

**PRE-FOX REMOVAL WILDLIFE SURVEYS AT AVATANAK ISLAND,
ALASKA**



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Key Words: Arctic fox, black oystercatcher, habitat restoration, harbor seal, invasive species, pigeon guillemot, rock sandpiper, seabird, sea otter, shorebird

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INTRODUCTION

Arctic and red foxes were introduced on many islands in the Aleutians for fur ranching purposes before 1930, and these predators extirpated or seriously reduced populations of native birds (Bailey 1993). Since 1949, the U.S. Fish and Wildlife Service has eradicated introduced foxes from 38 islands within the Alaska Maritime National Wildlife Refuge to restore native birds populations (Ebbert et al. in press). After fox removal many species of native birds reoccupy islands and reduced populations increase (Byrd et al. 1994) including the recovery of the once-endangered Aleutian Canada goose (Byrd 1998).

The oil spill settlement associated with the M/V *Kuroshima*, which went aground in November 1996 at Unalaska Island, included a project to remove introduced foxes from nearby Avatanak Island in order to restore native bird populations including species injured by the spill. As part of the overall project, the Trustee Council approved pre- and post-fox removal bird surveys to document the response of selected species to this mitigation project.

Arctic foxes were introduced to Avatanak by 1920 but few prior data exist concerning wildlife on the island. Nysewander et al. (1982) briefly surveyed wildlife along the north side of the island 17 June 1980. They recorded the following species: harlequin duck, common eider, bald eagle, pigeon guillemot, whiskered auklet, horned puffin, and common raven. Based on surveys elsewhere in the eastern Aleutians, a number of other species not observed by Nysewander et al. (1982) could be expected to occur at Avatanak as well. Our investigations included an inventory of all the species present in 2002 as well as the collection of baseline data on population densities of selected species to evaluate change after fox removal. Specifically, we wanted to obtain population indices for waterfowl, shorebirds, birds-of-prey, seabirds, and landbirds. Within each group we selected species especially vulnerable to predation by introduced foxes.

Surveys were conducted from the M/V *Tiglax* from 31 May - 2 June 2002. Observers involved in various surveys included: Poppy Benson (Alaska Maritime NWR, Homer), Catherine Berg (USFWS, Ecological Services, Anchorage), Vernon Byrd (Alaska Maritime NWR, Homer), Steve Ebbert (Alaska Maritime NWR, Homer), Dave Krueper (USFWS, Migratory Bird Office, Albuquerque, NM), Tony Godfrey (USFWS, volunteer), Cecil Magone (student intern, Qawalangin Tribe, Unalaska), Brian Shaishnikoff (student intern, Qawalangin Tribe, Unalaska), Steven Shaishnikoff (student intern, Qawalangin Tribe, Unalaska), and Jeff Williams (Alaska Maritime NWR, Adak).

STUDY AREA

Avatanak Island is located in the Krenitzen Island group in the eastern Aleutian Islands, Alaska. The island is approximately 9,000 acres in area. The interior is mountainous on the west and east ends of the island and has a gentle grade with rolling hills in the center. The highest point is 545 m in elevation. Most of the southern and eastern coasts are sheer

cliffs. Due to persistent southerly swells, erosion along the southern coast has created slide areas and nearshore areas are foul with submerged rocks. Kelp is not abundant along the southern coastline. The northern coast is characterized with sheer cliffs interspersed with larger stream valleys. Large, extensive kelp beds were found along the northern coast in contrast to the southern coast. Beaches tended to be narrow and short between cliffs and were mostly covered with boulders. The inter-tidal zone had numerous snails and limpets. Sea stacks were fairly common but there were few offshore islets with adequate soil for burrowing seabirds. The primary vegetation was a grass-umbel association near the coast interspersed at medium elevations with crowberry, moss and lichen associations. The higher areas had more bare rock and sparse vegetation. A number of freshwater lakes occurred in the interior of the island.

METHODS

Nearshore Coastline Surveys

Each morning, starting as soon as it was light enough to see well, two crews used inflatable boats to survey all birds and marine mammals in the water and on beaches and coastal talus slopes around the coastline of Avatanak. Boats operated as close to shore as kelp and rocks allowed, usually within 50 m. The procedure was to move along slowly and document all wildlife in each of 11 sections of the coastline (see Fig. 1). At least two observers were in each boat. Besides observations of individuals, nesting colonies of seabirds and nest sites of bald eagles were recorded.

Beach Surveys

We walked several stretches of beach along the high tide line and counted birds seen and heard on the beach and within 50 m inland. The surveys were conducted at various times of the day and were designed to gather abundance indices particularly for winter wrens and song sparrows.

Lake surveys

Ten lakes in the central portion of Avatanak (Fig. 2) were surveyed for nesting birds. Observers walked the perimeter of each lake documenting all avifauna. Observers split into 2 groups of 2 people and swept the perimeter out to 20 meters looking especially for nests. Birds out to 75 m from lake margins were recorded.

Off-Road Point Count

A standard 12-point route following the protocols for the Alaska Off-road Breeding Bird Survey (Handel 2002) was delineated with a GPS and marked with rebar stakes on 1 June. Surveyor's flags were placed every 10 m out to 100 m and every 25 m to 250 m from each stake to help with estimation of distances to birds detected. Plant cover also was identified within 50 m of center stakes and recorded according to the standard protocol (Handel 2002). On 2 June, Jeff Williams, with Cecil Magone recording,

conducted the survey according to established methods (e.g. all birds detected during 5 minutes at each plot were delineated in survey booklets).

Area Searches for Shorebirds and other Terrestrial Birds

As part of a program to develop standard methods for monitoring breeding shorebirds, Dr. John Bart, Boise State Univ., sent Dave Krueper and Tony Godfrey to survey shorebirds on 25 random plots (400 m x 400 m) on Avatanak (Figure 3). They located and surveyed 24 of the plots using GPS units and walked over each plot recording territorial pairs of shorebirds, particularly rock sandpipers. They also recorded rock ptarmigan and other birds encountered.

Other Observations

In addition to the more structured surveys, we kept track of all species of wildlife encountered during the work at Avatanak.

RESULTS

The following accounts focus on these species and species groups we predict are the most likely to experience significant population changes as a result of the removal of introduced foxes. Summaries of individual species observations (Appendix A), details of beach surveys (Appendix B), details of coastline surveys (Appendix C), photographs and coordinates of off-road point count plots (Appendix D), and coordinates for the area search plots (Appendix E) are attached to the report after the following accounts of our findings for selected species.

Arctic Fox

We saw foxes periodically during the survey, mostly on beaches. For example, on 2 June we counted 4 animals from our boats during the morning coastline survey (Table 1). Furthermore, we saw 6 foxes during our surveys of 5 beach segments (Table 2). We observed fox scat, fox fur, and well-worn trails around the perimeter of most lakes. Foxes appeared to be relatively common on the island.

Cormorants

Several breeding colonies were noted on cliffs inaccessible to foxes (Fig. 2). Additional nesting areas could become available after foxes have been eliminated.

Ducks

Foxes make it difficult for any species of ducks to successfully breed. During various surveys, we found one mallard nest and a predated egg that may have been from a green-winged teal. Only 2 green-winged teal were observed on 10 lakes surveyed (Table 3, Fig. 2). There was no evidence of nesting for red-breasted mergansers although we noted one

or two pairs in the near shore marine areas. The most common duck observed was the harlequin duck (Table 1). All harlequin ducks in the Aleutians are non-breeders and are known to summer in the Aleutians. No common eiders were seen, but this is a species that increased substantially after fox removal elsewhere in the Aleutians (Byrd et al. 1994). Overall it appeared few ducks are now breeding on Avatanak.

Glaucous-winged Gull

Gull nests are particularly susceptible to fox predation, and the only nesting birds we saw were on offshore rocks or on a single cliff area inaccessible to foxes (Fig.2). Nevertheless, we saw an average of 155 birds, mostly adults on morning coastline surveys (Table 1) so there is a population present that will likely begin to breed successfully as soon as the foxes are removed.

Rock Ptarmigan

A great deal of the island's interior was traversed while walking to and surveying the shorebird plots, point count route, and lake surveys. No birds were seen on the point count survey itself (Table 4), and only 2-3 ptarmigan were seen per day elsewhere by the shorebird crew (Table 5). The species is distinctly uncommon on Avatanak. Ptarmigan typically increase substantially after foxes are removed (Bailey 1993).

Black Oystercatcher

We found no evidence of nesting for this species even though a few birds were present. A high daily count of 13 was recorded on 31 May on the beaches during the morning coastline survey (Table 1). We saw singles and flocks of up to 5. All these birds were mobile and most were flushed from offshore rocks, not the main island. Observations elsewhere indicate oystercatchers are among the first species to begin nesting after foxes are removed (Byrd et al. 1997).

Rock Sandpiper

The shorebird crew recorded rock sandpipers on 6 of the 23 plots they surveyed (Table 5), and a few were seen elsewhere by the other crews. A nest with 4 eggs was found on 1 June. This species should benefit from fox removal, but this will be the first opportunity to quantitatively evaluate their response.

Pigeon Guillemot

Our population indices for pigeon guillemots were very similar among days ranging from 132 to 139 birds during the three morning surveys (Table 1). Guillemots probably were in the early incubation stage during our surveys based on what is known about average dates of laying (reference). This species increased in two other studies after fox removal (Byrd et al.1994 and Byrd et al. 1997).

Tufted Puffin

Puffins usually are unable to successfully nest in typical earthen burrows on islands with introduced foxes. We noted a single breeding colony in an area too steep for foxes to access, and several birds were seen flying into crevices in cliffs where they also were safe from foxes (Fig. 2). We counted more than 250 birds on two of the morning coastline surveys (Table 1). Williams (unpubl. data) documented a substantial increase in puffins after fox removal in the western Aleutians.

Song Birds

On coastline and beach surveys it was apparent that winter wrens were abundant at Avatanak (Tables 1 and 2). Apparently they are small enough and nest in inaccessible enough places to escape significant fox predation. Typically wrens tend to be restricted to coastal areas, but at Avatanak, wrens were found inland as well as near the coast, occurring on the majority of stations on the point count route (Table 4). Song sparrows were less common than wrens on the beach surveys (Table 1). In more inland areas, Lapland longspurs and savannah sparrows were the most common species (Tables 3 and 4).

Other Wildlife Observations

We recorded 34 species of birds and 3 species of marine mammals during surveys on Avatanak (Appendix A). Sea otters, which have declined in the central and western Aleutians in the past 15 years, are apparently maintaining at least moderate populations at Avatanak. We saw up to 27 adults and 5 pups (Table 1). Harbor seals also occurred in fairly high densities; up to 70 were seen on coastline surveys June 2 (Table 1). Avatanak had a diverse and dense group of raptors. We found 8 active nests of bald eagles (Fig. 2) and counted up to 37 adults and 7 juveniles. Also present were golden eagles, probably at least two different birds, and we saw 2 to 3 pairs of rough-legged hawks. The presence of voles probably accounted for the golden eagles and rough-legged hawks. The most unusual species encountered was Eurasian skylark, a stray from Asia. At least 5 singing males were observed in different parts of the island on 1 June.

DISCUSSION

The bird life on Avatanak was similar to other islands in the Aleutians with foxes. We found little evidence of nesting by waterbirds (loons and ducks), no surface-nesting seabirds (gulls and terns) on most of the island, no black oystercatchers nesting near beaches, and low densities of nesting sandpipers in upland areas. Rock ptarmigan populations also were very low, and burrow nesting seabirds (puffins) apparently were restricted to small populations nesting in inaccessible areas. The larger songbirds like song sparrows were not very common. Crevice-nesting species like pigeon guillemots were present in moderate numbers but likely will increase following fox removal.

The quantitative surveys conducted at Avatanak 31 May – 2 June, 2002 provide a basis for comparison after the planned removal of introduced foxes. Additional birds surveys conducted during fox removal will supplement the database used for future comparisons.

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Table 1. Coastline Survey at Avatanak I., 31 May-2 June, 2002.

Species	31-May	1-Jun	2-Jun	Min	Max	Mean	SD
DCCO ^a	32	5	12	5	32	16.3	14.0
DCCO(Nest)	15	0	0		15	5.0	8.7
PECO	25	1	15	1	25	13.7	12.1
PECO (Nest)	14	0	0		14	4.7	8.1
RFCO	10	6	29	6	29	15.0	12.3
UNCO	12	79	70	12	79	53.7	36.4
Total Cormorants	79	91	126	79	126	98.7	24.4
HADU	93	51	99	51	99	81.0	26.2
RBME	0	0	4	0	4	1.3	2.3
BAEA (ad)	25	34	37	25	37	32.0	6.2
BAEA (im)	7	7	3	3	7	5.7	2.3
BAEA (nest)	7	8	8	7	8	7.7	0.6
GOEA	0	1	1	1	1	0.7	0.6
RLHA	0	0	6	0	6	2.0	3.5
GWGU	145	162	159	145	162	155.3	9.1
BLOY	13	4	11	4	13	9.3	4.7
ROSA	0	2	1	0	2	1.0	1.0
CORA	10	12	13	10	13	11.7	1.5
PIGU	139	134	132	132	139	135.0	3.6
WHAU	0	1	0	0	1	0.3	0.6
TUPU	269	274	97	97	274	213.3	100.8
HOPU	108	87	61	61	108	85.3	23.5
WIWR	22	54	85	22	85	53.7	31.5
SOSP			25		25	25.0	
ROFI	0	0	8	0	8	2.7	4.6
WATA	0	0	1	0	1	0.3	0.6
ARFO	1	0	4	0	4	1.7	2.1
SEOT (ad)	14	27	18	11	27	19.7	6.7
SEOT (pup)	4	3	5	3	9	4.0	1.0
HASE	48	51	70	48	70	56.3	11.9
SSLI	23	24	20	20	24	22.3	2.1

^aCodes for species use first two letters of each name (e.g. DCCO is Double-crested Cormorant. See Appendix A for full names.

Table 2. Summary of observations of birds and arctic foxes seen on beach surveys at Avatanak 1-2 June, 2002.

Location	Winter Wrens	Song Sparrows	Black Oystercatchers	Arctic Fox
Chimney Cove Beach	2	4	0	2
Trapper Cove Beach	1	3	0	0
West Mountain Beach	20	4	0	1
Section I Beach	10	7	0	0
Beach w. of Trapper's Cove	19	13	0	3

Table 3a. Surveys of lakes on Avatanak Island, Alaska, 1 June 2002.

Species	Dorothy	Toto	Twister	Westwitch	Eastwitch	Flying Monkey	Auntie Em's	Lion	Scarecrow	Tinman
Aleutian green-winged teal			1			1				
Winter wren			1		2	1				
Lapland longspur	11		2	3		7	1	2	1	1
Song sparrow	2 ^a		1		4	2				
Savannah sparrow	10	3	4		6	11 ^b				
American pipit				1				1		
Least sandpiper					1					
Rock sandpiper						1				
Bank swallow						1				
Eurasian skylark	1			1	2	3				
Bald Eagle						1				

^a One nest with 4 eggs

^b Two nests, 5 and 4 eggs, respectively.

Table 3b. Location of lakes surveyed on Avatanak Island, Alaska, 1 June 2002.

Lake	Latitude	Longitude	GPS location
Dorothy	54° 04.91 N	165° 22.77 W	N end
Toto	54° 04.34 N	165° 23.23 W	NE end
Twister	54° 04.50 N	165° 23.71 W	SE end
Westwitch	54° 04.52 N	165° 23.29 W	N end
Eastwitch	54° 04.36 N	165° 22.78 W	NW end
Flying Monkey	54° 04.57 N	165° 22.21 W	SW end
Auntie Em's	54° 05.04 N	165° 22.14 W	SE end
Lion	54° 05.10 N	165° 22.16 W	S end

Table 4. Birds observed on Off-Road Point Count route 363, Avatanak Island, Alaska, 1 June 2002. Includes birds observed on the ground and flying over the census area.

Species	1	2	3	4	5	6	7	8	9	10	11	12	Tot
Lapland longspur	1	2	1	1	3	2	2	3	3	1	1	2	22
Savannah sparrow	3	1	2	2	1					1	1		11
Winter wren	2	1		1			2	1		2		1	10
Song sparrow	1												1
Bank swallow		1											1
Eurasian skylark			1		1					1	1		4
Rock sandpiper				1	2			1					4
Least sandpiper							1						1
American pipit				1		1				1	1		4
Rosy finch									1	1			2
Glaucous-winged gull	1	1	9	1								1	13
Common raven												1	1
Bald eagle	2											1	3
Rough-legged hawk					1								1

Table 5. Numbers of birds observed on 400 m 'shorebird' plots at Avatanak I., June 2002.

Plot	ROSA	LESA	ROPT	AMPI	SASP	SOSP	GCRF	SNBU	LALO	EUSK	WIWR
1		3		4	10				4		1
2	3				2						
3					1				2	1	
4				4				3			
5	4										
6				4	2				2	1	
7				6			3	4	2		
8				4	4				1		
9				3	5		3		2		2
10				4	2		3		1		
11	1		2								
12	3			6	6	3			4	1	
14									4		
15				7	3				3		
16	1			4	3	1					1
17			3	3	3						1
18			2	2	3					1	
22				7	6		3		5		
24				3	5	1			1		2
25				5	1				2		
26				3	6		2		2		
28	2			5	3				3		1
29				4	3	1	3		2		1
30				1	1		1				

* Codes: ROSA = rock sandpiper, LESA = least sandpiper, ROPT = rock ptarmigan, AMPI = American pipet, SASP = savannah sparrow, SOSP = song sparrow, GCRF = gray-crowned rosy finch, SNBU = snow bunting, LALO = Lapland longspur, EUSK = Eurasian skylark, WIWR = winter wren

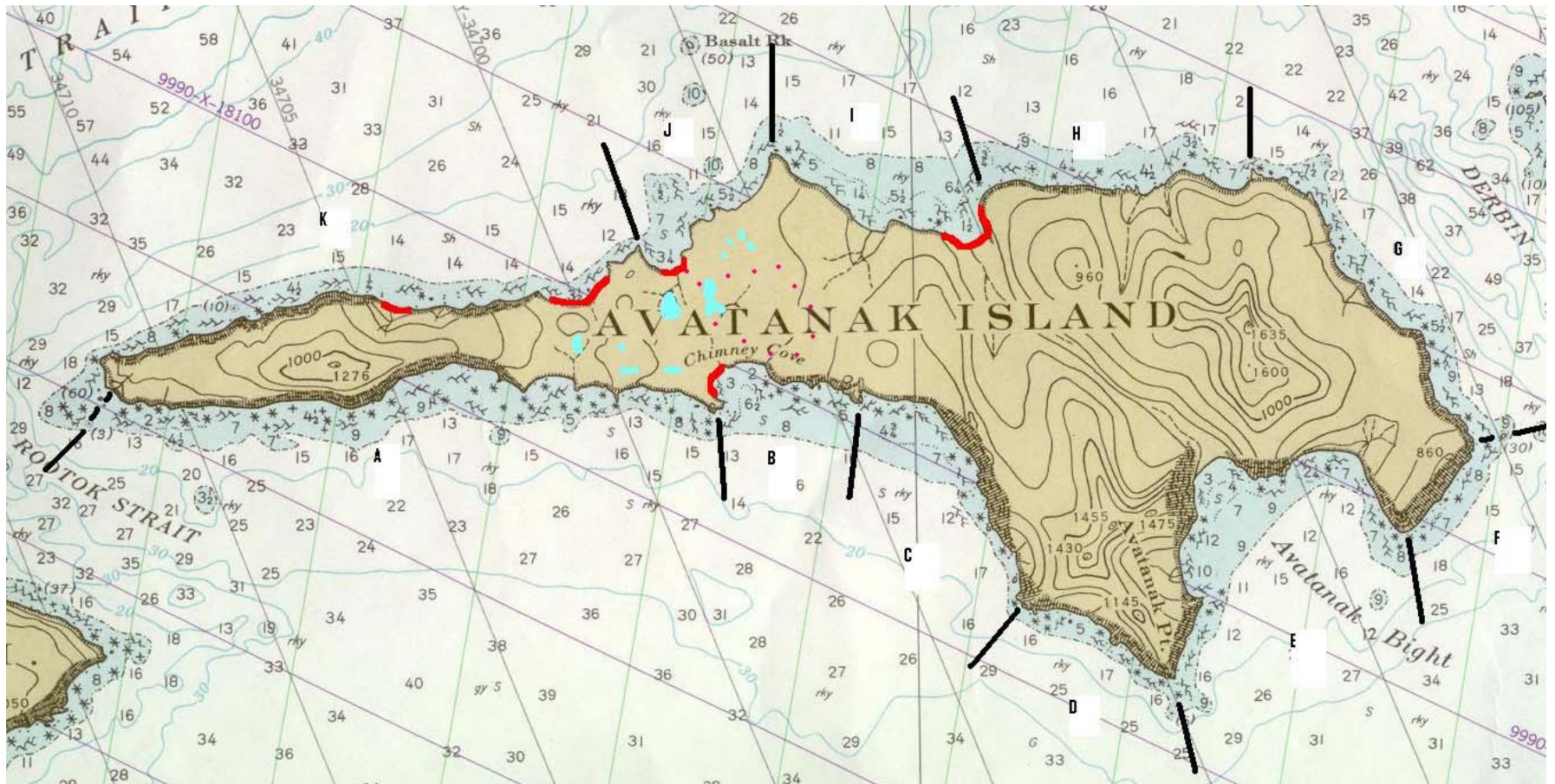


Figure 1. Map of Avatanak Island, Alaska. Dark black lines indicate coastline survey segments, light blue areas indicate lakes, purple dots indicate point count locations, red irregular lines indicate beach survey locations in 2002.

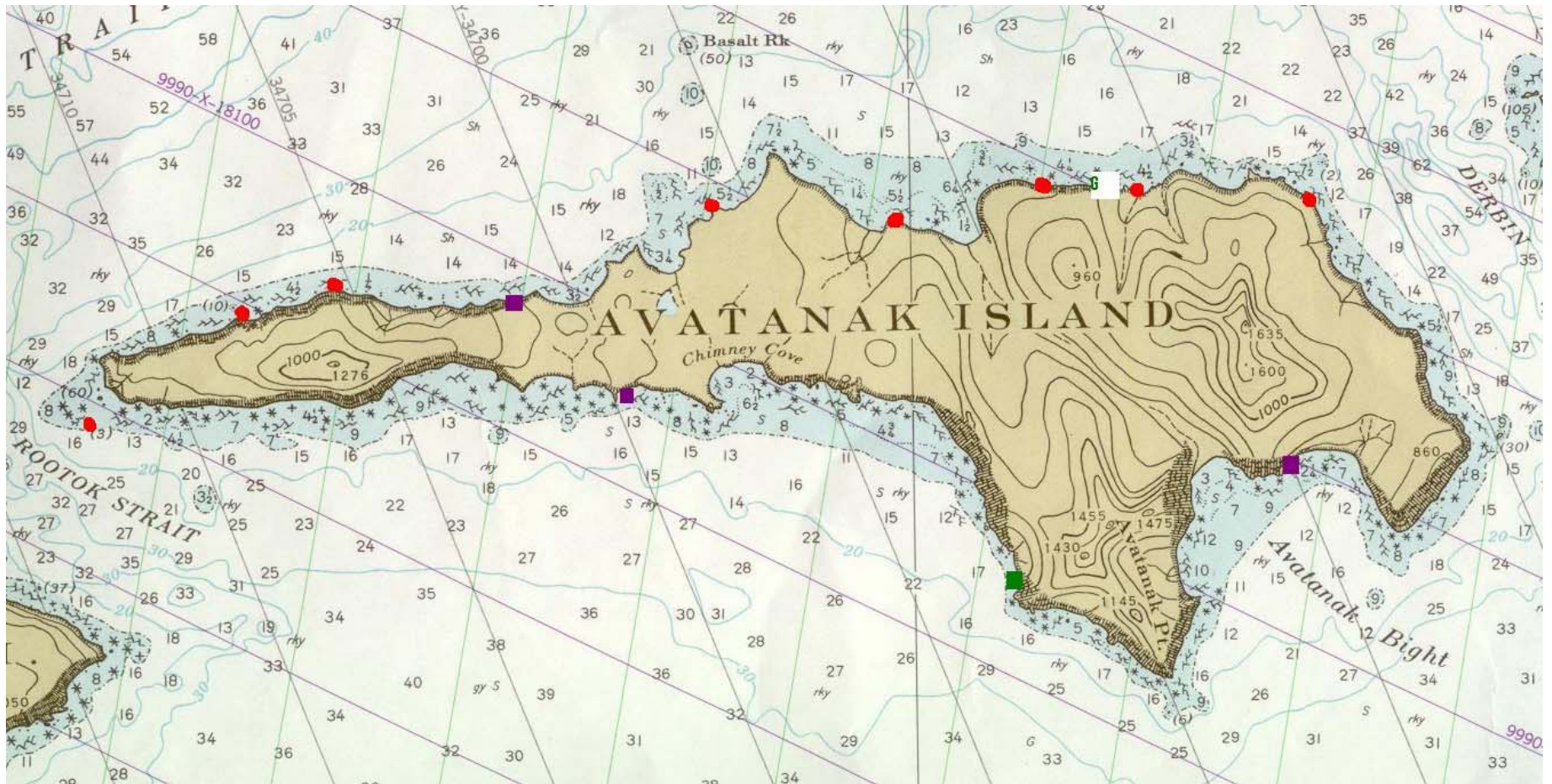


Figure 2. Map of Avatanak Island, Alaska showing location of bald eagle nests (red circles), cormorant colonies (purple squares), puffin colonies (green squares), and gull colonies (green letter G) in 2002.

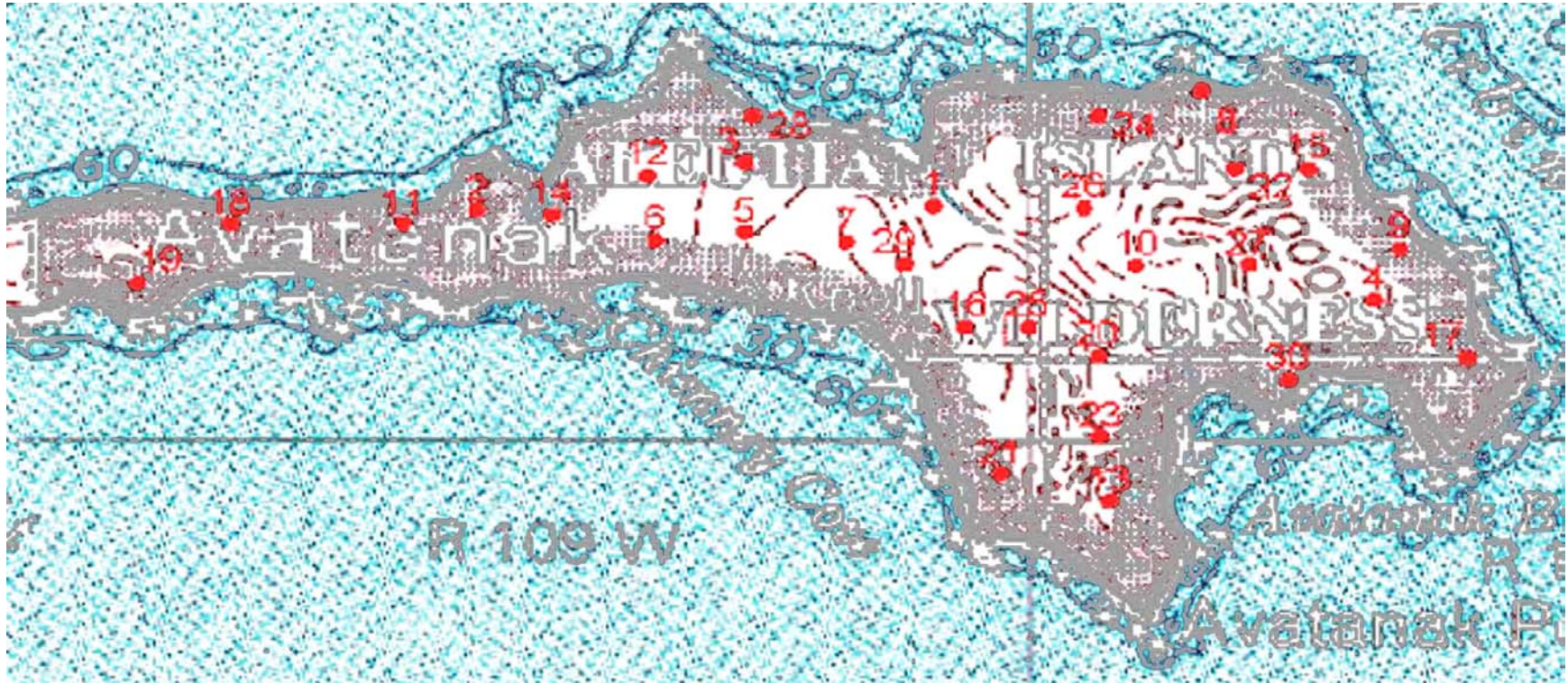


Figure 3. Map of Avatanak Island, Alaska showing location of “shorebird” plots (red circles) in 2002.

Appendix A: Annotated List of Species at Avatanak, 31 May – 2 June, 2002.

Double-crested cormorant (*Phalacrocorax carbo*): A colony was located on the south side (Fig. 1) containing at least 15 nests. We saw up to 32 birds on coastline surveys (Table 1). Numerous individuals were observed flying across the narrow portion of the island around Chimney Cove on several days.

Pelagic Cormorant (*Phalacrocorax pelagicus*): Up to 25 were seen on daily coastal surveys and at least 14 nests were counted on the south side.

Red-faced Cormorant (*Phalacrocorax urile*): Up to 29 were seen on daily coastal surveys. They probably were nesting.

Unid. Cormorant (*Phalacrocorax* spp.): During our surveys the south side was rough and it was difficult to separate red-faced and pelagic cormorants particularly. If we lumped all cormorants recorded, we saw up to 126 on a coastal survey (Table 1).

Green-winged Teal (*Anas crecca nimia*): A pair was seen on a lake on 31 May. Also two different males were seen on lake surveys. One predated egg found which probably was from this species.

Mallard (*Anas platyrhynchos*): One female was flushed off a nest with 8 eggs on 31 May, and a different female was seen at a creek in Segment I on 1 June (Fig. 1).

Red-breasted Merganser (*Mergus serrator*): One or possibly two pairs seen in nearshore waters on the north side of the island on 2 June.

Harlequin Duck (*Histrionicus histrionicus*): Numbers seen on daily coastline surveys varied from 55 to 99 (Table 1).

Bald Eagle (*Haliaeetus leucocephalus*): Bald eagles were particularly common. We saw up to 7 juveniles during coastline surveys, and we observed up to 37 adults. It was difficult to determine if there were nests on the south side because of survey conditions, but we found 8 nests, largely on the north side (Fig. 2).

Golden Eagle (*Aquila chrysaetos*): One adult was seen inland on 31 May, and single birds also were seen at cliff tops in Segment G on 1 June and in Segment I on 2 June.

Peregrine Falcon (*Falco peregrinus*): One was seen on the cliffs in Segment H on 1 June. Possibly a different bird, which appeared to be lighter than a typical *F. p. peali*, was seen on the east side of the island on 2 June. One light-bellied bird seen by Tony on the east side.

Rough-legged Hawk (*Buteo lagopus*): Two seen together (a pair) in interior on 1 June. One was seen harassing a bald eagle. At least 2 and possibly 3 pairs were seen along the north shore on 2 June. One bird appeared to be hovering low over an area that likely

contained a high density of voles. A single immature was observed on the east side of the island on 2 June.

Black Oystercatcher (*Haematopus bachmani*): Most of the oystercatches we saw were on offshore rocks. Up to 13 were seen in a day, but most were singles or small flocks (up to 5). We found no evidence of nesting.

Rock Sandpiper (*Calidris ptilocnemis*): One nest found with 4 eggs. A few also were seen on the beaches. Dave Krueper and Tony Godfrey had the impression that densities were low. It appeared most birds were incubating.

Least Sandpiper (*Calidris minutilla*): Three territorial males were seen in the draw back of Segment I, and another was seen elsewhere.

Wandering Tattler (*Heteroscelus incanus*): A single bird was seen on an offshore rock on 2 June.

Glaucous-winged Gull (*Larus glaucescens*): At least one nesting colony was found on the mainland on the north side (Fig. 2) containing about 30-35 birds. Nesting birds were also noted as singles or in very small groups (up to 5) on offshore rocks. Counts around the island averaged about 155 birds.

Rock Ptarmigan (*Lagopus mutus*): This species was uncommon at Avatanak. Approximately 2-3 seen each day during extensive walking on the shorebird plots and lake surveys.

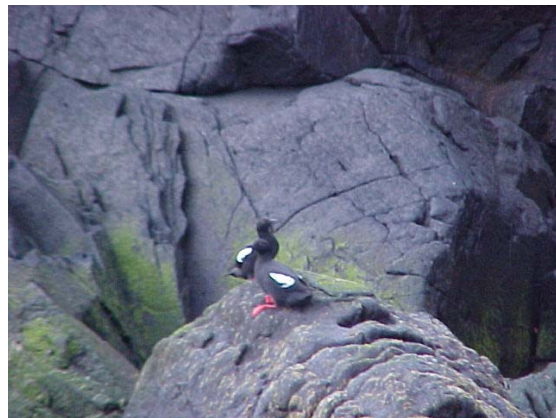
Tufted Puffin (*Fratercula cirrhata*): One small colony was seen on a sea stack on the south side, and there were several seen flying into crevices on cliffs on the main island. Peak counts were less than 300 on the coastline survey (Table 1).

Horned Puffin (*Fratercula corniculata*): Probably a few were nesting in crevices on the main island, particularly at the western end of the island. Up to 100 were seen on the coastline survey.

Pigeon Guillemot (*Cephus columba*): On the coastline survey, an average of 135 were counted, most were on the north side of the island.

Ancient Murrelet (*Synthliboramphus antiquus*): A few were seen near shore.

Whiskered Auklet (*Aethia pygmaea*): A sick bird was seen on the north side on 1 June.



Common Raven (*Corvus corax*): We saw 10-13 on the daily coastline surveys and a nest was found on a cliff ledge on the north side of the island on 2 June. We could not see the nest contents but a pair was in close attendance.

Bank Swallow (*Riparia riparia*): Two different individuals were seen on 1 June.

Dipper (*Cinclus mexicanus*): A single bird was singing on a creek on the east end of the island.

Song Sparrow (*Melospiza melodia maxima*): A total of 25 singing birds were recorded on the coastline survey on 2 June, and 31 birds were counted on a series of beach transects (Table 2). We found a Song sparrow nest containing 4 eggs and one fledgling was seen on 2 June.

Winter Wren (*Troglodytes troglodytes*): Wrens were abundant. Not only did we see and hear them on coastline surveys (up to 85 on 2 June, but wrens were also seen inland.

Rosy Finch : A few were seen on the cliffs.

American Pipit (*Anthus rubescens*): Territorial pairs were common in the uplands, up to 20 birds were seen each day.

Eurasian Skylark (*Alauda arvensis*): Up to 5 singing males were seen on 31 May and birds were seen also on 1-2 June.

Lapland Longspur (*Calcarius lapponicus*): These were fairly common.

Savannah Sparrow (*Passerculus sandwichensis*): This was one of the most common passerines. Three savannah sparrow nests were found, one with 5 eggs and two with 4 eggs, all in tufts of *Calamagrostis*.

Golden-crowned Sparrow (*Zonotrichia atricapilla*): One was heard near the cove in Segment I on 1 June.

Snow Bunting (*Plectrophenax nivalis*): Up to 8-10 were seen in scree slopes at high elevation.

Sea otter (*Enhydra lutris*): Up to 27 adults and 5 pups were seen on the coastline surveys.

Harbor Seal (*Phoca vitulina*): The peak count was 70 on the coastline survey on 2 June.

Steller Sea lion (*Eumatopias jubatus*): About 20-24 were seen each day.

Arctic fox (*Alopex lagopus*): We saw foxes frequently on beaches.

Vole: We saw a lot of digging, particularly in drainages. Steve collected 5. Rough-

legged hawks and maybe golden eagles may be feeding on these.

Atka Mackerel (*Pleurogrammos hexapterus*): A large school was seen by the ship in shallow water nearshore on the north side of the island.

Sandlance (*Ammodytes hexapterus*): At least two “balls” of age 1 or 2 fish (5-6 cm) were seen nearshore on the north shore during boat surveys for birds.

Unidentified fish: We observed numerous fish up to 4 inches in length in Twister, Flying Monkey, and Eastwitch lakes, but did not have time to capture any to confirm identification. Smaller fish, possibly of the same species were abundant in the same lakes. We assume the fish were most likely sticklebacks.

Appendix B. Beach Surveys at Avatanak Island, 1-2 June, 2002

Chimney Cove Beach

Time: 0916-0943
Observer: J. Williams, C. Magone
Start Location: 54 04.41N, 165 22.12W
End Location: 54 04.21N, 165 22.31W
Weather: calm, overcast, no precip.

WIWR: 2 heard
SOSP: 4 heard
CORA: 1 heard
ARFO: 2 seen

Trapper Cove Beach

Time: 1015-1051
Observer: J. Williams, C. Magone
Start Location: 54 05.10N, 165 22.02W
End Location: 54 04.21N, 165 22.58W
Weather: calm, overcast, no precip.

WIWR: 1 heard
SOSP: 3 heard

West Mountain Beach (mostly boulders, backed by steep hillside)

Time: 1300-1400
Observer: V. Byrd, P. Benson, R. Shaishnikoff, S. Shaishnikoff
Start Location: 54 04.83N, 165 25.34W
End Location: 54 04.91N, 161 25.95W
Length: 820 m
Weather: calm, overcast, no precip.

WIWR: 12 heard singing, 8 more seen
SOSP: 3 heard, 1 more seen
ARFO: 1 seen

Section I east beach (to 50 m inland) sand in the middle, boulder elsewhere, stream in center backed by valley, rest backed by steep hillsides

Time: 1445-1530
Observer: V. Byrd, P. Benson, R. Shaishnikoff, S. Shaishnikoff
Start Location: 54 05.46N, 165 19.43W
End Location: 54 05.27N, 165 20.04W

Length: 600 m

Weather: ne 15, overcast, no precip.

WIWR: 4 singing, 6 others seen

SOSP: 4 singing and 4 others seen including 1 fledgling

ROSA: 3 seen

AMPI: 2 seen

SASP: 1 seen

Beach w. of Trappers Cove Beach (mostly boulders, backed by steep cliffs and hillsides, stream in middle)

Time: 1445-1530

Observer: V. Byrd, J. Williams, S. Shaishnikoff

Start Location: 54 05.02N, 165 23.41W

End Location: 54 04.89N, 165 24.15W

Weather: ne 15, overcast, no precip.

WIWR: 19

SOSP: 13

ARFO: 3

CORA: 2 and nest

Appendix C. Table C.1. Counts of Birds and Marine Mammals along the coastline of Avatanak I. 31 May 2002

Species	A	B	C	D	E	F*	G	H	I	J	K	Total
Time	6:53-8:00	8:00-8:20	8:20-8:50	8:50-9:10	9:10-9:48	8:4-8:50	7:59-8:44	7:19-7:59	6:38-7:19	5:58-6:38	6:00-6:53	
Cond.	fair	fair	fair	fair	fair	poor	fair	good	good	good	good	
Observ.	JW, SE	JW, SE	JW, SE	JW, SE	JW, SE	CB, VB	CB, VB	CB, VB	CB, VB	CB, VB	JW, SE	
PIGU	8	3	11	1	10	6	9	20	18	33	20	139
BLOY				2		3	5	1	2	0		13
HADU	7	8	5			32	18	4	18	1		93
TUPU	85		19	48	20		22	50		2	23	269
HOPU	14	33	30	5		3	11		3	0	9	108
GWGU	19	6	15	1	1	2	42	34		8	17	145
BAEA (ad)	2	2			1		4	8	1		7	25
BAEA (im)								1	3	1	2	7
BAEA (nest)							1	2	1	1	2	7
DCCO	30							2				32
DCCO(Nest)	15											15
UNCO	2			1		3	6					12
PECO					21						4	25
PECO (Nest)					10						4	14
CORA	2	1	1						5		1	10
SEOT (ad)	3				2		4	1		3	1	14
SEOT (pup)							3			1		4
HASE	19				1	2	4	8	2	4	8	48
SSLI	1			18						3	1	23
												0
WIWR	5	2									11	18

*F only partially surveyed due to rough seas

Appendix C. Table C.2. Counts of Birds and Marine Mammals along the coastline of Avatanak I. 1 June 2002

Species	A	B	C	D	E	F	G	H	I	J	K	Total
Time	6:00-7:40	7:40-8:00	8:00-8:35	8:35-8:49	8:53-9:15	9:39-9:48	9:00-9:45	8:45-9:00	8:10-8:45	7:45-8:10	6:45-7:30	
Cond.	poor	poor	poor	poor	poor	poor	good	good	good	good	good	
Observ.	CB, SE	CB, SE	CB, SE	CB, SE	CB, SE	CB, SE	VB, PB	VB, PB	VB, PB	VB, PB	VB, PB	
PIGU	10		2		16		19	9	9	38	31	134
BLOY							4					4
HADU	7				20		1	6	10		7	51
TUPU	64	68	50	38	8		21	10	5		10	274
HOPU	4	19	3	12	4	3	8				34	87
GWGU	40	13	37	2			42	26	1		1	162
BAEA (ad)	8	3			1		4	4	2	4	8	34
BAEA (im)										2	5	7
BAEA (nest)	1						1		1	2	3	8
DCCO			2				3					5
DCCO(Nest)												0
UNCO	38		1	2	36		2					79
PECO			1									1
PECO (Nest)												0
RFCO			2		4							6
CORA	3		1				1	1	1		5	12
SEOT(ad)	5				3		6	4	3		6	27
SEOT(pup)								1	1		1	3
HASE	3	1					13	10	4	4	16	51
SSLI	1			20			2				1	24
WIWR	5	5			4		11	2	5	5	17	54
GOEA							1					1
WHAU							1					1
ROSA	2											2

e. end .10 not covered due to sea state

Appendix C. Table C-3. Counts of Birds and Marine Mammals along the coastline of Avatanak I. 2 June 2002

Species	A	B	C	D	E	F	G	H	I	J	K	Total
Time	10:00-11	9:30-10	8:56-9:30	8:37-8:56	7:15-8:33	6:57-7:11	6:57-7:37	7:39-8:40	8:40-9:10	9:10-9:30	9:30-10:20	
Cond.	poor	poor	poor	poor	poor	poor	good	good	good	good	good	
Observ.	CB, SE	CB, SE	CB, SE	CB, SE	CB, SE	CB, SE	VB, JW	VB, JW	VB, PB	VB, JW	VB, JW	
PIGU			8		13	10	13	20	11	30	27	132
BLOY		1	1				1	3			5	11
HADU	32	4	1		20		9	6	27			99
TUPU	15	5	16	12	18	3	8	7	4		9	97
HOPU	21	3	4		1	5	2				25	61
GWGU	34	7	31	10		1	26	47		1	2	159
BAEA (ad)	4	3	2	1	2		3	6	5	3	8	37
BAEA (im)	1						1				1	3
BAEA (nest)	1						1	2	1	1	2	8
DCCO			9				2			1		12
DCCO(Nest)												0
UNCO	56	3	2	4	2		3					70
PECO		1			14							15
PECO (Nest)												0
RFCO	29											29
CORA	3	1	1	1	2		2	2	1			13
SEOT(ad)	6		1		1		5	2	3			18
SEOT(pup)	1				1		3					5
HASE	32		1				3	26	8			70
SSLI			2	10		4	4					20
WIWR	3	1	2	2	5		28	19	5	6	14	85
GOEA								1				1
WHAU												0

ROSA			1								1
SOSP	3	1	1	2	4	2	3	3	2	4	25
ARFO		2					1			1	4
ROFI				1		4	1		1	1	8
RBME							2		2		4
RLHA								4		2	6
WATA								1			1

Appendix D. Avatanak Point-count Route Description

Route: Avatanak I.

Elevation change: 13 m to 140 m

Note: All compass bearings were 0 deviation

Point 1: $54^{\circ} 04.97' N$ $165^{\circ} 22.62' W$. 13 m elevation. Approximately 125 m from old trappers cabin in Trappers Cove. Photo looking NW toward cove.



Point 2: $54^{\circ} 04.97' N$ $165^{\circ} 22.35' W$. 26 m elevation. Photo looking 45° NE to Flying Monkey Lake. Pt. 3 is across lake.



Point 3: 54° 04.93N 165° 21.71W. 50 m elevation. Photo looking W from Pt. 3 to Flying Monkey Lake and Trapper Cove.



Point 4: 54° 04.96N 165° 21.71W. 53 m elevation. Note Flying Monkey Lake and Chimney Rock in background.



Point 5: 54° 05.01N 165° 21.96W. 70 m elevation. Photo from Pt. 5 looking 238°. Pt. 4 to right of person in background. Note Flying Monkey Lake in background



Point 6: 54° 05.06N 165° 21.05W. 116 m elevation. Photo looking 234° back to Pt. 5.



Point 7: 54° 04.82N 165° 20.93W. 140 m elevation. Photo looking 330° N to Tanginak Island (faintly visible) in distance.



Point 8: 54° 04.65N 165° 21.02W. 106 m elevation. In small ravine of triple lake system. Note lake and coastline in background.



Point 9: 54° 04.53N 165° 21.33W. 120 m elevation. Above small lake. Photo looking 212° to Chimney Cove.



Point 10: 54° 04.43N 165° 21.64W. 66 m elevation. Near small grassy marsh. Photo looking 248°.



Point 11: 54° 04.51N 165° 21.94W. 80 m elevation. Photo looking 320° back to Trappers Cove across Flying Monkey Lake.



Point 12: 54° 04.54N 165° 22.28W. 60 m elevation. Photo looking 320° back to Trappers Cove across W side of Flying Monkey Lake.



Appendix E. Area Search Plot Coordinates

ID	X COORD UTM	Y COORD UTM	LONG	LAT
1	479030.00000	5992395.00000	-165.31841	54.08015
2	474725.00000	5992355.00000	-165.38421	54.07960
3	477246.00000	5992877.00000	-165.34571	54.08441
4	483206.00000	5991361.00000	-165.25453	54.07101
5	477258.00000	5992108.00000	-165.34547	54.07750
6	476414.00000	5992029.00000	-165.35837	54.07675
7	478206.00000	5991997.00000	-165.33098	54.07654
8	481578.00000	5993680.00000	-165.27954	54.09180
9	483454.00000	5991930.00000	-165.25077	54.07613
10	480957.00000	5991741.00000	-165.28892	54.07435
11	474021.00000	5992202.00000	-165.39495	54.07819
12	476339.00000	5992738.00000	-165.35957	54.08312
13	480704.00000	5989142.00000	-165.29262	54.05098
14	475434.00000	5992302.00000	-165.37337	54.07916
15	482581.00000	5992812.00000	-165.26416	54.08403
16	479345.00000	5991070.00000	-165.31351	54.06826
17	484079.00000	5990734.00000	-165.24115	54.06540
18	472396.00000	5992206.00000	-165.41979	54.07814
19	471519.00000	5991556.00000	-165.43313	54.07225
20	480590.00000	5990744.00000	-165.29446	54.06538
21	479679.00000	5989448.00000	-165.30829	54.05369
22	481889.00000	5992803.00000	-165.27474	54.08393
23	480621.00000	5989858.00000	-165.29393	54.05741
24	480599.00000	5993394.00000	-165.29449	54.08919
25	479934.00000	5991067.00000	-165.30451	54.06825
26	480467.00000	5992376.00000	-165.29645	54.08004
27	482013.00000	5991754.00000	-165.27278	54.07450
28	477335.00000	5993383.00000	-165.34439	54.08896
29	478773.00000	5991760.00000	-165.32229	54.07444
30	482398.00000	5990492.00000	-165.26682	54.06317

UTM ZONE 3