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AERIAL BIRD SURVEY

OF THE COASTAL WATERS OF KODIAK ISLAND, ALASKA:

MARCH 9-14, 1977

by

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U.S. FISH AND WILDLIFE SERVICE

Kodiak National Wildlife Refuge

Kodiak, Alaska

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ABSTRACT.-- A total of 26,036 individuals of 29 nominal species was observed during an aerial survey conducted March 9-14, 1977 which covered more than 90% of the Kodiak Island coastline. The population density in the coastal waters was conservatively estimated at 100.71 ± 24.68 birds/km^2. The winter bird population is composed primarily of sea ducks 51%, dabbling ducks 17%, diving ducks 12%, gulls 8%, and alcids 6%. The upper ends of the bays and estuaries contained high concentrations (up to 368 birds/km^2) of dabbling ducks, goldeneye, scoters, and murres. Results are compared with previous surveys and the distribution pattern of each species is discussed.

INTRODUCTION

This survey was undertaken to (1) ascertain the species inhabiting the coastal waters of Kodiak Island during the winter, (2) determine their relative numbers, and (3) locate areas of abundance or concentration.

The coastal waters of Kodiak Island provide excellent habitat for large numbers of wintering waterfowl and seabirds. Until very recently this important resource was ignored by wildlife biologists. The staff of the Kodiak National Wildlife Refuge conducted ship-board surveys along much of the coastline in February of 1973 and 1975 (U.S. Fish and Wildlife Service, 1973, 1975), and the Alaska Department of Fish and Game conducted aerial transects of Kodiak and Afognak islands coastal waters in February and March of 1976 using a stratified-random design (Arneson 1977).

The Kodiak area will be highly impacted by proposed offshore oil drilling operations in the Gulf of Alaska, and the potential for an oil spill in coastal waters is great. Baseline quantitative data on the bird populations of these waters is urgently needed.

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METHODS

A Cessna 185 on amphibious floats, chartered from the Office of Aircraft Services in Anchorage, was used to fly the transects. The plane was piloted by Tom Balleau and all observations were made by John L. Trapp. The aircraft was flown at an airspeed of 177 km/hr (110 mph) and at an altitude of 30-60 m (100-200 ft). The pilot maintained a flight path approximately 0.4 km (0.25 mi) off the beach and all birds encountered within a 200 m transect were tallied. A portable tape recorder was used to record observations.

Survey segments were non-randomly selected and generally followed geographic features (i.e. they normally encompassed discrete bay systems). In large part, they were selected to correspond with similar transect routes used in the 1973 and 1975 boat surveys (Table 1). They were of no standardized length or time period. Transects ranged from 3 to 28 min in length and averaged 10.6 min.

The survey was conducted on March 9, 12, and 14. A total of 7.93 hours was spent in actual survey time. The 45 transects completed encompass more than 90% of the Kodiak coastline.

RESULTS AND DISCUSSION

A total of 26,036 individuals of 29 nominal species was observed during the course of the survey (Table 2). The mean population density in coastal waters was estimated at 100.71 $\pm$ 24.68 (95% confidence limits) birds/km^2 (SD = 12.59; range = 9.5 to 368). This estimate is almost certainly conservative, because (1) aerial surveys rarely record all birds present (Stott and Olson 1972), and (2) the effective width of the transect was probably less than 200 m.

The survey data is broken down by species in Table 2 and summarized by species groups in Table 3. The survey indicates that the winter bird population is composed primarily of sea ducks 51%, dabbling ducks 17%, diving ducks 12%, gulls 8%, and alcids 6%. The percentage of alcids in the population is probably greatly underestimated (see below). Scoters (Melanitta spp.) comprised 72% of the sea duck component, while

mallards (Anas platyrhynchos) comprised 79% of the dabbling duck component. The majority (65%) of the diving duck component was goldeneyes (Bucephala spp.), while murres (Uria spp.) accounted for 78% of the alcids observed.

Those areas having particularly high concentrations (More than two times the mean) were Barling Bay (368 birds/km^2), Portage Bay (207), Moser Bay (254), lower end of Olga Bay (276), East Arm of Uganik Bay (322), and Terror Bay (242). Other areas with notable concentrations were Sitkalitak Narrows, Kaiugnak Bay, Kiavak Bay, and Sulua Bay. The principal species in these concentrations were (in decreasing order of abundance): mallards, scoters, gulls (Larus spp.), goldeneyes, oldsquaws (Clangula hyemalis), and scaup (Aythya spp.)

It is quite obvious that the most important habitat type (as reflected in both densities and species diversity) for wintering waterfowl on Kodiak Island is the protected estuarine tidal flats found at the heads of nearly all the bays. Hayes et al. (In prep) listed the estuarine tidal flats as one of the coastal environments most susceptible to oil impact.

A comparison of the 1977 aerial survey data with the 1973 and 1975 boat survey results indicates marked discrepancies (Table 3). Compared to the boat surveys, the 1977 aerial survey had relatively more dabblers, scaup, goldeneye, bufflehead (Bucephala albeola), harlequin ducks (Histrionicus histrionicus), scoters, and gulls. Relatively fewer loons (Gavia spp.), Somateria eiders, oldsquaws, murres, murrelets (Brachyramphus spp.), and crested auklets (Aethia cristatella) were observed on the aerial surveys. These differences can be largely accounted for by the different survey techniques.

The dabblers, goldeneye, and bufflehead were all concentrated in the estuaries at the heads of the bays, an area which could not be surveyed by boat. Harlequin ducks, and to a lesser extent gulls, are restricted to the coast, or at least reach greatest densities there. Large gull concentrations were also encountered in the estuarine zone. The larger relative abundances of scaup and scoters is less easy to explain, although both species tended to occur in more protected waters at the heads of bays. Stott and Olson (1972) found that 98% of the waterfowl counted from the air along the New Hampshire coastline were within 500 yards (460 m) of shore.

Loons and Somateria eiders may have a more offshore distribution in the winter, in which case they would have been underestimated by the aerial survey. Arneson (1977) reported that common eiders (S. mollissima) tended to dive at the approach of aircraft. The relatively low murre numbers are hard to explain, but could be a result of several factors: local movements of birds in and out of the survey area, concentrations of murres just beyond the limits of the present survey, underestimate of numbers in dense feeding flocks, feeding behavior of birds, or reactions to low flying aircraft. Oldsquaws were found to be the most difficult duck to count in the New Hampshire study (Stott and Olson 1972). They are hard to see because of their small size, light color, active behavior, and tendency to dive at approach of aircraft. The factors just enumerated for oldsquaws probably also affect the detectability of murrelets. Crested auklets were probably missed because of their small size and patchy distribution.

As expected, there was much better agreement with Arneson's (1977) aerial survey data. There was very close correlation in the relative abundances of the major groups (Arneson's figures appear first): dabbling ducks, 10 vs 17%; diving ducks, 14 vs 12%; sea ducks, 53 vs 51%; gulls, 6 vs 8%; and alcids, 9 vs 6%. Despite these similarities in species groups, there was much variation among individual species. Both aerial surveys greatly underestimated the numbers of alcids. This group comprised 42-45% of all birds observed during the boat surveys (U.S. Fish and Wildlife Service 1973, 1975) compared with figures of 6-9% for the aerial surveys.

The 1973 and 1975 boat surveys indicated winter densities of 129 and 147 birds/km^2, respectively (U.S. Fish and Wildlife Service 1973, 1975; Gerry C. Atwell, pers. comm.). The predominant species group in both years was the alcids (45.0 and 41.5%, respectively). These winter densities are much higher than those reported for the coastal portions of the Lower Cook Inlet (0.4-14.0 birds/km^2; Erickson 1976) and Prince William Sound (40 birds/km^2; Dwyer et al. 1976). Dick et al. (1976) found a mean summer density of 113 birds/km^2 in Chiniak and Marmot bays, Kodiak Island. The predominant species were tufted puffin (Lunda cirrhata) and black-legged kittiwake (Rissa tridactyla) (45.8 and 20.6%, respectively).

Stott and Olson (1972) evaluated aerial waterfowl surveys on the New Hampshire coastline and found that they accounted for only 20.0 to 80.9% (average 50%) of the birds actually present. These authors concluded that the extreme variation in the aerial counts, and the large discrepancies between aerial and ground counts, cast

serious doubt on the usefullness of the aerial survey technique as as indicator of population trends of sea ducks.

SPECIES ACCOUNTS

Gavia spp. Unidentified Loon. Loons were observed on 24% of the transects but numbers were low. These conspicuous birds were probably not missed to any great extent. However, they range much further offshore than the limits of the transects and probably reach greater densities than reflected by this survey.

Podiceps spp. Unidentified Grebe. Observed in small numbers on 27% of the transects. The greatest concentration (one-half of all birds seen) was in Deadman Bay. All of the grebes positively identified were red-necked grebes (P. grisegena). The smaller horned grebe (P. auritus)was probably present but overlooked.

Phalacrocorax spp. Unidentified Cormorant. Cormorants were the most widely distributed species, occurring on 96% of the transects. It was generally impossible to identify cormorants to species from the air. As a group, these large, easily identified birds were very conspicuous, and estimates are probably more accurate than for any other group. I did not observe a tendency to dive at the approach of the aircraft as was noted by Arneson (1977).

Philacte canagica. Emperor Goose. Emperor goose numbers were almost certainly underestimated. They were observed on only five transects, all on the east and south sides of the island between Chiniak Bay and Cape Alitak. Emperors blend into the rocks and reefs on which they rest and feed and can be easily overlooked. All of the geese recorded were in flight.

Anas platyrhynchos. Mallard. Mallards were the second most abundant species recorded on the survey. The 3,512 individuals observed represents 13.5% of all birds seen. They were encountered on 40% of the transects. Invariably the birds were concentrated at the heads of the bays on the exposed estuarine tidal flats. Large concentrations were noted at Hidden Basin (151 birds), Kiliuda Bay (440), Midway Bay (325), Barling Bay (200), Portage Bay (230), Sulua Bay (200), Deadman Bay (252), Uyak Bay (185), Zachar Bay (200), East Arm of Uganik Bay (400), Terror Bay (350), and Sheratin Bay (381).

Anas strepera. Gadwall. Twelve birds were observed in Terror Bay. This species is probably more abundant and widespread than the survey results indicate.

Anas crecca. Green-winged Teal. A single bird was noted in Uyak Bay. This small duck may have been overlooked in the large concentrations of mixed dabblers present at the heads of most bays.

Anas americana. American Wigeon. A total of 90 birds was observed on 9% of the transects. Over one-half were seen in Deadman Bay. As with the last two species, American wigeon numbers were probably underestimated.

Anas spp. Unidentified Dabblers. Eighteen percent (812 birds) of the dabblers encountered were not identified to species. All were concentrated at the heads of the bays in the estuarine tidal flats. Pintails (A. acuta)were not identified in the survey, but are probably present in small numbers.

Aythya spp. Unidentified Scaup. Scaup were encountered in moderate numbers (700 birds) but their distribution was uneven, with birds recorded on only 13% of the transects. They were observed in Kiliuda Bay, Sitkalidak Narrows, Kiavak Bay, lower end of Olga Bay, and the East Arm of Uganik Bay. Mose were probably greater scaup (A. marila), but a few lesser scaup (A. affinis) may have been present.

Bucephala spp. Unidentified Goldeneye. Goldeneyes as a group were the third most abundant species encountered, with 2,025 individuals tallied on 69% of the transects. Goldeneyes were well distributed around the coastline but were most abundant in the more protected bays. Greatest concentrations was observed at the head of Terror Bay (341 birds). No a-tempt was made to distinquish common (B. clangula) and Barrow's (B. islandica) goldeneyes. Goldeneye numbers were probably greatly underestimated. The tendency of goldeneyes to flush upon approach of the aircraft (Stott and Olson 1972) was noted during the survey and made counting difficult.

Bucephala albeola. Bufflehead. This species was encountered in small numbers on 24% of the transects. They were always found at the heads of protected bays in the same area as the goldeneyes. Bufflehead numbers were probably underestimated.

Clangula hyemalis. Oldsquaw. Oldsquaws were well-distributed in good numbers, with 1,875 individuals observed on 76% of the transects. Oldsquaws are difficult to see from the air (Stott and Olson 1972) and were no doubt greatly underestimated.

Polysticta stelleri. Steller's Eider. Surprisingly few Steller's eiders were observed. A mere 677 birds were tallied on 27% of the transects. More than 90% of the birds were distributed along the east coast between Shakmanof Point on the north and Sitkalidak Narrows on the south.

Somateria spp. Unidentified Eider. One hundred and eight birds were identified as common (S. mollissima)and/or king (S. spectabilis) eiders. These species probably have a primary distribution lying offshore beyond the limits of this survey. Arneson (1977) found that common eiders dove upon approach of an aircraft.

Melanitta deglandi, M. perspicillata, and M. nigra. White-winged, Surf, and Black Scoters. Scoters were the most abundant species encountered in the coastal survey. The 9,609 individuals recorded accounts for 37% of all birds observed on the survey. Scoters were encountered on all 45 transects. Of the 3,622 scoters identified to species, 49% were white-winged, 5% were surf, and 47% were black scoters. Greatest concentrations of white-winged scoters were south of the Aliulik Peninsula between Cape Kaguyak and Cape Trinity, and the lower reaches of Olga Bay. Surf scoters were particularly numerous in Pasagshak Bay, while black scoters were encountered in greatest numbers in Kiavak Bay and Viekoda Bay. Overall, the greatest scoter densities by far (170 birds/km^2) were encountered in Moser Bay.

Mergus merganser, and M. serrator. Common, and Red-breasted Mergansers. Few mergansers were recorded. A total of 44 birds was observed on 18% of the transects. Of the 23 birds identified to species, there were 13 common and 10 red-breasted mergansers. These birds were almost certainly underestimated.

Athyinae. Unidentified Sea Duck. Two hundred and thirty-three ducks were lumped in this category. Most of these were probably harlequin ducks or scoters.

Scolopacidae. Small Unidentified Shorebird. A total of 164 birds was noted on two transects. These were most likely rock sandpipers (Calidris ptilocnemis). This survey was not designed to detect shorebird species and their number were grossly underestimated.

Larus hyperboreus, L. glaucescens, and L. canus. Glaucous, Glaucous-winged, and Mew Gulls. A total of 2,036 gulls was identified on the survey. They occurred on 43 (96%) of the transects. Little attempt was made to identify gulls to species. Of the 204 birds positively identified, there was 1 glaucous gull, 146 glaucous-winged gulls, and 57 mew gulls. These proportions probably do not reflect the true relative abundances of these species in the coastal waters.

Rissa tridactyla. Black-legged Kittiwake. A group of 25 birds noted near Pasagshak Point was the only observation.

Uria spp. Unidentified Murre. Murres were encountered in large numbers but were very restricted in their distribution, occuring on only 38% of the transects. Nearly 90% of the birds observed were concentrated in Uyak Bay, and the South, East, and Northeast Arms of Uganik Bay. The single largest concentration, estimated at 530 birds, was at the upper end of the Northeast Arm of Uganik Bay, opposite Sally Island. Moderate numbers were observed from Uganik Passage east to Kizhuyak Bay, and in Moser Bay.

Cepphus columbus. Pigeon Guillemot. A total of 14 birds was encountered on three transects. Numbers of this species were probably greatly underestimated by the survey.

Erickson, D.E. 1977. Distribution, abundance, migration and breeding locations of marine birds in lower Cook Inlet, 1976. Unpublished Preliminary Report, Alaska Department of Fish and Game. 82 pp.

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U.S. Fish and Wildlife Service. 1973. Planning and accomplishment narrative, Kodiak National Wildlife Refuge. Administrative Report, Kodiak, Alaska. 13 pp.

U.S. Fish and Wildlife Service. 1975. Refuge Narrative Report, Kodiak National Wildlife Refuge: July 1, 1974 to June 30, 1975. Administrative Report, Kodiak, Alaska. 40 pp.

ADDENDUM

The following paragraph should be inserted after Clangula hyemalis on page 7:

Histrionicus histrionicus. Harlequin Duck. This species is confined to a narrow coastal strip and is more or less uniformly distributed around the island. A total of 1,109 individuals was observed on 87% of the transects.

TABLE 1. Survey segments used for aerial waterfowl and seabird census, March 1977.

Survey Segment	Location
1	Cliff Pt.--Broad Pt.
2	Broad Pt.--Isthmus Pt.
3	Isthmus Pt.--Cape Chiniak
4	Cape Chiniak--Pasagshak Pt.
5	Pasagshak Pt.--west head Pasagshak Bay
6	west head Pasagshak Bay--Gull Pt.
7	Spruce Pt.--Shakmanof Pt.
8	Gull Pt.--Right Outter Cape
9	Right Outter Cape--Left Cape
10	Left Cape--Sitkalidak Narrows
11	Sitkalidak Narrows-- Barclay
12	Barclay--Cape Liakik
13	Cape Liakik--Cape Kasiak
14	Cape Kasiak-- Wide
15	Wide--Cape Kiavik
16	Cape Kiavik--east head Jap Bay
17	east head Jap Bay--west head Jap Bay
18	west head Jap Bay--Cape Kaguyak
19	Cape Kaguyak--Cape Trinity
20	Cape Trinity--Shag Bluff
21	Shag Bluff-Bert Pt.
22	Bert Pt.--west head Sulua Bay
23	head Anton Larson Bay--Shakmanof Pt.
24	Crag Pt.--Barabara Cove
25	Walcott Reef--Harvester Island
26	Harvester Island--outlet Larson Bay
27	outlet Larson Bay--Carlson Reef
28	Carlson Reef--Clover Rock
29	Clover Rock--Bird Rock
30	Bird Rock--Broken Pt.
31	Broken Pt.--Mink Pt.
32	Mink Pt.--Rock Pt.
33	Rock Pt.--East Pt.
34	East Pt.--east end Uganik Passage
35	east end Uganik Passage--Naugolka Pt.
36	Naugolka Pt.--Outlet Cape
37	Outlet Cape--Inner Pt.
38	Inner Pt.--Barabara Cove
39	Cape Hepburn--Moser Pt.
40	Moser Pt.--Olga Narrows
41	Olga Narrows-- Split
42	Split--Stockholm Pt.
43	Stockholm Pt.--Olga Narrows
44	Olga Narrows--Cape Alitak
45	Cape Alitak--Cape Ikolik

TABLE 2. Summary of birds observed by transect, birds recorded per minute, densities/km^2, and frequency of occurrence.

Page 1

SPECIES	Transect Number 1	2	3	4	5	6	7	8	9	10	11
Date	03-08-77	03-08-77	03-08-77	03-08-77	03-08-77	03-08-77	03-08-77	03-09-77	03-09-77	03-09-77	03-09-77
Time	1007-1013	1013-1021	1021-1026	1026-1040	1040-1044	1044-1112	1130-1140	0954-1006	1006-1032	1032-1040	1040-1045
Elapsed Time	6 min	8 min	5 min	14 min	4 min	28 min	10 min	12 min	28 min	8 min	5 min
unidentified loon						1			1		1
Red-necked Grebe	1								4	1	
Pelagic Cormorant	4			1		1		2			1
unidentified cormorant	3	2	4	17	1	12	12	5	89	18	15
Emperor Goose		4							60		
Mallard						151			440	325	200
Gadwall											
Green-winged Teal											
American Wigeon									15		
unidentified dabbler						2			85		2
Greater Scaup						225					150
unidentified goldeneye	8	6				138			99	25	28
Bufflehead											
Oldsquaw	6	1		8		44	21		116	8	
Harlequin Duck	28	35	41	4		10	34	7	84	28	30
Steller's Eider	7		80	145	33	16	25	15	20	275	
Common/King Eider	3		56	1			1	2	1	5	
White-winged Scoter						104		14	135	20	
Surf Scoter				6	38	35					
Black Scoter				48	8	50	3	5	74	8	40
unidentified scoter	45	4	15	3	4	174		10	216	50	120
Common Merganser									5		
Red-breasted Merganser											
unidentified merganser											10
unidentified sea duck								1	2		20
Small unidentified shorebirds						14					
Glaucous Gull											
Glaucous-winged Gull	4	2	3	21		26	3	6	7	1	
Mew Gull		2		1		17	1				5
unidentified gull	8	1		56		12	25	17	44	2	227
Black-legged Kittiwake				25					1		
unidentified murre									25	27	
Pigeon Guillemot											
unidentified murrelet											
Crested Auklet											
WATER BIRDS - Sub Total	117	45	199	336	84	1032	125	84	1522	793	1087
WATER BIRDS / Km^2	33.0	9.5	67.5	40.7	35.6	62.5	21.2	11.8	92.2	172.0	368.4
Bald Eagle				1		4		1	8	1	
Black-billed Magpie											
Northwestern Crow											
Common Raven											

TABLE 2. continued

Page 2

Transect Number

Species	Date / Time / Elapsed Time	12 03-09-77 1045 - 10:50 5 min	13 03-09-77 10:50 - 11:00 10 min	14 03-09-77 11:00 - 11:10 10 min	15 03-09-77 11:10 - 11:17 7 min	16 03-09-77 11:17 - 11:20 3 min	17 03-09-77 1120-1126 6 min	18 03-09-77 1126 - 1131 5 min	19 03-09-77 1131 - 1148 17 min	20 03-09-77 1148 - 1157 9 min	21 03-09-77 1157-1203 5 min	22 03-09-77 1203-1207 4 min
unidentified loon								1	2			
Red-necked Grebe			2	1					1			7
Pelagic Cormorant												
unidentified cormorant		2	35	63	13	37	3	28	44	12		1
Emperor Goose						30			12			
Mallard				20			15			75	230	200
Gadwall												
Green-winged Teal												
American Wigeon												
unidentified dabbler				75	125		90		25	20	120	
Greater Scaup					35							1
unidentified goldeneye			12	127	15		5	25	111		107	42
Bufflehead				85	1				2		5	20
Oldsquaw		2	20		10	1		1	28			2
Harlequin Duck			15	15	25	10		18	98	17	12	20
Steller's Eider					50							
Common / King Eider						1				20		
White-winged Scoter		46	20	61	18	4			250	10		80
Surf Scoter			5					3	20			7
Black Scoter			50	150	215			24	39	15		
unidentified Scoter		82	98	84	86		87	132	142	35	2	4
Common Merganser												
Red-breasted Merganser												
unidentified merganser												
unidentified sea duck												
Small unidentified shorebird												
Glaucous Gull												
Glaucous-winged Gull				1		1	3	2	6			
Mew Gull			2									
unidentified gull		1	38	252	32	12	30	1	74	1	136	7
Black-legged Kittiwake												
unidentified murre			8	2								
Pigeon Guillemot												
unidentified murrelet												
Crested Auklet												
WATER BIRDS: Sub-Total		134	313	939	620	96	183	235	854	205	612	402
WATERBIRDS/Km²		53.6	53.0	158.8	151.6	54.2	51.6	79.6	85.2	39.8	207.4	170.4
Bald Eagle			7	2	5	1			3			
Black-billed Magpie								1				
Northwestern Crow											50	
Common Raven				7								

Transect Number

Species / Date / Time / Elapsed Time	23 03-09-77 1345 - 1350 5 min	24 03-09-77 1350 - 1406 16 min	25 03-12-77 1010 - 1013 3 min	26 03-12-77 1013 - 1018 5 min	27 03-12-77 1018 - 1046 28 min	28 03-12-77 1046 - 1057 11 min	29 03-12-77 1057 - 1114 17 min	30 03-12-77 1114 - 1125 11 min	31 03-12-77 1125 - 1140 15 min	32 03-12-77 1140 - 1147 7 min	33 03-12-77 1141 - 1159 12 min
unidentified loon						1	1			1	
Red-necked Grebe											
Pelagic Cormorant						1			2		1
unidentified cormorant	35	12	14	2	54	21	29	10	17	8	18
Emperor Goose											
Mallard		381			185	200	28			400	
Gadwall											
Green-winged Teal					1						
American Wigeon						10				15	
unidentified dabbler		30									
Greater Scaup						1				90	
unidentified goldeneye	40	187			127	123	48			110	12
Bufflehead		55				28					
Oldsquaw		46	1		553	195	3	2	25	50	8
Harlequin Duck	5	36	28	12	79	26	26	1	18		3
Steller's Eider	10										
Common / King Eider							1				
White-winged Scoter		94	12		7		3	4	3	80	20
Surf Scoter		80									
Black Scoter		100	30	3	1	82		21	6	80	3
unidentified Scoter	75	370	12	22	120	108	110	69	181	205	24
Common Merganser						1					
Red-breasted Merganser		7									
unidentified merganser		3									
unidentified Sea Duck			1		117	1	9	12	2	2	
Small unidentified shorebirds											
Glaucous Gull											1
Glaucous-winged Gull					1		5	1	1		4
Mew Gull	1					3	23	1			1
unidentified gull	25		1	30	85	19	30	8	13	251	9
Black-legged Kittiwake											
unidentified murre	8	1			263		2		256	36	530
Pigeon Guillemot				1							
unidentified murrelet											
Crested Auklet											
WATERBIRDS: Sub-Total	199	1354	99	100	1593	820	318	125	444	1328	634
WATERBIRDS / Km²	67.4	143.4	56.0	34.0	96.4	124.4	31.6	19.2	50.2	321.6	89.6
Bald Eagle		3			3	2	3	1	1		
Black-billed Magpie											
Northwestern Crow		50	25		77		50	20		75	
Common Raven											

TABLE 2. continued

Page 4

SPECIES	Transect Number 34	35	36	37	38	39	40	41	42	43	44
Date	03-12-77	03-12-77	03-12-77	03-12-77	03-14-77	03-14-77	03-14-77	03-14-77	03-14-77	03-14-77	03-14-77
Time	1147-1159	1205-1217	1217-1232	1232-1246	1246-1251	0950-1013	1013-1018	1018-1023	1023-1042	1042-1048	1048-1101
Elapsed Time	12 min	12 min	15 min	14 min	5 min	23 min	5 min	5 min	9 min	6 min	13 min
unidentified loon			2			2		1			
Red-necked Grebe				1	1	24		3	2		
Pelagic Cormorant						1					
unidentified cormorant	42	8	8	14	25	31	19	23	25	18	6
Emperor Goose											
Mallard		350	30			252		30			
Gadwall		12									
Green-winged Teal											
American Wigeon						50					
unidentified Dabbler						50					
Greater Scaup								200			
unidentified goldeneye		341	85	29	6	33	1	49	21	8	57
Bufflehead		155				36	2				14
Oldsquaw		323	2	162	5	29	3	36	96	33	26
Harlequin Duck	8			63	35	95	5	5	22	22	45
Steller's Eider						1					
Common / King Eider				5		11					
White-winged Scoter	20	110	92	36	17	90	6	196	45		152
Surf Scoter		3									1
Black Scoter	180		349	4	1	38				36	54
unidentified scoter	21	220	175	721	82	134	1005	222	269	37	442
Common Merganser						7					
Red-breasted Merganser								2			
unidentified merganser							1	2	1		
unidentified sea duck			2			4		22	34	4	
Small unidentified shorebirds											150
Glaucous Gull											
Glaucous-winged Gull	1					9	2		2	2	
Mew Gull											
unidentified gull		175	90	17	1	27	1	21	2	1	40
Black-legged Kittiwake						1					
unidentified murre	14	13	7	6	2	21					
Pigeon Guillemot			1			12					
unidentified murrelet						283		1	3	15	
Crested Auklet						32					
WATERBIRDS: Sub-Total	286	1710	813	1058	175	1272	1045	813	522	176	995
WATERBIRDS / Km²	40.4	241.6	91.8	128.0	59.4	93.8	254.2	275.6	98.4	49.8	129.8
Bald Eagle				1		9					1
Black-billed Magpie											
Northwestern Crow		25									
Common Raven											

TABLE 2. continued

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Transect Number 45

Species	Date / Time Elapsed Time	1101 - 1119 18 min	Total Birds	Birds/Min. 47.5 min.	Birds/Km² 561.6 km²	% of Total	% Occurrence						
unidentified loon			14	0.03	0.04	0.05	24						
Red-necked Grebe			48	0.10	0.18	0.18	27						
Pelagic Cormorant			14	0.03	0.04	0.05	20						
unidentified cormorant			855	1.8	3.04	3.28	96	43					
Emperor Goose		7	113	0.24	0.04	0.43	11						
Mallard			3512	7.38	12.50	13.49	40						
Gadwall			12	0.02	0.04	0.05	2						
Green-winged Teal			1	<0.01	<0.01	<0.01	2						
American Wigeon			90	0.19	0.32	0.35	9						
unidentified dabbler			812	1.71	1.90	3.12	27	12					
Greater Scaup			700	1.47	2.50	2.69	13	6					
unidentified goldeneye			2025	4.25	7.20	7.78	69	31					
Bufflehead			403	0.85	1.44	1.55	24						
Oldsquaw		9	1875	3.94	6.68	7.20	76						
Harlequin Duck		12	1109	2.33	3.94	4.26	87	31					
Steller's Eider			677	1.21	2.04	2.22	27	12					
Common / King Eider		1	108	0.23	0.38	0.41	29						
White-winged Scoter		15	1764	3.71	6.28	6.78	69						
Surf Scoter		19	167	0.35	0.60	0.64	24						
Black Scoter		4	1691	3.55	6.02	6.49	69	2					
unidentified Scoter		55	5987	12.58	21.32	23.00	96						
Common Merganser		1	13	0.03	0.04	0.05	7	3					
Red-breasted Merganser		1	10	0.02	0.04	0.04	1	3					
unidentified merganser		4	21	0.04	0.08	0.08	13						
unidentified sea duck			233	0.49	0.84	0.89	33						
Small unidentified shorebirds			164	0.34	0.58	0.63	4						
Glaucous Gull			1	<0.01	<0.01	<0.01	2						
Glaucous-winged Gull		10	146	0.31	0.52	0.56	60	21					
Mew Gull			57	0.12	0.20	0.22	24	11					
unidentified gull		10	1832	3.85	6.52	7.04	91						
Black-legged Kittiwake			25	0.05	0.08	0.10	2						
unidentified murre			1221	2.57	4.34	4.69	38						
Pigeon Guillemot			14	0.03	0.04	0.05	7	3					
unidentified murrelet			302	0.63	1.08	1.16	9						
Crested Auklet			32	0.07	0.12	0.12	2						
WATERBIRDS : Sub-Total		147	26036	54.7	92.69								
WATERBIRDS / Km²		13.8											
Bald Eagle		1	54										
Black-billed Magpie			1										
Northwestern Crow			322										
Common Raven			7										