

Birds of the Northcentral Alaska Peninsula, 1976-1980

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ABSTRACT. Between spring 1976 and fall 1980 we studied the occurrence, abundance, and habitat use of birds over a 2000-km² segment of the northcentral Alaska Peninsula. During this period observers were present 473 days and obtained records for all seasons. A total of 125 species was recorded; 63% (79 of 125) were water-associated. The breeding avifauna was found to be a mixture of Panboreal (49%), North American (34%), and Aleutian (17%) species. The Aleutian group was dominant in terms of biomass and numbers of individuals during the nonbreeding period. Forty-two species were confirmed breeding in the area and another 19 were suspected of breeding. The majority of birds occurred as migrants; 14 species were considered permanent residents and an additional 20 were winter residents. Our observations extended the known Alaska breeding distribution of American wigeon (*Anas americana*), black turnstone (*Arenaria melanocephala*), northern phalarope (*Phalaropus lobatus*), short-billed dowitcher (*Limnodromus griseus*), western sandpiper (*Calidris mauri*), dunlin (*C. alpina*), horned puffin (*Fratercula corniculata*), tufted puffin (*Lunda cirrhata*), and orange-crowned warbler (*Vermivora celata*). Our observations also extended the known postbreeding range or significantly changed the known status of bar-tailed godwit (*Limosa lapponica*), whimbrel (*Numenius phaeopus*), lesser yellowlegs (*Tringa flavipes*), long-billed dowitcher (*Limnodromus solopaceus*), dunlin (*Calidris alpina*), marbled murrelet (*Brachyramphus marmoratus*), American robin (*Turdus migratorius*), yellow-rumped warbler (*Dendroica coronata*), and dark-eyed junco (*Junco hyemalis*). The area is a principal late summer and fall molting and staging area for several species of arctic and subarctic nesting waders and seabirds and emperor geese (*Anser canagica*). From late September through mid-October the density of water birds over the entire littoral and nearshore area approached 1000 birds km⁻². This density was exceeded many fold for certain species on particular segments of habitats in the area.

Key words: birds, Alaska Peninsula, abundance, migration, nesting, habitat, distribution, zoogeography

RÉSUMÉ. Nous avons étudié, entre le printemps de 1976 et l'automne de 1980, la présence ou l'absence, l'abondance et l'utilisation de l'habitat d'oiseaux sur un terrain au nord et au centre de la péninsule d'Alaska. Au cours de cette période, les observateurs ont été présents pendant 473 jours et ont relevé des données pour toutes les saisons. Les résultats ont indiqué que l'avifaune consistait principalement d'un mélange d'espèces panboréales (49%), nord-américaines (34%) et aléoutiennes (17%), ce dernier groupe dominant les autres en nombre et en biomasse. Un total de 125 espèces ont été enregistrées; 63% (79 des 125) sont aquatiques. Des activités de reproduction ont été confirmées dans la région pour 42 espèces, et sont soupçonnées de 19 autres. La plupart des espèces y étaient en voie de migration; 14 sont considérées comme en résidence permanente et 20 autres y résident pendant l'hiver. Nos observations ont agrandi la distribution du champs d'accouplement connu en Alaska du canard siffleur d'Amérique (*Anas americana*), du tourne-pierre noir (*Arenaria melanocephala*), du phalarope hyperboré (*Phalaropus lobatus*), du bécasseau roux (*Limnodromus griseus*), du bécasseau du Nord-Ouest (*Calidris mauri*), du bécasseau à dos roux (*C. alpina*), du macareux cornu (*Fratercula corniculata*), du macareux huppé (*Lunda cirrhata*) et de la fauvette verdâtre (*Vermivora celata*). Nos observations ont aussi élargi le champ connu de la période post-accouplement ou changé de façon importante le statut connu de la barge de Laponie (*Limosa lapponica*), du courlis corlieu (*Numenius phaeopus*), du petit chevalier à pattes jaunes (*Tringa flavipes*), du bécasseau à long-bec (*Limnodromus solopaceus*), du bécasseau à dos roux (*Calidris alpina*), de l'alque marbrée (*Brachyramphus marmoratus*), du merle américain (*Turdus migratorius*), de la fauvette à croupion jaune (*Dendroica coronata*) et du junco ardoisé (*Junco hyemalis*). La région représente en fin d'été et en automne un aire importante de mue et de rassemblement pour nombre d'espèces arctiques et sub-arctiques d'échassiers, de canards marins et d'oies empereurs (*Anser canagica*). De la fin de septembre jusqu'à la mi-octobre, la densité des oiseaux aquatiques sur le littoral ou près de celui-ci approche de 1000 oiseaux par km². Cette densité est multipliée plusieurs fois par certaines espèces dans de types d'habitat particuliers dans la région.

Mots clés: oiseaux, péninsule d'Alaska, abondance, migration, saison des nids, habitat, distribution, zoogéographie

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INTRODUCTION

The Alaska Peninsula, separating the Gulf of Alaska and the southeastern Bering Sea, is a striking feature of the Alaska landmass (Fig. 1). It extends southwest 800 km from its base to False Pass, is less than 100 km wide over most of its length, and is the beginning of an extensive "land bridge" to eastern Siberia through the Aleutian-Commander Island arc. The south side of the peninsula is steep and irregular with numerous bays, headlands, and offshore rocks while the north side is a gently sloping coastal terrace with numerous estuaries. The rugged Aleutian Range with several peaks above 1500 m runs the length of the peninsula. These features, plus those inherent in the oceanographic domains and current systems (Favorite *et al.*, 1976), combine to produce extremely rich

and varied avian habitats, a situation not likely duplicated for an area of comparable size at similar latitudes.

The earliest ornithological knowledge of our area is that of the north Alaska Peninsula. Studies began with the Stone Expedition of 1903 (Chapman, 1904) and Osgood's (1904) work at the base of the peninsula. Jaques (1930) was the first to spend appreciable time away from the base of the peninsula, but his efforts, combined with those of Chapman (1904), treated only 30 species for the north-central peninsula and only for the period May-June. Murie (1959), in his comparatively detailed faunal survey of the Alaska Peninsula from 1937-1939, added little new information about the bird life of this segment of the peninsula. The first systematic treatment of birds of the area came in 1969 (Bartonek and Gibson, 1972) when seabird surveys were conducted, in part, over offshore and inshore waters

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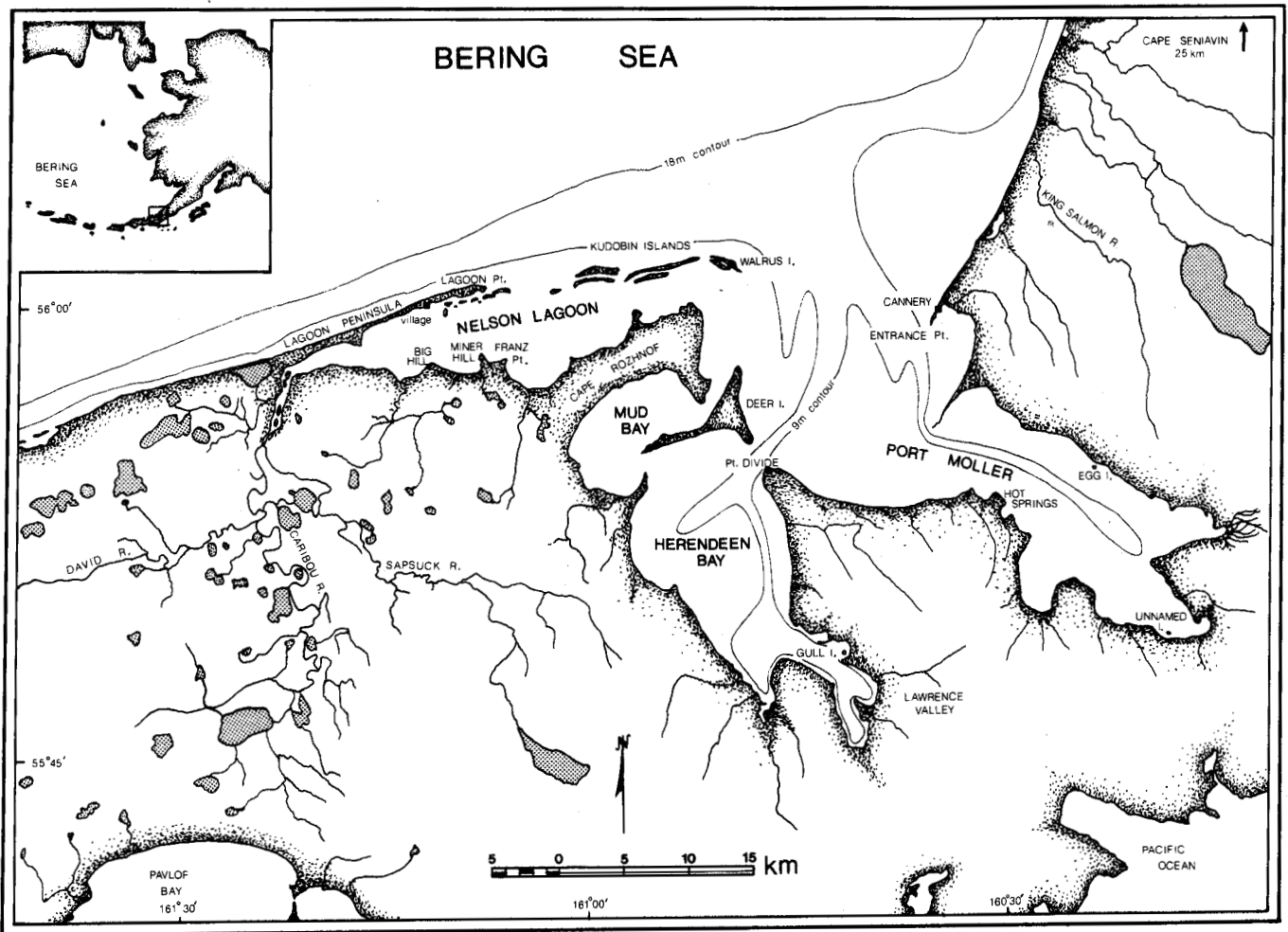


FIG. 1. Study area showing most localities mentioned in the text.



FIG. 2. View southwest, showing an approximately 48 km² area of Nelson Lagoon, Lagoon Peninsula, and several barrier islands. The main channel into this portion of Nelson Lagoon runs parallel to the peninsula.

off Port Moller during July and August. Shortly thereafter, personnel of the U.S. Fish and Wildlife Service (USFWS) conducted brief faunal surveys of Nelson Lagoon in late

summer and early fall 1972, and in 1975, Arneson (1980) began a series of aerial surveys of the north Alaska Peninsula, concentrating on seasonal habitat associations of water birds. There remained, however, no thorough on-ground assessment of the avifauna of the area. In this paper we present such an assessment, and summarize data on avian occurrence, distribution, habitat use, and relative abundance over the five-year period from spring 1976 through fall 1980.

STUDY AREA

Our studies focused on 2000 km² of the northcentral Alaska Peninsula and included Port Moller, Herendeen Bay, Nelson Lagoon, and an area within a 20-km radius of upper Nelson Lagoon (Fig. 1). The general physiographic, climatic, and floral features of the Alaska Peninsula have been described by Murie (1959) and Brower *et al.* (1977), and those of the study area in particular by Gill and Jorgensen (1979). Briefly, the area is typified by a relatively regular coastline of sand beaches, low terraces, and alluvial fan deposits. The estuarine area encompassed represents the largest single estuary and 44% of all such habitat along the north Alaska Peninsula (Fig. 2). At mean lower-low water



FIG. 3. View southeast from Lagoon Peninsula showing Nelson Lagoon, a portion of a low *Elymus*-covered island, and the gently sloping coastal terrace leading to the base of the Aleutian Range. The distance between the far shore and the base of the mountains is 20 km.

approximately 230 km² of intertidal mud and sand flats are exposed. The annual mean diurnal tide range at Nelson Lagoon is 5.4 m (Gill and Sanger, 1979). The coastal lowland, which is dotted by numerous shallow lakes and drained by several river systems, extends inland between 10 and 20 km to the base of the Aleutian Range (Fig. 3). Vegetation along the immediate coast and inland along the Caribou-Sapsuck river drainage is a mixture of wet and grass meadows while inland a mosaic of dwarf shrub meadow and shrub thicket predominates, especially around Herendeen Bay and Port Moller, on Deer Island, and south of Nelson Lagoon. The area is free of permafrost.

The estuarine and lacustrine waters of the area are generally ice-free between late April and early October and the adjacent Bering Sea is ice-free between late March and early January. In winter, the Bering Sea ice front usually extends south to the vicinity of Port Moller (Brower *et al.*, 1977). However, during our study ice advanced this far only during winter 1979-1980; in other years most nearshore and all inshore waters were ice-free in winter and available to birds. Fluvial waters are usually frozen between late October and early April. Prevailing northwest and northeast winds keep snow cover to a minimum along the immediate coast.

Permanent human settlements exist at Nelson Lagoon (approximately 50 residents) and at Port Moller cannery, where between two and 50 people reside depending on seasonal commercial fishing activities. Several abandoned canneries and small cabins occur throughout the area.

METHODS

Studies were conducted from spring 1976 to fall 1980, primarily from May-October, and occasionally during winter. Usually two (but up to five) observers were present for 473 days during this period (151 days in 1976, 21 April-22 December; 191 days in 1977, 27 January-15 October; 21 days in 1978, 26 September-16 October; 108 days in 1979, 20 June-5 October; and 2 days in 1980, 8-9 October).

Studies were conducted in conjunction with proposed development of offshore and onshore petroleum resources and were of two types: (1) baseline studies to determine numbers of, seasonal occurrence of, and habitat use by birds, and (2) detailed systematic studies of populations, food requirements, and migration of waterfowl and shorebirds (Gill, 1979; Gill and Jorgensen, 1979; Gill and Handel, 1981; Petersen, 1980, 1981). Data were collected through a number of standardized methods as briefly outlined here.

Aerial Surveys

Thirty-nine aerial surveys were flown during the study period. Survey design and operation are described in Gill and Jorgensen (1979). In 1976, 19 surveys were conducted, seven specifically for shorebirds in west Nelson Lagoon (10 July-11 November) and 12 for all water birds in Nelson Lagoon and Mud Bay (21 April-22 December). Six of the latter surveys included coverage of Herendeen Bay, Port Moller, or both (21 April-12 October). In 1977, 14 surveys of Nelson Lagoon and Mud Bay were conducted, 13 for all water birds (4 January-1 October), and one for shorebirds only (24 July). Surveys flown on 21 March, 12 May, and 27 September 1977 included Herendeen Bay and Port Moller. Only two surveys were flown during 1978, both to record shorebirds on Nelson Lagoon and Mud Bay (29 September and 11 October). In 1979, surveys were flown for waterfowl alone over Nelson Lagoon and around Deer Island (17 August and 9 September) and for all water birds on west Nelson Lagoon and Mud Bay (2-3 October). In 1980, we flew a single survey (8 October) over Nelson Lagoon and Mud Bay and recorded all water birds except gulls.

Boat Surveys

Information on birds on inshore and offshore waters between Nelson Lagoon and Port Moller, and along the Caribou, Sapsuck, and David rivers was obtained during occasional boat trips to these areas lasting one to several days. In 1976, 14 trips were made to upper Nelson Lagoon and the lower Caribou River (12 June-17 November), four as far as 25 km up the Caribou River (14 June-7 August), and one 37 km up the Caribou River (6-7 October). Five trips were made between Nelson Lagoon and Port Moller cannery (31 May-7 July), usually passing north of the Kudobin Islands. Between 30 July and 1 August we traveled from Nelson Lagoon to upper Herendeen Bay and returned to the lagoon. Numerous trips were made from our camp on Lagoon Peninsula to the south side of Nelson Lagoon. During 1977, we traveled to upper Nelson Lagoon and the Caribou River on four occasions (30 January, 28 May, 2 and 21 July). Twice we ventured out on the Bering Sea, going as far as 10 km northwest of Lagoon Point (18 June and 2 July) and on 23 September we went from Nelson Lagoon to Port Moller cannery. We also visited upper Herendeen Bay from 29 July-1 August. In 1978, we went up the Caribou River approximately 25 km

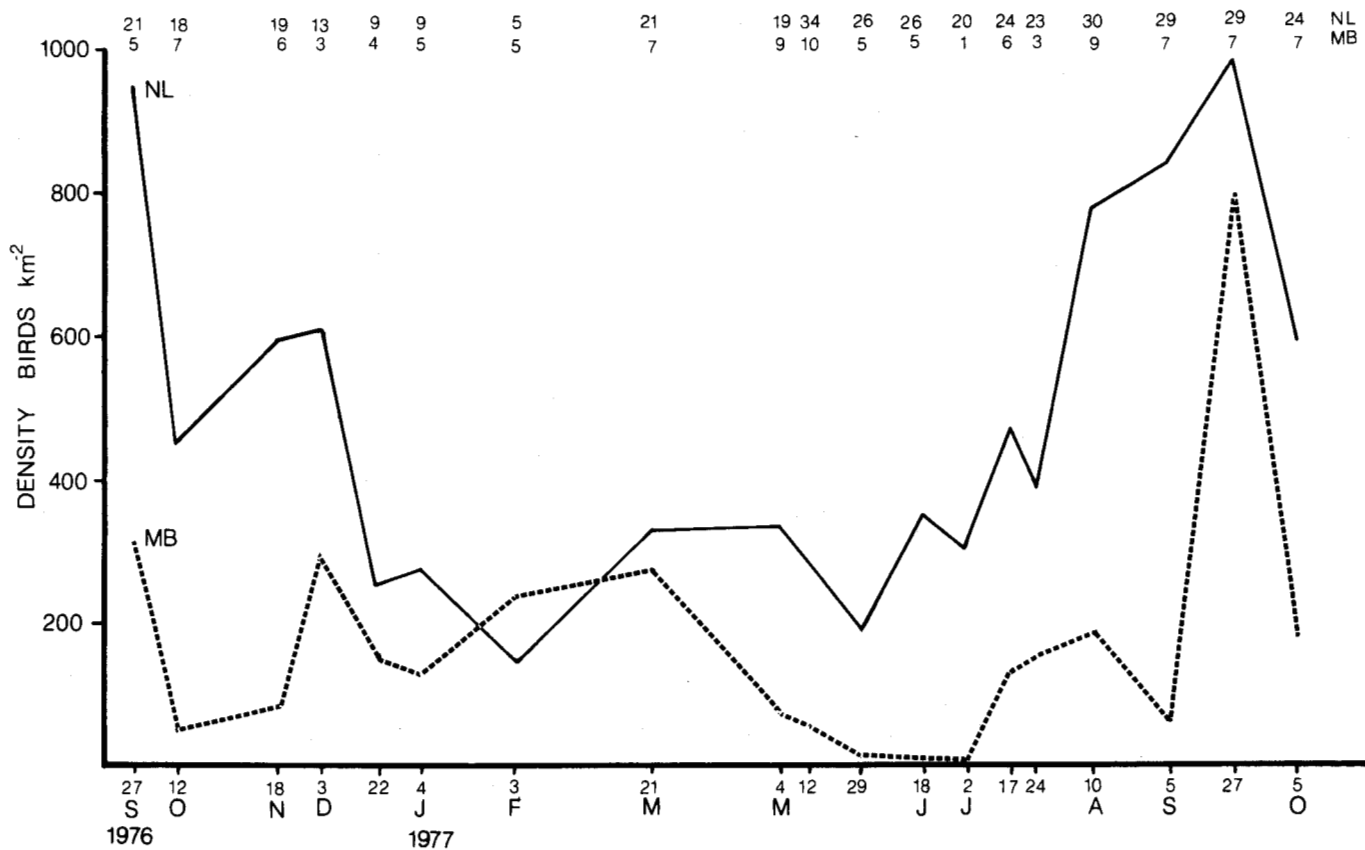


FIG. 4. Densities of water birds recorded during aerial surveys of littoral areas of Mud Bay (MB, 48 km², dashed line) and littoral areas and nearshore waters of Nelson Lagoon (NL, 130 km², solid line), September 1976-October 1977. The number of species recorded on each survey appears at the top of the figure.

(8 October) and twice visited upper Nelson Lagoon (11 and 14 October). The only extended boat trip in 1979 was to the confluence of the Caribou-Sapsuck rivers on 4 July.

Ground Observations

These included "sea watches" (records of birds on or migrating over inshore and offshore waters, observed through a 20x spotting scope for a 10-minute period at a fixed compass bearing); "cabin watches" (records of birds and their behavior observed during a single sweep of a predefined area within Nelson Lagoon, using a 20x spotting scope and censusing usually once every two hours between sunrise and sunset on a given census day); and fixed transects and plots (principally to determine nesting densities and productivity of gulls, terns, and shorebirds, but also to derive estimates of use of littoral areas by these birds following breeding). In 1976, 52 sea watches (21 May-21 November) and 18 cabin watches (10 September-23 November) were conducted. In 1977, sea watches were conducted on 30 occasions (28 June-16 September) and cabin watches on 42 days (17 April-15 October). In 1976 and 1977, plots were censused and transects run for nesting arctic and Aleutian terns and glaucous-winged gulls. During 1979, cabin watches were conducted on 23 days between 28 June and 30 September.

Unless otherwise stated, all references to numbers, habitat preferences, and timing of occurrence came from these systematic surveys and censuses. Seasonal densities (Fig. 4) of water birds using littoral substrates and nearshore waters of Nelson Lagoon (130 km²) and littoral areas of Mud Bay (48 km²) were derived from aerial surveys flown to enumerate all water birds ($n = 19$; 27 September 1976-5 October 1977).

SPECIES ACCOUNTS

The following annotated species accounts summarize records of 121 species from 1976-1980. We have treated four additional species not observed by us during this period but previously reported for the area (pale-footed shearwater *Puffinus carneipes*, red knot *Calidris canutus*, black-headed gull *Larus ridibundus*, and gray-crowned rosy finch *Leucosticte tephrocotis*). The relative abundance and seasonal occurrence (after Salter *et al.*, 1980, with modifications) are as follows:

abundant (A): observed each year, preferred habitat(s) widespread, occurred throughout preferred habitat(s), in migration in consistently high numbers, or both;
 common (C): as above, but in moderate numbers;
 fairly common (FC): as above, but numbers low to variable;

uncommon (U): usually observed annually, occurred in low numbers or in restricted habitats;
 rare (R): not observed each year or no more than a few locality records in any year;
 very rare (VR): fewer than five records during the study.

Status given as follows:

permanent resident (pr): some individuals present all year;
 summer resident (sr): usually breeding, but present only seasonally;

winter resident (wr): usually present, numbers variable;
 spring or fall migrant (spm, fm): present only during migration periods, or most abundant during migration;
 visitant (v): regular to infrequent seasonal visitor; never breeding.

Species for which we have only indirect evidence of nesting (*e.g.*, territorial defense, breeding or distraction displays, repeated sightings of pairs or singing males) are indicated as (sr?). Similarly, species whose status in win-

TABLE 1. Use of habitats by 104 species recorded from the northcentral Alaska Peninsula, 1976-1980. B = confirmed breeding, b = suspected breeding, x = preferred habitat(s) during migration or following breeding, r = roosting. Habitat nomenclature after Kessel (1979).

Species	Lacustrine waters	Fluvialite waters	Nearshore waters	Inshore waters	Offshore waters	Rocky shoreline	Beaches and tidal flats	Barrier islands	Cliff and block fields	Wet meadows	Dwarf shrub meadows	Grass meadows	Dwarf shrub mat	Shrub thickets	Artificial habitats
Common loon	B		x	x											
Arctic loon	b		x	x	x										
Red-throated loon	B		x	x	x										
Red-necked grebe	B	x	x												
Horned grebe			x	x	x										
Northern fulmar				x	x										
Sooty and short-tailed shearwater			x	x	x										
Fork-tailed storm-petrel				x	x										
Double-crested cormorant			x	x				B	B						
Pelagic cormorant			x	x	x			B	B						
Red-faced cormorant			x	x				B							
Whistling swan	x	x								B	B				
Canada goose										bx	bx				
Brant			x	x	x		x								
Emperor goose			x	x	x	xr	xr								
White-fronted goose	x	x					x								
Mallard	x	x	x				x	B		Bx		Bx			
Green-winged teal	x	x	x							Bx		Bx			
Gadwall	x	x	x				x	B		Bx		Bx			
American wigeon	x	x	x				x			Bx		x			
Pintail	x	x	x							Bx		Bx			
Northern shoveler	x						x			bx					
Steller's eider			x	x			r								
Common eider			x	x			xr	Br							
King eider			x	x											
Greater scaup	x	x	x							Bx					
White-winged scoter	bx	x	x	x						b		b			
Surf scoter			x	x											
Black scoter	Bx	x	x	x						b		b			
Harlequin duck		b	x	x		x									
Oldsquaw			x	x			xr	r							
Common goldeneye	x	x	x												
Bufflehead	x	x	x												
Red-breasted merganser		x	x	x				B							
Common merganser		x	x												
Rough-legged hawk															
Bald eagle															
Gyrfalcon							x	B	B						
Peregrine falcon							x	x	B						
Willow ptarmigan								x	x						
Sandhill crane														Bx	Bx
Semipalmated plover							x			Bx		x			
American golden plover							x			x					
Black-bellied plover							x			x					
Bar-tailed godwit							xr	xr							
Whimbrel							x				xr		x		
Greater yellowlegs							x			x					
Lesser yellowlegs							x			x					
Ruddy turnstone						x	x	x							
Black turnstone						x	x			B		B			

Species	Lacustrine waters	Fluvial/water	Nearshore waters	Inshore waters	Offshore waters	Rocky shoreline	Beaches and tidal flats	Barrier islands	Cliff and block fields	Wet meadows	Dwarf shrub meadows	Grass meadows	Dwarf shrub mat	Shrub thickets	Artificial habitats
Northern phalarope	x		x	x	x		x			B					
Red phalarope	x		x	x	x										
Common snipe										bx	bx				
Short-billed dowitcher										Bx	xr		Bx		
Long-billed dowitcher							x			x					
Surfbird							x								
Sanderling							x								
Western sandpiper							xr	xr			B				
Least sandpiper							x			bx	b				
Pectoral sandpiper							x	x		x					
Sharp-tailed sandpiper							x	x							
Rock sandpiper						xr	xr	xr						B	
Dunlin							xr	xr							
Pomarine jaeger			x	x	x										
Parasitic jaeger			x	x	x					B	B				
Long-tailed jaeger			x	x	x										
Glaucous gull			x	x			x	x							
Glaucous-winged gull	x	x	x	x	x		xr	Br							
Mew gull	x	x	x	x	x		x	xr		B					
Bonaparte's gull	x		x	x			xr								
Black-legged kittiwake			x	x	x		r	r	B						
Sabine's gull			x	x	x		x								
Arctic tern	x	x	x	x	x		x	B		B		B			B
Aleutian tern		x	x	x				B			B	B			
Common murre			x	x	x				b						
Thick-billed murre			x	x	x										
Pigeon guillemot			x	x					B						
Marbled murrelet			x	x											
Kittlitz's murrelet			x	x					b				b		
Ancient murrelet			x	x											
Crested auklet			x	x											
Horned puffin			x	x	x				B						
Tufted puffin			x	x	x				b						
Snowy owl								B		x		x			
Short-eared owl								Bx				B			
Tree swallow															
Black-billed magpie														Bx	Bx
Common raven															x
Black-capped chickadee														bx	
Hermit thrush															
Water pipit							x	x	bx						
Northern shrike								x							
Orange-crowned warbler														bx	x
Yellow warbler														Bx	
Wilson's warbler														bx	
Hoary redpoll														bx	
Common redpoll														bx	
Savannah sparrow								Bx			x	Bx			
White-crowned sparrow												x		bx	x
Golden-crowned sparrow												x		Bx	x
Fox sparrow														bx	x
Lapland longspur								x			x	bx	bx		
Snow bunting								x	bx						

ter is uncertain (*i.e.*, only limited observations, especially during the unusually mild 1976-1977 winter, or reported to winter elsewhere in the general area) are indicated as (wr?). Dates of earliest and latest observations are given for abundant through uncommon species, except for those considered permanent residents. In some instances a species was absent for a brief period during the inclusive dates listed. The timing of such absences is discussed in each narrative account.

Order and nomenclature of waterfowl species follow Delacour (1954-1959). For shorebirds we follow Vaurie (1965), and for all other species, A.O.U. (1957, 1973, 1976). Scientific names of plants follow Hultén (1968), and classification of habitat (Table 1) follows Kessel (1979). A

species listed as occurring on "marine waters" was found on all three marine habitats: nearshore, inshore, and offshore waters. Place names are taken from USGS 1:63 360 maps and NOAA 1:80 000 hydrographic charts, with the exception of "Cannery Island", the penultimate westward barrier island in Nelson Lagoon. The number of each species collected and the inclusive months of collection follow each species account. Specimen data can be obtained from the authors (RG and MP); the specimens themselves have been deposited with the USFWS, Marine Bird Research Section, Anchorage, Alaska; National Museum of Natural History, Washington, D.C.; University of California, Davis; and San Jose State University, San Jose, California.

COMMON LOON. *Gavia immer*. Uspm, Usr (20 April-22 September). Present in small numbers on inshore and nearshore waters during spring migration and found nesting on lakes along the Caribou River and S of Nelson Lagoon (adult with one young, 20 km SSW of Nelson Lagoon, 7 August 1976). Nesting is probably more widespread based on several records of calling pairs on the area in early July 1976 and 1977. Gromme (1927) reported them about small lakes along the upper Caribou River in late May and breeding plumaged birds (four) were seen near Port Moller cannery, 30 July 1969 (Daniel Gibson, University of Alaska, unpublished). We recorded no appreciable fall migration (three records, 26 August-22 September). Fall records extend to late October (single bird at the mouth of the Caribou River, 23 October 1973; G. Vernon Byrd, USFWS, unpublished).

YELLOW-BILLED LOON. *Gavia adamsii*. VRv. A single record: a bird in breeding plumage seen on inshore waters 200 m NW of Lagoon Point, 23 May 1976. The species is reported to be a regular winter resident at Izembek Lagoon, 120 km SW of Nelson Lagoon (Robert D. Jones, Jr., USFWS, unpublished). Three large, unidentified loons seen in Herendeen Bay, 21 March 1977, were probably this species.

ARCTIC LOON. *Gavia arctica*. Cspfm, U(sr?) (2 May-21 November). Arctic loons were the most abundant of the four loon species, regularly occurring over inshore waters in spring (peak, 5-11 May 1977 when several hundred were seen flying W during four 10-minute observation periods) and fall (15 September-23 November). Observations of courting birds on suitable nesting habitat (June-August) suggest breeding is common, but we failed to find any nests. Jaques (1930) reported the species common about Port Moller (1-23 June), usually flying and calling over the "tundra".

RED-THROATED LOON. *Gavia stellata*. FCspfm, Upr. Red-throated loons were common in spring and early summer and present in reduced numbers through October. Birds nest S of Franz Point (Peter Kust, resident, pers. comm.) and along the Caribou River (Paul Gundersen, resident, pers. comm.). The species has also been reported from the upper Caribou River in late May (Gromme, 1927). Birds were present in winter on Nelson Lagoon (21 March 1977) and on inshore waters (17 November 1976 and 1 February 1977).

RED-NECKED GREBE. *Podiceps grisegena*. Uspfm, Usr (19 April-23 September). Recorded over marine waters and occasionally on inland lakes and streams. We found birds nesting near Coast Lake (nest with three eggs, 28 May 1977). Also reported to nest S of Franz Point (floating nests in June, several years: Kust, pers. comm.) and pairs of adults have been reported on ponds near Port Moller in June (Jaques, 1930) and July (Gibson, unpublished).

HORNED GREBE. *Podiceps auritus*. Uspfm (27 April-20 May; 20 August-5 October). Observed regularly during spring and fall migration (1976 and 1977) and during fall

(1978 and 1979), but never in groups of more than three to four birds and usually on inshore waters. No nesting records are known for the Alaska Peninsula.

NORTHERN FULMAR. *Fulmarus glacialis*. Uv (25 April-30 September). Fulmars were recorded on five occasions during 1976 (seven dark phase, three light phase, all offshore, 8 June-30 September); once in 1977 (single light phase, Nelson Lagoon, 25 April); and once in 1978 (single light phase offshore, 28 September). The species nests on the Pribilof Islands and is probably more abundant over the immediate offshore and inshore waters than our observations indicate. Bartonek and Gibson (1972) found them widespread off Port Moller and Nelson Lagoon (mid-July to mid-August) and we frequently found fresh beach-cast birds (high of 20 along 2 km of beach, 8 June 1977). Recently moribund birds were also found beached in winter (30 January 1977).

PALE-FOOTED SHEARWATER. *Puffinus carneipes*. VRv. We did not observe this species in the area but two birds were seen NW of Walrus Island on 6 July 1973 (Byrd in Kessel and Gibson, 1978).

SOOTY and SHORT-TAILED SHEARWATER. *Puffinus griseus* and *P. tenuirostris*. Aspfm, Asv (11 May-16 November). Both species occur in the area (*P. tenuirostris* by far the more common) as migrants and summer residents from southern hemisphere breeding grounds (Gabrielson and Lincoln, 1959). Birds were regularly seen offshore from Port Moller to W of Nelson Lagoon (see also Bartonek and Gibson, 1972), and occasionally were recorded on nearshore waters of Nelson Lagoon. Spring migrants were first seen on 20 May 1976 and 11 May 1977 when an average of 300 and 175 birds min^{-1} , respectively, passed W offshore. These rates remained steady during a 3-hour period both days. During June both years large gyres of shearwaters (10 000+ birds) were recorded 2-3 km NNW of Lagoon Point. Numbers decreased during August both years but then increased in early September and were again comparable to numbers recorded in spring. Shearwaters were generally gone by late September (1976-1979). Birds regularly fed on inshore and offshore waters and on one occasion in a tide-rip in Nelson Lagoon in water less than 1 m deep (100-150 birds, 6 June 1977). Specimens JUN-OCT (4).

FORK-TAILED STORM-PETREL. *Oceanodroma furcata*. Rv. This species was observed on offshore and inshore waters on five occasions between 21 May and 30 September 1976 and once during 1977 on 18 May. Birds usually appeared in the area during or after storms (Gill, 1977). Specimens, SEP (1).

LEACH'S STORM-PETREL. *Oceanodroma leucorhoa*. VRv. One was observed in Nelson Lagoon on 30 May 1977, and a beach-cast bird was found on 16 September 1977. Records of *O. leucorhoa* from Bristol Bay are rare (Murie, 1959; Bartonek and Gibson, 1972; Eley, 1974), but further W in Izembek Lagoon they occur in small numbers each fall (Jones, unpublished).

DOUBLE-CRESTED CORMORANT. *Phalacrocorax auritus*. Usr, Rwr (27 January-23 November). Found nesting on barrier islands in Nelson Lagoon (10-15 pairs, 1976-1979), on Egg Island (75 pairs, 2 August 1976), and on an unnamed rocky island in upper Port Moller (25-35 pairs nesting on top with glaucous-winged gulls, 2 August 1976). Downy young were still present at Nelson Lagoon on 27 September 1976. In 1979, birds fledged between 10 and 20 September. Winter records include one at Franz Point (27 January 1977), plus five there the previous week (Kust, pers. comm.). Cormorants seen at the above colony sites during early spring aerial surveys (19 April 1976 and 21 March 1977) were probably this species.

PELAGIC CORMORANT. *Phalacrocorax pelagicus*. Uspfm, Rsv, Uwr. Pelagic cormorants were identified in Herendeen Bay, near Port Moller, and occasionally within Nelson Lagoon (March-October), but none was found nesting within the study area. The nearest breeding colony is on Cape Seniavin, 70 km E of Port Moller (Sowls *et al.*, 1978). Some 250 *P. pelagicus* (among 950 *P. urile*) were present at Seniavin on 9 April 1973 (Phil Havens, USFWS, unpublished) and the species was noted as "present", also among *P. urile*, on 10 July 1973 (in Sowls *et al.*, 1978). We noted white-flanked cormorants at Seniavin in early spring but made no distinctions between the numbers of *P. pelagicus* and *P. urile* present (700 +, 22 April 1976 and 800 +, 21 March 1977). Records in late summer and fall are of 2500 + pairs on 17 August 1979, and 1500 and 1200 birds present during the first week of October in 1979 and 1980, respectively.

RED-FACED CORMORANT. *Phalacrocorax urile*. Rv. We identified this species on four occasions: a single bird was seen among a flock of 14 *P. auritus* on a barrier island in Nelson Lagoon, 5 June 1976; a flock of 13 was sighted on the water 0.5 km NW of Lagoon Point, 8 June 1976; and singles were seen on the water, 18 May and 8 June 1977. Red-faced cormorants also nest at Cape Seniavin (Sowls *et al.*, 1978) where some 950 and 1500 birds were present on 9 April and 10 July 1973, respectively.

WHISTLING SWAN. *Cygnus columbianus*. Csr, Uwr. Found nesting on 11 occasions (1976 and 1977) on wet and dwarf shrub meadows along the Caribou River, S of Nelson Lagoon, and NW of Port Moller. Numerous other swans were present on the area during the nesting period, but breeding was not confirmed. Postbreeding birds began congregating on the Caribou River delta and adjacent lakes beginning late July, becoming common late August through October. Flocks of approximately 100 (adults and juveniles) were recorded on 19 September 1976 and 3 September 1977. Birds occasionally winter in the area (three, upper Nelson Lagoon, 2 February 1977), and on lakes 75 km NW of Port Moller (as many as several dozen: Kust and Jones, pers. comm.).

WHITE-FRONTED GOOSE. *Anser albifrons*. Rv. Observed on three occasions: a flock of six with emperor geese on Mud Bay, 19 September 1976; one along the

Caribou River, 28 May 1977; and one on Nelson Lagoon, 20 August 1979. An earlier record is of two among emperor geese on Nelson Lagoon 22 October 1971 (Byrd, unpublished). White-fronted geese are uncommon but occur regularly in the fall on Izembek Lagoon (Jones, pers. comm.).

EMPEROR GOOSE. *Anser canagica*. Cwr, Rsv, Aspfm. Recorded in spring and fall with numbers in fall being greater. Spring migrants first appeared in early April; most had passed by early May (peak 19 500, 1 May 1964: Jones, unpublished; peak 21 000, 4 May 1977). A few birds (subadults) were present in June and July 1976, 1977, and 1979. Birds returned to the area in numbers beginning mid-August and reached peak numbers during October (1976, 1977, 1979). Depending on winter ice conditions, however, the number of birds using this and other estuaries on the Alaska Peninsula is quite variable (*e.g.*, less than 2000 present on Nelson Lagoon during the 1975-1976 winter: Gundersen pers. comm.; but over 41 000 present on 21 December 1976). Numbers recorded in fall are also variable, probably reflecting annual differences in timing of movement of birds among the estuaries along the N peninsula (numbers for Nelson Lagoon and Mud Bay the first week of October 1970 — 15 000; 1971 — 20 000; 1976 — 16 000; 1977 — 24 000; 1979 — 13 000; 1980 — 35 000). Specimens, SEP-OCT (9).

CANADA GOOSE. *Branta canadensis*. U(sr?), FCfm (3 June-8 October). Both Taverner's (*B. c. taverneri*) and cackling (*B. c. minima*) Canada goose occurred in the area, the latter during fall migration and the former as a nesting species and fall migrant. Both subspecies preferred inland areas and were infrequently seen on coastal habitats (four records totaling 27 birds, 2 July-16 September). Taverner's Canada geese have been recorded nesting along the upper Caribou and David rivers (two nests late May: Gromme, 1927; and Gundersen, pers. comm.). A flock of 50+ molting, flightless birds was seen in the same area on 27 July 1971 (Edgar Bailey, USFWS, unpublished). *B. c. taverneri* is the more abundant fall migrant (500 along upper Caribou River, 8 October 1976; and a flock of 100 along the David River, 23 October 1971: Byrd, unpublished). Birds of both races probably move from this area to Izembek Lagoon where several thousand stage before fall migration.

BRANT. *Branta bernicla*. Cspfm (20 April-14 June; 28 August-19 November). Brant were generally transient and most (several thousand) passed offshore (1-7 km) in spring and fall. However, some birds regularly passed over S Nelson Lagoon ("several hundred" flew W past Franz Point, 15 September 1977 and lesser numbers 15 October 1977: Kust, pers. comm.); and some occasionally stopped on intertidal areas (flocks of 10, 14, 16, 17 and 70 on mudflats of Mud Bay, 28 August-15 October 1976). Izembek Lagoon is the fall staging area for the entire population wintering along the Pacific Coast of North America (Jones, 1973). Specimens, SEP (1).

MALLARD. *Anas platyrhynchos*. FCpr. A common breeder on wet and grass meadows (seven nests, 23 May-22 June) and occasionally on barrier islands (two nests, 23 May 1977). Flocking began early July, and groups of 100+ were common on intertidal areas and adjacent ponds late August through October (1976, 1977, 1979). Byrd (unpublished) recorded 1000-2000 daily (22-25 October 1971) about upper Nelson Lagoon. Numbers generally declined by early November (all years), but birds remained in the area as long as there was open water (Kust, pers. comm.).

GREEN-WINGED TEAL. *Anas crecca*. Csr (25 April-16 November). Observed regularly, being common on intertidal flats and coastal ponds from late July through early October (high count for Nelson Lagoon, 500 on 21 August 1976 and 1000+, 5 October 1978). Also reported from Nelson Lagoon in flocks of up to 200 birds, 22-25 October 1971 (Byrd, unpublished). Nesting birds were found on islands in upper Nelson Lagoon (nest with eight eggs, 14 June 1976, and seven broods, 6 July-6 August, range 5-10 young). The Alaska Peninsula is on the periphery of the range of *A. c. nimia*, but we identified none among the teal we observed closely.

GADWALL. *Anas strepera*. FCsr (23 April-28 September). Observed both inland and along the coast in spring in flocks of 20 to 50 pairs, using ponds, lagoon waters, and intertidal habitats. Gadwall nested throughout wet and grass meadows (19 nests, 28 May-6 August, average clutch 9 eggs, range 7-11). Postbreeding birds preferred coastal ponds and were infrequently recorded on intertidal areas; most birds were gone from the area by early September.

EUROPEAN WIGEON. *Anas penelope*. VRv. A pair was recorded at the head of Nelson Lagoon on 30 June 1976. We found no evidence of nesting.

AMERICAN WIGEON. *Anas americana*. Uspm, Usr, FCfm (25 April-24 September). Observed in late spring and summer at scattered locations S of Nelson Lagoon and along the Caribou-Sapsuck rivers. No nests were found, but adults with broods were observed in these areas (brood of five, 16 July; four, five and seven, 17 July; and four, 8 August). Observed in the late summer and fall on intertidal areas in mixed flocks with pintail and along the Caribou River where it was the most abundant species of waterfowl (several flocks of 30-50, 31 August 1977). The high count for Nelson Lagoon was 520, 5 September 1977. Most wigeon were gone by late September, but there are records extending into late October (largest flock, 30 birds, 23 October 1971: Byrd, unpublished).

PINTAIL. *Anas acuta*. Csr, FCspm, Cfm (23 April-18 November). Recorded during spring (23 April-15 May) and in late summer and fall (20 August-15 October) on intertidal areas and coastal ponds throughout the area. Nesting birds were found on barrier islands and wet and grass meadows (17 nests, 28 May-21 June, average clutch 7.6 eggs, range 5-11). Nesting was concentrated on a series of islands in upper Nelson Lagoon and over adjacent meadows, and also S of Miner Hill and Cape Rozhnof.

Fall migrants fed extensively on intertidal flats in Nelson Lagoon, in Mud Bay, between Point Divide and Hot Springs, and in upper Port Moller (high counts for Nelson Lagoon, 6000 on 29 September 1976 and 4200 on 13 October 1977).

NORTHERN SHOVELER. *Anas clypeata*. U(sr?) (23 April-19 September). Birds were recorded on six occasions (totalling 11 birds) during summer 1976 and on seven occasions (totalling 20 birds) during summer 1977, and were suspected of nesting on small islands in upper Nelson Lagoon (pairs present, 28 May-25 June). Our only record outside the nesting season was of a flock of 40 on 19 September 1977.

STELLER'S EIDER. *Polysticta stelleri*. Aspfm, Asv, FCwr. Steller's eiders were the most abundant waterfowl recorded, with flocks exceeding 40 000 birds common about the Kudobin Islands, near Deer Island, and along the N shore of Cape Rozhnof. Different age and sex classes of eiders used these areas in late summer while molting and in fall for staging (Petersen, 1980, 1981). *P. stelleri* regularly winter in the area (Kust, pers. comm.), with largest numbers present during mild winters (e.g. 100 000+ on 3 February 1977; and over 100 000 on 5 April 1964: Jones, unpublished). Specimens, APR-OCT (96).

COMMON EIDER. *Somateria mollissima*. Cspfm, Csr, Uwr. Recorded during migration on all marine waters, and found nesting on all fox-free barrier islands. McKinney (1959) reported "several thousand" birds nesting in Nelson Lagoon in 1958, but we found fewer than 200 pairs (1976, 1977, and 1979). In 1977, the average clutch size of 96 nests was 4.8 (range 1-9). Hatching began on 16 June and peaked on 1 July, with 60% occurring between 25 June and 12 July. Seventy-three of 96 nests hatched young (average 4.5). The high spring count for Nelson Lagoon was 6500 birds on 4 May 1977. Jones (unpublished) found 4500 and 1000 birds on Nelson Lagoon on 1 and 22 May 1964, respectively. After the nesting period, numbers of common eiders again began increasing and peaked in late October-early November (3000 on 18 November 1976; and 4000 on 22-25 October 1971: Byrd, unpublished). By 1 December 1976 most birds had left the area; a single pair was seen 1-3 February 1977. Birds had moved back to the area by late March (6500 near Kudobin Islands, 21 March 1977). Specimens, MAY-OCT (12).

KING EIDER. *Somateria spectabilis*. Awr (9 July-11 May). Birds were not recorded on a 22 April 1976 aerial nor on our arrival at our field camp on 18 May 1976. Beginning with the arrival of subadult males in July 1976, numbers of king eiders gradually increased with the majority of birds arriving in late fall and early winter. We detected no significant spring (1977) or late fall (1976 and 1977) migration over inshore and offshore waters (observations limited during fall). During winter 1977, numbers increased from 12 000 on 4 January to 20 000 on 3 February, and then declined to 8000 on 21 March with only 12 present on 11 May. Birds congregated and fed in the channel between Lagoon Peninsula and Cannery Island, throughout the

Kudobin Islands, and on waters around Deer Island. Far greater numbers have been recorded in previous years (e.g., 120 000 near Deer Island, 1 April 1964, down to 11 000 on 1 May: Jones, unpublished). Specimens, JAN-JUL (2).

CANVASBACK. *Aythya valisineria*. VRv. Single record: a female on lagoon waters near Cannery Island, 24 May 1976.

GREATER SCAUP. *Aythya marila*. R(wr?), Csr (21 March-16 October). This is probably the most abundant nesting waterfowl in the area, preferring wet meadows throughout the Caribou River drainage (23 nests, 12 June-12 July 1976, average clutch 8.9 eggs, range 3-11). This species was also abundant in late summer and fall on larger coastal lakes (1000+ on Coast Lake, 22 September 1976), was generally not found on Nelson Lagoon and Mud Bay, but was recorded on upper Port Moller (high count, 1500 on 12 October 1976) where it was also present in late winter (400 on 21 March 1977). *A. marila* normally winter westward in the Aleutians (Murie, 1959), and probably remain in the Nelson Lagoon area only during mild years.

WHITE-WINGED SCOTER. *Melanitta fusca*. Cspfm, R(sr?), Uwr. Recorded regularly during spring (18 April-15 May) along inshore waters, becoming more abundant on nearshore waters (Kudobin Islands, E of Cape Rozhnof, between Deer Island and Point Divide) and along the coast during fall (early August-late October). High counts were 1000 (molting) on 1 August 1976 and 2000 on 27 September 1977. Byrd (unpublished) reported "several thousand" in Nelson Lagoon, 22-25 October 1971. Birds were present in low numbers about Point Divide on 3 February 1977 and a group of 300 was recorded in upper Port Moller on 21 March 1977. We suspected scattered nesting on lakes along the Caribou River drainage (19 records of paired birds, 28 May-28 June).

SURF SCOTER. *Melanitta perspicillata*. R(wr?), Uspfm, FCsr. Observed occasionally on inshore waters in spring (three records totalling five birds, 30 April-11 June), but more commonly in late summer as birds moved into the area to molt (750 and 3000 in mixed-species flocks of scoters near Point Divide, 1 August 1976 and 29 July 1977, respectively). Most birds were gone by early September (last seen 18 November 1976, 23 September 1977, and 3 October 1979). We have one winter record: a single bird among a flock of king eiders and oldsquaw near Lagoon Point, 31 January 1977.

BLACK SCOTER. *Melanitta nigra*. Cspfm, Ustr, Awr. This was the most common of the three scoter species, both as a spring and fall migrant over inshore and nearshore waters, and during summer when molting birds congregated near Point Divide and S of Walrus Island. Flocks of 5000 molting birds were recorded from these areas on 1 August 1976 and 10 August 1977. Concentrations in fall for the entire area exceeded 20 000 on 28 September 1976 and 11 000 on 5 September 1977, while in spring over 22 000 have been recorded (1 May 1964: Jones, unpublished).

During winter (1976-1977) concentrations of 14 000 and 4000 were recorded near Point Divide, 3 December 1976 and 3 February 1977, respectively. There is an interesting record of a "dense" raft (approximately 0.8 km wide and 5.0 km long) of predominantly black scoters on the E side of Deer Island on 1 October 1970 (Kust, pers. comm.). We found *M. nigra* nesting along the Caribou River drainage (broods of seven and four on 10 August 1976 and 31 August 1977, respectively), and on a coastal lake 10 km SW of Nelson Lagoon (brood of six, 16 August 1976). We have several additional records of courting birds from these areas during June and July. Jaques (1930) found paired birds on fresh water ponds near Port Moller, 23 May-20 June, and McKinney (1959) observed courting birds in Nelson Lagoon, 10-29 May.

HARLEQUIN DUCK. *Histrionicus histrionicus*. U(sr?) (11 May-11 October). Harlequin ducks are suspected of nesting about upper Port Moller and Herendeen Bay where the only suitable habitats occur. Pairs were common in these areas during May (10 pairs plus a group of three males and a female in upper Port Moller, and seven pairs plus groups of mixed sexes in Herendeen Bay, 11 May 1977). Also, flocks of 13 and 25 birds (mixed age and sex) were recorded in Herendeen Bay on 31 July 1976 and 29-31 July 1977, respectively. Jaques (1930) recorded "pairs" near Port Moller in June. In spring and fall birds were seen flying over inshore waters off Nelson Lagoon and roosting on barrier islands in the lagoon. Byrd (unpublished) reported small groups of 5-10 birds on Nelson Lagoon in late October 1971, and observed four approximately 14 km up the Sapsuck River on 24 October.

OLDSQUAW. *Clangula hyemalis*. Rspfm, Rsv, Cwr. Observed in spring (1976 only) on two occasions (flock of five flying NE off Lagoon Point, 19 May; and eight on inshore waters, 22 May). Jones (unpublished) recorded 1000 in Nelson Lagoon "area", 1 May 1964. Birds were rarely seen in summer (male flying E, 11 July 1976; and three molting, flightless birds, 25 June and 11 July 1976). They were absent from late July through mid-September (1976, 1977, and 1979) and did not appear in numbers until late October (all years), when they used both inshore and nearshore habitats. Records of birds in fall and winter in Nelson Lagoon include: 4600 on 18 November 1976; 4700 on 4 January 1977; and 2900 on 21 March 1977. During severe winters numbers are greatly reduced (Kust, pers. comm.). Specimen, JUL (1).

COMMON GOLDENEYE. *Bucephala clangula*. Uspfm, FCwr (22 September-21 March). We have only four spring records: 20 on Nelson Lagoon on 22 April 1976; one male on Nelson Lagoon, 21 May 1976; seven males and two females on upper Nelson Lagoon, 25 April 1977; and two females flying NE over Nelson Lagoon, 1 June 1977. Birds were not recorded again until late fall (22 September 1976; 8 October 1978), when they were observed along the Caribou River. A high of several hundred was reported there, 22-25 October 1971 (Byrd, unpublished). Birds were also

present in the area in winter (25 on lower Caribou River, 30 January 1977, and 200 on upper Port Moller and two near Cape Rozhnof, 21 March 1977). On the 21 March 1977 aerial survey we also saw eight birds that appeared to be Barrow's goldeneye (*B. islandica*), but we have no positive identification for this species for the area. Barrow's goldeneye are regular winter residents along the NE Alaska Peninsula (Murie, 1959).

BUFFLEHEAD. *Bucephala albeola*. Rv. An immature volant female was found dead along the upper Caribou River (6 October 1976) and an adult male was observed in the same area that day. In 1977, six were seen with common goldeneye on upper Port Moller in spring, and pairs were seen in upper Nelson Lagoon (25 April) and on a lake S of Franz Point (5 June).

RED-BREASTED MERGANSER. *Mergus serrator*. Cspfm, UCsr, Cwr. Observed regularly during spring and fall on inshore waters, throughout Nelson Lagoon and Mud Bay, and on adjacent coastal lakes. This species nested on barrier islands (nest with 11 eggs, 29 June 1976; nine eggs, 25 June 1979; nine downy young, 26 July 1976; one downy young, 27 July 1977). It also nested on islands in upper Nelson Lagoon (female with five downy young, 23 July 1977). Pairs were also seen regularly from late May through July (1976 and 1977) S of Franz Point and along the upper Caribou River, and in June near Port Moller (Jaques, 1930). During late summer 1976 and 1977 flocks of 100+ (predominantly males) were seen feeding around Deer Island, and on 8 October 1980, a flock of 600+ was seen on a coastal lake 30 km NE of Port Moller. In winter 1976-1977, birds were found on Mud Bay (40 on 4 January) and on upper Nelson Lagoon and along the lower Caribou River (20+ on 3 February).

COMMON MERGANSER. *Mergus merganser*. Uspfm, Usv, Rwr. Observed in spring (pair at Cannery Island, 22 May 1978); in summer (flock of seven males on intertidal, 9 July 1976 and four single males in upper Nelson Lagoon, 24 July-10 September); and in winter (single male, upper Nelson Lagoon, 30 January 1977 and a flock of six males, upper Port Moller, 21 March 1977). Previous records include a flock of 30 from Port Moller, 1 April 1964 (Jones, unpublished). Jaques (1930:362) noted it as "abundant" along King Salmon Creek, N of Port Moller (mostly all adult males) where he described it as "occurring in greater numbers than any other duck" during June. Despite these records, we found no evidence of nesting.

ROUGH-LEGGED HAWK. *Buteo lagopus*. Usr (28 May-22 September). We recorded this species on six occasions during the study and found birds nesting in upper Port Moller and Herendeen Bay (single dark phase bird flushed from a nest on W side of upper Port Moller, 2 August 1976, and two light phase birds off a nest containing one feathered young, Gull Point, Herendeen Bay, 30 July 1977). Chapman (1904:402) lists two female (light) and one male (dark) *B. lagopus* collected from "Muller Bay" (=

Port Moller), 22-24 May, and a set of three eggs from Herendeen Bay, 17 May.

BALD EAGLE. *Haliaeetus leucocephalus*. Cpr. Bald eagles were observed on all coastal habitats and along the length of the Caribou River drainage, where they nested on barrier islands, bluffs, and rocky cliffs. Nineteen active eyries were found in 1976 (18 May-31 August). Twenty fully feathered juveniles were counted in 10 eyries on a 2 August 1976 aerial survey of Port Moller (Cannery to Hot Springs). Adults and subadults were present in winter near upper Nelson Lagoon, on Miner Hill, on Deer Island, and on Cannery Island (highest count, four adults and six subadults, 28 January 1977; Kust (pers. comm.) has seen as many as 20 adults concentrated on SE Deer Island in December). Five adults were found at three nests on 21 March 1977 and by 2 May 1977, 14 eyries had one or more adults present. Twenty adults and six subadults were recorded for the area during a 12 May 1976 aerial survey. Beginning mid-August, eagles began congregating about intertidal areas as postbreeding waterfowl and silver salmon (*Oncorhynchus kisutch*) returned to the area. Numbers of eagles were noticeably lower by late September (all years).

MARSH HAWK. *Circus cyaneus*. Rv. Three records: a female was observed over Lagoon Point, 19 May 1976; a pair was seen foraging on Cape Rozhnof, 22 July 1976; and a single bird was seen on Lagoon Peninsula, 1 October 1979.

GYRFALCON. *Falco rusticolus*. Upr. Observed regularly and found nesting in Herendeen Bay and Port Moller (three active eyries, 1976 and 1977). Chapman (1904:402) cites a record of an adult female collected in "Muller Bay", 24 May 1903, and Townsend (*in* Murie, 1959) obtained a juvenile from Herendeen Bay, 15 July 1890. In late summer and fall adults or juveniles were observed almost daily as they pursued waterfowl and shorebirds (observed with prey in talons on five occasions). Only adults were seen in the area during winter (five records totalling seven birds, 17 November-21 March).

PEREGRINE FALCON. *Falco peregrinus*. Uspfm, Rsv, Rwr. We recorded peregrine falcons twice in spring (19 and 29 May 1976), on 11 occasions during summer (3 August-20 September), and on seven occasions in fall (23 September-7 October). We have one winter record (28 January 1977) of an adult sitting on ruins on Cannery Island. We found no evidence of nesting and none has been reported previously. Observations of fall birds were of both adults and juveniles. Birds were frequently observed attempting to kill roosting shorebirds and waterfowl, and between 27 August and 27 September an adult resided on Lagoon Point and fed regularly on dunlin (*Calidris alpina*).

WILLOW PTARMIGAN. *Lagopus lagopus*. Apr. Found breeding in suitable habitat throughout the area (13 records, June 25-15 August). Birds were most abundant on dwarf shrub mat south of Nelson Lagoon, along the Cari-

bou River drainage, in upper Herendeen Bay, and about Port Moller. Rock ptarmigan (*L. mutus*) occur throughout the Alaska Peninsula (Murie, 1959) but we saw none during our only visit to suitable habitat (uplands around Herendeen Bay, 31 July 1977).

SANDHILL CRANE. *Grus canadensis*. FCsr (29 April-10 September). Found nesting on grass and wet meadows throughout the Caribou River drainage and S of Big Hill. Adults with downy young were seen on 14 June 1976 (two pairs, each with two young) and on 25 June 1977 (a pair with one newly hatched young). Birds flocked from early August through early September, and groups of 6-8 birds were occasionally seen on coastal wet meadows and on unvegetated intertidal, a habitat not typically used by this species. Birds were recorded on the latter (on mudflats off Miner and Big hills and on Mud Bay) on eight occasions (25 July-28 August) where they were actively feeding.

SEMIPALMATED PLOVER. *Charadrius semipalmatus*. Ustr (10 May-30 August). Found nesting at Port Moller (22 June 1976), on the Kudobin Islands (4 July 1976), and on Lagoon Point (13 July 1976). Jaques (1930) and Gibson (unpublished) also found nesting birds at Port Moller. Numerous other incidental sightings were recorded with high counts of eight at Lagoon Point on 1 July 1977 and 15 near Mine Harbor, Herendeen Bay on 30 August 1977.

AMERICAN GOLDEN PLOVER. *Pluvialis dominica*. Uspm, Cfm (22 April-9 October). Spring records are of 30 birds at Lagoon Point on 22 April 1976; one flying east on 19 May 1976; and one feeding on intertidal, 19 May 1977. The paucity of spring records is in keeping with the migration patterns exhibited by this and other transoceanic migrants in that birds are thought to move directly to the vicinity of their breeding grounds in spring (Gill and Handel, 1981). Fall migrants, adults preceding juveniles, began arriving in late July and were common throughout September. Birds preferred intertidal areas and were recorded away from there on only two occasions. The high count for Nelson Lagoon and Mud Bay was 200+ birds on 25 August 1977. Specimens, AUG (2).

BLACK-BELLIED PLOVER. *Pluvialis squatarola*. Rv. Considered a rare migrant anywhere along the Bristol Bay coast and on the Bering Sea islands (Kessel and Gibson, 1978). We observed this species on six occasions: a single bird in breeding plumage with a golden plover, 19 May 1977; three in winter plumage, 4 October 1977; 15 in winter plumage, 5-6 October 1978; five near Franz Point, 8 October 1978; a flock of 500 on Mud Bay on 11 October 1978; and eight on intertidal flats, 2 October 1979.

HUDSONIAN GODWIT. *Limosa haemastica*. VRfm. We have only three fall records: one among a flock of five bar-tailed godwits 5 km E of Franz Point on 10 August 1977; three flying E and eight flying W near Cannery Island, 29 August and 1 September 1979, respectively.

BAR-TAILED GODWIT. *Limosa lapponica*. Uspm, Afm (18 May-19 October). Recorded only once in spring 1976, but on eight occasions in spring 1977 (18 May-2 June). The

largest flock was of 39 on 26 May 1977. Postbreeding birds began arriving in mid-July and reached peak numbers of 10 000+ and 7000+ on 19 September 1976 and 15 September 1977, respectively. Similar numbers and timing probably occurred in 1979 but systematic surveys were not conducted for this species that year. Nelson Lagoon appears to be a major fall staging area for this species (Gill and Jorgensen, 1979; Gill and Handel, 1981). Godwits regularly fed over the intertidal SW of the village and at high tide flew to roosting areas on Mud Bay. The bivalve *Macoma balthica* was the predominant food item found in a sample of 10 stomachs. The weights of these birds averaged 473 g \pm 33 SE, attesting to the build-up of fat required for their long overwater migration. Specimens, SEP-OCT (10).

WHIMBREL. *Numenius phaeopus*. Cfm (2 June-4 September). The whimbrel was the earliest fall migrant shorebird, occurring in numbers (600) by mid-June (1976 and 1977), and reaching peak numbers by late July (1900 on 22 July 1976 and 3900 on 17 July 1977). Most were gone by late August. This species, like the bar-tailed godwit, had preferred feeding and roosting areas, flying from the intertidal along the S shore of Nelson Lagoon to inland roosting/feeding areas S and E of Franz Point. Several hundred birds also concentrated on flats between Point Divide and Hot Springs and roosted on adjacent uplands and on Deer Island. The only previous records of whimbrel from the area were of birds at Port Moller, 28 July-14 August 1969 (199 total on three occasions: Gibson, unpublished). The species is also known from the Cold Bay area, but seldom occurs in flocks of more than a few dozen birds (Gibson and Byrd, 1972; Jones, pers. comm.). Specimen, JUL (1).

GREATER YELLOWLEGS. *Tringa melanoleuca*. FCfm (25 June-15 October). Birds were commonly seen along upper Nelson Lagoon; around Mine Harbor, Lawrence Valley, and Herendeen Bay; and at the head of Port Moller, where they frequented the muddier substrates and shallower ponds. High counts were of 60 and 30 on 27 September 1976 and 17 July 1977, respectively. There was no evidence of nesting.

LESSER YELLOWLEGS. *Tringa flavipes*. Ufm (17 July-2 October). Recorded on four occasions in 1976 (12 birds), once in 1977 (four birds), and on eight occasions in 1979 (19 birds). The majority of sightings occurred after mid-August when birds were frequently found with greater yellowlegs.

WANDERING TATTLER. *Heteroscelus incanus*. VRfm. We have records of one bird feeding on a gravel beach 1 km E of Nelson Lagoon village on 7 September 1979 and one "perched" on the gunwale of a skiff on 23 September 1979. Other records of this species on the N Alaska Peninsula are few (McRoy and McRoy, 1965; Kessel and Gibson, 1978).

RUDDY TURNSTONE. *Arenaria interpres*. FCspm, Cfm (8 May-2 October). Observed in spring (8 May-9 June) along Nelson Lagoon beaches and in wet meadows

on the S side of Nelson Lagoon. No evidence of breeding. First fall migrants (adults) were seen 4-9 July 1976, 1977 and 1979. Our high count was 300 on 6 August 1976. Juveniles were present in numbers by the first week of August (all years), when populations peaked at a few thousand birds for the area. Several hundred (all juveniles) were present into early October (1976-1980). In fall, birds concentrated along the gravel beaches of Lagoon Point, Cape Rozhnof, and Deer Island. Specimens, OCT (3).

BLACK TURNSTONE. *Arenaria melanocephala*. Ustr, Ufm (5 May-29 August). Found nesting on a small island at the head of Nelson Lagoon in 1976 (nest with four eggs, 14 June) and 1977 (nest with four eggs, 28 May). Nests were placed among stands of *Carex Lyngbyaei* and *Calamagrostis canadensis*. No previous nesting records exist for the Alaska Peninsula, although Murie (1959) suspected the species to breed near Ugashik. Five additional spring observations (1976 and 1977), totaling nine birds, exist from three other locations in Nelson Lagoon. In mid-summer we recorded only two groups of adults (five birds each on 5 and 20 July 1977) and then saw hatching-year birds occasionally through late August (1976, 1977, and 1979; high of 10 in August 1979). The young birds were regularly seen with hatching-year ruddy turnstones. Specimens, MAY (egg set).

NORTHERN PHALAROPE. *Phalaropus lobatus*. Csr, Cfm (10 May-16 November). This species nested throughout the area on wet meadow habitat, particularly S of Nelson Lagoon and along the Caribou-Sapsuck river drainage. Jaques (1930) reported it common about Port Moller in June and Byrd (unpublished) saw it regularly on wet meadows near Port Moller, 7-8 July 1973. Three pairs were recorded nesting on a 5-ha study plot near Franz Point in 1976. Clutch initiation began the first week of June. In early July courtship displays and territorial birds were still evident although large flocks of postbreeding birds began to occur on lagoon waters. A flock of 170 birds observed on 14 July 1976 comprised 24 in breeding plumage, 97 in molt, and 49 in winter plumage. Several flocks of 500-1000 birds were seen feeding in tide-rips and along shores during August. Numbers decreased by mid-September, but 25+ were seen each day throughout the month and into early October (all years). Specimens, AUG (3).

RED PHALAROPE. *Phalaropus fulicarius*. Uspm, FCfm (10 May-16 November). Recorded on nearshore and in-shore waters in spring (10 May-12 June) and in greater numbers, but sporadically, from early July through October. This species was never as abundant as the northern phalarope. Flocks were usually of 5-10 birds, seldom exceeding 20 (high count of 200 on 25 August 1977). Over offshore waters of the northcentral Alaska Peninsula "several thousand" red phalaropes have been recorded the last week of August 1971 (Gibson, 1972a:93).

COMMON SNIPE. *Gallinago gallinago*. U(sr?), Ufm (25 May-3 October). Observed in spring and early summer

(1976 and 1977) at inland sites along the Caribou-Sapsuck river drainage and S of Franz Point where several (12) were seen in aerial courtship display. Jaques (1930) reported this species common about Port Moller in June, and Byrd (unpublished) found it on wet meadows around Port Moller, 7-8 July 1973. Although no nests have been found, these observations plus Murie's (1959) from Cold Bay suggest that snipe also nest on the central and W Alaska Peninsula. During 1976, a small wave of migrants passed through Nelson Lagoon in late September, but no such movement was noted 1977-1979.

SHORT-BILLED DOWITCHER. *Limnodromus griseus*. Ustr, Cfm (12 May-22 September). Single nests were found on an unnamed island at the head of Nelson Lagoon in 1976 (two eggs on 12 June, three on 14 June, nest empty on 30 June) and 1977 (four eggs on 28 May). Fifteen territorial pairs were also found on an adjacent smaller island (12-20 June 1976) and 12-16 additional pairs were on the larger island on 28 May 1977. Other adults (three) were seen perching atop alders (*Alnus* sp.) along a 4-km stretch of the Caribou River, 4 June. Both Jaques (1930) and Murie (1959) suspected that this species bred on the W Alaska Peninsula. Postbreeding and migrant birds were common on mudflats of Nelson Lagoon and Mud Bay from late June through early September. Several hundred roosted on old cannery buildings (early July 1976, 1977, and 1979) and up to 2900 were seen with whimbrels feeding on flats and roosting inland near Franz Point on 29 June 1977. The population declined to a few hundred over the entire area by early September. Specimens, MAY-SEP (8 + egg set).

LONG-BILLED DOWITCHER. *Limnodromus scolopaceus*. Cfm (15 August-15 October). Not as abundant as the short-billed dowitcher but remained longer, overlapping in occurrence with *L. griseus* in late August. Unlike *L. griseus*, which occurred over most of the mud-sand intertidal of Nelson Lagoon, *L. scolopaceus* was found only along the upper end, where it preferred muddier substrates. It was also noted about the head of Port Moller on similar habitat. Numbers peaked on Nelson Lagoon and Mud Bay on 2 October 1976 (900 birds) and on 27 September 1978 (1500 birds). We recorded fewer than 200 during late September 1977. During the first week of October 1979 and 1980, 500-700 birds were recorded SW of Big Hill. Most birds were gone by mid-October (1976-1978). A bird seen 23 October 1971 and reported by Byrd (*in* Gibson, 1972b) as *L. griseus* was probably a long-billed dowitcher because of the late date and location of the sighting. Although *L. scolopaceus* is not known to breed on the Alaska Peninsula, it uses Nelson Lagoon and probably other estuaries as part of its regular fall migration route (Gill and Handel, 1981). Specimen, SEP (1).

SURFBIRD. *Aphriza virgata*. Rfm. Three adults were observed at Port Moller on 10 August 1977; one adult at Cannery Island on September 1977; and a juvenile among rock sandpipers, also at Cannery Island, 1 October 1978. No other records are known for the area (Kessel and

Gibson, 1978). The species may breed in very low numbers throughout the Aleutian Range.

REDKNOT. *Calidris canutus*. VRfm. None was recorded during our studies. Up to four were found at Port Moller, 18-19 August 1970 (Kessel and Gibson, 1978).

SANDERLING. *Calidris alba*. VRspm, FCfm, Rwr. We have only one spring record, that of two birds in breeding plumage at Port Moller cannery on 17 May 1976. The species was absent during June and July, but fall migrants arrived as early as 12 August 1976 (two birds). Birds were usually not present in numbers until mid-September (all years), and then were most commonly found on sandy substrates along the Kudobin Islands, on the sea-beach of Nelson Lagoon peninsula, at Port Moller, and on the beaches of Deer Island. High counts for Nelson Lagoon and Mud Bay in fall were: 150 on 27 September 1976; 416 on 27 September 1977; 100+ on 27 September 1978. Sanderlings were still present but in reduced numbers during early October 1979 and 1980; in late October 1970 (Gibson, unpublished); and on 17 November 1976 (flock of 100+). During mild winters, such as 1976-1977, sanderlings were resident (20 and five on 4 and 31 January, respectively, and 20 on 21 March). Sanderlings are a regular winter resident further W at Izembek Lagoon and throughout the Aleutian Islands (Jones, pers. comm.; Kessel and Gibson, 1978).

WESTERN SANDPIPER. *Calidris mauri*. Asr (18 May-24 September). This was the second most abundant shorebird on the area. Nests were found on the islands of upper Nelson Lagoon (28 May-2 June 1977) and displaying birds were seen about dwarf shrub meadows S of the lagoon. Nesting is thought to be widespread. Postbreeding adults moved to littoral areas beginning mid-June (females first, followed by males) and reached peak numbers (7000-10 000) by mid-July. Juveniles arrived beginning late July and reached peak numbers by mid-August. Birds preferred to roost at high tide on small barrier islands in Nelson Lagoon and along the north shore of Cape Rozhnof. Specimens, JUN-SEP (31 + 2 egg sets).

RUFOUS-NECKED SANDPIPER. *Calidris ruficollis*. VRfm. One on Nelson Lagoon beach among a flock of 2000+ adult western sandpipers on 9 July 1977.

LEAST SANDPIPER. *Calidris minutilla*. U(sr?) (10 May-22 August). Seen regularly in spring about wet meadows on the S side of Nelson Lagoon and along portions of the Caribou-Sapsuck river drainage. Birds in aerial display were seen near Franz Point, 8 June 1976 and 25 June 1977; nests were not found. Also, several "defensive" birds were seen near Port Moller, 7-8 July 1973 (Byrd, unpublished). Postbreeding adults began flocking in late June and were commonly seen on the intertidal of upper Nelson Lagoon and over wet meadows of Herendeen Bay. High count was of 200+ at Mine Harbor, 31 July 1977. Most birds had departed the area by mid-August (1976 and 1977).

PECTORAL SANDPIPER. *Calidris melanotos*. Ufm (5 September-4 October). Observed in the vicinity of upper Nelson Lagoon and along the N shore of Cape Rozhnof (one on 28 September 1976; four on 1 September 1977; 18 between 30 September and 4 October 1978; and two on 4 October 1979).

SHARP-TAILED SANDPIPER. *Calidris acuminata*. FCfm (5 September-8 October). This species is not known to nest in Alaska (Kessel and Gibson, 1978) but does occur regularly and in numbers (almost entirely juveniles) in western Alaska in fall (Gill and Handel, 1981). Over the northcentral Alaska Peninsula it usually frequented mixed mud-sand intertidal substrates but was also recorded on muddy intertidal in upper Nelson Lagoon. The species was not observed in 1977 but was recorded on 26 occasions in other years with high counts of 21 on 22 September 1976; 63 on 5 October 1978; and four on 7 September 1979. Interestingly, 60 of 64 birds recorded on 5 October 1978 were flying ENE. Specimens, SEP (2).

ROCK SANDPIPER. *Calidris pilocnemis*. FCpr. Found nesting over dwarf shrub mat S of Franz Point (nest with three eggs, 10 June 1976; nest with four eggs, 25 June 1977). Other displaying birds were seen SE of Franz Point and up the Caribou River in late June. Nesting was also reported by Chapman (1904:401) for "Muller Bay" (nests with four and five eggs, 9 June 1903). A population of 4000-6000 postbreeding birds was present in Nelson Lagoon throughout late summer and fall (1976, 1977, and 1979) and roosted along Lagoon Point and on Cannery Island. Other smaller flocks were resident along the N side of Cape Rozhnof, on Deer Island, and at Port Moller (total less than 2000 birds). After completion of molt in early October many birds departed the area, some to wintering areas in the Gulf of Alaska (Gill, 1979) and others possibly to areas further W along the Alaska Peninsula and throughout the Aleutian Islands. A flock of 1000+ birds was seen on Mud Bay on 3 February 1977, an unusually mild winter. Specimens, JUL-OCT (94).

DUNLIN. *Calidris alpina*. A(sr?), Afm (4 May-15 October). Dunlin appeared during early spring on intertidal flats and then were seen regularly during May and early June on wet meadow habitat along the Caribou River, S of Franz Point, and over Cape Rozhnof where numerous displaying birds were observed. Nests were not found but birds most certainly nested over these areas in fair numbers (see also Murie, 1959). On 28 May 1977, more than 100 birds were observed in display flights and chases (see Holmes, 1970) throughout wet meadows 12 km SW of Nelson Lagoon village. Unsuccessful breeders and postbreeding birds arrived on intertidal throughout the area beginning early June, and continued to build in numbers through summer, peaking in early October, 1976-1980. Several flocks exceeding 20 000 birds roosted on Lagoon Point and barrier islands, and dispersed at low tide to feed over the adjacent littoral. Specimens, JUN-OCT (80).

BUFF-BREASTED SANDPIPER. *Tryngites subruficollis*. VRv. This species was observed on 7 September 1979 (flocks of seven and 12) feeding with lesser yellowlegs along the shoreline of Nelson Lagoon, and again on 22 September 1979 (single bird seen on a barrier island).

POMARINE JAEGER. *Stercorarius pomarinus*. Uspm, Usv, Vrfm (27 May-23 September). With the exception of a single hatching-year bird seen on 23 September 1977 off the Kudobin Islands, all of our sightings were in spring and early summer (27 May-23 July). Spring migrants, usually in groups of three to seven, were occasionally seen passing 1-3 km offshore of Nelson Lagoon the last week of May and first week of June, 1976 and 1977, but a few groups were noted as late as mid-July both years. We have five records from within Nelson Lagoon, all of single birds, between 17 June and 23 July. Bartonek and Gibson (1972) found the species common within 50 km of shore off Nelson Lagoon, 13 July-20 August 1969.

PARASITIC JAEGER. *Stercorarius parasiticus*. Csr (1 May-27 September). This, the most common of the three jaeger species, was observed throughout coastal areas and nested over wet and dwarf shrub meadows S of Nelson Lagoon and along the Caribou River (nest with one egg, 19 June 1976; nest with two eggs, 5 June 1977). Numerous other territorial pairs were encountered. The species was also common both in Nelson Lagoon and offshore during spring and fall migration when it was seen almost daily. Specimen, JUL (1).

LONG-TAILED JAEGER. *Stercorarius longicaudus*. Rv. Observed on eight occasions (total 13 birds: two offshore and 11 over Nelson Lagoon) between 29 May and 24 July. Bartonek and Gibson (1972) recorded only 14 birds at sea and one from shore during surveys in Bristol Bay, 13 July-20 August 1969.

GLAUCOUS GULL. *Larus hyperboreus*. Rv. We have sightings of 14 subadult birds (first- and second-year) in the area between 21 March and 1 July, and of two adults on Mud Bay on 21 March 1977.

GLAUCOUS-WINGED GULL. *Larus glaucescens*. Asr, Cwr. Widespread and common in summer throughout coastal areas. Birds were present in numbers and territorial upon our arrival in early April 1977. Colonies were located on eight fox-free barrier islands in Nelson Lagoon, on Gull and Egg islands, and on an unnamed island in upper Port Moller. The species had previously been reported from the unnamed island (25 pairs the last week of May) by Gromme (1927). The Nelson Lagoon colony made up 90% of the 7000+ pairs nesting in the area. In 1976, the barrier island colonies averaged 202 active nests ha⁻¹ (range 54-387) and in 1977, 213 nests ha⁻¹ (range 27-400). Laying began on 23 May 1977 (majority between 1 and 22 June) and peaked on 10 June (n = 780 nests). The first chicks hatched on 2 July, and the majority by 18 July. In summer, adults foraged over nearshore and inshore waters where they fed predominantly on Pacific sand lance (*Ammodytes hexapterus*) and bivalves (*Macoma balthica*). Sand lance

was the only food present in 13 of 14 regurgitations collected from 3- to 6-week old chicks between 3 July and 15 August 1976. In late summer and fall there was a movement of adults to inland lakes and streams, probably in response to an influx of spawning salmonids. The majority of birds, however, remained along the coast. By late October most birds had departed the area, but groups of 100+ were regularly seen feeding on intertidal areas, especially about upper Nelson Lagoon (November 1976 and February 1977). The species is a common winter resident all years (Kust and Gundersen, pers. comm.). Juveniles banded at Nelson Lagoon have been recovered at Kodiak Island, Alaska (two), along the Oregon coast (one), and at San Francisco Bay (one) and Crescent City (one), California. All were recovered the first winter following banding.

HERRING GULL. *Larus argentatus*. VRv. Single second-year birds were seen near Cannery Island on 27 May 1977 and on Deer Island on 17 June 1977, and two adults were seen on Mud Bay, 21 March 1977.

MEW GULL. *Larus canus*. Csr, Uwr. Mew gulls were widespread in summer about upper Nelson Lagoon and on numerous small lakes S of Franz Point and along the Caribou-Sapsuck river drainage, where they were found nesting in 1976, 1977, and 1979. Some 100 pairs nested on a small island at the head of Nelson Lagoon (five nests with five eggs each, 28 May 1977). The breeding population was estimated at 1000 birds for the study area in 1976 and 1977. Several hundred were seen sitting on and flying over inshore waters on 16 November 1976; 50-75 were at the head of Nelson Lagoon on 30 January 1977; and 105 were recorded in the area on the 21 March 1977 aerial survey. Specimens, SEP (3).

BLACK-HEADED GULL. *Larus ridibundus*. VRv. The first record of this species for the Alaska mainland was of a bird collected at Entrance Point on 13 August 1969 (Bartonek and Gibson, 1972). We did not see this species during our tenure.

BONAPARTE'S GULL. *Larus philadelphia*. Csv, Cfm (8 May-12 October). Observed over most areas throughout the summer, but nesting was not confirmed. We detected no spring and little fall migration over marine waters. However, birds were common (late July-early September) over intertidal flats (preferred habitat) and coastal lakes and meadows where flocks of 1000+ were occasionally seen (high counts of 2000+ on intertidal habitat of upper Port Moller, 2 August 1976 and Mud Bay, 24 July 1977). Specimens, JUN-SEP (5).

BLACK-LEGGED KITTIWAKE. *Rissa tridactyla*. Cspfm, Usr (21 March-10 October). Occurred both offshore and on lagoon waters during spring migration and nested in small colonies on Gull Island (100-125 pairs, 30 July 1976) and on an unnamed island in upper Port Moller (200-250 pairs, 2 August 1976). Several almost fledged young were seen at each site on the above dates. The closest large nesting colony is at Cape Seniavin (2000 birds on 8 April 1964: Glen Davenport, ADFG, unpublished; 5000-7000

birds on 21 March 1976; 4500 pairs on 17 August 1979; 10 000+ birds on 8 October 1980). Beginning in late July (1976, 1977, 1979), large numbers (flocks of 500 common, largest 1400+) of adults and subadults moved into the area; they roosted on barrier islands and spread out to feed over inshore and nearshore waters. Fall migration was most pronounced during September (all years). During fall, birds were most frequently seen over inshore waters. We suspect that a segment of spring and fall migrants moving to and from the Bering Sea crosses the Alaska Peninsula at the Pavlof Bay-Caribou River isthmus (birds observed 20-30 km inland in May and September).

SABINE'S GULL. *Xema sabini*. Rspm, FCfm (23 May-20 November). Observed twice in spring (three on 23 May 1976; one on 9 June 1976), but seen regularly between 5 July and 15 October (1976, 1977, and 1979). This species was most abundant during late September over inshore waters and occasionally within Nelson Lagoon. Most records were of groups of two to five birds, the largest being 16 (all adults) off Walrus Island on 24 September 1977. Murie (1959) believed that *X. sabini* might nest near Port Moller but we found no evidence of this.

ARCTIC TERN. *Sterna paradisaea*. Asr (5 May-7 October). Scattered nesting was found throughout the area on wet and grass meadows S and SW of Nelson Lagoon, and colonies were found at Entrance Point (300 pairs), on Cannery Island (350-400 pairs), on an unnamed barrier island (40-60 pairs), on Lagoon Point (380-500 pairs), and on a small island in upper Nelson Lagoon (50-75 pairs). We noted considerable annual variation (1976, 1977, and 1979) in the size of the Cannery Island and Lagoon Point colonies, suggesting interchange between sites. Laying began the third week of May (1977) at all colonies and was generally completed by mid-June. The average clutch size among the five colonies was 2.04 ($n = 183$ nests). Postbreeding birds began flocking in early August (1976 and 1977) and by mid-August groups of 300-500 were common on Mud Bay, Nelson Lagoon, and Entrance Point (largest 1100 at Lagoon Point, 15 August 1976). Arctic terns (mostly hatching-year and subadults) remained common through late September 1976 and 1977 (flocks of 30 and 100+ feeding on inshore waters 23 September 1976 and 1977). Most terns had departed the area by the first week of October all years. Specimens, JUN-AUG (2).

ALEUTIAN TERN. *Sterna aleutica*. Csr (21 May-30 August). Colonies were found at Entrance Point (560-720 pairs when first visited 7 July 1976, and 300+ pairs, 9 June 1977), and on an island in the lower Caribou River (75-100 pairs, 23 July 1976 and 100-125 pairs, 23 July 1977). Jaques's (1930) record of *S. aleutica* from Entrance Point in May 1929 suggests a long history for this colony. We saw adult terns foraging in tide-rips between Entrance Point and Walrus Island, along the Caribou River, and over inshore waters of the Bering Sea SW of Nelson Lagoon. None was seen feeding in Nelson Lagoon or in freshwater lakes about the area during the nesting season. The first volant

young were noted on 2 August 1976; both adults and young were gone from Entrance Point by 30 August, but several were seen feeding offshore on that date. Twelve birds were still present at the Nelson Lagoon colony on 28 August 1976, but none was seen there on 14 September. Specimens, JUN-AUG (9 + 3 egg sets).

COMMON MURRE. *Uria aalge*. Aspm, U(sr?), Ufm, VRwr. This species was present in late March (three, Herendeen Bay, 1977), and became an abundant offshore migrant from mid-April through mid-May (30-100 breeding-plumaged birds moving E and W during several sea watches; high of 500, all flying W, during a 10-minute sea watch on 11 May 1977). Throughout the summer we had scattered observations of birds on inshore (1-5 km off shore) and nearshore waters, usually in pairs but sometimes in flocks of 8-12. Bartonek and Gibson (1972) found the species abundant over offshore waters off Port Moller and Nelson Lagoon in summer 1969. We recorded no appreciable fall migration. We did not find the species nesting in the area but they are suspected of nesting on Cape Seniavin (Sowls *et al.*, 1978; 500+ birds present on cliffs on aerial survey, 17 August 1979) and on islands in Port Moller.

THICK-BILLED MURRE. *Uria lomvia*. VRv. We identified this species only once (three on the water 300 m SE of Wolf Point, Walrus Island, 9 June 1976). None was identified in a massive die-off of common murre along this segment of the Alaska Peninsula during April 1970 (Bailey and Davenport, 1972), and Bartonek and Gibson (1972) recorded only three at sea during their summer surveys of seabirds in Bristol Bay (one approximately 25 km NW of Port Moller plus one dead on the beach at Port Moller).

PIGEON GUILLEMOT. *Cephus columba*. FCsr (20 April-2 August). Pigeon guillemots nested on Gull Island (25-30 pairs, 30 July 1976 and 1977) and along cliffs of Herendeen Bay and Port Moller. Jaques (1930:357) reported colonies at "Moller Bay." We found three nests with single eggs and three with young (ranging from three days to three weeks old) on Gull Island on 30 July 1977. The species was seen away from these areas only twice (one flying E off Lagoon Point on 20 April 1977 and one in Nelson Lagoon, 3 August 1979). Bartonek and Gibson (1972) did not record *C. columba* during mid-summer surveys on Bristol Bay.

MARBLED MURRELET. *Brachyramphus marmoratus*. VRv. We observed this species on two occasions: two flightless adults were seen on Nelson Lagoon, 3 September 1977, and one volant winter-plumaged bird was seen in the lagoon on 9 October 1977. Other records from the area are of four on 6 July 1973 (offshore Port Moller) and one (7-8 July 1973) SE of Entrance Point (Byrd, unpublished). Specimens, SEP (2).

KITTLITZ'S MURRELET. *Brachyramphus brevirostris*. R(sr?). Present during late spring and summer 1976 and 1977. Twelve were recorded between Nelson Lagoon and Entrance Point (8-9 June 1976); a single bird and 10-12

pairs were observed 1-5 km NW of Lagoon Point on 1 June 1977; and two single birds were seen 8-11 km NW of Lagoon Point on 28 July 1977. Jaques (1930) collected one at Port Moller on 6 June. Small alcids, probably this species, were seen in Herendeen Bay (31 July-1 August, 1976 and 1977) and are suspected of nesting in the area. The species is known to nest in similar habitat W of the area (Gabrielson and Lincoln, 1959; Bailey, 1973).

ANCIENT MURRELET. *Synthliboramphus antiquus*. Rsv. We have three records (nine birds) from 1976 (9 June-23 September) and four records (six birds) from 1977 (1 February-4 October). Birds were seen on all marine waters and in breeding plumage (9-21 June) and winter plumage. We saw no hatching-year birds, but Bartonek and Gibson (1972) saw family groups at sea WNW of Port Moller and suggested that the species might nest on Unimak Island, 200 km SW of Nelson Lagoon.

PARAKEET AUKLET. *Cyclorhynchus psittacula*. VRv. A single bird in breeding plumage was seen preening on the water approximately 400 m offshore of Nelson Lagoon on 8 June 1977.

CRESTED AUKLET. *Aethia cristatella*. Rv. We have a single record in 1976 (two adults on the water between Walrus Island and Entrance Point, 9 June), and four records in 1977 (two pairs on the water, 1 June; two flying W, 18 June; 11 flying W, 3 July; and three flying W, 11 July). The only other record from the area is of an adult 100 km WNW of Nelson Lagoon (Bartonek and Gibson, 1972).

HORNED PUFFIN. *Fratercula corniculata*. Uspm, Ustr (18 May-29 September). Observed periodically on offshore and inshore waters during spring (three records totalling 15 birds, all flying W) and throughout summer (seven records, 17 birds, all flying W). We also found the species nesting on Gull Island (18-25 pairs on 30 July 1976, and 10-12 pairs on 30 July 1977). Byrd (unpublished) recorded a "few" on the water between Entrance Point and Walrus Island, 7-8 July 1973 and Bartonek and Gibson (1972) saw fewer than a dozen birds offshore of Port Moller, 27 July-14 August 1969.

TUFTED PUFFIN. *Lunda cirrhata*. Cspfm, Ustr (8 May-17 September). Tufted puffins were a common migrant offshore in spring and fall and locally common breeder (14-22 pairs, 1976-1979) on barrier islands in Nelson Lagoon (Gill and Sanger, 1979). They are also suspected of nesting on Egg Island, Port Moller (50+ adults seen on the water around the island and 25+ seen flying from cliff faces on a 22 July 1976 aerial survey). Remains of 35 beach-cast juvenile tufted puffins were counted along a 2-km segment of N Lagoon Peninsula on 20 April 1977. This suggests that fair numbers may winter on offshore waters of the SE Bering Sea, particularly during mild winters.

GREAT HORNED OWL. *Bubo virginianus* VR(pr?). Several primary and contour feathers as well as pellets were found in cannery ruins in upper Herendeen Bay on 30 July 1976. Murie (1959) makes no reference to this species

occurring west of the base of the Alaska Peninsula; however, Narver (1970) observed it at Chignik on the south side of the Peninsula, 90 km E of Port Moller.

SNOWY OWL. *Nyctea scandiaca*. Uwr. Considered a regular winter resident (more abundant in some years) around Nelson Lagoon and Port Moller (Kust, pers. comm.). We saw birds in winter at Franz Point (one on 29 January 1977) and along Lagoon Peninsula (three on 30 January 1977), and in spring at Port Moller cannery (one on 21 April 1977) and at Lagoon Point (one on 21 April 1977). The latter bird was seen to capture and partially eat a short-tailed weasel (*Mustela erminea*).

SHORT-EARED OWL. *Asio flammeus*. R(wr?), Ustr, FCfm (2 May-19 November). Sightings were limited primarily to coastal areas, including grass meadows along the lower Caribou River. Nests were found on Cannery Island (four nearly volant young, 2 August 1976, and a nest with five eggs, 19 June 1977) and on a nearby barrier island (five downy young, 7 July 1977). Numerous other birds flushed from dense *Elymus* on Lagoon Peninsula and other barrier islands may have been nesting. We also suspected nesting in the vicinity of Franz Point (courtship displays, 4-25 June 1977). Fall migrants were most evident between mid-September and mid-October; high count (non-systematic) was of eight on 24 September 1977. Our latest sighting was of five birds on Lagoon Peninsula on 19 November 1976, but birds occasionally spend the winter in the area (Gundersen and Kust, pers. comm.).

BELTED KINGFISHER. *Megaceryle alcyon*. VRv. The characteristic call of this species was heard at Mine Harbor, Herendeen Bay on 31 July 1977, but the bird was never seen. The species has been reported previously from the E and W Alaska Peninsula (Murie, 1959).

TREE SWALLOW. *Iridoprocne bicolor*. FCsr (15 May-7 August). Found nesting about most dwellings in the area (Port Moller cannery, Franz Point, Herendeen Bay, Cannery Island, Nelson Lagoon village, and cabins along the Caribou-Sapsuck river drainage). We also saw it about Coast Lake (23 May and 30 July 1976, and 15 May and 7 August 1977). Murie (1959) suggested that *I. bicolor* did not occur on the Alaska Peninsula away from coniferous forests before modern man's arrival.

BANK SWALLOW. *Riparia riparia*. FCsr (15 May-31 August). Found nesting at Franz Point (50-60 pairs, 7 June 1976 and 18 pairs, 5 June 1977), Miner Hill (12-15 pairs, 7 June 1976), Point Divide and Doe Point (10 pairs each, 30 July 1977), and Mine Harbor (3-5 pairs, 1 August 1976). It was also observed near Port Moller cannery but nesting was not confirmed (38+ birds on 28-30 July 1969: Gibson, unpublished; and "several", 7-8 July 1973: Byrd, unpublished).

BLACK-BILLED MAGPIE. *Pica pica*. Cpr. We observed this species only during summer and fall, and only in inland areas with alder and willow thickets (nest on Egg Island on 22 July 1976; adult feeding volant young at Mine Harbor, 30 July 1976; plus nine additional sightings, total-

ling 14 birds, 31 July-28 September). It was seen occasionally about dwellings (Port Moller cannery, Nelson Lagoon village, Franz Point) in fall and winter (Kust, pers. comm.).

COMMON RAVEN. *Corvus corax*. Cpr. Ravens have been observed nesting in Herendeen Bay (Gundersen, pers. comm.). We flushed three birds from cliffs in the Right Head of Port Moller (8 August 1976) but saw no nests. This species was observed regularly in all areas, but preferred coastal areas in late summer and winter. Our high counts (non-systematic) were of 35 at the Port Moller cannery (29 August 1976) and 75+ along upper Nelson Lagoon, associating with bald eagles and mew and glaucous-winged gulls (30 January 1977).

BLACK-CAPPED CHICKADEE. *Parus atricapillus*. U(pr?). Observed in dense alder at Crow Point, Herendeen Bay when first visited on 31 July 1976 and 1977; along upper Caribou River on 6 October 1977 (two birds); and in willows S of Franz Point on 20 November 1976 (flock of five). Byrd (unpublished) also observed this species in the vicinity of Port Moller cannery (one seen, others heard), 7-8 July 1973.

AMERICAN ROBIN. *Turdus migratorius*. VRv. Single adult birds were seen near Mine Harbor on 30 July 1976 and at Port Moller cannery on 9 August 1976. These are apparently the only records for this species on the Alaska Peninsula away from its base.

HERMIT THRUSH. *Catharus guttatus*. U(sr?) (3 July-22 September). Seen and heard (five observations, totalling 17 birds) about the area in dense shrubbery (Mine Harbor, upper Herendeen Bay, Coast Lake, Miner Hill) but probably nesting only in areas away from the coast.

WATER PIPIT. *Anthus spinoletta*. U(sr?), FCfm (31 July-27 September). Observations of seven to nine adults above the alder line in the mountains surrounding Herendeen Bay (31 July 1977) suggested that breeding may occur throughout the area (see also Murie, 1959). Pipits were also observed along the coast in migration during late summer and fall each year. Birds were first seen between 6 and 13 August 1976, 1977, and 1979. High count (non-systematic) was of 35 at Port Moller cannery on 23 September 1977.

NORTHERN SHRIKE. *Lanius excubitor*. Upr. In 1976 singles were seen near Crow Point, Herendeen Bay on 31 July; at Port Moller cannery on 29 August; at Coast Lake on 22 September; and along the Caribou River on 7 October. During 1977 we saw two adults at Nelson Lagoon village on 20 April; a single adult near Big Hill on 29 September; and a juvenile at Lagoon Point on 9 October. In 1979 we saw only a single adult, at Cannery Island on 29 September. The species is a regular winter resident around Franz Point (Kust, pers. comm.).

ORANGE-CROWNED WARBLER. *Vermivora celata*. VRsr. An observation of two adults feeding volant young in an alder thicket near an abandoned cannery in Herendeen Bay on 30 July 1977 indicated nesting in the area. However, there are no confirmed nesting records away from the

base of the Alaska Peninsula (Kessel and Gibson, 1978). We believe the species is probably more common than our single observation indicates (see Bailey, 1974a).

YELLOW WARBLER. *Dendroica petechia*. C(sr?) (14 June-15 August). Numerous scattered observations of singing males suggested breeding, but no nests were found. Kessel and Gibson (1978) believed this a common breeding species throughout the Alaska Peninsula. We recorded several birds along the Caribou River (14-15 June 1976) and found them common about Mine Harbor and Herendeen Bay in late July and early August 1976 and 1977, a period when fall migrants and local birds were probably present.

YELLOW-RUMPED WARBLER. *Dendroica coronata*. Rv. A singing male (myrtle) was seen and another heard 3 km S of the mouth of the Caribou River on 12 June 1976, and a pair was seen near Franz Point, 22 July 1976. None was seen during 1977 or 1979. The nesting status of this species in the area is uncertain.

WILSON'S WARBLER. *Wilsonia pusilla*. U(sr?) (30 July-29 August). We saw this species on only three occasions. An adult female was captured at Nelson Lagoon on 24 August 1976 and what was probably the same bird was seen again on 29 August. We also saw an adult male in Herendeen Bay, 30 July 1977. The species has also been reported from Port Moller (several on 7-8 July 1973; Byrd, unpublished). We suspect it to nest among alder thickets in Herendeen Bay and Port Moller.

GRAY-CROWNED ROSY FINCH. *Leucosticte tephrocotis*. R(wv?). We did not observe this species on the study area but residents of Nelson Lagoon reported seeing flocks of rosy finches on occasion in winter, usually about the village (Kust, pers. comm.). The species is a regular winter resident about Cold Bay (Bailey, 1974b; Jones, pers. comm.).

HOARY REDPOLL. *Carduelis hornemanni*. R(sr?), Rfm. We have three records: a singing male near Franz Point, 25 July 1976; two birds at Mine Harbor, 31 July 1976; and two at Coast Lake, 22 September 1976. We saw none in 1977 and 1979, but spent little time in these areas. They have been reported as common in fall (1-26 October) about Cold Bay (Osgood, 1904). Bailey (1974a) captured small numbers at Cold Bay in 1970 and 1971. Specimen, JUL (1).

COMMON REDPOLL. *Carduelis flammea*. U(sr?), FCfm, U(wr?) (14 June-8 October). This species was seen more frequently than *C. hornemanni*. We saw and heard birds in June and July about willow and alder thickets along the Caribou River and in alder at Port Moller and Herendeen Bay in July and August. Byrd (unpublished) found them common in alders in the vicinity of Port Moller cannery (7-8 July 1973), and he also recorded them during late October 1973 along the Sapsuck River (flock of 20). Our sightings were usually of one to three birds; the largest flock was of eight. Among 53 *C. flammea* captured by Bailey (1974a) at Cold Bay, 46 were caught between 7 August and 9 October.

SAVANNAH SPARROW. *Passerculus sandwichensis*. Asr (8 May-9 October). This species was widely distribut-

ed over coastal grass meadows and barrier islands, along the Caribou River throughout grass and wet meadow habitats, and inland about Port Moller and Herendeen Bay. Breeding density was estimated at 53 territories km⁻² immediately inland from Franz Point (1976). Fall migration of adults peaked in late July and migration of hatching-year birds extended into early September. Ninety-five of 102 birds mist-netted along the upper Caribou River on 7 August 1976 were juveniles.

DARK-EYED JUNCO. *Junco hyemalis*. VRv. A flock of three (slate-colored) remained on Lagoon Peninsula from 17-25 September 1976.

WHITE-CROWNED SPARROW. *Zonotrichia leucophrys*. C(sr?) (16 May-7 August). Seen during spring along Lagoon Point (single birds, 23 May 1976 and 16 May 1977) and suspected of nesting near Miner Hill (singing males, 5-25 June 1977). Away from the coast it was common about dense shrubbery in Herendeen Bay and along the upper Caribou River where it most certainly nested.

GOLDEN-CROWNED SPARROW. *Zonotrichia atricapilla*. Csr (23 May-18 September). Seen on one occasion during spring (three on 23 May 1976), but probably the most abundant passerine away from the coast in alder thickets in Port Moller, in Herendeen Bay, and along portions of the Caribou River drainage (one nest on 14 June 1976). We observed no major movement along the coast in fall (only one record, a hatching-year bird, 17-18 September 1977).

FOX SPARROW. *Passerella iliaca*. U(sr?) (30 July-6 October). This species was seen only at inland sites during summer. Adults and juveniles were common about cannery ruins and alder thickets in Herendeen Bay (30 July-1 August 1976 and 1977). Nesting is known from the W Alaska Peninsula (Murie, 1959) and we suspect it for the central peninsula (our observations; plus Chapman, 1904).

LAPLAND LONGSPUR. *Calcarius lapponicus*. C(sr?) (5 May-9 October). This was one of the most common passerines and was found throughout summer on *Elymus*-dominated coastal strand, grass meadows, and dwarf shrub habitat throughout the area. Males arrived during the first weeks of May; females arrived soon after. Display flights of males were noted well into July all years. Peak fall migration occurred 15 September-4 October (1977) when daily we noted several hundred moving E along Lagoon Peninsula.

SNOW BUNTING. *Plectrophenax nivalis*. Cwr, U(sr?). Observations were confined largely to coastal areas except for those of several hatching-year birds seen about block-fields in mountains surrounding Herendeen Bay (30 July 1977) where nesting is suspected. Flocks of buntings (largest 55, average 10-30) were usually seen daily along the coastal strand beginning the last week of September (1976 and 1977) and were present through the winter (Kust, pers. comm.). We never identified McKay's buntings (*P. hyperboreus*) among them.

TABLE 2. Zoogeographical affinity of species known or suspected of breeding on the northcentral Alaska Peninsula, 1976-1980

Species	Zoogeographical affinity ¹		
	Panboreal	North American	Aleutican
Known breeders			
Common loon		x	
Red-throated loon	x		
Red-necked grebe	x		
Double-crested cormorant		x	
Pelagic cormorant			x
Red-faced cormorant			x
Whistling swan		x	
Mallard	x		
Green-winged teal		x	
Gadwall	x		
American wigeon		x	
Pintail	x		
Common eider			x
Greater scaup	x		
Black scoter	x		
Red-breasted merganser	x		
Rough-legged hawk	x		
Bald eagle		x	
Gyr Falcon	x		
Willow ptarmigan	x		
Sandhill crane		x	
Semipalmated plover		x	
Black turnstone			x
Northern phalarope	x		
Short-billed dowitcher		x	
Western sandpiper			x
Rock sandpiper			x
Parasitic jaeger	x		
Glaucous-winged gull			x
Mew gull	x		
Black-legged kittiwake	x		
Arctic tern	x		
Aleutian tern	x		
Pigeon guillemot			x
Horned puffin			x
Tufted puffin			x
Short-eared owl	x		
Tree swallow		x	
Bank swallow	x		
Black-billed magpie	x		
Orange-crowned warbler		x	
Savannah sparrow		x	
Golden-crowned sparrow		x	
Suspected breeders			
Arctic loon	x		
Canada goose		x	
Northern shoveler	x		
White-winged scoter		x	
Harlequin duck		x	
Common snipe	x		
Least sandpiper		x	
Dunlin	x		
Common murre	x		
Kittlitz's murrelet			x
Common raven	x		
Hermit thrush		x	
Water pipit	x		
Northern shrike	x		
Yellow warbler		x	
Wilson's warbler		x	
Hoary redpoll	x		
Common redpoll	x		
White-crowned sparrow		x	
Fox sparrow		x	
Lapland longspur	x		
Snow bunting	x		

¹Where greatest proportion of breeding range occurs.

DISCUSSION

The zoogeographical affinity of most (49%) of the species confirmed or suspected of breeding on the northcentral Alaska Peninsula is Panboreal (Table 2). Another 34% has a contemporary breeding range centered in North America. The Aleutican group (after Fay and Cade, 1959; and Kessel, 1963) accounts for 17%. The Aleutican group, however, accounts for greatest avian biomass and largest number of individuals on nearshore and littoral habitats during the nonbreeding period (e.g., emperor geese, Steller's and common eiders, western sandpiper, long-billed dowitcher, and glaucous-winged gull). Over inshore and offshore waters a single Old World species, short-tailed shearwater, was dominant.

Our observations extend the known breeding ranges beyond those described by Gabrielson and Lincoln (1959), Murie (1959) and Kessel and Gibson (1978) for American wigeon, black turnstone, northern phalarope, short-billed dowitcher, western sandpiper, dunlin, horned and tufted puffins, and orange-crowned warbler. Our observations also extend the known postbreeding range or significantly change the known status of bar-tailed godwit, whimbrel, lesser yellowlegs, long-billed dowitcher, dunlin, marbled murrelet, American robin, yellow-rumped warbler, and dark-eyed junco. We considered 11 species to be permanent residents and an additional 23 species to be winter residents. Somewhat fewer, however, probably winter regularly in the area because most of our records came from unusually mild winters.

All 16 habitats (after Kessel, 1979) identified in the area were used by birds at some time during the annual cycle (Table 1). The 16th, not listed in the table, is subterranean soil, which was used only by bank swallows (see species accounts) and tufted puffins, which nested in burrows on barrier islands (Table 1). The northcentral peninsula provides important nesting habitat for several species (e.g., greater scaup, dunlin, glaucous-winged gull, Aleutian tern, savannah sparrow) but is more important as a migration, molting, and staging area, particularly for water birds in summer and fall. Indeed, almost the entire population of emperor geese probably uses the area at some time between late summer and the following spring, and most subadult Steller's eiders are thought to use the area during molt (Petersen, 1980, 1981). Numerous other species, such as bar-tailed godwit and whimbrel, also move from arctic and subarctic nesting grounds to littoral and nearshore areas of the northcentral peninsula to molt and build lipid reserves for migration.

We found water birds predominate in the area in diversity (79 of 125 species recorded), abundance, and biomass during all seasons. Use of the area by water birds was greatest during late September and early October 1976 and 1977 (Fig. 4). Nelson Lagoon, with varied littoral and nearshore habitats, supported a diverse avifauna with overall use approaching 1000 birds km⁻², while Mud Bay, hav-

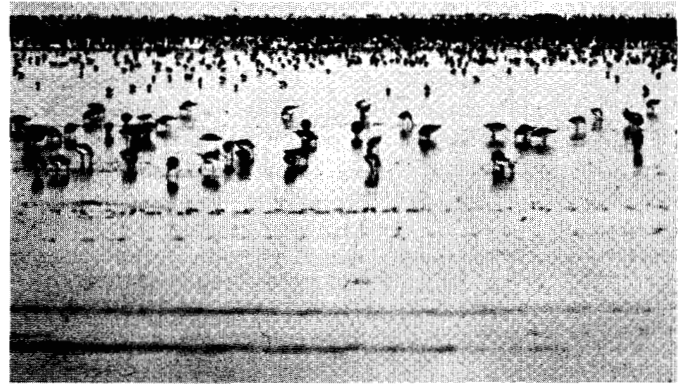


FIG. 5. A dense, mixed species flock of bar-tailed godwit (*Limosa lapponica*), dunlin (*Calidris alpina*), and long-billed dowitcher (*Limnodromus scolopaceus*) feeding on exposed tidal flats of northwest Nelson Lagoon. Such concentrations were common during late September and mid-October when the area received its heaviest use by shorebirds and waterfowl.

ing a generally monotypic mudflat habitat, supported fewer species and lower densities of birds. Over a particular habitat type, especially in Nelson Lagoon, the density of certain species or groups of species often exceeded 1000 birds km⁻². Seaducks (Steller's and common eiders and black scoter), emperor geese, and shorebirds (Gill and Jorgensen, 1979) made up the majority of birds using Nelson Lagoon in fall (Fig. 5). On Mud Bay, pintail, emperor geese, dunlin, and glaucous-winged and mew gulls accounted for most of the use recorded during fall. On both Nelson Lagoon and Mud Bay densities declined dramatically beginning late October as shorebirds, particularly dunlin and bar-tailed godwit, and portions of the glaucous-winged gull population departed the area. Arneson (1980) found similar densities of water birds in both areas in fall 1976, and of all estuaries along the north Alaska Peninsula, only Izembek Lagoon supported a slightly higher density of water birds. Emperor geese, Steller's and king eiders, oldsquaw, and black and white-winged scoters remained in numbers on the study area through winter. Interestingly, no increase in bird use of littoral and nearshore areas was recorded in spring. Instead, a slight decrease occurred during this period as overwintering birds departed for breeding areas. The overall number of species increased, however, reflecting movement of birds into and through the area during migration, but with little accompanying use of littoral and nearshore areas. Arneson (1980) also surveyed Nelson Lagoon and Mud Bay in spring 1977, but differences between his and our survey methods and data analysis prevented a direct comparison of results. During late spring and early summer, water birds occurred on Nelson Lagoon in densities between 200 and 300 birds km⁻², with glaucous-winged gulls, western sandpipers, whimbrel, and subadult Steller's eider most frequently recorded. Bird use of Mud Bay was at its seasonal low during this period when only a few glaucous-winged and mew gulls used the area.

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REFERENCES

- American Ornithologists' Union. 1957. Check-list of North American Birds. Fifth ed. A.O.U., Baltimore. 691 p.
- American Ornithologists' Union. 1973. Thirty-second supplement to the American Ornithologists' Union check-list of North American birds. *Auk* 90:411-419.
- American Ornithologists' Union. 1976. Thirty-third supplement to the American Ornithologists' Union check-list of North American birds. *Auk* 93:875-879.
- ARNESON, P.D. 1980. Identification, documentation and delineation of coastal migratory bird habitat in Alaska. Final Report. Environmental Assessment of the Alaska Continental Shelf. NOAA, Environmental Research Laboratory, Boulder, Colorado. 350 p.
- BAILEY, E.P. 1973. Discovery of a Kittlitz's murrelet nest. *Condor* 75:457.
- . 1974a. Passerine diversity, relative abundance, and migration at Cold Bay, Alaska. *Bird-Banding* 45:145-151.
- . 1974b. Winter banding of passerines on the Alaska Peninsula. *Bird-Banding* 45:307-314.
- and DAVENPORT, G.H. 1972. Die-off of common murres on the Alaska Peninsula and Unimak Island. *Condor* 74:215-219.
- BARTONEK, J.C. and GIBSON, D.D. 1972. Summer distribution of pelagic birds observed in Bristol Bay, Alaska. *Condor* 74:416-422.
- BROWER, W.A., Jr., DIAZ, H.F. and PRECHTEL, A.S. 1977. Marine and coastal climatic atlas. In: Climatic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska. Vol. 2. Bering Sea. Arctic Environmental Information and Data Center, Publication B-77, Anchorage, Alaska. 28-443.
- CHAPMAN, F.M. 1904. List of birds collected in Alaska by the Andrew J. Stone expedition of 1903. *Bulletin of the American Museum of Natural History* 20:399-406.
- DELACOUR, J. 1954-1959. *The Waterfowl of the World*. 3 Volumes. London: Country Life, Ltd.
- ELEY, T.J., Jr. 1974. A sight record of Leach's petrel north of the Aleutian Islands, Alaska. *Murrelet* 55:44-45.
- FAVORITE, F., DODIMEAD, A.J. and NASU, K. 1976. Oceanography of the subarctic Pacific region, 1960-1971. *International North Pacific Fisheries Bulletin* 33. 187 p.
- FAY, F.H. and CADE, T.J. 1959. An ecological analysis of the avifauna of St. Lawrence Island, Alaska. University of California Publications in Zoology 63:73-150.
- GABRIELSON, I.N. and LINCOLN, F.C. 1959. *The Birds of Alaska*. Washington, D.C.: Wildlife Management Institute. 922 p.
- GIBSON, D.D. 1972a. The changing seasons — Alaska region. *American Birds* 25:93.
- . 1972b. The changing seasons — Alaska region. *American Birds* 26:105.
- and BYRD, G.V. 1972. The changing seasons — Alaska region. *American Birds* 26:891.
- GILL, R.E., Jr. 1977. Unusual foraging by a fork-tailed storm-petrel. *Auk* 94:385-386.
- . 1979. Shorebird studies in western Alaska, 1976-1978. *Wader Study Group Bulletin* 25:38-40.
- and HANDEL, C.M. 1981. Shorebirds of the eastern Bering Sea. In: Hood, D.W. and Calder, J.A. (eds.). *Eastern Bering Sea Shelf: Oceanography and Resources*. Vol. 2. Washington, D.C.: U.S. Department of Commerce, National Oceanic and Atmospheric Administration. 719-738.
- GILL, R.E., Jr. and JORGENSEN, P.D. 1979. A preliminary assessment of the timing and migration of shorebirds along the northcentral Alaska Peninsula. *Studies in Avian Biology* 2:113-123.
- GILL, R.E., Jr. and SANGER, G.A. 1979. Tufted puffins nesting in estuarine habitat. *Auk* 96:792-794.
- GROMME, O.J. 1927. Some highlights of the faunal life of the Alaska Peninsula. *Milwaukee Public Museum Yearbook* 7:30-45.
- HOLMES, R.T. 1970. Differences in population density, territoriality, and food supply of dunlin on arctic and subarctic tundra. *Symposium British Ecological Society* 10:303-319.
- HULTÉN, E. 1968. *The Flora of Alaska and Neighboring Territories*. Stanford, California: Stanford University Press. 1008 p.
- JAQUES, F.L. 1930. Water birds observed on the Arctic Ocean and the Bering Sea in 1928. *Auk* 47:353-366.
- JONES, R.D., Jr. 1973. A method for appraisal of annual production in the black brant populations. M.Sc. thesis, University of Alaska, Fairbanks. 117 p.
- KESSEL, B. 1963. West-east relationships of the birds of northern Alaska. In: Gressitt, J.L. (ed.). *Pacific Basin Biogeography, a Symposium*. Tenth Pacific Science Congress, Honolulu, Hawaii, 1961. Honolulu: Bishop Museum Press. 79-84.
- . 1979. Avian habitat classification for Alaska. *Murrelet* 60:86-94.
- and GIBSON, D.D. 1978. Status and distribution of Alaska birds. *Studies in Avian Biology* 1. 100 p.
- McKINNEY, F. 1959. Waterfowl at Cold Bay, Alaska, with notes on the display of the black scoter. *Wildfowl* 10:133-140.
- McROY, P. and McROY, N. 1965. Field observations on the summer birds of Izembek Lagoon region of the Alaska Peninsula. *Bulletin Alaska Ornithological Society* 5:1-7. (mimeographed)
- MURIE, O.J. 1959. Fauna of the Aleutian Islands and Alaska Peninsula. *North American Fauna* 61. 364 p.
- NARVER, D.W. 1970. Birds of the Chignik River drainage, Alaska. *Condor* 72:102-105.
- OSGOOD, W.H. 1904. A biological reconnaissance of the base of the Alaska Peninsula. *North American Fauna* 24. 86 p.
- PETERSEN, M.R. 1980. Observations of wing-feather moult and summer feeding ecology of Steller's eiders at Nelson Lagoon, Alaska. *Wildfowl* 31:99-106.
- . 1981. Populations, feeding ecology, and molt of Steller's eiders. *Condor* 83:256-262.
- SALTER, R.E., GOLLOP, M.A., JOHNSON, S.R., KOSKI, W.R. and TULL, C.R. 1980. Distribution and abundance of birds on the Arctic coastal plain of northern Yukon and adjacent Northwest Territories, 1971-1976. *Canadian Field-Naturalist* 94:219-238.
- SOWLS, A.L., HATCH, S.A. and LENSINK, C.J. 1978. *Catalog of Alaskan Seabird Colonies*. U.S. Department of Interior, Fish and Wildlife Service, FWS/OBS-78/78, Anchorage, Alaska.
- VAURIE, C. 1965. *The Birds of the Palearctic Fauna*. Vol. 2. Non-Passeriformes. London: H.F. and G. Witherby.