428542	6770914
	9	25	6	428252	6770586
	10	50	6	428277	6770359
	11	50	6	428086	6770215
	12	50	7	427841	6770108