QUARTERLY REPORT

Contract #03-5-022-69
Research Unit #3
Reporting Period June 15-Sept.30, 1977

Identification, Documentation and Delineation of Coastal Migratory Bird Habitat in Alaska

Paul D. Arneson

October 1, 1977

I. Task Objectives

A. Summarize and evaluate existing literature and unpublished data on the distribution, abundance, behavior, and food dependencies of birds associated with littoral and estuarine habitat in Bristol Bay and Aleutian Shelf.

B. Determine seasonal density distribution, critical habitats, migratory routes, and breeding locales for principal bird species in littoral and estuarine habitat in Bristol Bay and Aleutian Shelf. Identify critical species particularly in regard to possible effects of oil and gas development.

II. Field Activities

A. Field Trip Schedule: From June 16 to July 14, 1977 an Avon rubber raft was used to do shoreline and pelagic bird surveys around the Walrus Islands, Bristol Bay, Alaska.

B. Scientific Party: For bird surveys during this quarter, observers were Paul Arneson and Dave McDonald, Alaska Department of Fish and Game, Anchorage.

C. Methods: Pelagic bird surveys were conducted between islands by an observer recording all birds within 100 meters on either side of the Avon raft. Numbers of birds by species or group and their activity were recorded on cassette recorders for minute intervals along the entire distance between islands.

We cruised the shoreline of all islands by raft, and bird observations along the coast were recorded. When colonies were encountered, we stopped and often anchored to record specific information about the colony. Black-legged Kittiwake and cormorant nests were counted. Individuals were counted for Pigeon Guillemots, Parakeet Auklets, Horned Puffins and Tufted Puffins, and estimates of population size were made for Common Murres. Other bird information was recorded and photographs were taken of many of the colonies.

D. Sample Localities: See Figure 1.

E. Data Collected: Approximately 160 kilometers of coastline was surveyed and information about bird colonies was recorded. Eighteen different pelagic boat surveys totaling 34.5 kilometers were done on 10 transects lines between islands. From these pelagic transects, 266 observations were recorded for computer storage.

Also during this quarter, data from five previous surveys was transcribed and sent to the keypuncher. For those surveys, just over 7500 records will be computerized.

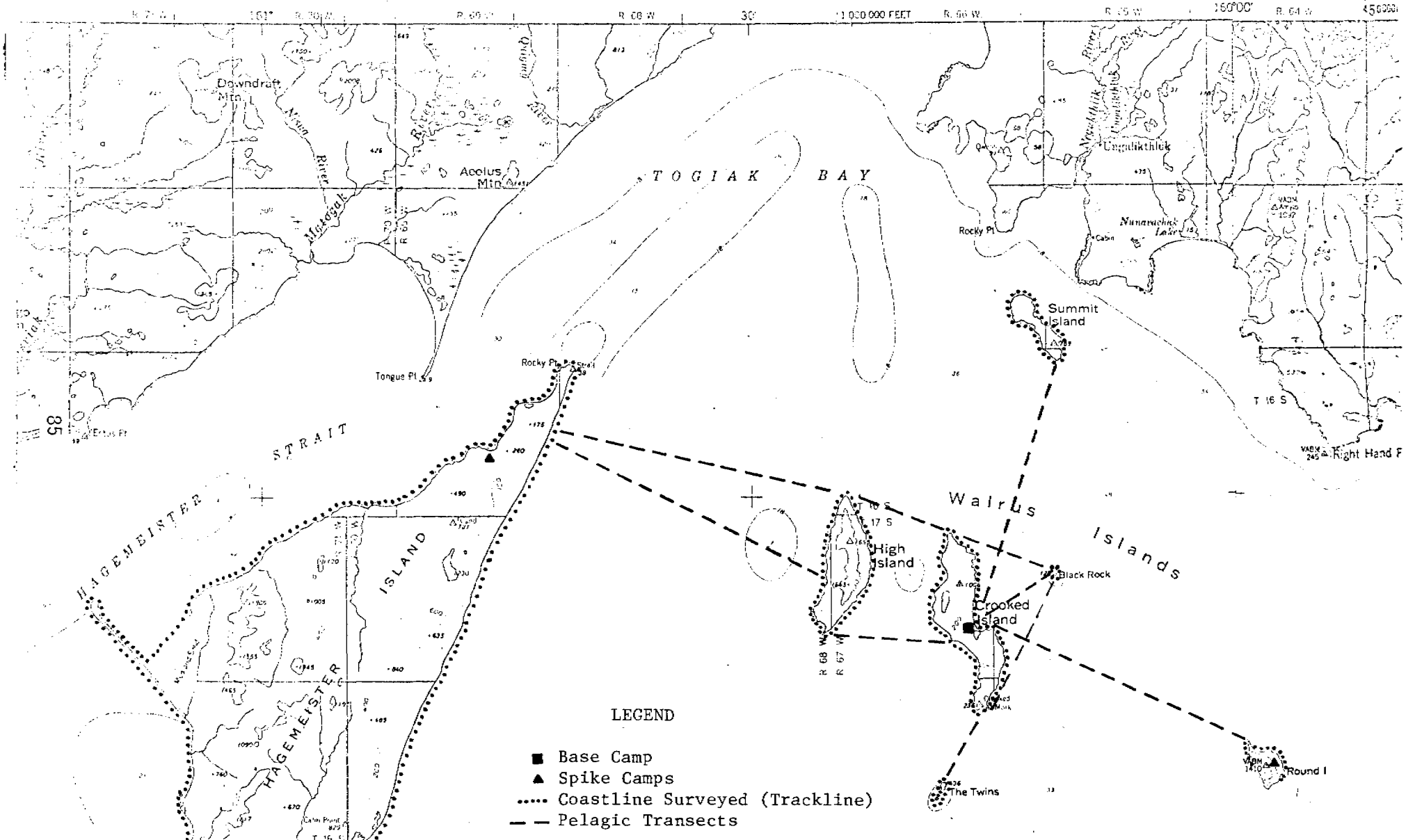

Figure 1. Trackline of shoreline and pelagic bird surveys in the Walrus Islands and Hagemeister Island, 16 June-14 July, 1977.

III. Results

Shoreline Surveys: Thorough shoreline surveys for birds were conducted around the perimeters of all the Walrus Islands with the exception of portions of Round Island. The trackline for these surveys is shown in Figure 1. Accurate counts were made of breeding birds on the colonies (Table 1), and from these counts, estimates were made of population sizes of seabirds using the islands during the breeding season, 1977 (Table 2). On Round Island only 44 percent of the west side and 70 percent of the east side were surveyed, and therefore population estimates were extrapolated from those portions that were surveyed.

Although Hagemeister Island is not a member of the Walrus Island group, it was also surveyed, but inclement weather prevented us from making accurate counts on portions of the south end of the island.

Besides recording breeding seabird data, we recorded the use of the islands by other species of birds, locations of roost areas, presence or absence of predators, human activity on the islands, marine mammal data and any other noteworthy information. This information was summarized on "Colony Status Record" forms and submitted to the U.S. Fish and Wildlife Service for inclusion in the Catalog of Seabird Colonies, RU#338/343.

Common Murres (*Uria aalge*) were by far the most abundant breeding bird on the islands. North Twin supported the largest population where it appeared that all available breeding habitat was utilized. No Thick-billed Murres (*Uria lomvia*) were positively identified. Murres nested on all the islands except Crooked and Summit as did Black-legged Kittiwakes (*Rissa tridactyla*), the next most abundant breeding bird. Only one Red-legged Kittiwake (*Rissa brevirostris*) was sighted, and it was roosting on the beach rocks of High Island. It was not determined if this species was breeding on the islands.

Pelagic Cormorants (*Phalacrocorax pelagicus*) were commonly seen and were breeding on all areas except Black Rock. Double-crested Cormorants (*P. auritus*) were found in small numbers on only Summit Island, and Red-faced Cormorants (*P. urile*) nested in small numbers on only Hagemeister Island.

Puffins were the next most numerous nesting seabirds, but neither species was abundant. Horned Puffins (*Fratercula corniculata*) were most common on the eastern shore of Round Island and Tufted Puffins (*Lunda cirrhata*) on the talus slopes of the north end of North Twin. Both species were fairly common on High Island where they were often seen in rock outcrops high on the hillsides. Parakeet Auklets (*Cyclorrhynchus psittacula*) were found on all islands except Summit and South Twin but were common on only Round and High. Pigeon Guillemots (*Cepphus columba*) were relatively ubiquitous but were surprisingly dense on the north side of Summit Island and also on the east side of Round Island.

Table 1. Number of seabirds actually counted or estimated on colonies of Walrus Islands, 16 June-14 July, 1977.

Species	ISLAND								
	Round[1]	Summit	Black Rock	Crooked	North Twin	South Twin	High	Hagemeister	TOTAL
DC Co [2]	0	6	0	0	0	0	0	0	6
Pe Co [2]	406	204	0	1,213	318	4	2,208	905	5,258
RF Co [2]	0	0	0	0	0	0	0	8	8
Gl Gu [2]	?	0	P	?	P	0	0	P	P
GW Gu [2]	1	50	1	12	67	?	6	13	150
BL Ki [2]	8,386	0	558	0	3,475	630	8,438	4,347	25,834
RL Ki	0	0	0	0	0	0	1	0	1
Ar Te	0	0	0	0	0	0	0	48	48
Al Te	0	0	0	0	0	0	0	5	5
Co Mu	17,206	0	18,500	0	75,735	17,750	13,500	5,485	148,176
Pi Gu	119	165	4	131	30	0	133	60	642
Pa Au	280	0	3	14	6	0	268	158	729
Cr Au	15 min.	0	0	0	0	0	0	0	15
Rh Au	1	0	0	0	0	0	0	0	1
Ho Pu	580	26	3	122	3	1	260	108	1,103
Tu Pu	143	4	3	37	750[3]	2	127	17	1,083
TOTAL	27,137	455	19,072	1,529	80,384	18,387	24,941	11,154	183,059

[1] Only 44% of the west side and 70% of the east side of Round Island were surveyed. All other islands were surveyed in their entirety.

[2] Numbers for these species represent nests counted. All other numbers represent number of individuals sighted (estimated or counted individually).

[3] Extrapolation from a subsample.

P = Present ? = Status Unknown

Table 2. Estimated population sizes of seabirds inhabiting the Walrus Islands during June-July, 1977.

Species	ISLAND								
	Round	Summit	Black Rock	Crooked	North Twin	South Twin	High	Hagemeister	TOTAL
DC Co	0	15	0	0	0	0	0	0	15
Pe Co	2,000	530	30	2,700	830	30	5,740	2,350	14,210
RF Co	0	0	0	0	0	0	0	20	20
GW Gu	150	150	75	125	175	30	125	350	1,180
BL Ki	43,000	0	1,450	0	9,000	1,600	22,000	11,300	88,350
Co Mu	93,000	0	55,500	0	228,000	53,300	40,500	16,500	486,800
Pi Gu	400	330	10	270	60	0	270	120	1,460
Pa Au	1,500	0	5	30	15	0	540	320	2,410
Cr Au	100	0	0	0	0	0	0	0	100
Ho Pu	1,750	55	8	250	10	4	520	220	2,817
Tu Pu	400	20	10	75	1,500	4	260	40	2,309
TOTAL	142,300	1,100	57,088	3,450	239,590	54,968	69,955	31,220	599,671

Although Glaucous-winged Gulls (*Larus glaucescens*) were commonly observed on all islands, the only breeding "concentration" was a small island off the middle of the southwest side of Summit Island where 36 nests were counted. The only other nesting concentration was among the Tufted Puffin burrows on the talus at the north end of North Twin. Second year Glaucous Gulls (*Larus hyperboreus*) were occasionally observed, but the breeding status of that species on the islands was not determined.

Terns were observed on only Hagemeister Island where both species - Arctic (*Sterna paradisaea*) and Aleutian (*Sterna aleutica*) - likely nested, although no sites were located. Arctic Terns far outnumbered Aleutian's in abundance.

Only two other seabird species were observed in the vicinity of the islands during our month-long stay. A small group of Crested Auklets (*Aethia cristatella*) was observed on the east coast of Round Island near the cabin. Only one of these birds came ashore to roost on the rocks, and the breeding status of this species on the island was not determined. A single Rhinocerous Auklet (*Cerorhinca monocerata*) in breeding plumage was observed July 4, 1977 on the water, east of the cabin on Round Island. To my knowledge this is the first record for this species in the Walrus Islands or Bristol Bay. The nesting status of this auklet on Round Island was not determined.

Seaducks were the only other marine bird commonly seen on nearshore waters of the islands. Steller's Eiders (*Polysticta stelleri*), White-winged Scoters (*Melanitta deglandi*), and Harlequin Ducks (*Histrionicus histrionicus*) were the most abundant and numbered in the hundreds around the four largest islands. Species observed in lesser numbers were Oldsquaw (*Clangula hyemalis*), Common Eiders (*Somateria mollissima*), King Eiders (*S. spectabilis*), Surf Scoters (*Melanitta perspicillata*), Black Scoters (*M. nigra*) and Red-breasted Mergansers (*Mergus serrator*).

We will attempt to publish a report on other bird species observed on our stay in the Walrus Islands.

Pelagic Transects: While travelling between islands to document seabird colony information, pelagic transects were conducted to determine use of inshore waters by marine birds. In all, 18 surveys were conducted along the 10 transect lines (Figure 1). The most frequently surveyed transect was the one between Crooked Island and North Twin, and it was conducted four times. Another transect was surveyed three times, three were completed twice and five done only once.

From these transects a relative measure of species abundance, diversity, and density was determined (Table 3). The most frequently observed birds were those nesting in greatest numbers on nearby colonies - murres, cormorants and kittiwakes. However, densities on pelagic waters between islands were not directly proportional to

Table 3. Bird abundance in pelagic transects conducted between islands of the Walrus Island group, Bristol Bay, Alaska.

Species	Total No. of Birds	Frequency of Occurrence % of Total Transects	Mean No. of Birds/Transect	Density Birds/KM^2
RT Lo	1	6	Tr	Tr
Corm	521	100	29	15.1
Olds	6	17	Tr	0.2
Harl	30	6	2	0.9
Eide	2	11	Tr	Tr
WWSc	232	83	13	6.7
Su Sc	2	11	Tr	Tr
Bl Sc	3	11	Tr	0.1
Scot (unid)	97	44	5	2.8
Subtotal	372	83	21	10.8
Me Sh	6	6	Tr	0.2
GW or Lg Gu	42	67	2	1.2
BL Ki	166	100	9	4.8
Tern	1	6	Tr	Tr
Subtotal	209	100	12	6.1
Murr	3484	100	194	101.0
Pi Gu	68	72	4	2.0
Pa Au	7	11	Tr	0.2
Ho Pu	36	72	2	1.1
Tu Pu	39	78	2	1.1
Subtotal	3634	100	202	105.3
TOTAL	4743	100	264	137.5

actual numbers of birds breeding on the islands. Although murres were most dense on the transects (101 birds/Km^2 and 194 birds/transect), this was largely a result of large rafts of murres roosting on nearshore waters off murre colonies. If transects had been terminated a greater distance from colonies, a substantial reduction in murre densities would have been evident. When murres observed during the last two minutes of a transect were subtracted from the total number in the transect, only 1,632 murres were censused and the density drops from 101 to 47 murres/Km^2. By comparison, 15.1 cormorants/Km^2 were recorded, a three-fold difference from the corrected murre density. However, in total estimated populations for the islands, murres were over 34 times more abundant than cormorants (486,800 vs. 14,245). Kittiwakes were over six times more abundant than cormorants in total numbers on colonies, but their density in pelagic transects was only 4.8 birds/Km^2 or one-third as many.

Surprisingly, the third most numerous bird on the transects was the White-winged Scoter. This species was seen on 83 percent of the transects in densities of 6.7 birds/Km^2. The only other noteworthy finding was the abundance of Pigeon Guillemots on transects in relation to their relative abundance on shoreline counts. They were almost twice as abundant as puffins on pelagic transects but only one-half as abundant on shoreline counts. Almost 70 percent of the total number of guillemots on the pelagic surveys (47 of 68) were observed on the four transects between Crooked Island and North Twin.

Sea Watches: Often strong winds prevented bird surveys from the rubber raft, and we were relegated to gather bird information near base camp on Crooked Island. This included bay watches to the east of camp on an irregular basis. The area surveyed is shown in Figure 2. A summary of the species observed is presented in Table 4.

Glaucous-winged Gulls were the only species observed on all watches (assuming that large gulls were mostly Glaucous-winged). They frequently roosted at the mouth of a creek at the north end of the beach or fed upon a walrus carcass that had washed up on the beach. Kittiwakes, White-winged Scoters, and murres were the next most frequently observed species although murres were present in much smaller numbers than the other two.

A colony of 778 Pelagic Cormorants nested within a few hundred meters of the north end of the watch area, and yet cormorants were seen on only four of the bay watches.

The number and species composition present in the bay appeared to vary with weather conditions and wind direction and velocity. Occasionally an unusually large group of birds (particularly seaducks) would roost and feed in the bay when it was in the lee of the wind.

Brackish Lagoon Usage: Because it was noticed that many Black-legged Kittiwakes were stopping into the brackish lagoon near base

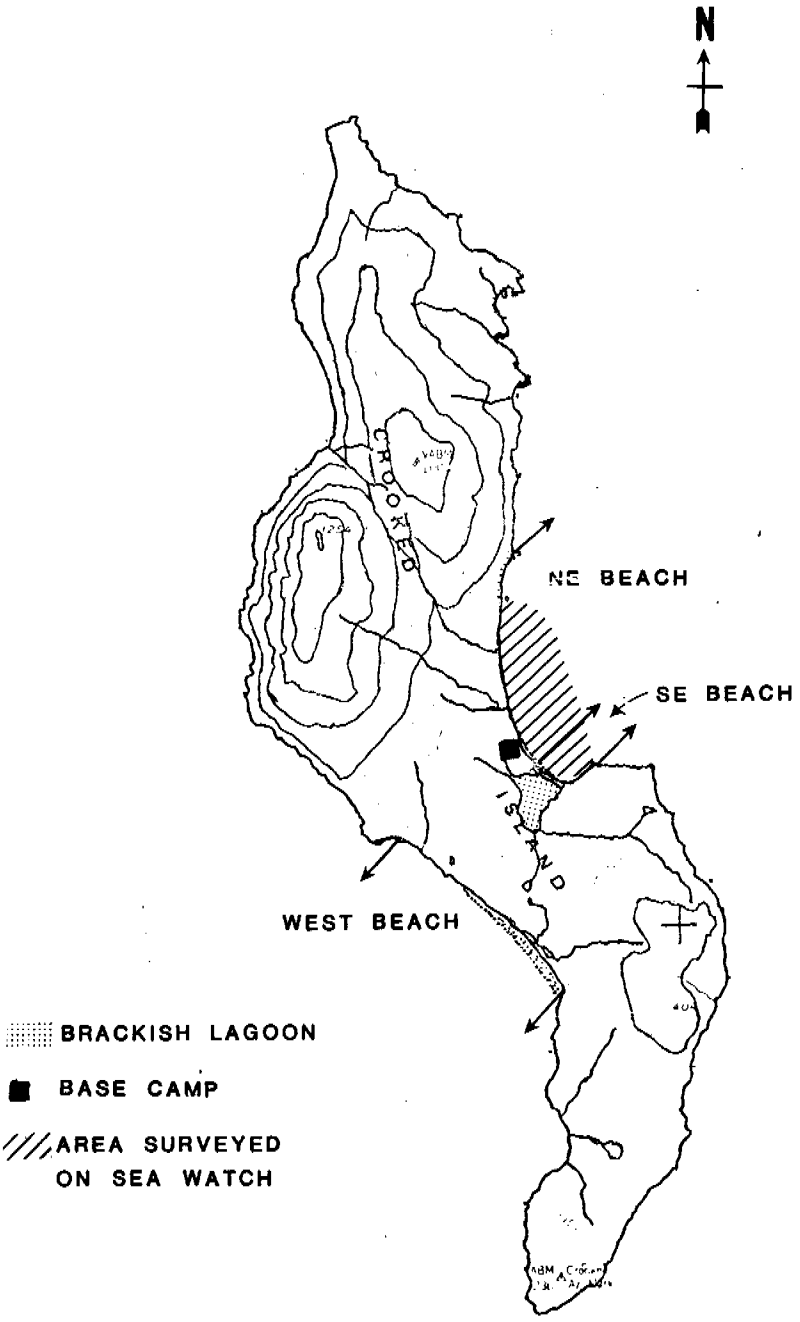

Figure 2. Location of nearshore waters censused on sea watches, brackish lagoon used by kittiwakes and beaches walked for beached birds on Crooked Island, Walrus Islands, Bristol Bay, Alaska, June-July 1977.

Table 4. Numbers of birds observed on nearshore waters during sea watches from Crooked Island, Walrus Islands, June-July 1977.

Species \ Date-Time	6-22 10:35	6-22 19:30	6-23 10:20	6-23 19:50	6-24 9:45	6-25 8:45	6-26 10:30	6-26 21:00	6-27 11:00	6-27 21:45	6-28 11:00	6-28 21:40	6-29 11:00	7-7 16:30	7-8 15:50	7-8 20:30	7-12 10:50	7-12 16:10	7-13 11:10
Co Lo	1																		
Ar Lo	2	3		1			1		2		1	2							
RT Lo					1								1			2			
RN Gr							1		1	1					1				1
Comm	2					6									1	1			
Olds										11			7		2				
Harl												2			1				
St Ei														41		31			
Ki Ei									34					1		1			1
WW Sc	69	8		1					8	8	23	8	18	4	11	14	7	7	3
Su Sc	6								15	2					6	5		3	
Bl Sc									4	1					8	3		2	1
Scot	40				1	3				3		5	8		13		5		
RB Me									4	10	1		12		1	3			
Pa Ja									1										
Gl Gu								1											
GW Gu	2	2		27	44		23	5	29	3	19	12	19	5	5	21	25	17	27
Lg Gu			22			24		24											
Kitt	1	62	1	46			2		7	1	4	4	11	6	154	9	5	32	
Murr	1	1		1		6				2	2	14	6		2	5	2	1	1
Pi Gu	2													1	1				
Ho Pu															3				

camp on Crooked Island, we spent a day determining peak use of the lagoon. For 15 minutes every hour, kittiwakes flying into or out of the lagoon were counted. As many as 45 per minute and 346 per 15 minute interval were counted flying from east to west into the lagoon. Peak use was in late afternoon/early evening (Figure 3).

Few birds moved back out of the lagoon in an easterly direction. Most preened and bathed for a few minutes in the lagoon and then continued westerly over the island to roost on the sandy west beach or flew southerly along the west coast of Crooked Island in the direction of the Twins.

It was difficult to determine the direction whence the birds were coming, but it appeared many came in the direction of the point on the south end of the cove east of camp. The day of the survey (25 June, 1977) seemed to be a "typical" day for kittiwake movements. Westerly winds prevailed, and it blew up to 20 knots most of the day. However, on other days no matter what the wind direction or weather conditions, kittiwakes moved in a similar manner. Even when fog was too dense for us to navigate in our raft, kittiwakes still utilized the lagoon.

Glaucous-winged Gulls used the lagoon to a much lesser degree for preening and bathing during the day but often would alight on the water late in the evening. Apparently it was a traditional roost site for 30-40 individuals.

The lagoon was also frequented by a variety of other species of birds including waterfowl, shorebirds and passerines.

Beached Bird Surveys: As time permitted, beaches were walked to obtain baseline information on beached birds from natural mortality. After the initial cleaning of the beach when relatively large numbers of carcasses were found, few new carcasses washed ashore. In order of their frequency of occurrence, shearwaters, murres and kittiwakes were the most often encountered species. Ten different bird species were identified on beached bird surveys (Table 5).

Drift lines on all beaches that were walked did not contain much organic matter, but each beach seemed to be specific in the type of debris that was at the high tide line. On SE beach of Crooked Island the most common pelecypods were blue mussels (*Mytilus edulis*) and cockles (*Clinocardium* sp.). Algae (*Fucus* sp.) also frequently washed ashore on this beach. Horse crabs (*Telmessus cheiragonus*) often were found dead on both the SE and NE beaches. Little else washed up on the NE beach, however, a dead harbor seal pup (*Phoca vitulina*) was recorded. On the west beach of Crooked Island the most common organism of the drift line was an unidentified sponge. Also present in relatively large numbers were several starfish species and horse crabs.

On the north side of Summit Island the debris on the high tide line consisted largely of horse crabs, *Fucus* and eelgrass (*Zostera marina*). Drift lines on south side beaches contained many starfish, some horse crabs and both *Fucus* and *Lamineria* algaes.

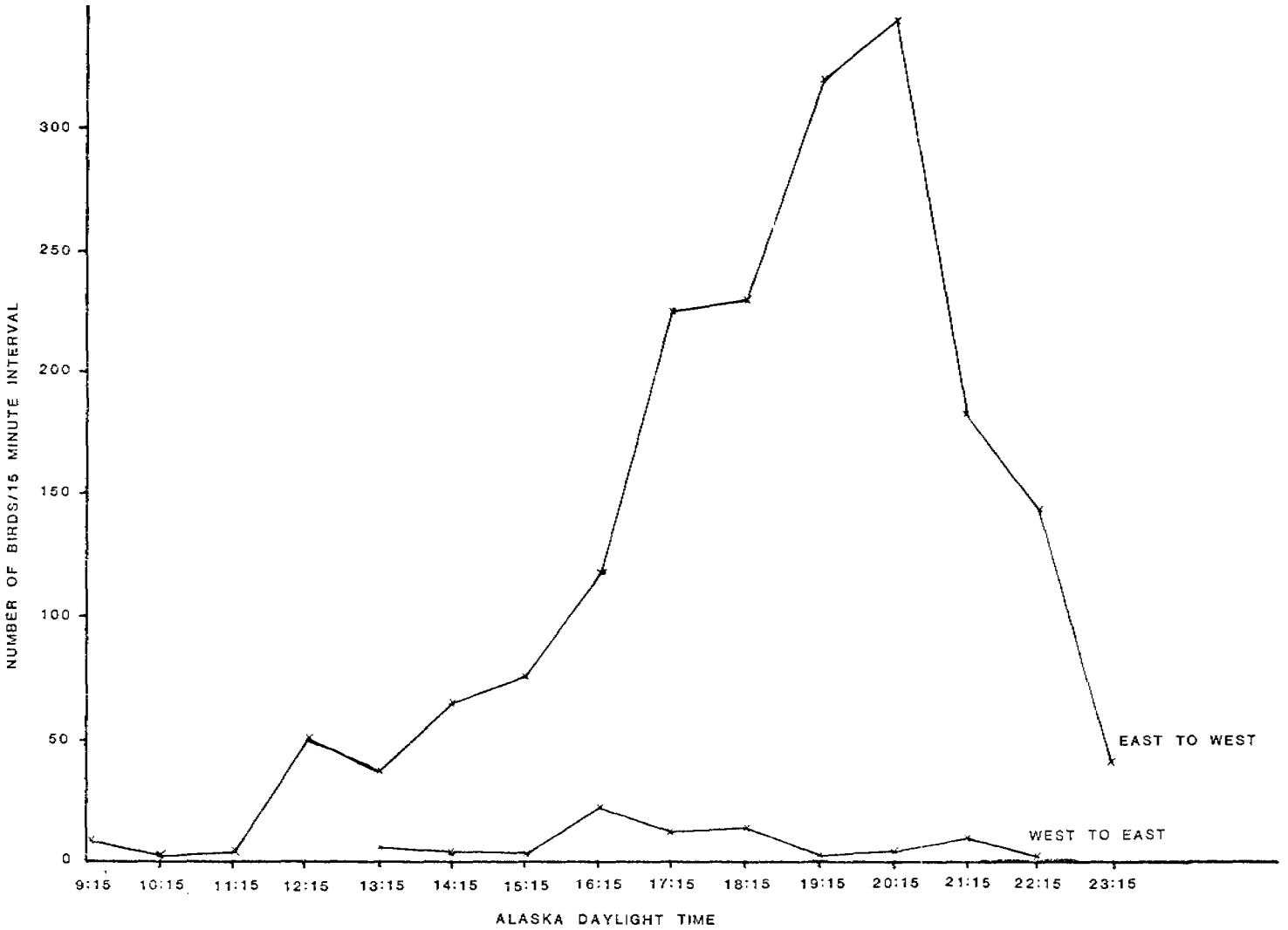

Figure 3. Black-legged Kittiwake diurnal movements into a brackish lagoon on Crooked Island, Bristol Bay, Alaska, June 25, 1977.

Table 5. Numbers of dead birds by species found on beached bird surveys of Crooked and Summit Island, Walrus Islands, June-July 1977.

	CROOKED ISLAND											SUMMIT IS.	
	Northeast Beach					Lagoon Mouth	Southeast Beach				Beach West	NE	SW
Species	6-17*	6-21	6-24	6-27	7-7	6-24*	6-19*	6-21	6-23	6-27	6-20*	7-11*	7-11*
Shearwater	12	2			1	2	2			3	1		
Cormorant	2					1		1		1			
Emperor Goose			No Birds						No Birds		1	No Birds	
Pintail				No Birds							1		1
Oldsquaw	1												
King Eider											1		
Kittiwakes	5				1	5	3				6		
Murre	12	3				3	6	1			7		
Horned Puffin							1						
Unid. Alcid	1												
Wilson Warbler		1											
Unid. Bird	3				4								
TOTAL	36	6	0	0	6	11	12	2	0	4	17	0	1

* Original cleaning of beach, accumulation for an unspecified period of time.

IV. Preliminary Interpretation of Results

Shoreline Surveys: The Walrus Islands and Hagemeister Island are extremely important to nesting seabirds. The population of nearly 600,000 birds likely represents an underestimation of the total bird population utilizing the islands. Survey conditions were ideal for most of the colony work, and therefore reasonably accurate counts and estimates were made. However, an accurate correction factor for breeding birds away from the cliffs and shoreline and for non-breeding birds using the colony could not be made. It is my feeling that population estimates were on the conservative side of a reasonable estimate of the true value.

Summit and Crooked Islands were the least productive for seabirds both in total numbers of birds and species diversity. Because of its habitat diversity however, Crooked supports large numbers of other species of marine and terrestrial birds. Little cliff-nesting habitat is available on Hagemeister Island and therefore seabird colonies were not large, but due to its large size, extensive habitat is available for other marine and terrestrial species.

North Twin supported the largest populations, and it appeared that all available habitat was utilized. Species diversity of nesting seabirds was greatest on Round Island and population sizes of most seabird species were relatively large. Several additional seabird species are presumably present on Round, but we did not observe them on our six-day stay on the island. In July 1962 D.N. Weir (unpublished data) reported seeing over 100 pair of nesting Red-faced Cormorants on the east side of Round Island. We did not observe this species in our surveys, but it may have nested on portions that we did not cover. T.J. Eley, Jr. spent two weeks on Round Island in July 1974 and reported seeing several Fork-Tailed Storm-Petrels (*Oceanodroma furcata*) and a possible burrow area on the east side of the island. He also reported that Mew Gulls (*Larus canus*) were common but no nests were found. We did not observe this species on any of the islands even though they are abundant on the mainland of North Bristol Bay. Five Least Auklets (*Aethia pusilla*) including two young and a pair of Black Oystercatchers (*Haematopus bachmani*) with two young were also observed by Eley (unpublished report).

Because of the species diversity and abundance and the relatively ready access to colony sites, Round Island should be considered the best site in the island group for future studies. North Twin is less desirable because access to the colony is very limited.

During shoreline surveys an incidental observation was made concerning Glaucous-winged Gulls. This species was not breeding in large numbers and no major breeding concentrations were found. These gulls often nested in close association with cormorant nests. They either nested among the cormorants or in close proximity to them. The reason for this association was not ascertained.

Pelagic Surveys: Without further analysis and more pelagic surveys farther from the islands, only tentative conclusions can be drawn about the species composition and abundance of the pelagic transects. It appeared that of the major seabird species nesting on the islands, only cormorants remained near the islands to feed. Murres and kittiwakes presumably foraged some distance to the west and south of the islands. Few of these two species were found in transects between islands in proportion to numbers nesting on colonies. Large flocks were seen in the air on the horizon southwest of both South Twin and Round Island. Pigeon Guillemots were likely foraging near the islands whereas both puffin species probably flew greater distances to feed.

Large numbers of non-breeding or molting sea ducks also inhabited nearshore waters of the islands. The area between Crooked and High Islands was a particular concentration area as well as rocky promontories on all the islands.

Sea Watches: No major conclusions were drawn about the results of sea watches except that it appeared that an inordinate amount of feeding was done at the mouth of the creek on the north end of the beach in comparison to other parts of the beach. Sea ducks (in particular scoters) were the most frequently encountered foraging species. The Arctic Loon (*Gavia arctica*) was commonly observed in the bay but no nests were found on nearby freshwater ponds. Murres often fed close to shore but only as scattered individuals. Only one kittiwake feeding "frenzy" was observed in the bay but the long, narrow fish on which they were feeding was not identified.

Brackish Lagoon Usage: Use of the brackish lagoon on Crooked Island by kittiwakes apparently pointed out the importance of a "fresh" water rinse (the salinity of the lagoon was not taken) in the daily habits of the birds. Birds were coming long distances often during adverse weather to use the lagoon, and approximately 7500 kittiwakes would stop during the day. Because no fresh water was available for bathing on both Round Island and The Twins, it was assumed that birds were coming from those islands.

We hypothesized that the early evening peak of abundance meant that the birds were returning to bathe after a day of feeding. Two individuals were collected to test the hypothesis, but one Black-legged Kittiwake's stomach was empty and the other contained only one otolith tentatively identified as that from a cottid. Either food had been digested on their return from pelagic foraging areas, or possibly the kittiwakes were incubating birds relieved of their duties and flew to fresh water for bathing and preening.

On other islands where large fresh water streams were available, large (several hundred individuals) groups of kittiwakes were often observed bathing at the mouth or roosting nearby. Travelling to the lagoon on Crooked was not necessary for them.

The lagoon on Crooked Island was very important to other species of birds also and should not be disturbed in the future if development occurs in the area.

Beached Bird Surveys: The only noteworthy outcome of beached bird surveys was that although no shearwaters were observed during the month-long stay on the islands, they frequently washed ashore. [Only Slender-billed Shearwaters (*Puffinus tenuirostris*) were identified.] Large numbers must have been frequenting nearby waters and their carcasses must have remained afloat for several days. Some newly arrived carcasses were fresh while others were already well-decayed.

Miscellaneous Observations: The only mammalian predator observed on the islands was the red fox (*Vulpes fulva*). It was most abundant on Round and Hagemeister Islands. A minimum of 10 adults were suspected on Round Island. Only two sightings of a fox occurred on Crooked Island, and it may have been the same individual. Their population on that island appeared to be very low. Fresh tracks were observed on Summit Island but no fox was sighted. There appeared to be no fox on High Island (no tracks or other sign and many bird nests were very accessible but untouched), and no suitable fox habitat was present on the smaller islands.

V. Problems Encountered.

No major problems were encountered during this report period.

VI. Funds Expended

Salaries	$11,400
Per Diem/Travel	330
Contractual Services	1,700
Commodities	105
Equipment	-0-
Total	$13,535

Environmental Assessment of the Alaskan Continental Shelf

July-September 1977 quarterly reports from Principal Investigators participating in a multi-year program of environmental assessment related to petroleum development of the Alaskan Continental Shelf. The program is directed by the National Oceanic and Atmospheric Administration under funding from and for use by the Bureau of Land Management.

ENVIRONMENTAL RESEARCH LABORATORIES
Boulder, Colorado
December 1977