A FISH AND WILDLIFE RESOURCE INVENTORY OF THE ALASKA PENINSULA, ALEUTIAN ISLANDS AND BRISTOL BAY AREAS

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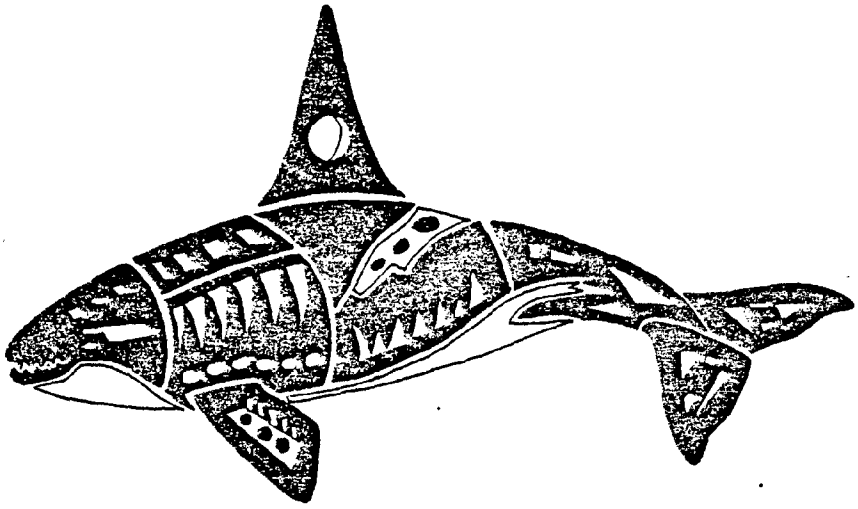

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DRAFT REPORT

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COMPILED BY THE ALASKA DEPARTMENT OF FISH AND GAME UNDER CONTRACT TO THE ALASKA COASTAL MANAGEMENT PROGRAM - DIVISION OF POLICY DEVELOPMENT AND PLANNING

VOLUME I STUDY TEAM

EDWARD G. KLINKHART JOHN W. SCHOEN

CARTOGRAPHIC STAFF

SUSIE M. ELSNER PAMELA D. JOSEPH

MARY LU LARSON

1977

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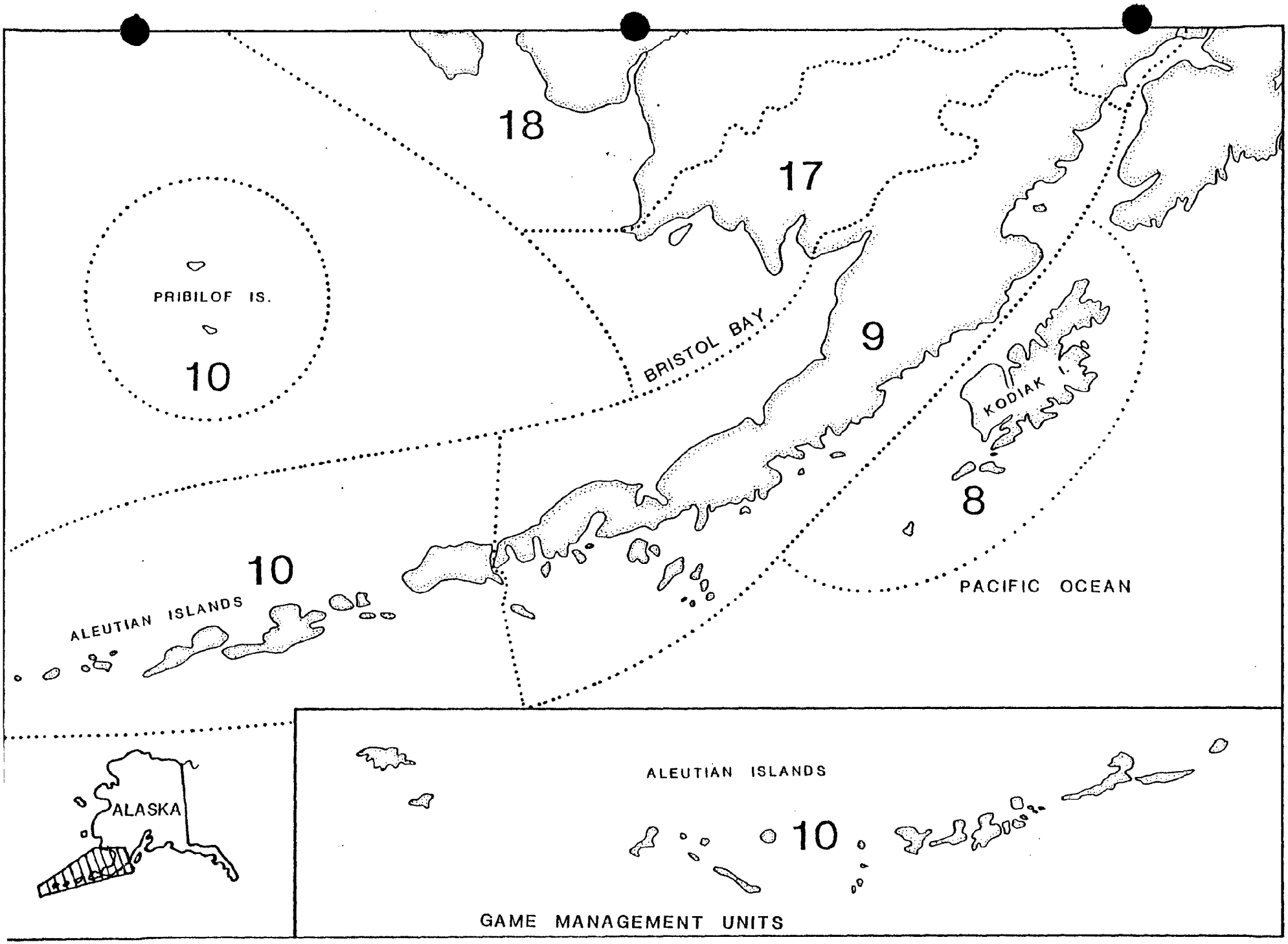
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INTRODUCTION

The Alaska Peninsula-Aleutian Islands-Bristol Bay-Pribilof region contains some of the most abundant wildlife populations found anywhere in the world. This region includes the area from Cape Igvak on the Alaska Peninsula southwestward 1,500 miles to Attu Island, all of Bristol Bay west to Cape Newenham, including the drainages to the north and the Pribilof Islands.

The north shore of the Alaska Peninsula (GMU 9) shelves off gradually into the shallow waters of the Bering Sea, forming a low coastal plain with a comparatively even coastline. Farther inland, however, the land rises to the rugged volcanic Aleutian Range, which runs the length of the Peninsula. On the south side of the Peninsula the ocean floor drops off more sharply into the deeper water of the North Pacific. Accordingly, the south shore is irregular and rugged with bays, headlands and offshore rocks and is fringed by offshore islands - notably the Kodiak-Afognak, Semidi, Shumigan and Sanak Islands groups. This side of the Peninsula has a maritime climate, with twice the precipitation of the Bristol Bay side.

The Alaska Peninsula has frequently been called a "sportsman's paradise". It is here that the brown bear occurs in abundance; some 20,000 barren ground caribou roam the tundra; moose thrive throughout the area; and each year millions of waterfowl utilize the lakes, ponds and marshes of the Peninsula.

Extending in an 1,100 mile arc to the west of the Alaska Peninsula are the Aleutian Islands (GMU 10). These islands form a chain separating the North Pacific Ocean and the Bering Sea. The Aleutian Islands

have a maritime climate characterized by persistently overcast skies and frequent, often violent, cyclonic storms. Weather can be very local, with conditions of fog, low ceilings, precipitation, and clear weather all encountered in a distance of a few miles. It is thought by many that no other area in the world has weather worse than the Aleutian Islands.

The flora and fauna of the Aleutian Islands are composed of species from both the North American and Asian continents, with many plant species being combinations of each. The Chain is treeless except for a few spruce introduced by the Russians in 1805 and by the Americans during W.W. II.

The eastern Aleutians have a fauna typical of the Alaska mainland while the western islands are more typically Asiatic. A total of 183 avian species and races have been recorded for the Aleutian Islands and adjacent waters (Sekora 1973). Of special significance are the large numbers of sea birds and the endangered Aleutian Canada Goose. Sea otter, seals, sea lions and whales inhabit both adjacent waters and the islands rocks and beaches. Foxes, caribou, reindeer and domestic cattle occur on many of the islands.

The Aleutians were once the home of 15,000 to 20,000 Aleuts, but they were severely decimated following the Russian discovery of the islands in 1741. Today only six villages exist in the Aleutian chain, they are Atka, Nikolski, Unalaska, Akutan, False Pass and Paulof Harbor.

The Aleutian Islands National Wildlife Refuge was established in 1913. The boundaries of the refuge today includes all of the Aleutian Islands west of False Pass, encompassing Amak Island, Sea Lion Rocks and the Sanak Island group, except for Akun, Akutan, Sanak, Tigalda, Umnak, Unalaska and Sedanka Islands. The refuge was established with the objectives of preserving the breeding grounds for native birds,

for the propagation of reindeer and furbearing animals and for the encouragement and development of the offshore fisheries.

Game Management Unit 17 and the northern portion of Unit 9 make up the Bristol Bay drainages. Here the Mulchatna, Nushagak and Kvichak Rivers flow through gently sloping hills and broad valleys into Bristol Bay. Wet tundra, with numerous lakes and marshes, is common along much of the low coastal area. Dry tundra occurs in the uplands to 1,200 ft. elevation. A broad band of alder, willow and dense tall grass, separates the two types along the length of the western side of the Aleutian Range. A herd of about 15,000 caribou ranges throughout some 20,000 square miles of Units 9 and 17. Brown bear, moose and a few sheep may also be found here. The greatest concentration of beaver found anywhere in Alaska occur in Unit 17.

The maps with this report identify seasonal distribution and movements, high density areas, critical habitat zones and areas of particular concern. Map coverage includes the coastal waters, beach fringes and uplands which have a direct or significant impact on the wildlife resources of the area. Big game information is included here only if it is new or in addition to that presented in Alaska's Wildlife and Habitat. Raptor nesting distribution is presented on a state-wide basis.

The accompanying wildlife narrative provides additional information relative to big game, furbearers, small game, waterfowl, seabirds and marine mammals shown on the maps. Narrative accounts of life histories are restricted to information specific to area and species. General life histories for big game and marine mammals may be found in Appendix A. Recreational and subsistence information by area and type of

user, and distribution and abundance as related to habitat zones is presented for each species. Although not included in this report, it is important to recognize that many species of birds and small mammals inhabitat this region. Some species such as the microtine rodents are a food source of many mammals and birds. These species play an important part in the total ecosystem.

It is imperative that those who use this report recognize that wildlife populations are a viable, ever-changing resource. The information contained herein is as up to date as possible, but changing land tenure, human use and development and a multitude of natural factors require that our data be continuously gathered and updated.

Most of the wildlife information in this report was obtained from Alaska Department of Fish and Game biologists who reside in the area. Additional contributions were made by other staff members and from members of other wildlife resource agencies. These contributions are greatfully acknowledged.

MOOSE

The moose (Alces alces), which has a circumboreal distribution, is an animal of the northern forests. In Alaska they range throughout most of the state except the southeastern portion and coastal islands. Moose most frequently inhabit regions of second-growth hardwood forests, timberline plateaus and areas along major river systems. The Alaskan subspecies (Alces alces gigas) is the largest subspecies of moose, which is the largest member of the deer family (Cervidae).

Calving occurs in late spring usually around the first of June. At this time pregnant cows seek out isolation for the birth of their calves. This usually occurs near riparian or muskeg areas. First year breeders usually produce a single calf, but after that about 60 percent of the cows produce twins. The productivity in any given area, however, is directly related to the physical condition of the cow which in turn reflects the local range conditions. Calf mortality is often quite high during the first six weeks following parturition. During this period and through summer moose forage on water associated vegetation, grasses, sedges, forbs and the leaves of hardwoods, primarily birch, willow and aspen. During summer moose are usually widely dispersed and solitary.

The rut or breeding season occurs during late September and October. On good range yearling cows may breed. Yearling cows in less than optimum condition may not breed however, until they are two and a half years old. During fall and winter moose utilize the annual growth of hardwoods particularly willow, aspen and birch. Winter and early spring is a critical period for moose as forage quality and quantity are generally low and consequently mortality is usually high at this time.

This may be further compounded by severe weather, poor range conditions and high predator populations. Although moose may move from 20 to 40 miles distance during the year they are generally considered sedindary compared to species such as caribou or elk. In general moose prefer forest habitats in early to mid succesional stages of development such as those resulting from fire or timber harvest.

Unit 9

Although moose are considered relative newcomers to the Alaska Peninsula, early reports (Osgood, 1904) suggest that in the late 1800's they were present as far west as Bear lake near Port Moller. They may have been periodically eliminated from major portions of the peninsula by cataclysmic volcanic eruptions. As conditions stabilized and vegetation became reestablished, moose reappeared, thus giving rise to the hypothesis of recent western movement. The populations between Iliamna and Mother Goose Lakes apparently increased rapidly from the late 1940's through the mid-1950's. The population expansion below Mother Goose Lake continued into the early 1960's.

Currently moose densities are highest along rivers and their headwaters from King Salmon-Egegik Rivers to and including the Meshik River. Direct counts of selected areas have included over 2,000 animals in past years although a current (1976) estimate places the total population at approximately 5,000 moose: 1,500 north of King Salmon and 3,500 south of King Salmon (Jim Faro, Area Biologist, A.D.F.&G., King Salmon, pers. comm.). Throughout the central portion of Unit 9 moose numbers have reached or possibly exceeded the carrying capacity of the range. This has resulted in a population decline where calf production is very

low. There is also heavy predation by brown bear in this area (Jim Faro, pers. comm.). In the northern portion of Unit 9 moose populations currently appear to be stable. Moose have just recently begun to appear south of Port Moller.

Throughout Unit 9 seasonal movements reflect forage availability and snow depths. Most of these movements are of an altitudinal nature except in the Cook Inlet region where moose often move to the northwest side of the peninsula to winter then return to the Cook Inlet drainages in May. Critical moose habitat includes high well drained areas of willow and cottonwoood and riparian areas. Seasonal concentrations occur throughout the unit in restricted areas. In winter moose range almost to the Bering Sea beach. Thus this region is an important winter range area.

In 1975 the Unit 9 moose harvest was 232, a decrease of three fold from the previous year's harvest of 705 (see Table 1.). This was the result of a greatly reduced season (August 20 - December 31 in 1974 to September 20 - September 30 in 1975) and no antlerless season in 1975. A Bristol Bay subsistence report by the Institute of Social, Economic and Government Research at the University of Alaska estimated the total annual subsistence harvest at 311 moose for Units 9 and 17.

Unit 9 has traditionally been Alaska's most productive area for large bull moose. This area sustains a high proportion of non-resident hunting pressure every year. About one-half of the moose harvest reported in this unit is taken by non-residents. This area is receiving increasing pressure from Anchorage hunters as moose populations

Table 1. Moose harvest and hunting pressure - Unit 9

Year	Bulls	Cows	Unid.	Total	Hunters	Percent Success	% Non-Resident
1964	185	64	0	249	--	--	
1965	213	68	4	285	--	--	
1966	240	75	8	323	519	62.2	
1967	301	68	9	378	509	74.3	
1968	366	72	5	443	583	76.0	
1969	317	70	6	393	527	74.6	47.6
1970	266	84	2	352	457	77.0	
1971	317	116	7	440	591	74.5	41.4
1972	454	91	11	556	773	71.9	50.7
1973	607	206	25	839	1,175	71.4	36.0
1974	520	167	18	705	1,072	65.8	43.2
1975	222	0	10	232	436	53.2	

around this, and other cities, continues to decline. Only 27 percent of resident hunters that reported were from the Alaska Peninsula.

Nonconsumptive use of moose in this unit is relatively minor. Viewing and photography occur from June to October on the headwaters of the King Salmon River in Katmai National Monument.

Unit 17

The current (1976) population estimate for moose in unit 17 is approximately 700 animals (Jim Faro, Area Biologist, A.D.F.&G., King Salmon, pers. comm.). This population is considered relatively stable and no changes in distribution have occurred. Critical habitats and seasonal movements are generally similar to those discribed for Unit 9.

The Unit 17 moose harvest for 1975 was 115 animals a substantial increase over the 1974 harvest of 69 animals (see Table 2.). This increase is the result of growing recreational trophy hunting pressure. Throughout this unit moose have been eradicated near the villages due to intensive hunting pressure. This intensive pressure is now being directed at more remote populations. Noncomsumptive use of moose in this unit is relatively minor.

Unit 10

Moose do not occur in this unit.

Table 2 . Moose harvest - Game Management Unit 17.

Year	Bulls	Females	Unknown Sex	Total
1964	31	1**		32
1965	41	1**		42
1966	25	1**		26
1967	37		1	28
1968	45		1	46
1969	11	1**	3	15
1970	23		2	25
1971	36		1	37
1972	35		3	38
1973	39	2	1	42
1974	65	2	2	69
1975	87		2	89

** No legal cow season.

Table 3 . Moose sex and age ratios - Unit 9.

Year	Total MM per 100 FF	Small MM per 100 FF	Sm. MM per 100 Lg. MM	Sm. MM % in Herd	Sm. MM per 100 MM Calves	Calves per 100 FF	Twins per. 100 FF w/calf	Calf % in Herd	Moose per Hour	Total Sample
Nov., 1962	99.4	19.0	23.6	8.2	115.2	33.0	24.4	14.2	91.0	1,113
Nov., 1963	62.1	11.9	23.7	6.4	97.5	24.4	17.5	13.1	104.0	1,852
Nov., 1964	67.8	11.8	21.2	6.4	137.7	17.2	9.9	9.3	146.0	1,312
1965*	-	-	-	-	-	-	-	-	-	-
Nov., 1966	73.5	13.9	23.3	6.6	85.9	32.4	16.3	15.4	96.0	786
Oct., 1967	73.0	14.0	23.0	7.0	121.0	24.0	30.0	12.0	89.0	1,447
Oct., 1968	63.3	9.1	15.7	4.8	84.7	21.3	19.1	11.1	163.9	1,619
Nov., 1969	53.9	18.7	52.9	10.3	148.8	25.1	14.1	13.9	65.0	620
Nov. & Dec., 1970	44.9	14.7	48.7	9.4	118.8	12.4	11.3	7.9	93.2	1,016
Oct. & Nov., 1971	46.8	11.2	31.6	7.1	219.7	10.2	4.5	6.5	105.9	1,091
Nov. & Dec., 1972	51.0	11.8	30.1	7.1	170.0	13.9	6.8	8.4	91.3	954
Dec., 1973	30.5	5.1	20.3	3.7	119.0	8.6	11.1	6.2	65.1	677
Nov., 1974	23.0	5.6	32.6	4.1	83.5	13.5	5.3	9.9	91.0	1,402

* Sex and age composition counts were not conducted in 1965

PREPARED BY: James B. Faro, Game Biologist

Table 4 . Moose sex and age ratios, 1974 - Alaska Peninsula - Unit 9

Trend Area	Total MM per 100 FF	Small MM per 100 FF	Small MM per 100 Large MM	Sm. MM % in Herd	Small MM per 100 MM Calves	Calves per 100 FF	Twins per 100 FF w/calf	Calf % in Herd	Moose per Hour	Total Sample
Mother Goose	15.3	4.1	36.4	3.1	57.1	14.3	3.7	11.0	62.0	254
Pacific	45.8	1.4	3.0	.9	66.7	4.2	0	2.8	98.2	108
Katmai	34.6	7.6	28.1	5.0	83.7	18.1	7.7	11.9	154.0	362
Cinder River	28.7	7.4	35.0	4.9	66.7	22.3	10.5	14.8	94.7	142
Flats	12.5	3.9	45.8	3.2	66.7	11.8	3.1	9.5	183.1	348
Meshik River	12.8	2.6	25.0	2.0	40.0	12.8	0	10.2	24.5	49
Dog Salmon River	22.0	11.0	100.0	8.6	400.0	5.5	0	4.3	63.2	139
TOTALS	23.0	5.6	32.6	4.1	83.5	13.5	5.3	9.9	91.0	1,402

PREPARED BY: James B. Faro, Game Biologist

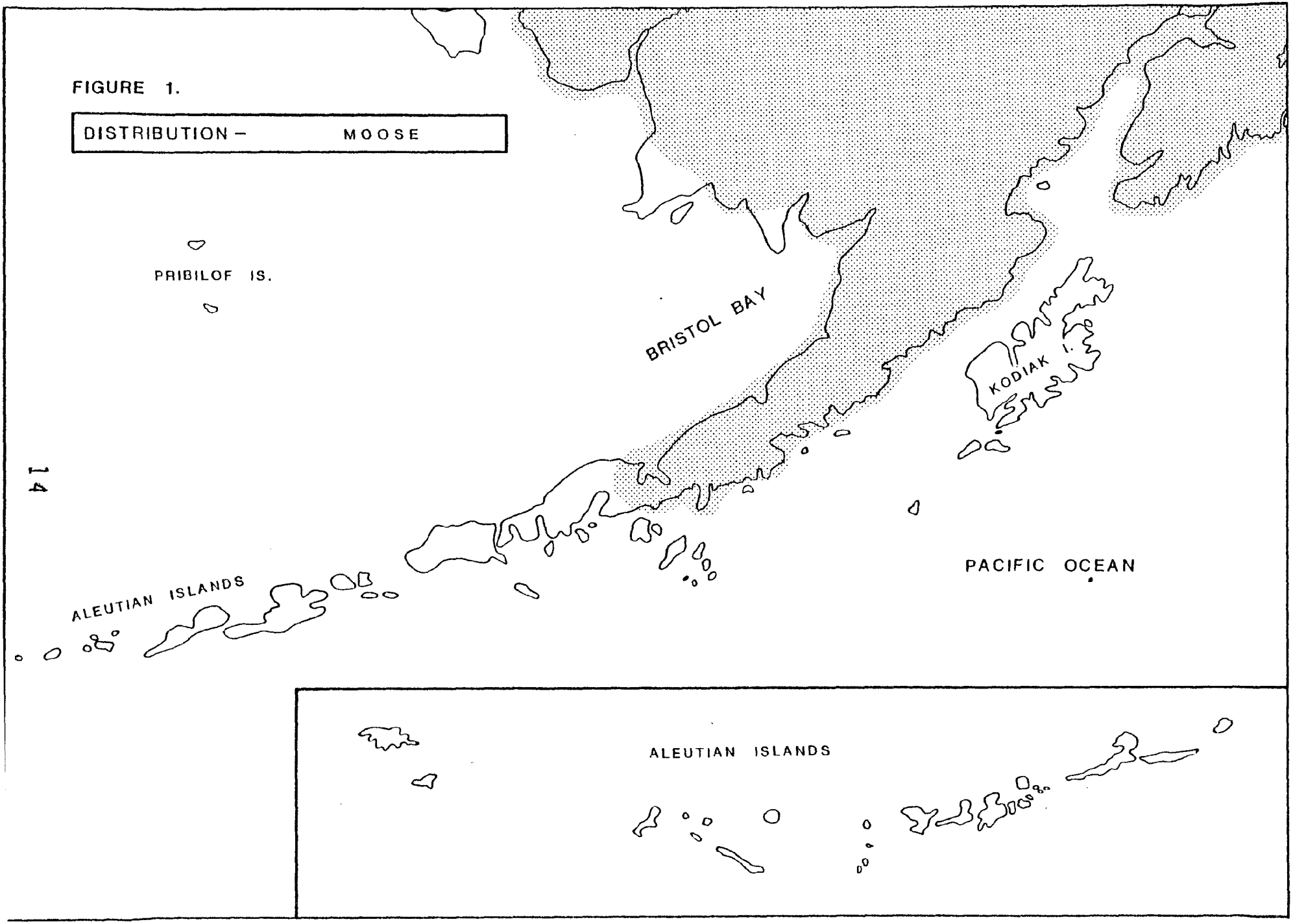
Table 5 . Moose sex and age composition - 1974 - Unit 9

Trend Area	Date	Lg. MM	Sm. MM	Total MM	FF W/O	FF W/1	FF W/2	Total FF	Total Adults	Total Calves	Unid. Sex & Age	Total Sample
Mother Goose	Nov.15	22	8	30	169	26	1	196	226	28	0	254
Pacific	Nov.16	32	1	33	69	3	0	72	105	3	0	108
Katmai	Nov.18	64	18	82	198	36	3	237	319	43	0	362
Cinder River	Nov.20	20	7	27	75	17	2	94	121	21	0	142
Flats	Nov.20	24	11	35	248	31	1	280	315	33	0	348
Meshik River	Nov.23	4	1	5	34	5	0.	39	44	5	0	49
Dog Salmon River	Nov.23	12	12	24	103	6	0	109	133	6	0	139
TOTALS		178	58	236	896	124	7	1,027	1,263	139	0	1,402

PREPARED BY: James B. Faro, Game Biologist

FIGURE 1.

DISTRIBUTION – MOOSE



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CARIBOU

The barren ground caribou (Rangifer tarandus) is primarily an animal of the northern tundra. This species ranges throughout the entire state of Alaska except for most islands and the southeastern portion of the state. Caribou often occur in large herds which display wide ranging migratory movements. A general knowledge of these movements is helpful in assessing how caribou utilize their environment.

The annual cycle of caribou in Alaska has been described by Hemming (1971). Caribou are on the move throughout most of the year. Migrations between summer and winter ranges are usually over well defined routes especially in larger herds. Animals are most dispersed during both late summer and midwinter. During late winter and early spring cows and calves start to aggregate and slowly move toward the calving ground. During this period the cow-calf bond breaks. Most calving occurs around the first of June with cows, three years and older, producing a single calf. After calving the cows and new calves form large groups while males and yearlings usually remain segregated from the cows. During summer caribou consume a wide variety of forage species including leaves of willow and dwarf birch, grasses, sedges and forbs. At this time insects often keep caribou agitated and clumped together. By fall caribou begin to move toward their winter ranges where their diet is limited primarily to lichens and sedges. It is usually during this move that breeding takes place.

Caribou inhabiting the Alaska Peninsula and Aleutian Island region represent the Alaska Peninsula herd, the southern portion of the Mulchatna

herd and populations inhabiting two Aleutian Islands, Unimak and Adak. The history of caribou on the Alaska Peninsula is incomplete and some confusion exists because reported changes in populations may only reflect shifts in caribou distribution. Russian travelers and explorers of the 1700's provided the first record of caribou on the Peninsula. They reported large populations to the south of Port Moller and on outlying islands.

During the 1800's this population apparently expanded northward to occupy the entire Peninsula. It was during this period that migrations regularly crossed the Kvichak River. The population peaked between 1872 and 1874 and then declined. Following this peak, animals remained abundant in the northern portion, but few caribou were found on the southern tip or outlying islands and migrations across the Kvichak River ceased.

By the early 1900's populations had again reached high levels on the southern tip of the Peninsula and the outlying islands, but the northern sub-populations had declined. The June 1912 eruption of Mt. Katmai covered that area of the Peninsula with ash and had a severe effect upon caribou habitat. In 1925, Olaus Murie estimated 2,500 caribou south of Port Moller, and 7,000 on Unimak Island, but made no mention of caribou on the northern portion of the Peninsula (Murie, 1935).

During the 1930's, the herd expanded to the north, but climatic conditions severely reduced the total number of animals. Heavy snows, followed by freezing rains were reported for the winters of 1930-31, 33-34, and 38-39 (Alaska Game Commission, 1925-1948, and Burdick, 1940). Under these conditions ice overlays made it nearly impossible for caribou to forage. Consequently, a large number of caribou were reported to

have died during these winters.

Reindeer herding existed in the northern Peninsula during the early 20th century. In 1942, the Alaska native Service estimated 6,500 reindeer for the Naknek-Egegik area. However, herding ceased about 1943, and the untended animals scattered. Most of the reindeer were assimilated into the Peninsula caribou herds. Even with the influx of the feral reindeer, caribou populations were reported at their lowest recorded level. A U.S. Fish and Wildlife Service survey in 1949 estimated only 2,500 animals, 2,000 in the northern portion and 500 on the southern tip with none on Unimak Island. Four causes for this decline have been suggested: (1) climate, (2) predation, (3) excessive harvest, and (4) disease (Hammond, undated).

Following the low population level of the late 1940's, the herd began to grow. By 1953, the U.S. Fish and Wildlife Service estimated a population of 4,999 caribou. In 1964, the Alaska Department of Fish and Game estimated 10,300 caribou on the Peninsula and 1,400 on Unimak Island. A 1968 census by the State, estimated 12,500 for the Peninsula, and 1,500 for Unimak Island, for a total population of 14,000 caribou.

Currently, the Alaska Peninsula caribou herd ranges south of the Naknek river and is comprised of three sub-populations. The largest, herd, estimated in 1975 at a minimum of 10,342 caribou (Irvine, 1976), ranges between the Naknek River and Port Moller. The current estimate for this herd is in the range of 13,000 to 20,000 (Jim Faro, A.D.F.&G., Area Biologist, King Salmon, pers. comm.). The majority of the calving occurs south of Port Heiden Bay and near the mouth of the Cinder River. The current sex and age composition for this herd is presented in Table 6.

Table 6 . Sex and age composition of the Port Moller, Naknek River portion of the Alaska Peninsula herd, July 9-12 and November 4-5, 1975.*

Date	Males/ 100 females	Calves/ 100 females	Calves (%)	Cows (%)	Bulls (%)	Sample size
7/9-12	24.2	49.2	667 (26.8)	1357 (56.9)	329 (16.3)	2025
11/4-5	33.0	44.6	602 (25.1)	1349 (56.3)	445 (18.6)	2396

* From Irvine, 1976

Following calving, the herd scatters: The males to the hills of the Aleutian Range, and the females and calves to the Bering Sea Flats. In late August and early September, they begin a northward movement to the wintering grounds. This area lies between the Egegik and the Naknek Rivers. Except for a few scattered animals, few caribou are recorded to have crossed the Naknek River since major migrations ceased in the late 1870's. They begin moving south to the calving areas in late March or early April, arriving in early May.

Prior year-round hunting seasons and liberal bag limits, have subjected this sub-population to constant hunting pressure. The estimated annual harvest is 2,000 animals. Fall trophy hunting, selective for bulls, has affected the herd sex ratio; in 1970 there were 48.3 bulls per 100 cows, and 1975 there were 33.0 bulls per 100 cows.

A spring 1975 survey located 2,627 caribou ranging between Port Moller and False Pass (Irvine, 1976). These animals comprise the second sub-population of the Alaska Peninsula herd which is currently estimated at 5,000 animals (Jim Faro, pers. comm.). No migratory pattern is presently defined for this group, but they calve near the Caribou

River and in the Black Hills. The current sex and age composition of this herd is presented in Table 7. Due to the remoteness of the area, these animals are lightly harvested. Residents of Nelson Lagoon and Cold Bay exert the primary hunting pressure. Some animals are taken by trophy hunters in the fall. The yearly estimated harvest is less than 150 caribou.

Table 7. Sex and age composition of the Cold Bay, Port Moller portion of the Alaska Peninsula caribou herd, July 13.*

Date	Males/ 100 females	Calves/ 100 females	Calves (%)	Cows (%)	Bulls (%)	Sample size
7/13	19.8	49.0	235 (29.0)	480 (59.3)	95 (11.7)	810

* From Irvine, 1976

The remaining sub-population is found on Unimak Island. Due to the remoteness of the area, few data have been collected. Calving has been observed on the south west coast between Pogromni Volcano and Eickelberg Peak, but other calving grounds may exist. A Department of Fish and Game survey in October 1971 counted 4,391 animals. A spring 1975 photo census located 3,334 caribou (Irvine, 1976). Both surveys are considered incomplete and the population is currently estimated at 5,000 animals (Jim Faro, pers. comm.). Hunting pressure is light, and restricted almost entirely to the residents of Cold Bay and False Pass.

The animals north of the Kvichak River are called the Mulchatna caribou herd. This emerged as a distinct population in the mid 1870's when crossing of the Kvichak River ceased (a recent crossing of about 2,500 animals occurred in 1972, near Igiugig). The herd ranges through

portions of GMU's 9, 16, 17, and 19. The primary habitat appears to be centered around the Mulchatna River with most calving occurring north of the Bonanza Hills. An aerial census of the calving grounds in 1974 identified 13,079 animals. The Mulchatna herd is currently (1976) estimated at 15,000 animals (Jim Faro, pers. comm.).

Extensive trophy hunting has only recently been directed at these animals and the herd has primarily provided subsistence hunting for local villages. This limited trophy hunting is reflected by the 1974 ratio of 55 males to 100 females. Since caribou can be hunted the same day the hunter has been airborne in Units 9 and 17 between January 1 and March 31, the herd was heavily hunted by Anchorage area residents during the early months of 1974 and 1975.

The introduction and current status of caribou on Adak Island in the central Aleutians has been described by Burris and McKnight (1973). In response to a request from the National Military Establishment in 1958, the U.S. Fish and Wildlife Service and the military cooperated in a project to transplant caribou to Adak Island (Jones, 1966). The Fish and Wildlife Service supplied personnel to capture the caribou and to supervise the project while the military provided transportation.

Because of the expense and difficulty involved in transplanting adult animals, it was decided to capture newborn calves and hand-raise them until they were self-sufficient (Jones, 1966). The calves were captured from the Nelchina herd using Air Force helicopters and transported in Navy cargo aircraft to Adak, a distance of nearly 1,400 miles. The calves were reared on Adak Island by military personnel from the Marine

Barracks and the Special Service Department of the Navy Base.

Initial mortality of calves was very high with most loss occurring within the first two weeks (Jones, 1966). Mortality was 68 percent in 1958 and 69 percent in 1959. Two-thirds of the loss occurred within the first 48 hours. In 1958, 31 calves were captured and ten were released (seven females and three males). Forty-five were captured in 1959 and 14 released (five males and nine females).

By 1967, the population was estimated at 189 animals (Hemming, 1971). At latest report (fall 1972) this herd had expanded to 347 animals. Adak caribou apparently have achieved optimal growth and an adult bull weighing 700 pounds (whole body weight) was killed in 1968 (Hemming, 1971).

In an attempt to hold the population below the critical level on Adak, the Board of Fish and Game authorized the first hunting season for the period August 15-August 25, 1964. Under the stipulations of this hunt, 10 permits were issued for the taking of bull caribou only. In 1965, the season was lengthened to 17 days and the bag limit changed to one bull with no permit requirement. Another change in 1966 set a limit of 30 caribou, but allowed the taking of either sex. In 1967, the allotment was raised to 50 animals of either sex and a bag limit of two caribou was established. The objective of the management plan for the Adak caribou herd is to hold the population at between 200 and 250 animals by harvesting approximately 50 animals annually. In late 1972 it became apparent that this harvest was inadequate to maintain the population at the desired level and efforts were made to attain a larger kill. Total population and mortality figures for the Adak herd are presented in Table 8.

Table 8. Adak caribou herd, population and mortality 1958 - 1974.

Year	Winter Population	Natural Mortality*	Hunting Mortality*
1958	10	1	0
1959	23	1	0
1960	-	0	0
1961	-	1	0
1962	36	0	0
1963	43	0	0
1964**	65	1	4
1965**	87	8	2
1966**	106	3	18
1968**	163	3	55
1969**	167	0	51
1970**	214	0	53
1971**	230	3	45
1972**	347	1	98
1973**	230(est. Post Hunting population)	0	108
1974**	264(est. Post Hunting population)	0	93

* Essentially, all natural mortality was due to entanglement in wire prior to 1969.

** Allowable harvest: 1964 - 10; 1965 - 30; 1967 - 50; 1968 - 50; 1969 - 50; 1970 - 50; 1971 - 50 plus 20 more; 1972 - 50 plus 97 more; 1973 - 140; 1974 - 70 plus 48 more.

Source - Sexton, 1976, A.D.F.&G., Survey Inventory Rept.

REINDEER

Reindeer were first introduced to Alaska from Siberia in 1892. Since then numerous transplants have taken place throughout the state. Reindeer were introduced to Atka Island in the central Aleutians in 1914. It was recently reported (Sekora, 1973) that there were between 2,500 and 3,500 animals inhabiting that island. There are currently no closed seasons or limits on this herd although less than 200 reindeer are harvested, primarily by Atkans, annually.

Reindeer were introduced to Umnak in the western Aleutians in the early part of the century. Sheep owners attempted to eliminate those animals which were competing with sheep, but caribou were still present in 1937 (Murie, 1959). Jones, former refuge manager for the Aleutian Islands National Wildlife Refuge, estimated (pers. comm.) that there were approximately 7,000 reindeer on Umnak about ten years ago. Although the current status is unknown, Jones estimated that there are probably in excess of 2,000 animals.

Reindeer also occur on Hagemeister Island in Bristol Bay where they are privately managed by the village of Togiak (Department of Interior, 1973). The current population is estimated at between 200 and 300 animals (Rae Baxter, A.D.F.&G., Fisheries Biologist, Bethel, pers. comm.).

In 1911 forty reindeer were indroduced into the Pribilof Islands by the United States government. The history of this introduction leading up to 1950 has been documented by Scheffer (1951). Four males and 21 females were released on St. Paul Island, while three males and 12 females were released on St. George. The following spring 17 and 11 offspring were produced on St. Paul and St. George respectively. Predators were not present on either island and the herds increased. By 1922 the

St. George herd had reached a maximum population of 222 reindeer. This herd then declined and was extinct by the early 1950's (Hajny, Resource Management Specialist for the Pribilof Islands, National Marine Fisheries Service, pers. comm.). The St. Paul herd continued to grow slowly until it erupted in the early 1930's. The peak was reached in the 1938 when the population numbered in excess of 2,000 animals. By 1950, 12 years later, it had crashed to eight animals. The next year only two animals remained (Wilke and Hajny, 1974).

The prime factor responsible for the St. Paul crash was overpopulation. Scheffer (1951) has estimated that this herd was at least three times beyond the carrying capacity of the range. At this point the lichen flora, an important winter food source, was seriously depleted.

In August of 1951 seven males and twenty-four females were reintroduced to St. Paul (Wilke and Hajny, 1974). By 1962 this population had increased to 762 animals. This herd was then reduced by harvesting. Wilke and Hajny (1974) reported that the primary management objective was to annually harvest 50 to 75 animals leaving an overwintering population of approximately 260 animals. The estimated 1976 population of reindeer on St. Paul is 370 animals with a 28 percent reproduction rate (Hajny, pers. comm.). Population and harvest figures from 1951 to the present are presented in Table 9.

Table 9. Count of reindeer, St. Paul Island, Alaska, 1951-76.*

Year	Number	Kill	Remaining after kill 1/	Percentage increase 2/
1951	34	-	34	-
1952	-	-	-	65
1953	-	-	-	65
1954	100	-	100	65
1955	-	-	-	30
1956	160	-	160	30
1957	215	-	215	30
1958	271	38	233	26
1959	-	-	530	33
1960	400	247	479	37
1961	530	-	530	33
1962	726	247	479	37
1963	537	105	432	12
1964	481	275	206	11
1965	265	50	215	29
1966	264	34	230	-3
1967	147	-	147	-44
1968	185	-	185	26
1969	246	-	246	33
1970	339	83	256	38
1971	353	40	314	44
1972	368	98	270	39
1973	384	84	300	43
1974	385	87	289	28
1975	368	43	325	28
1976	370			

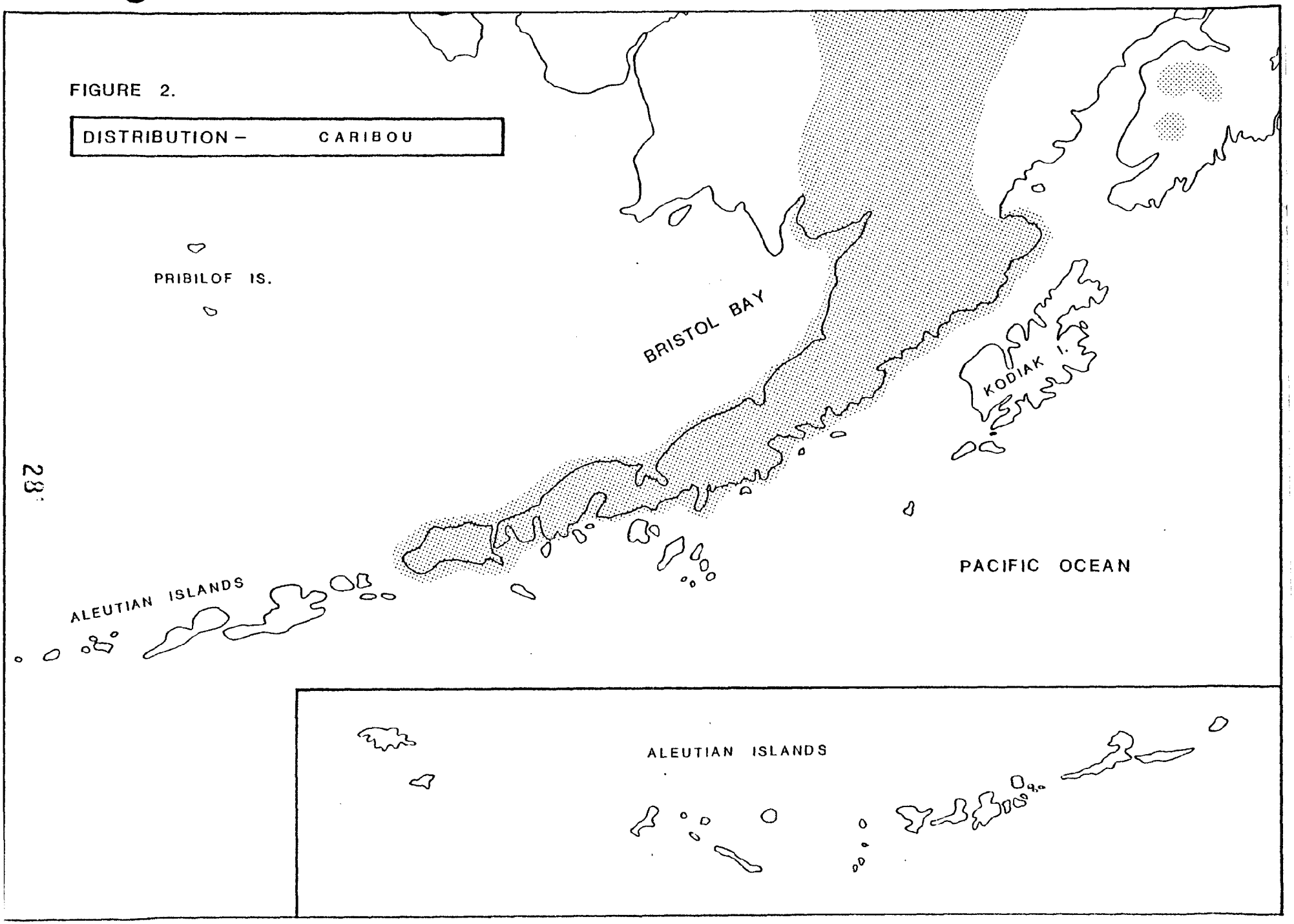
* From Wilke and Hajny (1974) and Hajny (pers. comm.).

1/ Loss of about 100 animals in 1966 due to an undetermined factor resulted in no hunting season until herd reached a satisfactory level.

2/ Increase based on number remaining after kill was deducted in first year and on number before kill in second year. Counts were not made in all years. Therefore, the percent of increase in 1952, 1953, and 1954 is 1/3 of the total from 1951 to 1954, the percent increase for 1955 and 1956 is 1/2 the total from 1954 to 1956, and the percent increase in 1958 and 1959 is 1/2 the total from 1958 to 1960.

FIGURE 2.

DISTRIBUTION – CARIBOU



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DALL SHEEP

Dall sheep (Ovis dalli), the northernmost species of sheep in North America, occur throughout all the major mountain ranges in Alaska. They are primarily a species of the alpine zone, though seasonally they may range into lower areas. The stability of most sheep populations reflects the stable climax communities of the alpine zone. Sheep prefer areas where preferred forage species such as grasses, forbs, mosses and lichens are dispersed within suitable escape cover such as cliffs and rocky outcrops.

Lambing occurs around the first of June at which time a single lamb is usually born (twins and triplets are occasionally produced). Ewes select the most inaccessible areas to lamb. Rams usually occur in the higher country during the spring and summer, segregated from the ewes and lambs. Both sexes begin to congregate during the fall as breeding begins in late November and continues through mid-December. Most ewes breed when they are two and a half years old. During winter, snow restricts the movements of sheep to a small portion of their annual range. Winter weather is probably the most important factor in regulating sheep numbers. This occurs when deep snows and icing condition limit the availability of forage on the normally wind swept ridge tops.

Unit 9 and 17

The only Dall sheep range in this region is restricted to the Lake Clark area in Units 9 and 17. This area is the southern most limit of Dall sheep habitat in the Alaska Range. This limit is probably the result of adverse winter snow conditions. Thus sheep numbers here fluctuate more than in more suitable habitat to the north. During the

severe winter of 1969-70 local residents reported a population reduction in this area. Recent harvest data suggest however, that this population is again increasing. The current (1976) estimate of sheep in this area is between 150 and 200 animals (Jim Faro, A.D.F.&G., Area Biologist, King Salmon, pers. comm.). Further population data are unavailable. Since sheep inhabit such a limited area within these units their entire range should be considered as critical habitat.

Historically harvests have been low in this area and subsistance use is virtually absent. The harvest figures for Units 9 and 17 are presented in Tables 10&11. The 1975 harvest of 13 sheep in Unit 9 was the highest recorded for this unit. Currently there is little non-consumptive use of sheep in either of these units.

Unit 10

Dall sheep do not occur in Unit 10.

Table 10. Historic harvest of legal rams in Unit 9.

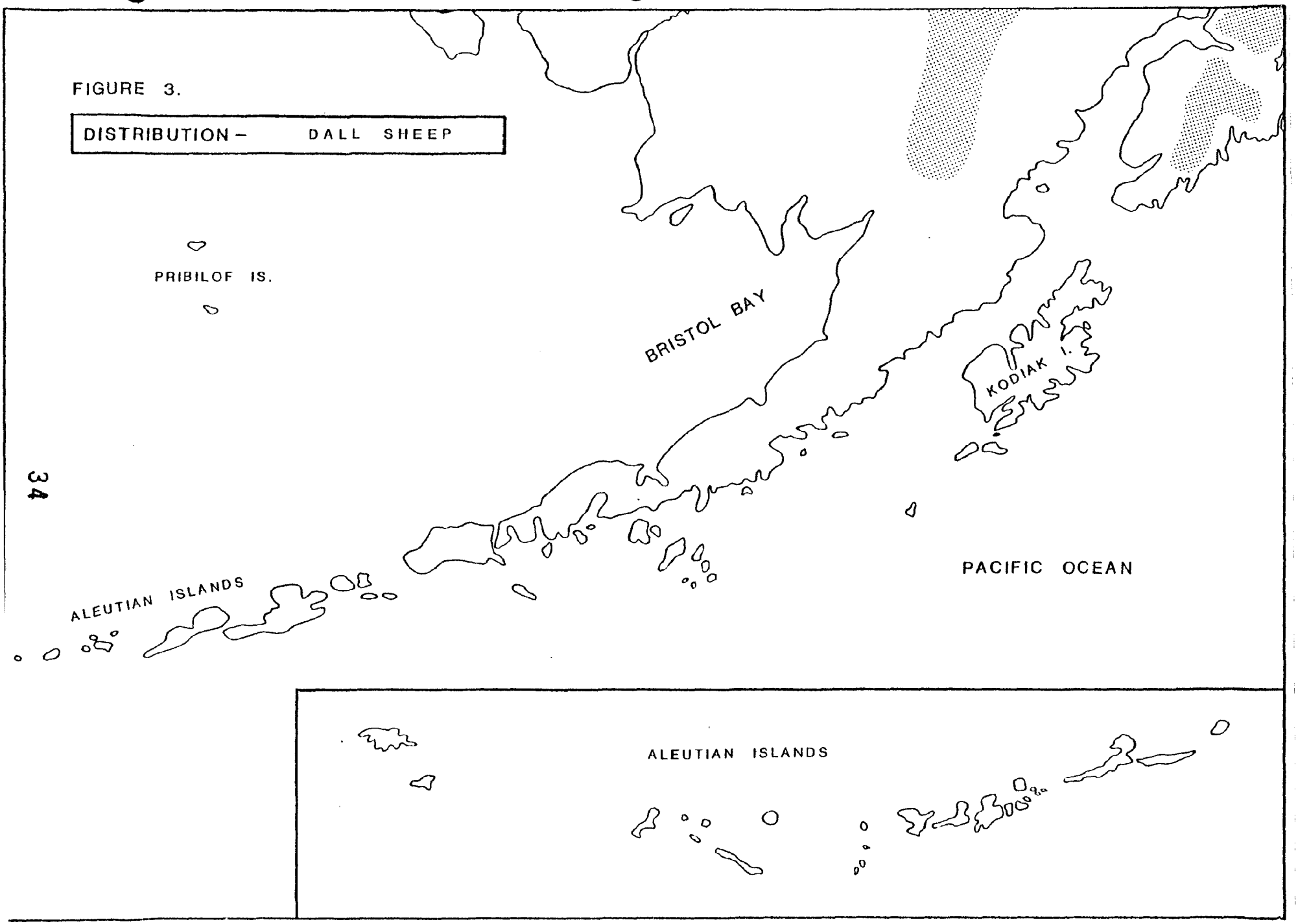
Year	Harvest	Year	Harvest
1962	0	1969	7
1963	1	1970	2
1964	2	1971	2
1965	0	1972	3
1966	0	1973	3
1967	6	1974	8
1968	10	1975	13

Table 11. Historic harvest of legal rams in Unit 17.

Year	Harvest	Year	Harvest
1965	14	1970	6
1966	7	1971	6
1967	6	1972	5
1968	15	1973	5
1969	9	1974	4
		1975	5

FIGURE 3.

DISTRIBUTION – DALL SHEEP



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BROWN-GRIZZLY BEAR

The brown-grizzly bear (Ursus arctos) is the largest land carnivore in the world. This species attains its largest size (up to 1,300 pounds) in southern Alaska. Generally brown bears are considered coastal populations whereas grizzlies are considered interior populations of the same species. This species is distributed throughout Alaska except for the Aleutian Islands beyound Unimak Island and the islands south of Frederick Sound.

Brown-grizzly bears appear to prefer open grassland or tundra habitats. The greatest population densities occur in the lush grassland communities on the Alaska Peninsula and Kodiak Island. The brown-grizzly bear utilizes a wide range of forage material. During spring numerous species of grasses and forbs make up an important part of the diet while during summer and fall a wide variety of fruit and berry producing plants are consumed. Insect larvae, small mammals, occasional ungulates and a variety of carrion is also utilized when available. Spawning salmon is a major forage item when in season, and the cause of bear concentrations near streams.

In Alaska the brown-grizzly bear breeds from May through mid-July. Both sexes attain sexual maturity at three and a half to four and a half years of age. One to four (average of 2.2) cubs are born in the den during late January or February. The female generally breeds every third year.

In Alaska brown-grizzly bears enter their den during November or December where they go through a period of winter dormancy. They emerge from the den during April or May. The length of denning generally reflects the severity and length of the winter season. This varies from region to region.

Unit 9

Although little historical information is available for Unit 9 it appears that brown bear distribution has remained relatively stable there in recent times. Brown bears are abundant throughout this area with densities comparable to Kodiak Island. The greatest densities occur between Port Moller and Katmai National Monument. Although it is difficult to estimate the total population, a conservative estimate of 2,000 bears has been made for the area south of the Naknek River and Katmai National Monument (Alaska's Wildlife and Habitat, 1973). Productivity appears to be higher in the Black Lake area as compared to the McNeil River area to the north (Jim Faro, A.D.F.&G., Area Biologist, King Salmon, pers. comm.).

Seasonal altitudinal shifts in distribution reflect the availability of forage and the approaching period of winter denning. During spring the bears move from their denning areas on the steeper slopes to lower subalpine and coastal flats where they feed on new plant material. At this time the grass flats on the beach fringe and the head of the bays are critical spring habitat. This habitat is most limited on the Pacific side of the peninsula. During spring brown bear are known to prey on moose calves (Jim Faro, pers. comm.).

The high availability of salmon in the many streams throughout the Alaska Peninsula provide an abundant food supply during the summer and early fall. The availability of this high protein diet is probably the most important factor in the large size of peninsula bears. Salmon

generally become available earlier in the Pacific drainages. Thus some bears are first attracted to these drainages then later cross over to take advantage of runs in the Bristol Bay drainages. Brown bears inhabiting the Alaska Peninsula are considered to be of one population as interchange between the Pacific and Bristol Bay sides is common (Jim Faro, pers. comm.). Brown bears on the peninsula also make frequent movements into the subalpine and alpine areas beginning in early August. These movements are in response to ripening berry fields such as blue berries and cranberries.

Denning begins in late October and November. Primary denning sites include upper slopes in the alder-willow zone. Males and single bears usually den later and emerge earlier than females with cubs.

A mandatory bear hide sealing program was initiated in 1961. Since then the Alaska Peninsula has contributed over 25 percent of the statewide harvest of brown-grizzly bears. Unit 9 has consistently been a popular area for hunting large trophy size brown bears. The average annual harvest since 1961 has been 182.5 bears. The yearly harvest figures are presented in Table 12. Non-resident harvest has accounted for 72 percent of the average annual harvest since 1961. The highest harvest occurred in 1972 when 279 bears were taken. The lowest take was during 1961 when 93 bears were harvested. Since 1961 the percentage of males in the harvest has declined (73% in 1961 to 56% in 1975). In 1976 the department imposed alternate year seasons to increase both the average age and the proportion of males in the harvest.

Local use of brown bears in this unit is low, probably less than five annually. This use is primarily from the Lake Iliamna and Chignik-

Table 12.

111-0104
/13/76

GAME MANAGEMENT UNIT 09
YEARLY BEAR SPORT HARVEST 1961 - 1975
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY BEARS

CALENDAR YEAR	TOTAL KILL	# OF MALES	# OF FEMALES	% OF MALES	% OF FEMALES	# OF UNKNOWN	# BY NONRES	% BY NONRES	SEASON DATES
1961	0120	084	031	073	027	005	071	59	264 DAYS
1962	0194	108	046	070	030	000	096	62	264 DAYS
1963	0164	102	055	065	035	007	114	70	273 DAYS
1964	0156	103	045	070	030	008	110	71	273 DAYS
1965	0209	136	069	066	034	004	138	66	273 DAYS
1966	0229	157	062	072	028	010	172	75	273 DAYS
1967	0214	147	063	070	030	004	163	76	248 DAYS
1968	0160	113	042	073	027	005	134	84	238 DAYS
1969	0093	066	022	075	025	005	067	72	177 DAYS
1970	0158	103	050	067	033	005	119	75	56 DAYS
1971	0195	122	063	066	034	010	137	70	47 DAYS
1972	0279	154	119	056	044	006	203	73	47 DAYS
1973	0242	139	098	058	042	006	183	76	31 DAYS
1974	0141	075	066	053	047	000	114	81	15 DAYS
1975	0224	120	096	056	044	008	141	63	31 DAYS
TOTALS	2738	1728	0927	0065	0035	0083	1962	72	

Source: Compiled by Leland Glenn, A.D.F.& G. Game Biologist, 1976

Black Lake areas. Nonconsumptive use of brown bears on the peninsula occurs primarily at McNeil River Falls and Katmai National Monument. High potential for nonconsumptive use exists at Right and Left Hand Valleys near Cold Bay.

Unit 10

Brown bears occur only on Unimak Island in Unit 10. Little information is available on their history or their current population numbers. It is suspected however that their densities are probably similar to those on the lower portion of the peninsula. Hunting is rather limited in this unit. The harvest figures since 1961 are presented in Table 13. The average annual harvest is currently 5.3 bears. The highest harvest was 15 bears in 1964. Nonconsumptive use is minimal in this unit.

Unit 17

Brown bears are common throughout most of Unit 17 although they tend to be slightly smaller than those from Unit 9. Little data is available on the history or population numbers of brown bears in this unit. The density of brown bears in Unit 17 however is considered to be less than that of Unit 9. Seasonal movements and critical areas are generally similar to those described for Unit 9. The most abundant and available salmon runs are found primarily in the Nushagak drainage and Togiak River during August and September. Denning is believed to be slightly longer in this unit than in Unit 9 and is probably not as confined to the higher slopes as it is on the Peninsula.

Because of the remoteness of Unit 17 substantially fewer bears are harvested here than in Unit 9. The harvest figures for Unit 17 since

Table 13.

III-0104
/13/76

GAME MANAGEMENT UNIT 10
YEARLY BEAR SPORT HARVEST 1961 - 1975
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY BEARS

CALENDAR YEAR	TOTAL KILL	# OF MALES	# OF FEMALES	% OF MALES	% OF FEMALES	# OF UNKNOWN	# BY NONRES	% BY NONRES	SEASON DATES
1961	0001	001	000	100	000	000	000	0	243 DAYS
1962	0003	002	001	067	033	000	000	0	243 DAYS
1963	0000	000	000	000	000	000	000	0	273 DAYS
1964	0015	009	006	060	040	000	005	33	273 DAYS
1965	0010	007	003	070	030	000	001	10	259 DAYS
1966	0006	004	002	067	033	000	001	17	259 DAYS
1967	0008	003	005	038	063	000	000	0	248 DAYS
1968	0004	002	002	050	050	000	004	100	217 DAYS
1969	0004	003	001	075	025	000	000	0	201 DAYS
1970	0005	004	001	080	020	000	000	0	47 DAYS
1971	0004	001	003	025	075	000	000	0	47 DAYS
1972	0005	003	002	060	040	000	000	0	47 DAYS
1973	0003	001	002	033	067	000	000	0	47 DAYS
1974	0005	003	002	060	040	000	000	0	47 DAYS
1975	0006	002	003	040	060	001	000	0	37 DAYS
TOTALS	0079	0045	0033	0058	0042	0001	0011	14	

Source; Compiled by Leland Glenn, A,D,F,& G. Game Biologist, 1976

1961 are presented in Table 14. The average annual harvest is 16.2 bears of which over 75 percent are taken by non-residents. The highest number of bears (30) were taken in 1973. Nonconsumptive use of brown bears is minimal in this unit.

Table 14.

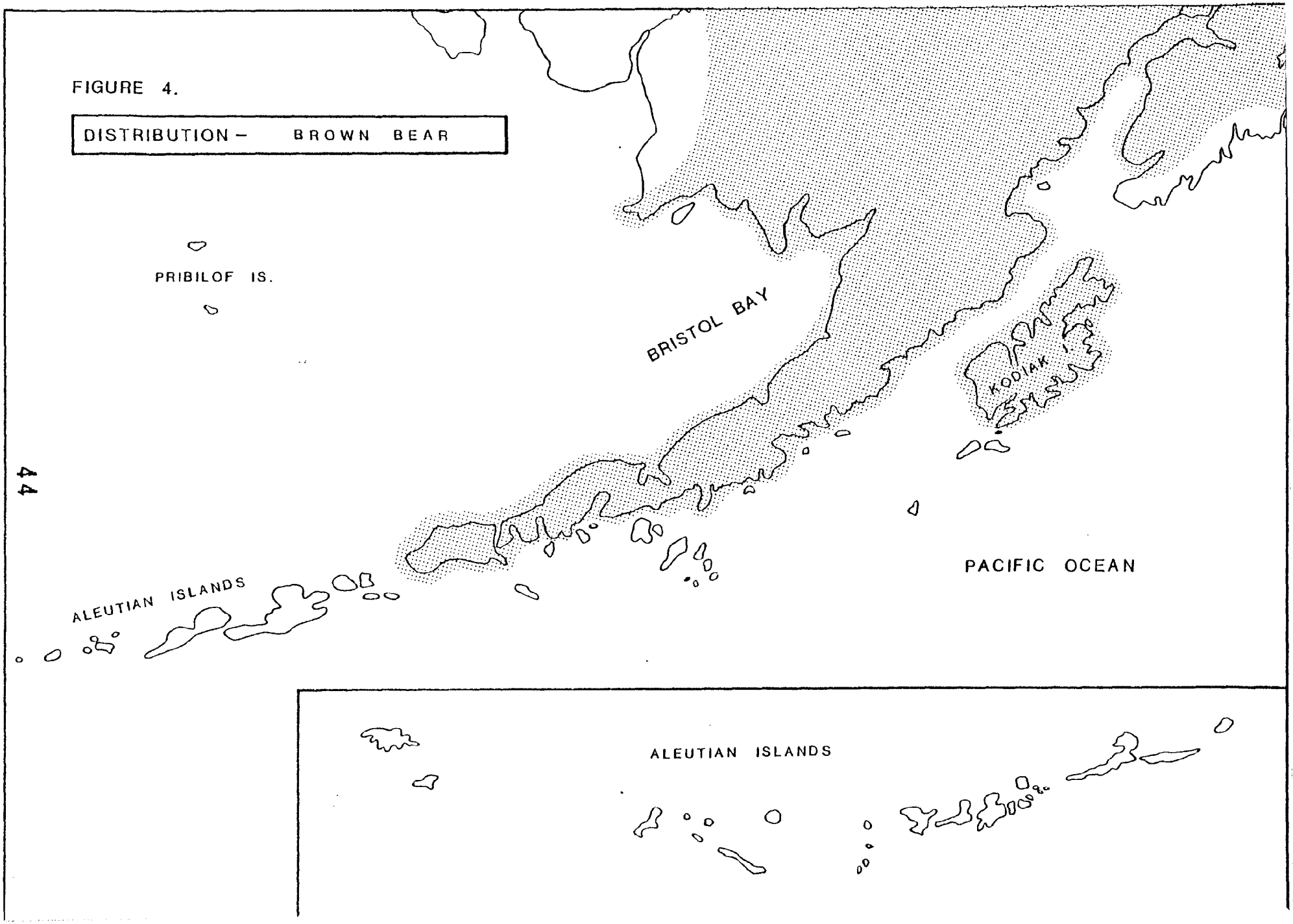
11-0104
13/76

GAME MANAGEMENT UNIT 17
YEARLY BEAR SPORT HARVEST 1961 - 1975
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY BEARS

CALENDAR YEAR	TOTAL KILL	# OF MALES	# OF FEMALES	% OF MALES	% OF FEMALES	# OF UNKNOWN	# BY NONRES	% BY NONRES	SEASON DATES
1961	0002	001	001	050	050	000	000	0	154 DAYS
1962	0002	002	000	100	000	000	000	0	154 DAYS
1963	0003	001	000	100	000	002	000	0	154 DAYS
1964	0004	002	002	050	050	000	003	75	154 DAYS
1965	0006	002	004	033	067	000	005	83	154 DAYS
1966	0009	004	004	050	050	001	004	44	154 DAYS
1967	0011	003	008	027	073	000	010	91	154 DAYS
1968	0010	007	003	070	030	000	006	60	154 DAYS
1969	0006	003	003	050	050	000	003	50	77 DAYS
1970	0023	012	010	055	045	001	020	87	72 DAYS
1971	0033	021	011	066	034	001	026	79	72 DAYS
1972	0035	022	013	063	037	000	027	77	72 DAYS
1973	0041	030	010	075	025	001	033	80	42 DAYS
1974	0029	024	005	083	017	000	022	76	42 DAYS
1975	0029	023	006	079	021	000	025	86	31 DAYS
TOTALS	0243	0157	0080	0066	0034	0006	0184	76	

Source: Compiled by Leland Glenn, A.D.F.& G., Game Biologist, 1976

FIGURE 4.


DISTRIBUTION – BROWN BEAR
PRIBILOF IS.
BRISTOL BAY
KODIAK I.
PACIFIC OCEAN
ALEUTIAN ISLANDS
ALEUTIAN ISLANDS

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BLACK BEAR

Black bears (Ursus americanus) range throughout most of northern North America. They are comparatively much more adaptable to human population distribution than are brown-grizzly bears. The black bear however, has a more limited distribution throughout Alaska than does the brown-grizzly bear. Primarily a forest animal, black bear range throughout most of the state except north of the Brooks Range, the Seward Peninsula, Kuskokwin Delta, Alaska Peninsula south of the Branch River, the islands of southeastern Alaska north of Frederick Sound, Kodiak, Montague and Hinchinbrook Islands as well as the Aleutians and the islands to the north. In terms of island distribution they are generally absent from those occupied by brown-grizzly bears.

Black bears generally prefer open forests which include fruit producing shrubs interspersed with meadows. Except for southeastern Alaska black bear populations in the state are comparatively more sparse than populations further to the south.

Sexual maturity in black bears is generally attained at about three and a half years of age. Breeding occurs from mid-June through mid-July. Normally two cubs are born in the den during late January or February. Females usually breed in alternate years.

Black bears are omnivorous. During early spring they feed primarily on grasses and herbaceous vegetation. During summer they consume quantities of berries and salmon when these items are available. Invertebrates and carrion are also taken when available.

Winter denning in black bears usually begins in October and extends through April and sometimes into May. As in brown-grizzly bears the duration of denning varies regionally.

Units 9 and 17

Black bear populations in both Units 9 and 17 are very low and limited primarily to the forested areas of the Upper Cook Inlet drainages and the Lake Clark area. Their range extends to Dillingham and Togiak Bay. Katmai National Monument is the southern most limit of their distribution. Little data is available on black bear populations within these units although their numbers appear to be increasing and slowly extending southward (Jim Faro, A.D.F.&G., Area Biologist, King Salmon, pers. comm.).

Altitudinal movements take place seasonally reflecting changes in available forage. Habitats critical to black bear appear to be similar to those of brown bear. Beach fringes and lowland river valleys are quite important.

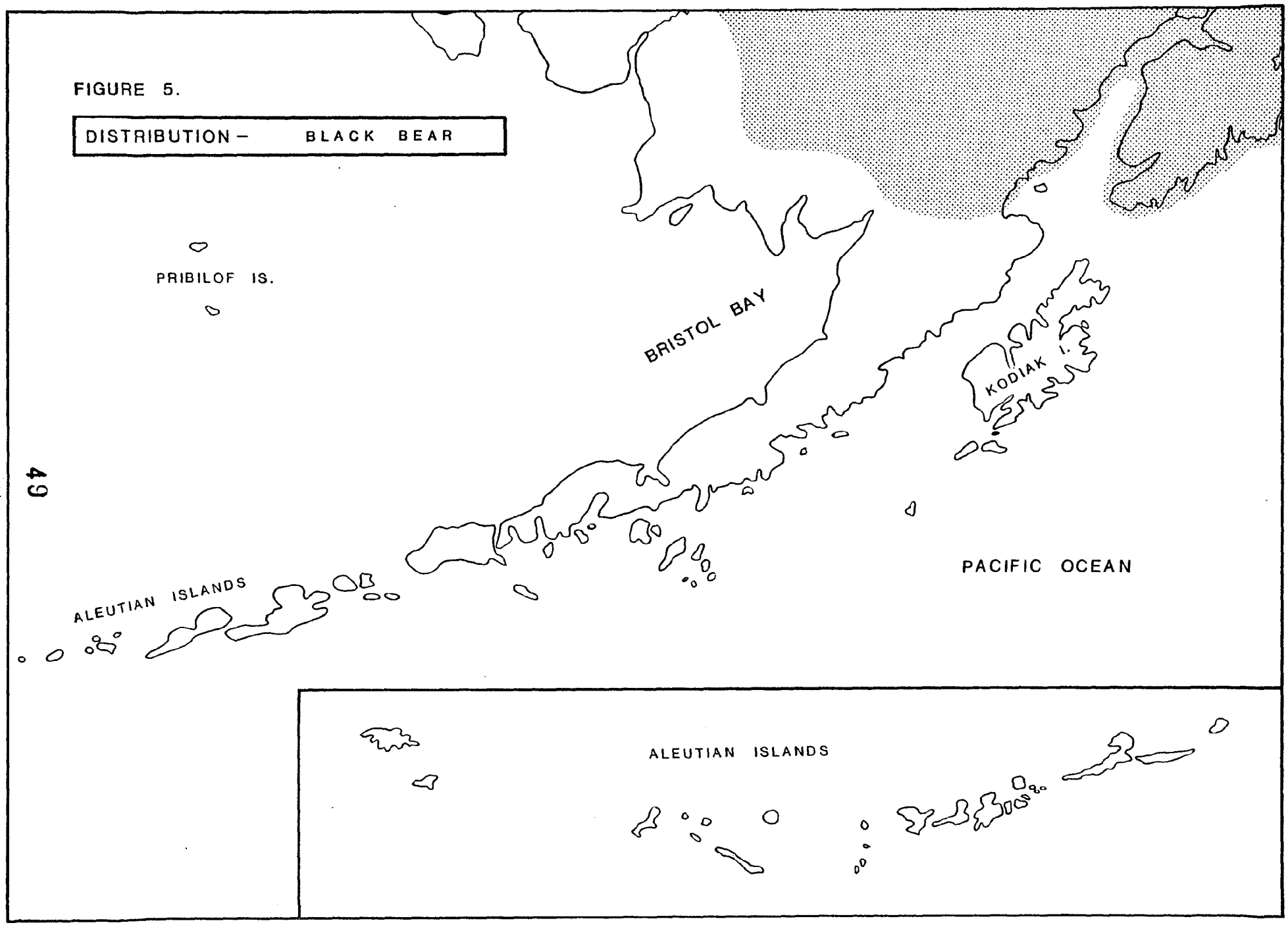
No mandatory sealing program is in effect for black bear in either of these units. It is estimated however, that approximately 15 bears are harvested annually in these two units (Jim Faro, pers. comm.). Approximately half of the annual harvest is taken by local residents. Noncomsumptive use of black bears is minimal in these units.

Unit 10

Black bears do not occur in Unit 10.

FIGURE 5.

DISTRIBUTION – BLACK BEAR



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FURBEARERS, SMALL GAME AND UPLAND GAME BIRDS

Furbearers, small game and upland game birds occur throughout portions of Units 9 and 17 in varying numbers. Although many species are present on Unimak Island in Unit 10, most are absent from the rest of the Aleutian Chain west of Unimak. Specific data for most of the species inhabiting these units is not available. In some cases relative abundance can be estimated from trapping records, but these are often incomplete and pertain only to specific species such as beaver, wolf and wolverine. Most of the information presented here was obtained either from the literature or from Alaska Fish and Game Department Area Biologists and U.S. Fish and Wildlife Service Biologists familiar with the area.

Furbearers occurring in Units 9, 10 and 17 include wolf, coyote, red fox, arctic fox, lynx, wolverine, marten, mink, short-tailed weasel, least weasel, land otter, beaver, muskrat, marmot, arctic ground squirrel, red squirrel and flying squirrel. Of these, the most important is probably the beaver which is harvested most intensively in the northern portion of Unit 17. Only three species of furbearers occur in Unit 10 west of Unimak. They are the arctic ground squirrel, arctic fox and red fox.

Small game included in this report consists of snowshoe hare, tundra hare and porcupine. Snowshoe and tundra hare occur only in Units 9 and 17 while porcupine, which also occur in those units, are reported to occur on Unimak Island in Unit 10.

Upland game birds which occur within Units 9 and 17 include willow, rock and white-tailed ptarmigan and spruce, ruffed and sharp-tailed grouse. Willow ptarmigan occur in Unit 10 only on Unimak Island while

rock ptarmigan are present on most major islands throughout the Aleutian Chain.

WOLF

The wolf (Canis lupus), once distributed throughout most of North America, is today limited primarily to the northern wilderness of Canada and Alaska. Wolves are very adaptable in terms of climate and habitat. They occur throughout the entire state of Alaska except for some offshore islands including the Aleutians south of Unimak. Wolves are classified in Alaska both as a big game species and as a furbearer where they are harvested for commercial purposes by trapping or shooting. Current market value may range up to several hundred dollars for each prime pelt.

Since wolves prey primarily on big game species such as caribou, moose and deer they often come into conflict with man, who places a high recreational and/or subsistence value on these same species. This and the fact that they often took domestic stock (because their natural prey was reduced by hunting or habitat reduction) was the primary factor which brought about their demise, through predator control programs, over most of the lower 48. Other prey species utilized by wolves (although of secondary importance) consist of snowshoe hares, beavers, salmon, sheep and occasionally goats. Their food consumption is in the range of four to eight pounds of meat per wolf per day.

Wolves usually range over a large area (up to 60 miles or more in diameter) and travel in packs of from 2 to 30 animals. The social structure of these packs is highly developed and complex and is an important factor in their success as a predator.

Pupping usually occurs in May or early June. Females generally produce their first litter at two years of age and most litters average

five to six pups. In Alaska, although most females breed every year, productivity is related to available food resources and in periods of low prey densities pup mortality may be high.

Historically the wolf has been a contraversial figure. Today emotions run high on both sides of the issue of wolf management. The logical approach to such problems however, is to develop sound management policies, based on objective biological data. Such management should provide for the long term conservation of our big game species as well as ensuring the continued conservation of the wolf, which is considered by many to be a symbol of the northern wildnerness.

Units 9 and 17

Wolves occur throughout Units 9 and 17, however little historical or population information is available. Currently these populations are not considered abundant although they appear to be increasing. Wolves are not considered an important factor in the regulation of either caribou or moose populations inhabiting these units. The harvest data from these units are presented in Table 1. The average annual harvest for Unit 9 is approximately 26 wolves while Unit 17 is approximately 24 wolves. Most of these animals are taken by shooting. Traditional trapping methods harvest only a few wolves each year. Nonconsumptive use of wolves is generally minimal except in Katmai National Monument where hunting of wolves is not permitted.

Unit 10

Wolves occur in Unit 10 only on Unimak Island, however, their current status there is unknown. Since 1961, only one wolf has been reported harvested from Unit 10.

Table 1. Wolf harvest Units 9, 10 and 17.

Date	Total Harvested Unit 9	Unit 10	Unit 17
61-62	4	--	--
62-63	9	--	15
63-64	16	--	14
64-65	44	--	1
65-66	27	--	18
66-67	51	--	26
67-68	24	--	24
68-69	22	--	15
69-70	26	--	3
70-71	7	--	13
71-72	24	--	28
72-73	24	1	20
73-74	31	--	20
74-75	52	--	111
Average Annual Harvest	25.8		23.7

Table 2. 1974-1975 Wolf harvest, Unit 9.

Month	Number	Percent	Month	Number	Percent
July	--	--	January	11	21.3
August	--	--	February	14	26.9
September	5	9.6	March	9	17.3
October	9	17.3	April	2	3.8
November	1	1.9	May	--	--
December	1	1.9	June	--	--
			Unknown	--	--
			TOTAL	52	100

Method of Take	Number	Percent
Ground Shooting	48	92.3
Trapping	4	7.7
Snaring	--	--
Other	--	--
TOTAL	52	100

Color of Wolves Taken	Number	Percent
White	3	5.8
Brown	3	5.8
Gray	40	76.9
Black	6	11.5
Unknown	--	--
TOTAL	52	100

Sex	Harvest
Males	33
Females	14
Unknown	5
TOTAL	52

Table 3. 1974-1975 Wolf harvest, Unit 17.

Month	Number	Percent	Month	Number	Percent
July	--	--	January	--	--
August	--	--	February	28	25.2
September	--	--	March	64	57.7
October	1	0.9	April	16	14.4
November	--	--	May	--	--
December	2	1.8	June	--	--
			Unknown	--	--
			TOTAL	111	100

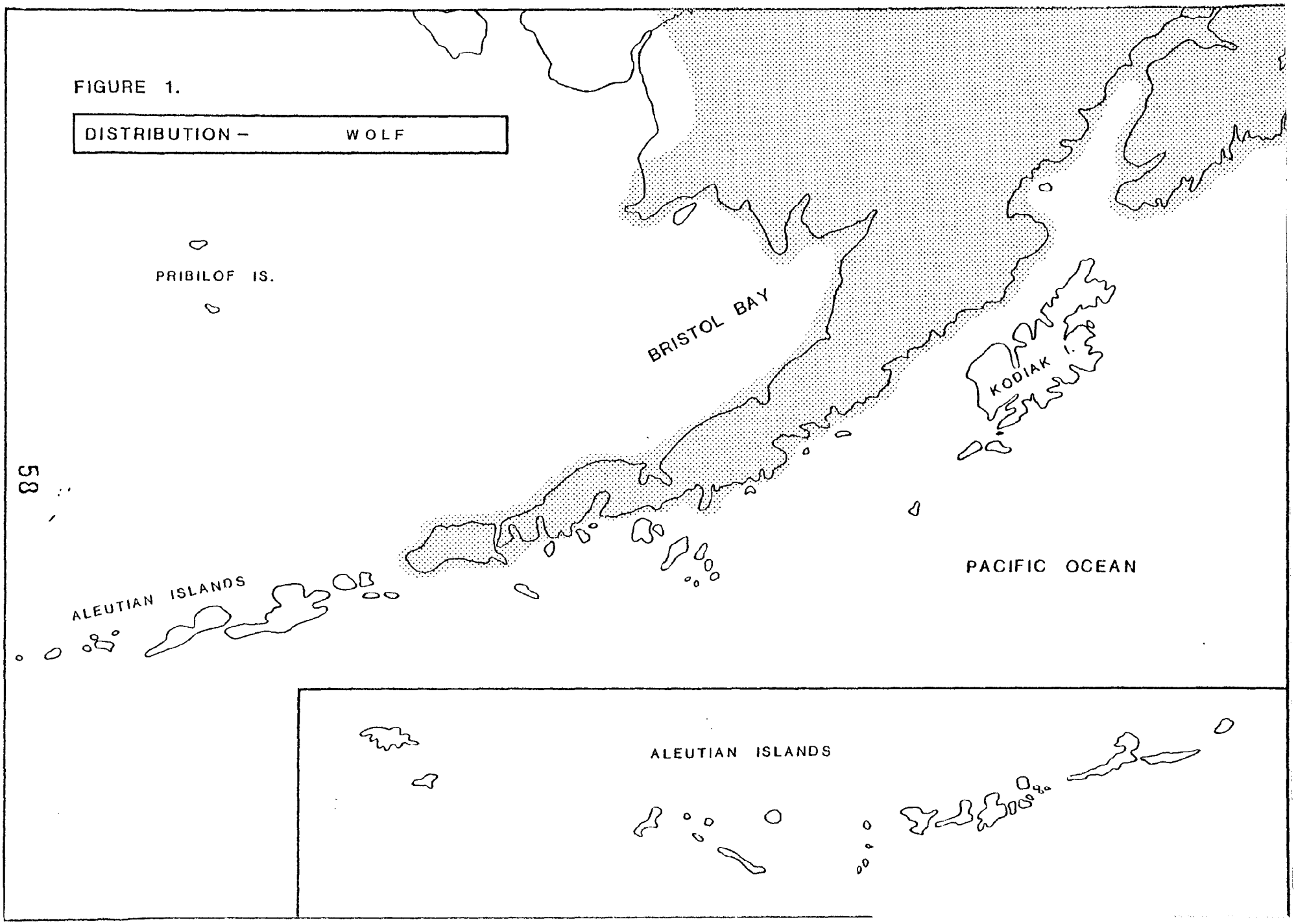
Method of Take	Number	Percent
Ground Shooting	104	93.7
Trapping	7	6.3
Snaring	--	--
Other	--	--
TOTAL	111	100

Color of Wolves Taken	Number	Percent
White	3	2.7
Brown	11	9.9
Gray	79	71.2
Black	18	16.2
Unknown	--	--
TOTAL	111	100

Sex	Harvest
Males	56
Females	54
Unknown	1
TOTAL	111

FIGURE 1.

DISTRIBUTION – WOLF



COYOTE

The coyote (Canis latrans) has only recently become established in Alaska. It was first observed in Alaska around 1915. Following their first appearance they spread rapidly across the state with the highest density centered in the Tanana Valley around 1950. By 1953 the center of their distribution had shifted toward southcentral Alaska. In 1964, the Alaska Department of Fish and Game reported: "We can advise that these animals (coyotes) are at an extremely low level of abundance in Alaska at this time. Formerly, we had good populations which apparently crashed as a result of rabies or some other disease." Today coyotes occur in most areas of the state except the Arctic coast, the far western portion, most of the Alaska Peninsula, much of Southeastern and the coastal islands. Although coyotes are common throughout their range they are usually not abundant. Coyotes are very adaptable animals and occur throughout a variety of habitats.

Coyotes prey on a wide variety of small mammals including hares, ground squirrels and numerous species of mice. They are opportunistic foragers and their diet includes berries, invertebrates and carrion when available. Although they perfer to hunt during the night or during the twilight hours, they are also active during daylight throughout the Arctic summer. Coyotes usually hunt alone although occasionally they hunt in pairs.

Coyotes usually breed from January to March. After a gestation period of approximately 60 days females give birth to five to seven pups. Pups are born in a den usually located in the cover of a natural crevice. Females become sexually mature during their second winter

and usually produce one litter per year.

Prior to 1969 there was a bounty on the coyote throughout Alaska. This was removed in 1969 since coyotes do not significantly affect the abundance of most game species. Coyotes are occasionally trapped for their pelts.

Unit 9

Coyotes have occurred on the Alaska Peninsula at various times. Currently however, they are only occasionally present in the northern portion of Unit 9. No other information is available on their status in this unit.

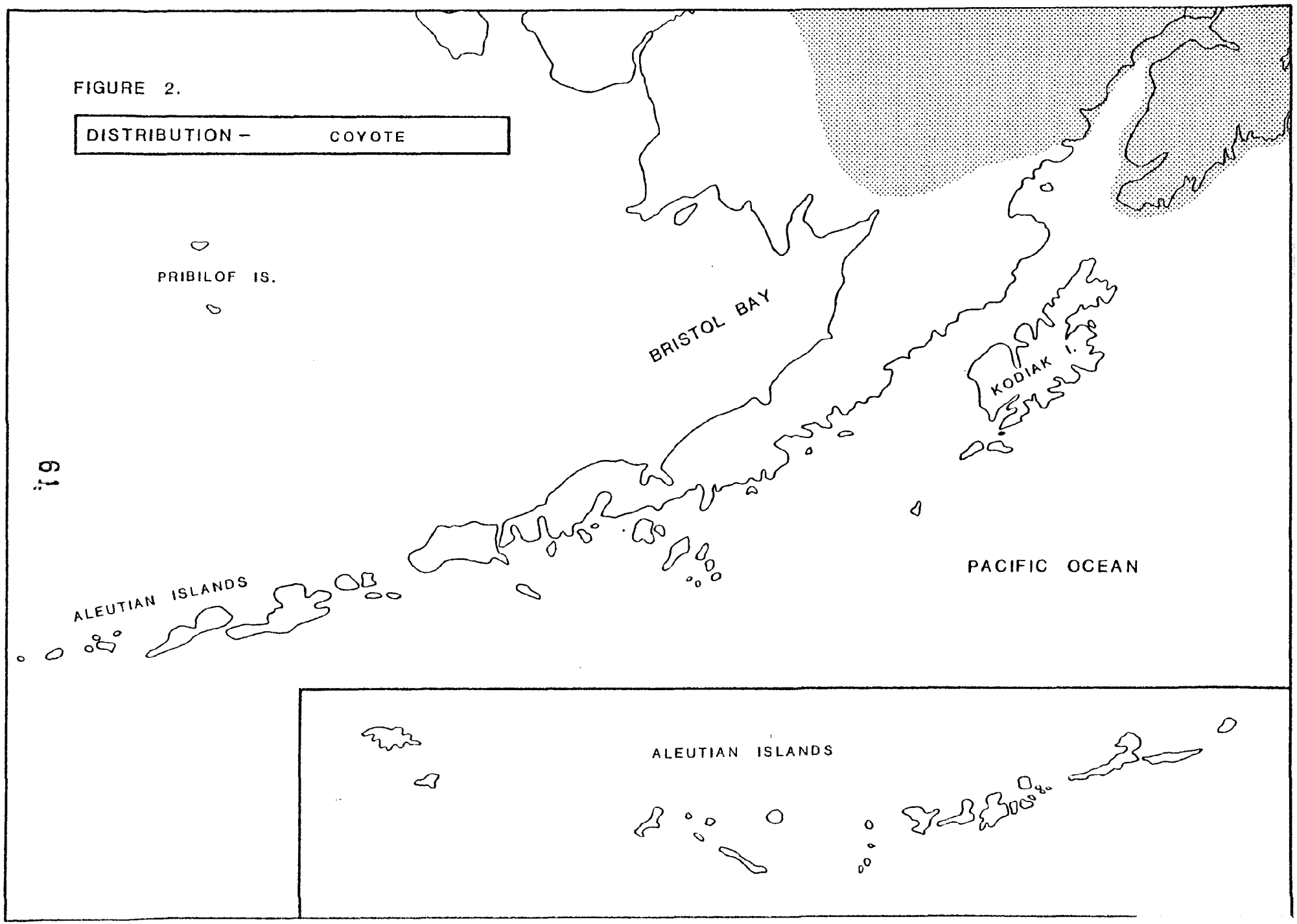
Unit 10

Coyotes do not occur in Unit 10.

Unit 17

Coyotes are occasionally present throughout the northern portion of Unit 17. No other information is available on their status there.

FIGURE 2.


DISTRIBUTION – COYOTE
PRIBILOF IS.
BRISTOL BAY
KODIAK I.
PACIFIC OCEAN
ALEUTIAN ISLANDS
ALEUTIAN ISLANDS

RED FOX

The red fox (Vulpes fulva) occurs throughout Alaska except for some islands in southeastern Alaska and Prince Williams Sound. Red foxes inhabit a variety of habitats, but seem to prefer broken country of forest openings interspersed with hills and draws south of the Arctic tundra. This species is native to most of Alaska, but has been introduced to many islands as a result of fox farming operations in early 1900's.

The red fox is omnivorous and forages on a wide variety of items including small mammals, birds, eggs, invertebrates, plant material and carrion. Their diet often fluctuates seasonally, reflecting the relative availability of specific items. Generally however, mice (especially microtines) and hares appear to be preferred and are probably taken most often. Red fox populations fluctuate with respect to changes in prey densities. During summer and fall foxes feed heavily on berries and invertebrates whereas during winter they are restricted almost exclusively to fresh meat and carrion.

The red fox breeds during February and March. Following breeding the pair locate an appropriate denning site. Dens are excavations, usually 15 to 20 feet long, located on the side of a well drained hill. This den may have several entrances. Following a 53 day gestation period a litter of usually four kits is born in a grass lined nest within the den. One litter is usually produced each year. Both parents care for the young and the family persists until fall when the individuals disperse.

In Alaska, the red fox is considered one of the states most important

furbearers and recently their value has increased. In 1976 the market value for a single pelt ranged from $60 to $150. This increase in value may result in increasing harvest pressure. Currently however, they do not appear to be over harvested anywhere in the state.

Units 9 and 17

The red fox is common throughout this region. Some of the best red fox habitat in the state is considered to be in Units 9 and 17. Red foxes feed on carrion found on the sea beaches of these coastal units. Thus they are not totally dependent on small mammal populations for a food source. Because of this, their populations near these areas may be more stable. However, rabies epidemics frequently occur in these populations, resulting in wide-spread mortality.

Foxes are harvested in these units primarily by local trappers for the fur market and for local domestic use, such as parka ruffs. Sport hunting and nonconsumptive use of red fox is relatively minor in this area.

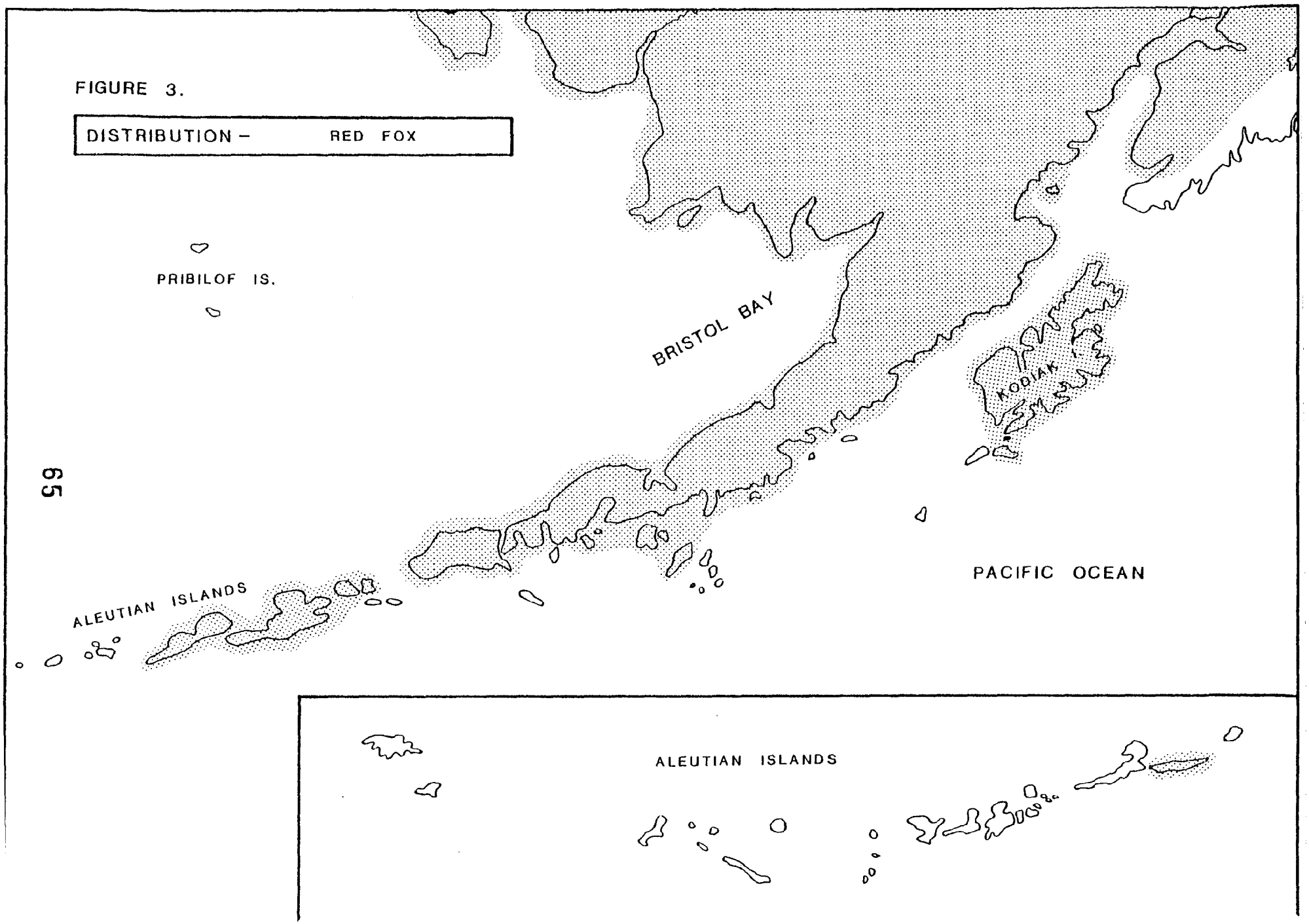
Unit 10

The red fox is native to the larger islands of the Aleutians west to and including Umnak Island (Murie, 1959). However, beginning with the Russian occupation of the Aleutians and continuing through 1932 many fox introductions were made. Apparently the early Russian introductions were limited to the dark phase of the red fox. Red fox populations established from these introductions occurred on Great Sitkin, Kanaza, Amlia, Adak, Seguam and possibly other islands, but were later eliminated to facilitate introduction of the Arctic Fox (Alopex lagopus), (Murie, 1959).

Currently red foxes are known to occur on Unimak, Akun, Akutan, Unalaska and Umnak islands. A small population may also occur on Seguam Island. No other information is currently available on their status on these islands.

FIGURE 3.

DISTRIBUTION – RED FOX



ARCTIC FOX

The arctic fox (Alopex lagopus) is an animal of the northern tundra. In Alaska this fox occurs in a narrow band along the marine coasts, on open tundra, rocky beaches and sea ice many miles from shore. The southern limit of its natural distribution is the northwestern shore of Bristol Bay. This species, however, has been widely transplanted for fox farming on many islands throughout the state, including the Pribilofs and Aleutians.

The arcitc fox feeds on a variety of material such as small mammals, including hares and microtine rodents (especially lemmings), birds, eggs, and a variety of carrion. Arctic foxes display extreme fluctuations in population densities with periodic peaks in fox populations occuring approximately every four years. These fluctuations correspond to forage availability especially with respect to densities of lemming populations. Foxes patrol the tide line on beaches in search of many forms of carrion. They also search out polar bear kills located far out on the pack ice. This fox is also a highly efficient predator on the eggs and young of waterfowl and seabirds.

The arctic fox breeds at one year of age, usually in March or April. It produces four to eight young per litter generally in May or June. Productivity however, is directly related to the abundance and availability of food resources. This species prefers to den in elevated well-drained soils with a deep active frost layer and high soil temperatures. These areas are considered prime breeding habitat for the arctic fox.

The harvest of arctic fox in Alaska is highly variable. The average annual harvest of arctic fox between 1912 and 1963 was 4,072 while

between 1968 and 1974 it averaged 2,369. Most arctic fox furs are sold outside of Alaska (Chesemore, 1967).

Unit 9

Arctic fox generally do not occur in Unit 9, although an occasional animal may be present in the northwestern portion of the unit.

Unit 10

It does not appear that the arctic fox ever occurred naturally in the Aleutian Islands except possibly in the Near Islands (the most westerly group) which possibly were colonized from the Commander Islands in the U.S.S.R. (Murie, 1959). The arctic fox however, has been introduced extensively throughout the Aleutians west of Umnak. These introductions were primarily for fur ranching. All the major islands and most of the smaller ones west of Umnak were inhabited by arctic foxes by the late 1940's. By the end of 1947 however, trapping activities had come to an end in the Aleutians.

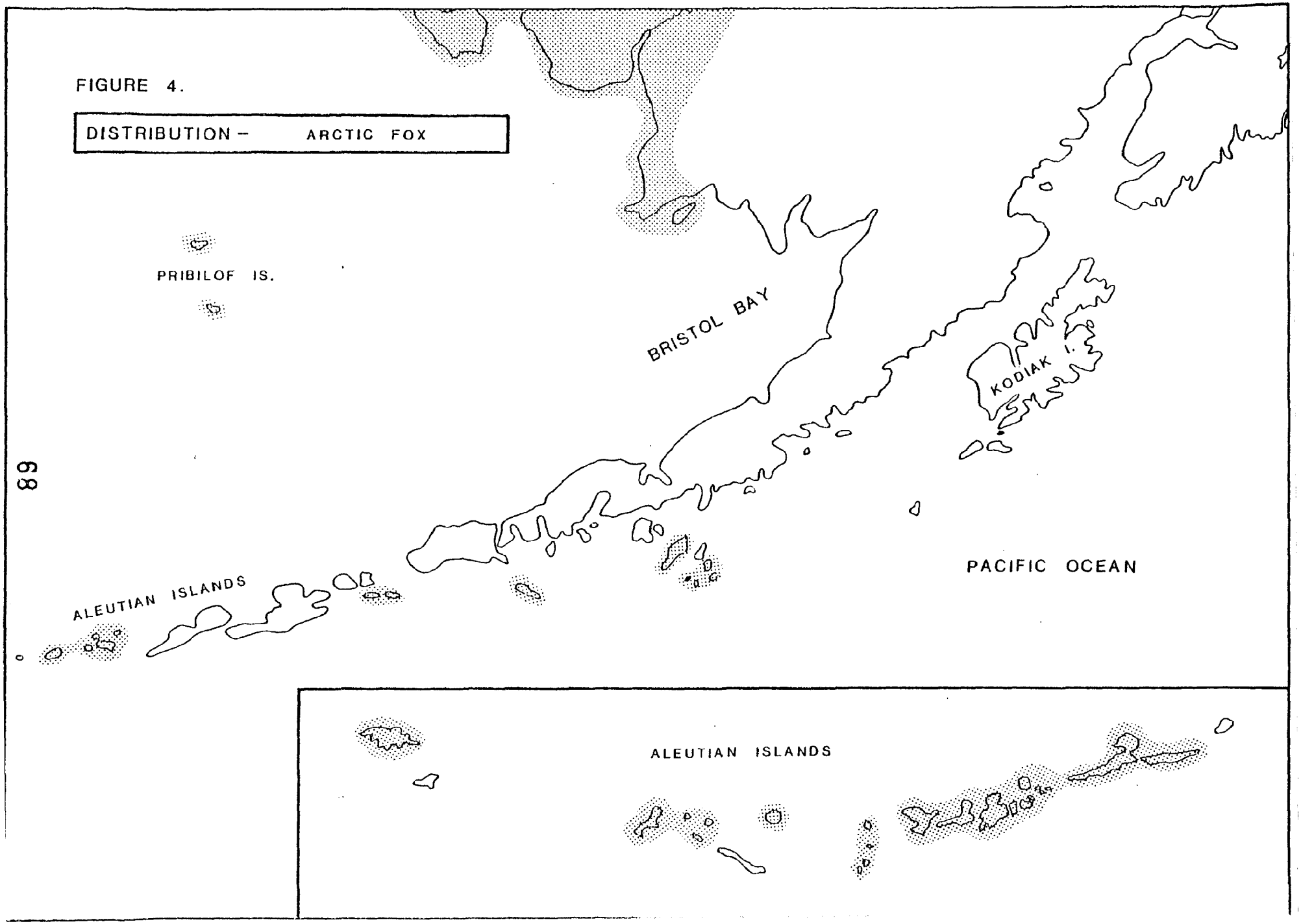
Because the fox was an efficient predator on nesting birds on these islands it was eliminated from Amchitka Island where the U.S. Fish and Wildlife Service was attempting to re-establish the Aleutian Canada goose. The blue color phase of the arctic fox predominates throughout its range in the Aleutians. The arctic fox is indigenous to the Pribilof Islands where it occurs on St. George, St. Paul and Otter Islands.

Unit 17

Arctic fox generally occur only in the southwestern portion of Unit 17. No other information is available on their status there.

FIGURE 4.

DISTRIBUTION – ARCTIC FOX



LYNX

The lynx (Lynx canadensis) is the only member of the cat family (Felidae) native to Alaska. Lynx occur throughout Alaska except for the Yukon and Kuskokwim Deltas, the southern portion of the Alaska Peninsula and coastal islands. They generally prefer climax forests with dense undercover where their primary prey, the snowshoe hare, occurs. A solitary animal, the lynx is usually nocturnal except during the long daylight periods of the Arctic summer.

Lynx generally breed during March or April. After approximately a 60 day gestation, usually one to four kittens are born in a den formed by a natural cavity. Productivity is closely related to prey density and thus is prone to fluctuation.

Lynx feed on a variety of small mammals and birds as well as carrion. Their primary prey however, is the snowshoe hare whose populations are prone to drastic fluctuations. Lynx populations also fluctuate in response to these changes in prey density. The lynx-hare cycle is well known by biologists and population highs can sometimes be predicted, usually every eight to ten years.

The lynx is regarded as a highly valuable fur bearer and is harvested throughout its range, primarily by trapping. Currently prime pelts may bring from $200 to $300 each.

Unit 9

Lynx occur in low numbers throughout most of Unit 9 north of Port Heiden. No additional information is currently available on their status in this unit.

Unit 17

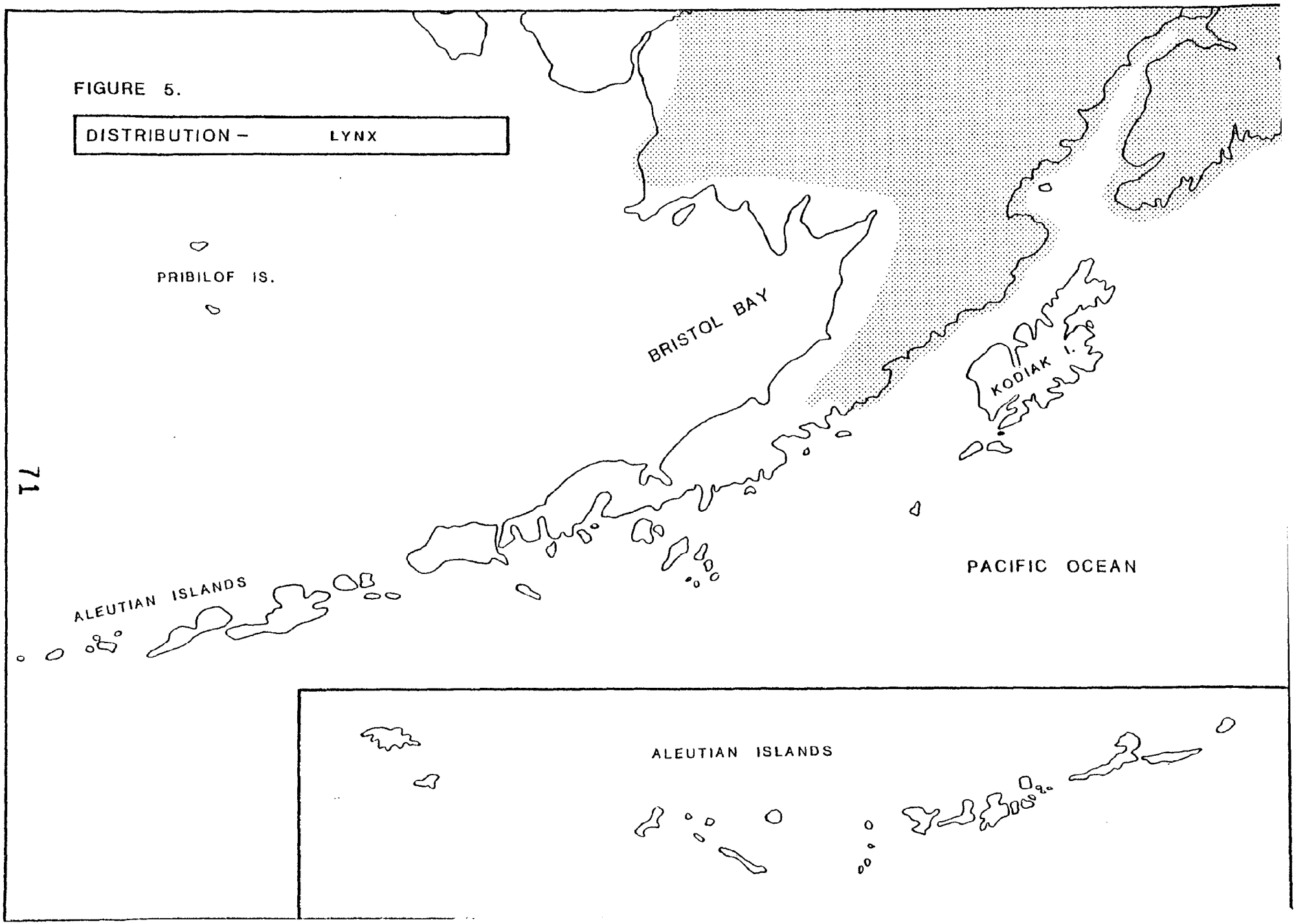
Lynx are present throughout most of Unit 17. No additional information is available.

Unit 10

Lynx do not occur in Unit 10.

FIGURE 5.

DISTRIBUTION – LYNX



WOLVERINE

The wolverine (Gulo luscus) is the largest North American land member of the weasel family (Mustelidae). They occur throughout northern North America in Canada, Alaska and a few northwestern states. In Alaska they occur throughout the mainland and on a few islands in southeasten. Wolverines inhabit forests and tundra from sea level into the mountains. Although they have a wide distribution throughout the state they are nowhere found in high densities.

Wolverines are omnivorous and eat a wide variety of material including small mammals and birds, fruits, berries, insect larvae and carrion. They generally breed during May through July. Following delayed implantation, parturition occurs from January through April. Kits, born in a den, usually number two to three.

The specific habitat requirements for the wolverine are unknown. They occur over a large area of diverse country where food is abundant. There is no evidence, however that wolverine predation adversely affects game populations or causes excessive economic loss. The wolverine is considered a valuable furbearer and a single hide is often worth $250.

Units 9 and 17

Wolverines occur through Units 9 and 17. Although these populations currently appear to be relatively abundant, specific population data and numbers are not available. In Unit 9 they are often seen along the Bering Sea beaches.

Harvest figures for these Units and Unit 10 are presented in Table 4. Since 1971 the annual harvest has averaged 69 animals in Unit 9 and 41 animals in Unit 17. This harvest has, in the past, been conducted primarily by trapping. Recently, however hunting has become more common. Most of this harvest is by local residents for the fur trade. Some additional animals are also taken for local domestic use such as for parka ruffs.

Nonconsumptive use in these units is low, primarily because wolverines are only infrequently observed. The only area set aside for nonconsumptive use is the Katmai National Monument in Unit 9.

Unit 10

Wolverines occur in Unit 10 only on Unimak Island. Their status there is currently unknown. Harvest pressure is very limited thus few animals are taken annually. Nonconsumptive use is minimal in this unit.

Table 4. Wolverine harvest Units 9, 10 and 17.

Date	Total Harvested Unit 9	Unit 10	Unit 17
62-63	14	*	8
63-64	34	*	70
64-65	39	*	7
65-66	40	*	27
66-67	63	*	31
67-68	43	*	35
68-69	10	*	24
69-70	5	*	*
70-71	*	*	*
71-72	46	0	21
72-73	71	0	45
73-74	89	2	22
74-75	72	0	78

* No data available.

Table 5. 1974-1975 Wolverine Harvest, Unit 9.

Month	Number	Percent	Month	Number	Percent
July	--	--	January	11	15.3
August	--	--	February	17	23.6
September	1	1.4	March	20	27.7
October	5	7.0	April	--	--
November	2	2.8	May	--	--
December	16	22.2	June	--	--
			Unknown	--	--
			TOTAL	72	100

Method of Take	Number	Percent
Ground Shooting	36	50
Trapping	36	50
Snaring	--	--
Other	--	--
TOTAL	72	100

Sex	Harvest
Males	48
Females	18
Unknown	6
TOTAL	72

Table 6. 1974-1975 Wolverine harvest, Unit 17.

Month	Number	Percent	Month	Number	Percent
July	--	--	January	5	6.4
August	--	--	February	31	39.6
September	2	2.5	March	28	36.1
October	--	--	April	4	5.1
November	1	1.3	May	--	--
December	7	9.0	Unknown	--	--
			TOTAL	78	100

Method of Take	Number	Percent
Ground Shooting	31	39.6
Trapping	46	59.1
Snaring	1	1.3
Other	--	--
TOTAL	78	100

Sex	Harvest
Males	50
Females	25
Unknown	3
TOTAL	78

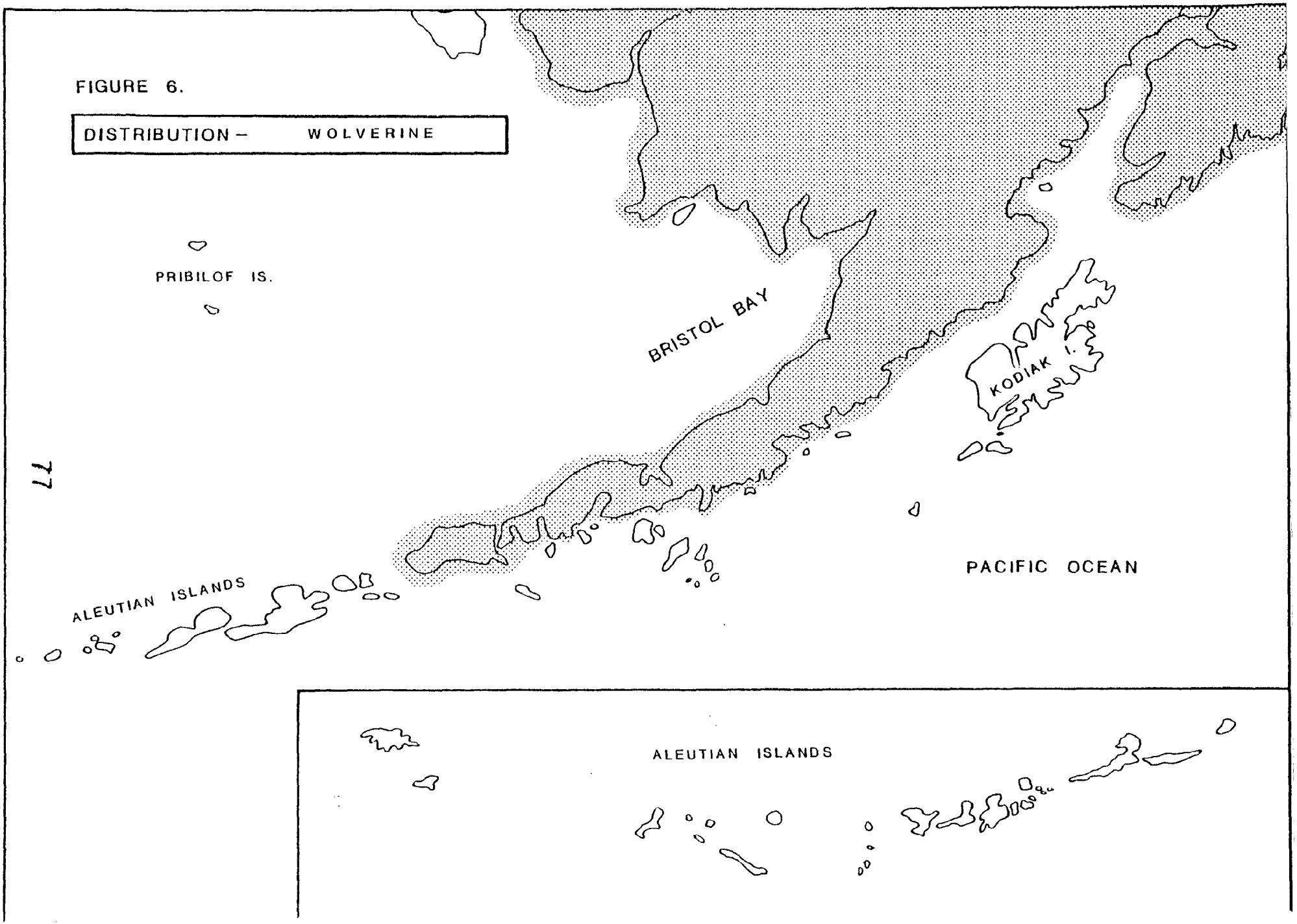


FIGURE 6.
DISTRIBUTION – WOLVERINE
PRIBILOF IS.
BRISTOL BAY
KODIAK I.
PACIFIC OCEAN
ALEUTIAN ISLANDS
ALEUTIAN ISLANDS

MARTEN

The marten (Martes americana) occurs throughout Alaska except for the Arctic Slope, Seward Peninsula, Yukon-Kuskokwim Delta and most of the Alaska Peninsula. The distribution of marten is limited primarily to climax spruce forests from sea level to timberline. This forest community therefore is the critical habitat element for this species. Marten may occur in limited numbers however, throughout the deciduous forests of the interior.

Marten food habits vary according to what food items are available. During the summer and fall berries constitute an important part of the diet. Throughout the year microtine rodents, red squirrels, hares, birds and carrion are taken relative to their abundance. On the coasts marten also forage along beaches.

Marten breed during the summer months. Parturition generally occurs in April, following a long gestation period of from 220 to 290 days (approximately five months of this period are the result of delayed implantation). Litter size ranges from two to four young which are usually born in a den located in a hollow tree or log. Sexual maturity is reached at about two years of age.

The marten is one of the most important furbearers in Alaska. Prior to 1973 the annual statewide harvest averaged 8,000 animals. Following an increase in fur prices however, trapping pressure increased substantially. Although trapping pressure often influences local marten densities, loss of habitat has a greater influence on overall numbers.

Unit 9

Marten are restricted primarily to the areas of Unit 9 where

climax spruce forests occur. Consequently, they are limited mainly to the northern portion of this unit and are not present on most of the Alaska Peninsula. No additional information is currently available on their status in Unit 9.

Unit 10

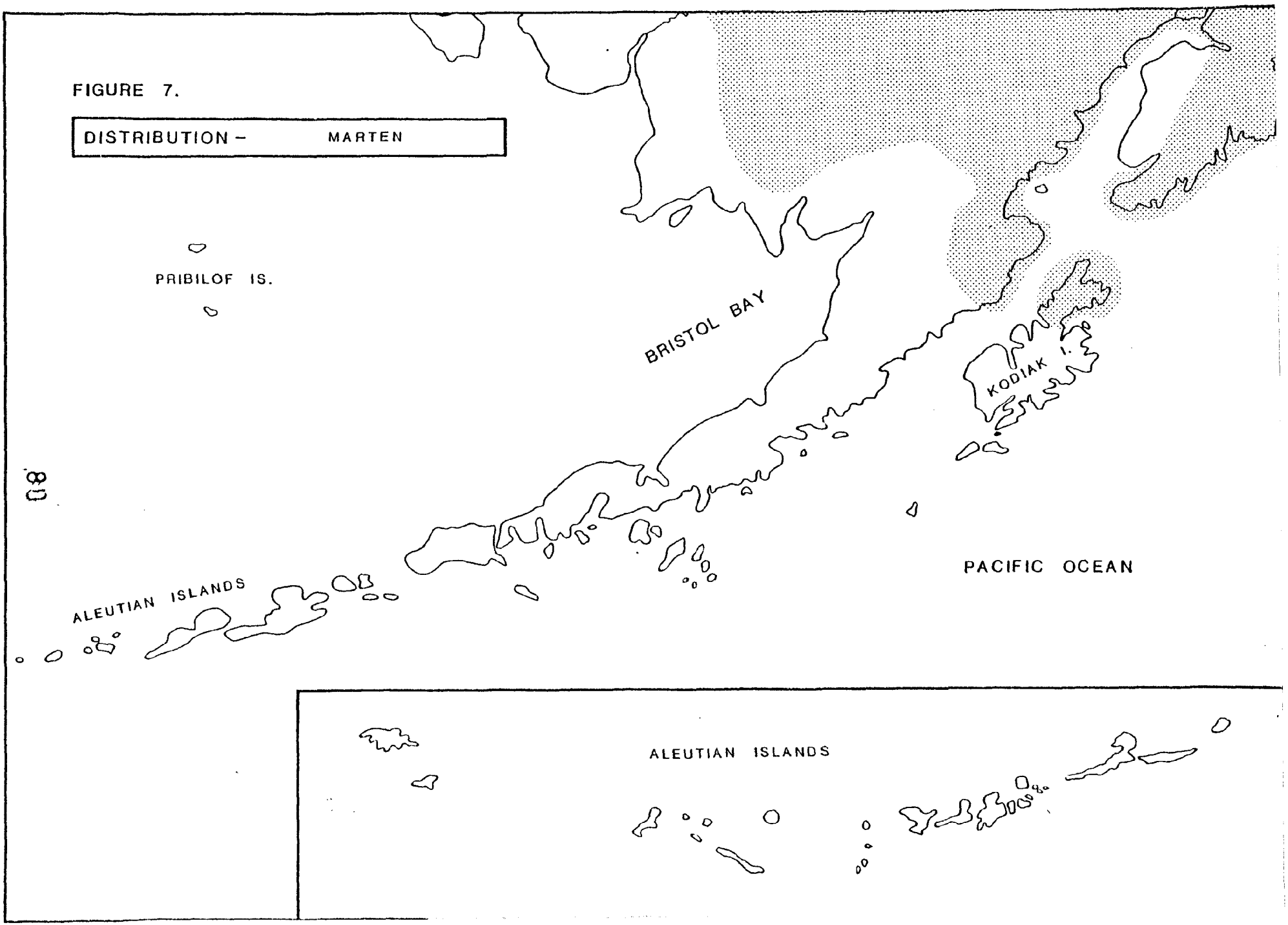
Marten do not occur in Unit 10.

Unit 17

Marten have been observed in the lower Mulchatna drainage. They probably occur throughout suitable habitat in the northern portion of Unit 17. No additional information is currently available on their status in Unit 17.

FIGURE 7.

DISTRIBUTION – MARTEN



MINK

The mink (Mustela vison), a member of the family Mustelidae, is one of the most important furbearers inhabiting Alaska. Mink occur throughout the entire state except for most of the Arctic slope, the offshore islands of the Bering Sea, the Aleutians west of Unimak and the Kodiak group. Preferred mink habitats include wetland areas associated with streams, ponds and marshes, and coastal beaches. However, during periods when microtine rodent and hare populations are abundant they often move inland in search of these prey species.

Mink utilize a wide variety of food resources which include fish, birds, eggs, small mammals and invertebrates. Of the small mammals, snowshoe hares, microtine rodents and muskrats are commonly consumed. Their diet varies both regionally and seasonally relative to prey availability.

In Alaska mink breed from March through late April. Some latitudinal variability in breeding occurs with southern populations generally breeding two weeks earlier than northern populations. Gestation varies from 40 to 75 days with an average of 51 days. This great variability is a result of delayed implantation which is characteristic of many of the mustelids. Parturition usually occurs during mid-June. The average litter is five with a range of from four to ten. This variability in litter size is related to prey density. Mink become reproductively mature at one year of age.

Mink are one of the most important furbearers in Alaska. They are harvested by trapping and provide a source of income and recreation for many Alaskans. In a single year the combined income generated from mink trapping exceeded one million dollars (Burns, 1968). The highest quality mink found in the state occur in the Yukon-Kuskokwim Delta.

Units 9 and 17

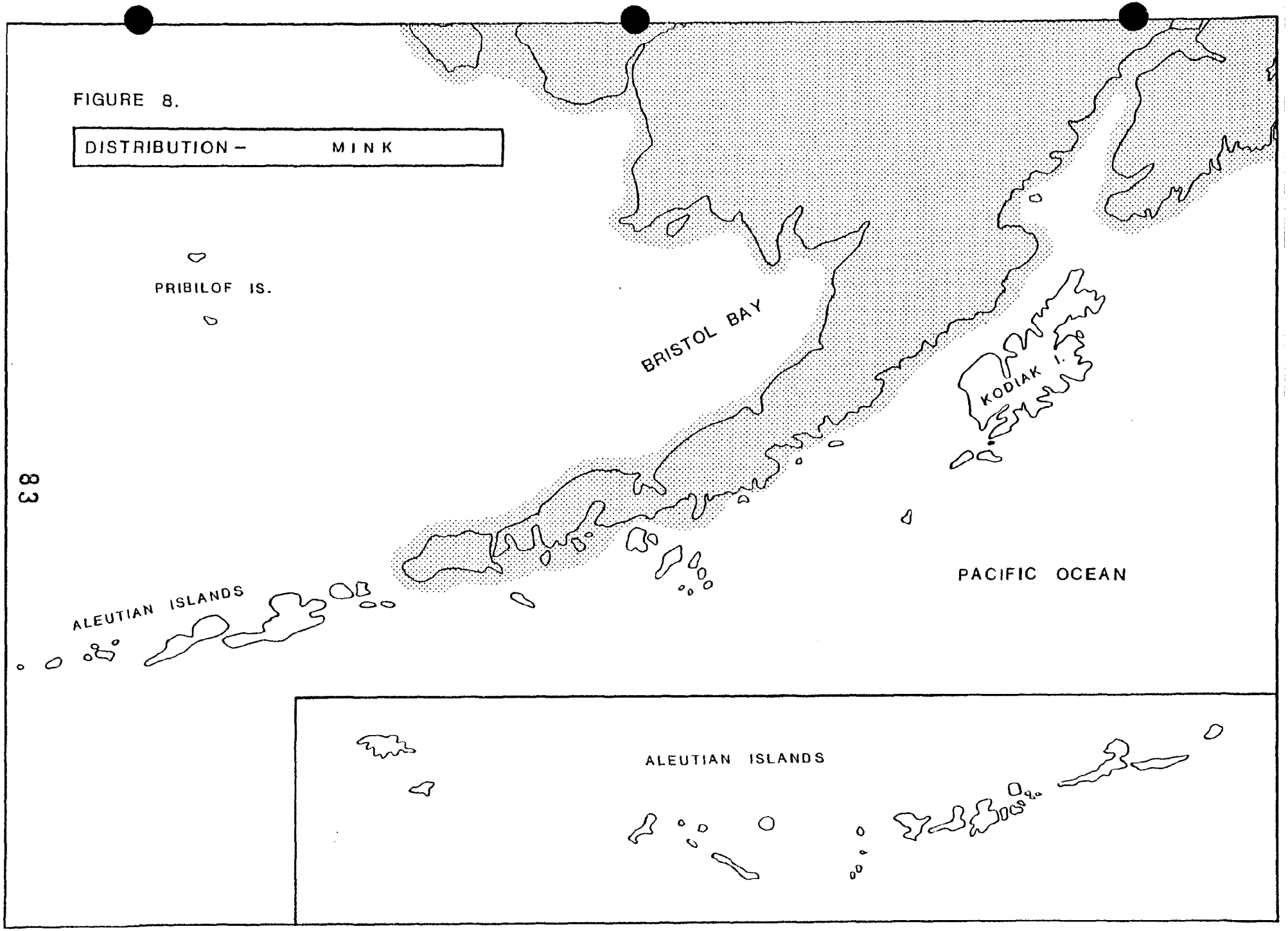
Mink occur throughout both Units 9 and 17. This species is harvested locally throughout its suitable habitat (refer to general account). No other information is available on the status of this species in either of these units.

Unit 10

Mink occur in Unit 10 only on Unimak Island where they are taken by trappers (Murie, 1959). No other information is available on the status of Unimak Island mink.

FIGURE 8.

DISTRIBUTION – MINK



SHORT-TAILED WEASEL

The short-tailed weasel or ermine (Mustela erminea) occurs throughout Alaska except for the offshore islands of the Bering Sea and the Aleutian Islands west of Unimak. Short-tailed weasels prefer forested or brushy areas in broken terrain. They occur however, throughout a wide range of habitats.

The primary prey of the short-tailed weasel includes microtine rodents, shrews and mice. Other prey items included in their diet consist of birds, eggs, young hares, pikas, insects and fish. Predators of this weasel include owls, hawks, falcons, lynx, fox, coyotes and mink.

Short-tailed weasels usually breed during their second summer. Parturition takes place during April or May, following a ten month gestation. Litter size usually ranges between four and eight young.

As a furbearer, the short-tailed weasel is not of major importance. It is usually taken incidental to the trapping of other furbearers. The value of the average pelt is generally worth less than $1.

Units 9 and 17

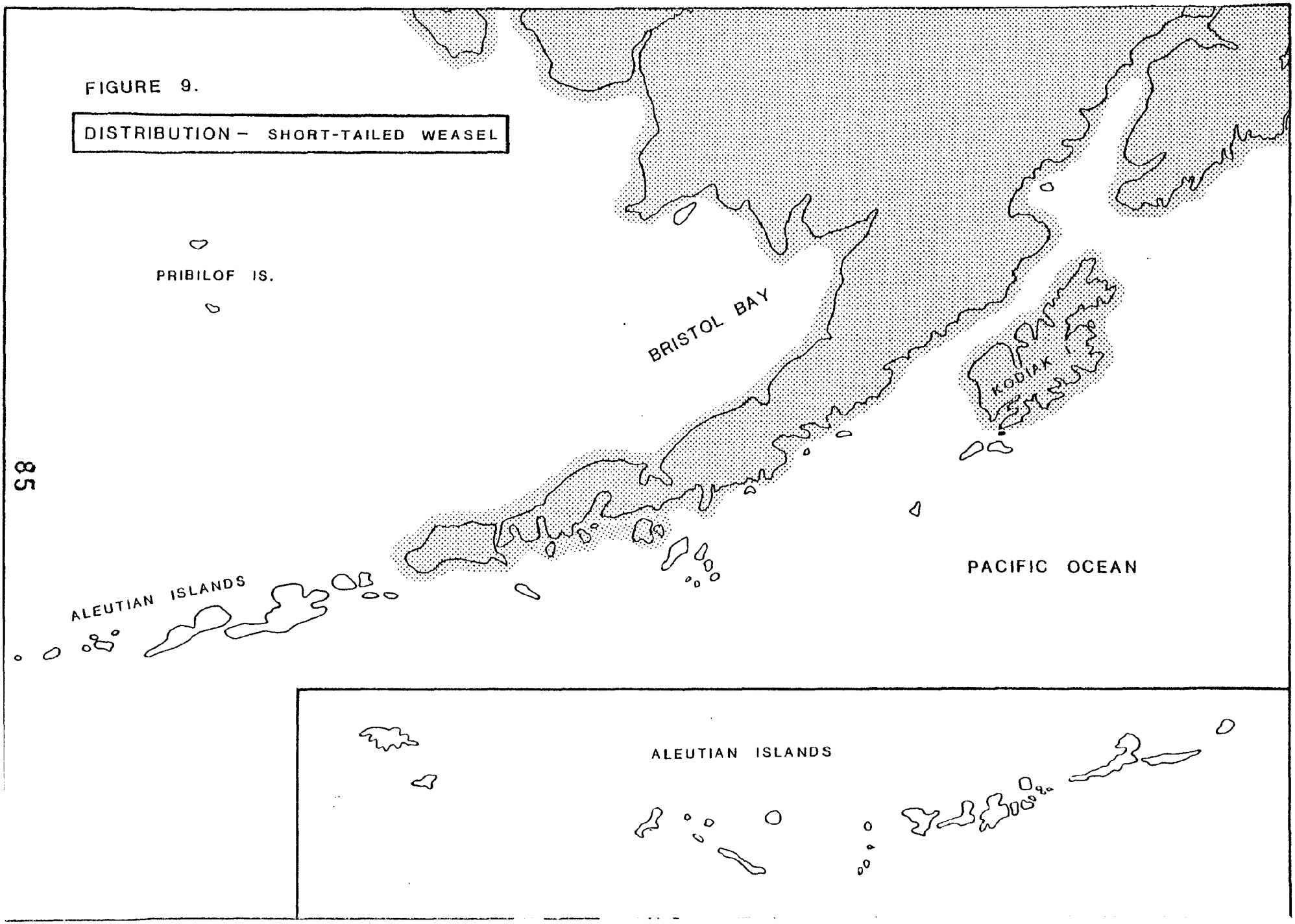
Short-tailed weasels are present in both Units 9 and 17. No other information is available on their status in these units.

Unit 10

Short-tailed weasels are present only on Unimak Island in Unit 10. No additional information is available.

FIGURE 9.

DISTRIBUTION – SHORT-TAILED WEASEL



LEAST WEASEL

The least weasel (Mustela rixosa) occurs throughout the state except in southeastern Alaska south of Glacier Bay, the southeastern corner of southcentral Alaska, the offshore islands of the Bering Sea, the Aleutians west of Unimak Island and the Kodiak Island area. This weasel is sparsely distributed throughout its range except along the Arctic Slope where it becomes abundant, especially during periods of high microtine rodent populations. Least weasels occur throughout a variety of habitats including forests and tundra.

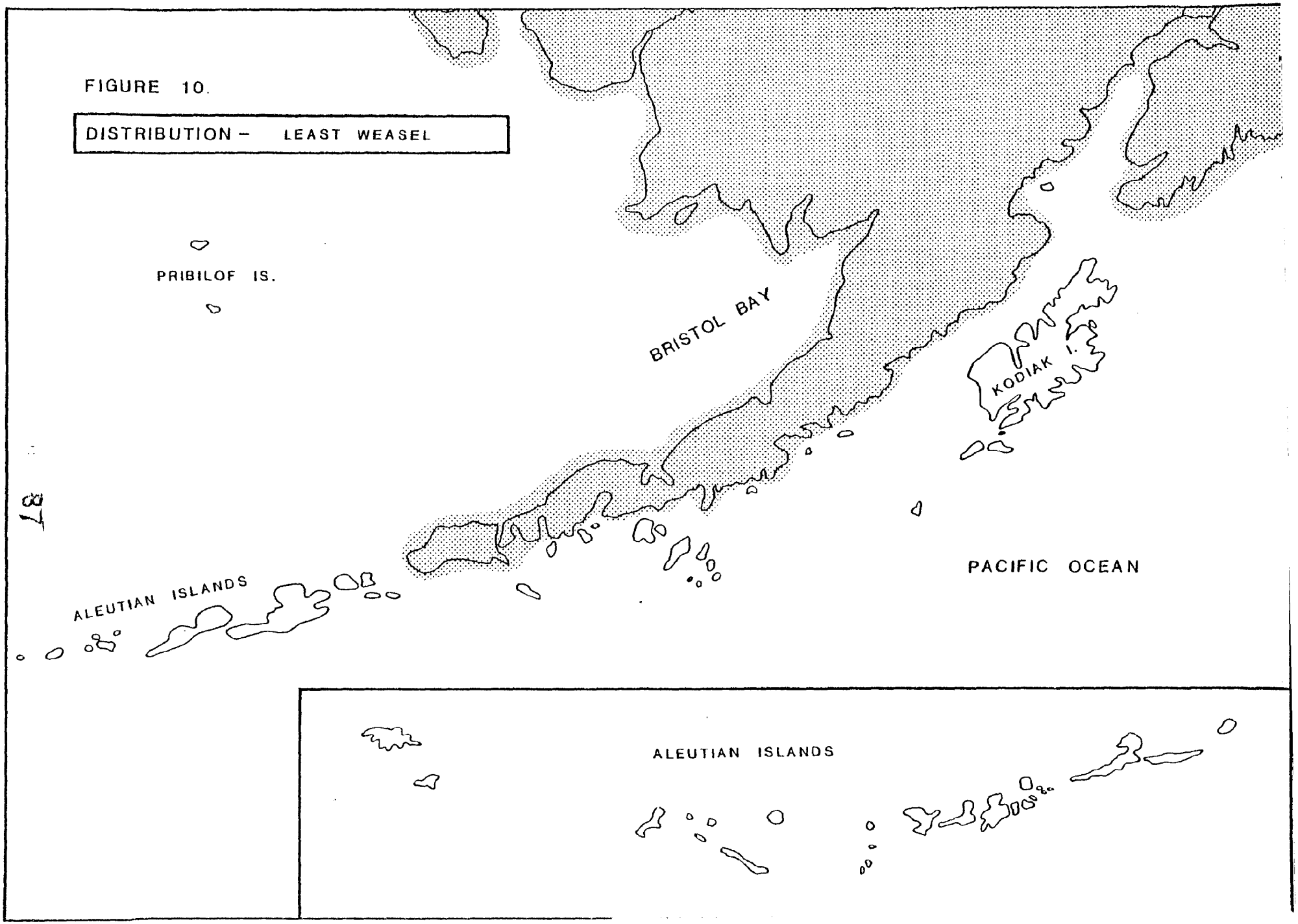
Least weasels prey primarily on mice and voles. They also feed on birds, insects and worms. Five young are usually born during the spring. Owls, hawks, and a variety of mammalian predators prey on the least weasel. Their population densities, however, are probably most influenced by prey abundance. Trapping of this species is minimal.

Units 9, 10 and 17

Least weasels occur in limited numbers throughout these units. In Unit 10 they occur only on Unimak Island. No other information is available on their status in these units.

FIGURE 10.

DISTRIBUTION – LEAST WEASEL



LAND OTTER

The land, or river, otter (Lutra canadensis) occurs in suitable habitat throughout Alaska except for most of the area north of the Brooks Range, the Aleutian Islands west of Unimak and the offshore islands of the Bering Sea. Preferred otter habitat includes areas associated with streams and rivers or coastal marine shorelines. Consequently, otter are most abundant statewide, in the Yukon-Kuskokwim River Deltas and in the southcentral and southeastern coastal regions. Throughout the coastal areas otter populations are relatively stable since food is usually abundant in these marine environments.

The food habits of land otters are varied. In the interior they prey on freshwater fishes, frogs, birds, small mammals and insects as well as consuming some plant material. On the coast however, their diet also includes a variety of marine invertebrates, such as shellfish and crustaceans, saltwater fishes and marine birds.

In Alaska land otters usually breed during May. Following a gestation period of between nine and thirteen months (like most mustelids, otters undergo delayed implantation), the young are born between February and June. One to six (an average of three) young are usually born in an underground den.

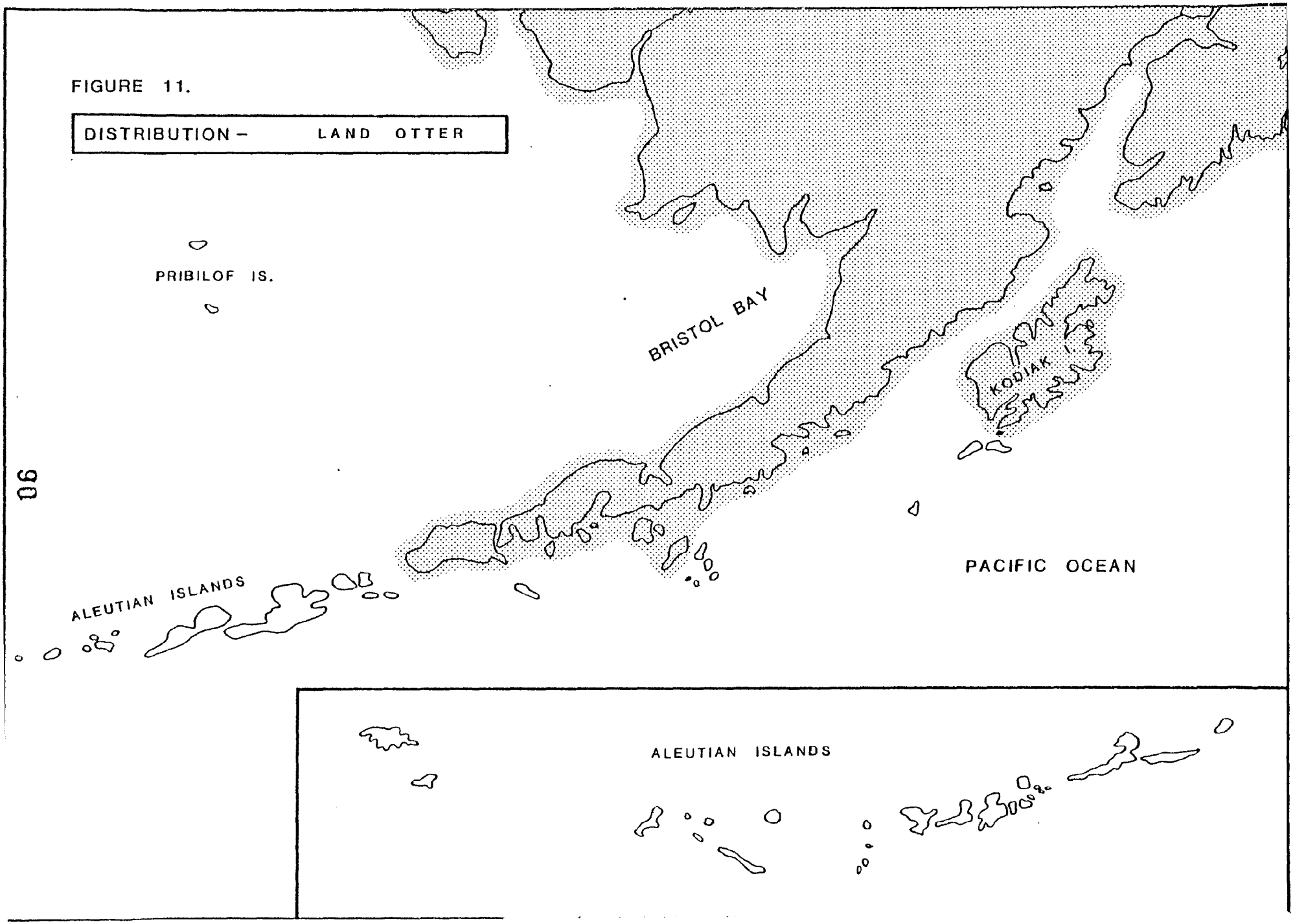
Land otters are trapped commerically in many parts of the state. Prime pelts are worth between $60 and $80 on the fur market. Most of the harvest is taken from the southeast, southcentral and Yukon-Kuskokwim Delta regions. Land otters are also an important nonconsumptive resource in terms of providing photography and viewing opportunities.

Units 9, 17 and 10

Land otter occur in suitable habitat throughout Units 9 and 17, and on Unimak Island in Unit 10. They occur in both freshwater lakes and streams and in saltwater along the shorelines. Along the coast they often swim some distance to the islands lying offshore. No other information is available on their status in these units.

FIGURE 11.

DISTRIBUTION – LAND OTTER



BEAVER

The beaver (Castor canadensis), a large aquatic rodent, is widely distributed over most of the North American Continent. Beaver occur throughout most of the state of Alaska south of the Brooks Range. They do not occur in the Aleutians, in the far western portion of either the Seward or Alaska Peninsulas and they only occasionally occur on the Kuskokwim Delta. Beaver occur from sea level up to 4,000 feet along slow moving rivers, streams and lakes where willow, aspen, birch, poplar and cottonwood are present.

Beaver consume a variety of vegetation including the leaves and bark of deciduous trees and shrubs as well as roots and stems of aquatic vegetation and sedges. Conifers are also used occasionally in some areas. During spring and early summer succulent plants are consumed while during fall and winter beaver are limited primarily to the bark of shrubs and trees. Beaver seem to prefer aspen although willow is probably the most important forage staple. Birch, cottonwood and poplar are also important forage species. Most beaver colonies collect a winter food supply during the fall. This food supply is usually placed in a winter storage pile anchored in the mud on the bottom of the pond near the beaver's lodge.

Beavers are well known for their construction of dams and lodges. These are usually built of mud and sticks on slow moving streams. Most of this activity occurs at night or during dawn and dusk. A beaver colony consisting of a pair of adults, young of the year and yearlings, generally occupies a single lodge. Not all beavers build winter lodges or dams, however. Some simply burrow into the banks of streams or

lakes.

Adult beaver breed from January through March. Their gestation period is believed to be around 100 days. Parturition occurs from late April to Late June. The average litter generally consists of four kits. During spring the two year old kits are driven from the colony. They soon disperse and generally form colonies of their own.

As one of the state's most valuable furbearers, beaver played an integral part in Alaska's history. Beaver pelts and castoreum were extensively exported during both the early Russian trade and later under U.S. Territorial status. Following American occupation beaver were harvested to the point that their populations declined to low levels and the taking of beaver was eventually prohibited in 1910. The season was opened in 1921 and more than 16,000 beaver were harvested before the season was again closed in 1922. The Alaska Game Commission reopened the season in 1926 with an annual limit of 20 beavers. From 1926 to 1929 about 60,000 beaver pelts were exported from Alaska. Since 1932 to the present, beaver seasons have been regulated according to the regional abundance of these animals. Although the value of beaver pelts has not risen at the same rate as other furs, beaver are still considered one of the states most important furbearers. Currently the average pelt is valued between $30 and $40. Since 1957 beaver pelts have been sealed and measured. This has provided annual harvest statistics as well as the age structure of the harvest. A harvest of over 20 percent kits in any given area generally reflects an overharvested population.

The nonconsumptive value of beaver, for viewing and photography, is relatively high throughout many areas of the state. Beaver are also valuable in that their dams create water impoundments which are often

beneficial to many other wildlife species.

Unit 9*

Beaver are abundant throughout the northern portion of Unit 9. They may occur in limited numbers down the Peninsula as far south as Port Moller. Except adjacent to villages, trapping pressure (primarily by local residents) is relatively light throughout this unit. In regions immediately adjacent to villages, especially in the Kvichak watershed, trapping pressure keeps populations relatively low. The 1974-75 harvest of beavers in Unit 9 was 439 animals. Recent harvest statistics for this unit are presented in Table 7. Critical beaver habitat includes those areas of willow and hardwood forests adjacent to lakes and slow moving streams. No other information is currently available on the status of beaver in this unit.

Unit 10*

Beaver do not occur in Unit 10.

Unit 17*

Historically the Nushagak-Mulchatna drainages in Unit 17 have been one of the major beaver producing areas in the state. While beaver populations are generally declining near villages throughout this unit, they have been increasing in areas which are more inaccessible to trapping pressure. In these more remote areas active beaver lodges are as much as five times as abundant as in areas near villages. Harvest data show that in areas close to villages over 35 percent of the take includes kits, while in more remote areas the harvest of kits averages 10 percent

Table 7. Beaver harvest statistics for Unit 9, 1969-1975.

Year	Limit	% Kits	% Kits & Yearlings	% Adults	Total No. Beaver	No. Trappers	Average No. Beaver/Trapper
1969	40 and 15*	23.4	34.4	66.0	148	17	8.7
1970	40 and 15*	19.6	34.2	65.8	419	37	11.3
1971	40 and 15*	26.4	42.7	57.3	246	25	9.8
1972	40 and 20*	21.3	36.0	64.0	337	27	12.5
1973	40 and 20*	19.7	35.4	64.6	726	57	12.7
1974	40 and 20*	23.8	42.0	57.0	439	35	12.5
1975	40 and 20*	22.2	33.6	66.4	451	43	10.5

* This unit was divided into two subdivisions with different bag limits.

or less. Beaver trapping in this unit is a traditional winter activity. Thus trapping generally occurs regardless of fluctuating fur prices. Recent harvest statistics for this unit are presented in Table 8. Currently the beaver season in the lower portion of Unit 17 is closed. This area is not expected to reopen until survey data indicate an increase in population density. Critical beaver habitat in this unit is similar to that described for Unit 9.

* Jim Faro, A.D.F.&G., Area Biologist, King Salmon, pers. comm.

Table 8. Beaver harvest statistics for Unit 17, 1960-1975.

Year	Limit	% Kits	% Kits & Yearlings	% Adults	Total No. Beaver	No. Trappers	Average No. Beaver/Trapper
1960	15	24.3	34.2	65.8	3,721	279	13.3
1961	15	23.1	24.7	65.2	2,849	230	12.3
1962	15	29.5	41.5	58.5	1,903	175	10.8
1963	15	23.3	36.8	63.2	2,172	189	11.5
1964	15	28.4	38.4	61.6	1,766	180	9.8
1965	15	22.1	34.9	65.1	957	97	9.9
1966	15	25.2	37.9	62.1	1,424	143	10.0
1967	15	25.3	37.0	63.0	2,711	215	12.6
1968	20	25.7	36.4	63.6	3,158	198	15.9
1969	No Harvest Reported				Est. 1,750	Est. 150	Est. 11.6
1970	15	22.6	34.1	65.9	1,190	48	10.1
1971	15	27.5	41.0	59.0	824	80	10.3
1972	15	20.5	34.0	66.0	762	70	10.9
1973	15	23.9	35.8	64.2	1,849	163	11.3
1974	15	23.9	36.6	63.4	1,681	169	9.9
1975	15	15.8	27.2	72.8	928	85	10.9

Table 9. Aerial beaver cache surveys, GMU 17, Bristol Bay, 1974 and 1975.

River	River Miles	Caches	1975 M/C	1974 M/C	% Change	1975 Time (Min.)	1974 Time (Min.)
Klutuk	47	34	1.38	2.5	-45%	24	25
Kokwok	30	24	1.25	.7	79%	26	36
Iowithla	62	48	1.29	1.72	-25%	38	40
Sunshine	25	17	1.47	1.14	29%	11	N.A.
Togiak	76	25	3.04	N.A.	N.A.	37	N.A.
Ongivinuk	32	25	1.28	1.03	24%	22	24
Harris	29	21	1.38	1.5	- 8%	12	20
Mosquito	29	46	.63	.66	- 5%	18	20
Mulchatna	52	101	.51	.44	16%	46	80
Stuyahok	40	43	.93	.63	48%	22	40

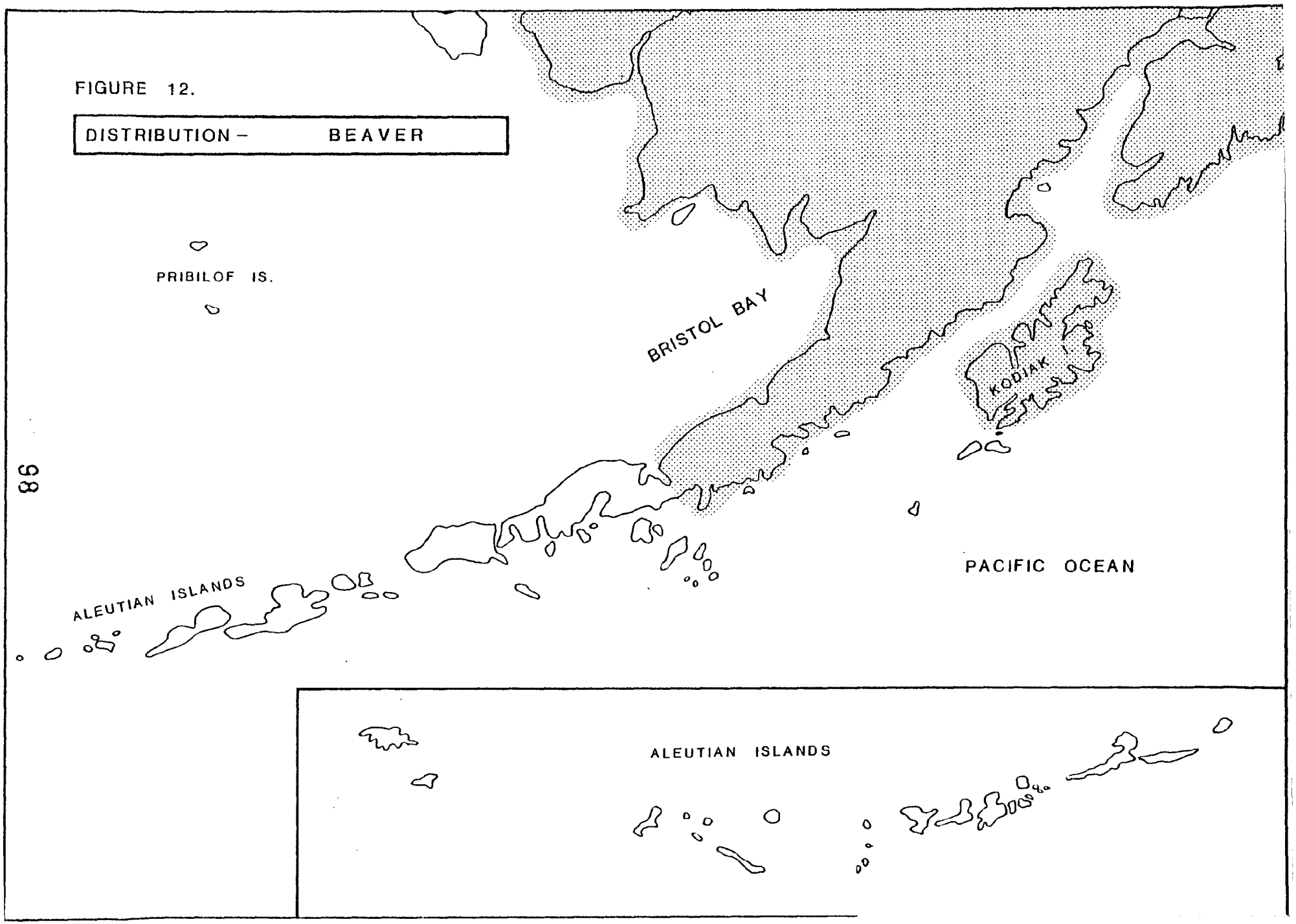
Average M/C 1975 = 1.32

Average M/C 1974 = 1.15

1975 = 15% increase in M/C

FIGURE 12.

DISTRIBUTION – BEAVER



MUSKRAT

Muskrats (Ondatra zibethicus) occur throughout most of the Alaskan mainland except the Arctic Slope north of the Brooks Range. They are relatively sparse however, throughout the southeastern portion of the state. Muskrats inhabit water associated areas bordering fresh and saltwater marshes, rivers, streams and lakes. However, they sometimes travel several miles from water.

Muskrats feed on a variety of material including sedges, aquatic plants, invertebrates and fish. They construct houses out of vegetation and sometimes nest in association with beavers. Muskrats begin breeding in March or April. Their gestation period is approximately thirty days. They usually produce two litters per year with an average of six young per litter.

High mortality is generally characteristic of most muskrat populations. The mink is the primary predator of the muskrat. In the interior, muskrat populations are also influenced by extreme winter temperatures which cause many lakes and ponds to freeze solid. For example, during winters when ice thickness of five feet or more are common, muskrat populations throughout the interior are substantially reduced.

The muskrat is an important furbearer in Alaska in terms of total numbers taken. Apporximately 40,000 are harvested annually, more than any other furbearer. Although the muskrat season begins in November and terminates in June, most animals are taken during the last six weeks of the season. Eighty percent of muskrats harvested in Alaska are taken by shooting with a .22 caliber rifle. Statewide only a small proportion of good muskrat habitat is hunted or trapped.

Unit 9

Muskrats are present in suitable habitat throughout Unit 9 west to the vicinity of Port Moller on the Alaska Peninsula. No other information is available on the status of muskrats in this unit.

Unit 10

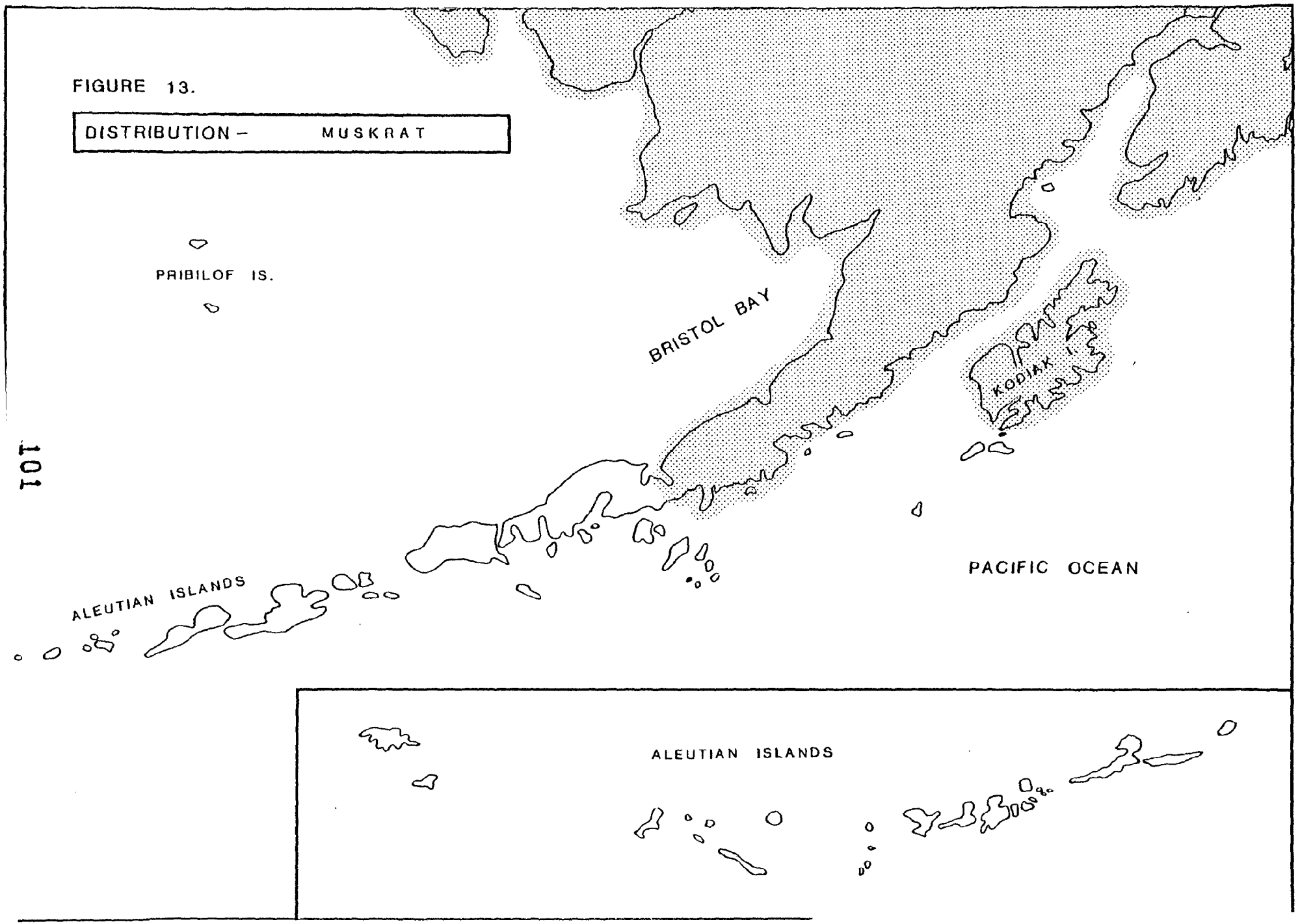
Muskrats do not occur in Unit 10.

Unit 17

Muskrats occur in suitable habitat throughout Unit 17 where they are moderately trapped for commercial use. No other information is currently available on their status in this unit.

FIGURE 13.

DISTRIBUTION – MUSKRAT



MARMOT

The hoary marmot (Marmota caligata) inhabits the mountainous regions of mainland Alaska. It prefers talus slopes bordering meadow vegetation, near or above timberline.

Marmots are herbivores. They consume a variety of green vegetation, including tender stems and leaves of grasses and forbs. Marmots breed shortly after they emerge from hibernation. Following a gestation period of approximately one month a single litter is produced which numbers three to eight young. During the summer they accumulate fat which enables them to enter their winter hibernation in a burrow under the snow. Their primary predators include golden eagles, coyotes, wolves and wolverines.

Although marmot fur is sometimes used locally for parka trim there is no commercial market for them. Where these animals are abundant they provide viewing and photographic opportunities for the wildlife observer.

Units 9 and 17

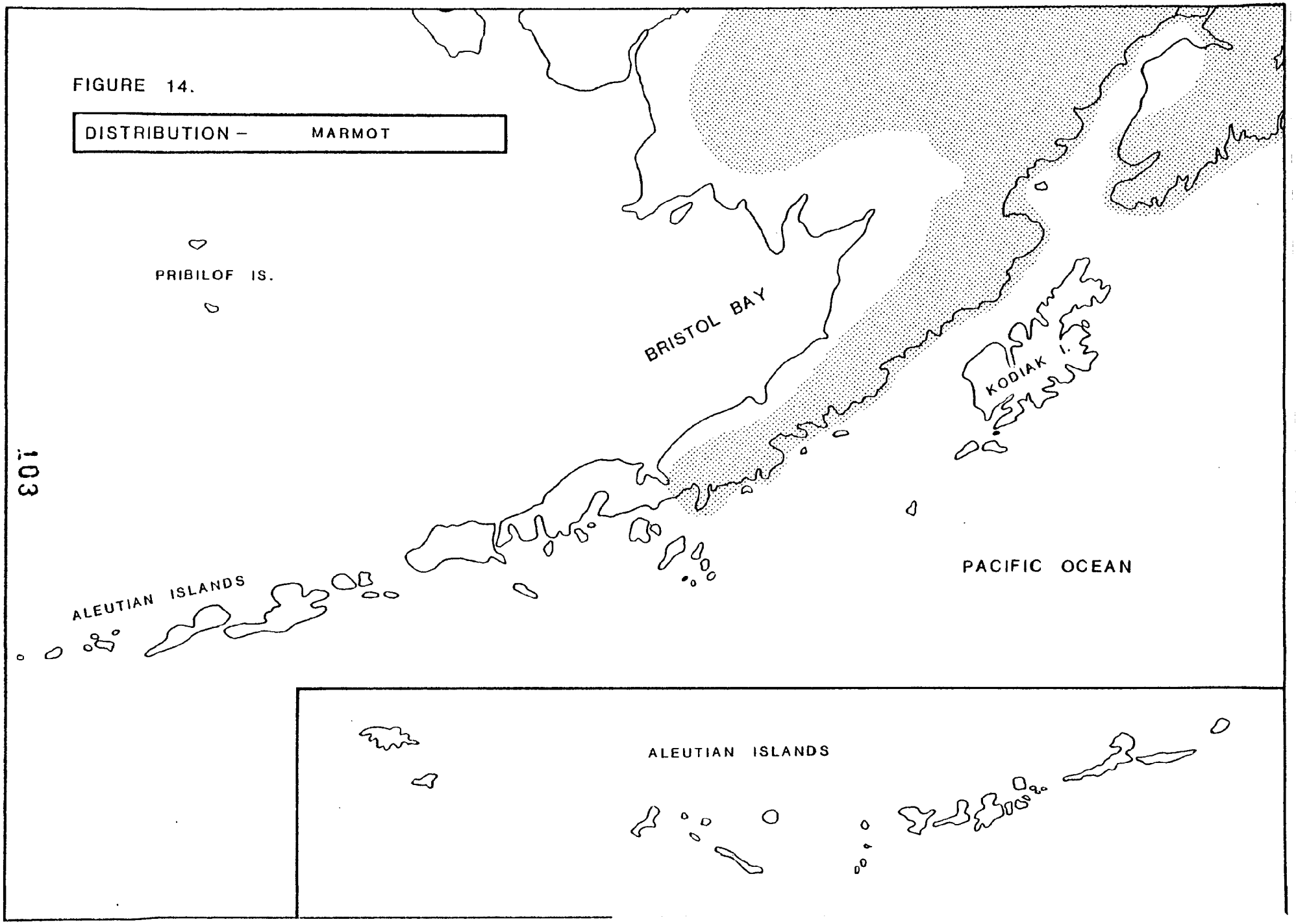
Marmots occur in the mountainous areas of Units 9 and 17. They are reported to occur as far west as Port Moller on the Alaska Peninsula (Howell, 1915). No other information is available on their status in these Units.

Unit 10

Marmots do not occur in Unit 10.

FIGURE 14.

DISTRIBUTION – MARMOT



ARCTIC GROUND SQUIRREL

Arctic ground squirrels (Spermophilus undulatus) occur throughout most of Alaska from sea level into the mountains. They are not present in southeastern Alaska, the Prince William Sound region or the Kenai Peninsula. They prefer open areas with vegetated well drained soils. Throughout such areas they occur in small to moderate sized colonies.

During the summer period ground squirrels forage on seeds, roots, plant stems and leaves, mice, insects and carrion. Throughout this period they store up large fat reserves which enable them to go into hibernation over the long arctic winter. They hibernate in underground burrows beneath the snow. In some regions hibernation may last up to seven or eight months. Following a 25 day gestation period, four to eight young are born, usually in June or July. Predators of the ground squirrel include grizzly bears, wolves, foxes, wolverines and raptors. Ground squirrels are sometimes used locally for meat and fur.

Units 9 and 17

Arctic ground squirrels are present in suitable habitat throughout Units 9 and 17. No other information is currently available on their status in these units.

Unit 10

Arctic ground squirrels are indigenous to Unimak Island. They have been introduced to Unalaska, Umnak, and Kavalga Islands. No other information is available on their status in this unit.

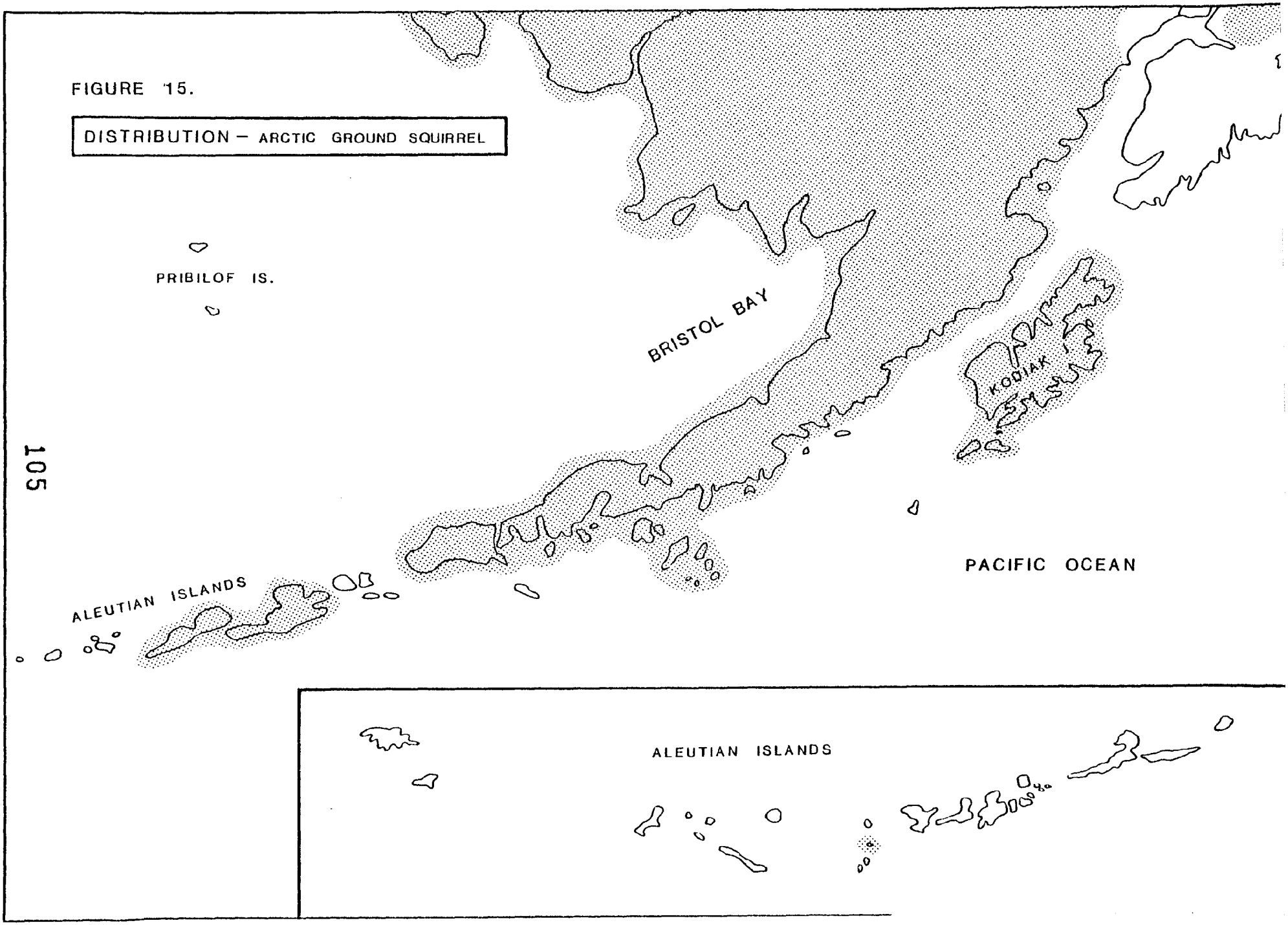


FIGURE 15.

DISTRIBUTION – ARCTIC GROUND SQUIRREL

RED SQUIRREL

Red squirrels (Tamiasciurus hudsonicus) inhabit most of forested Alaska, principally throughout the coniferous forests. They do not occur north of the Brooks Range, on most of the Seward Peninsula, the Yukon-Kuskokwim Delta or the lower portion of the Alaska Peninsula approximately south of the Naknek River.

Throughout most of interior Alaska the primary food item of the red squirrel is the seed of the white spruce. They also utilize seeds and leaf buds of other conifers and hardwood trees. Red squirrels produce one litter per year averaging four young per litter. Breeding usually occurs during late April or May with parturition occurring during late May or June. Predators include marten, fox and raptors. A few squirrels are hunted or trapped while others provide viewing and photography opportunities for the wildlife observer.

Units 9 and 17

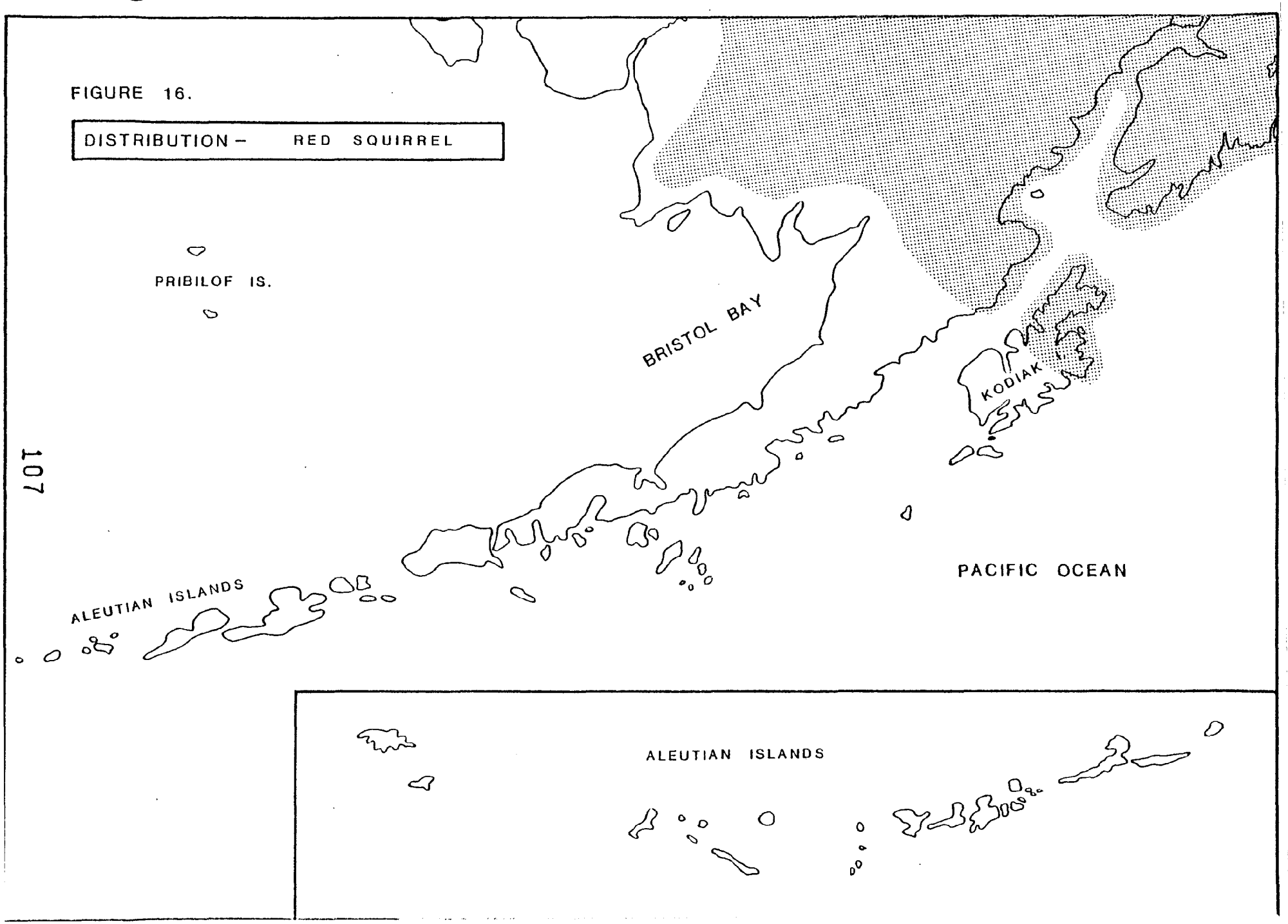
Red squirrels occur in suitable habitat throughout these units. No other information is available on their current status.

Unit 10

Red squirrels are not present in Unit 10.

FIGURE 16.

DISTRIBUTION – RED SQUIRREL



NORTHERN FLYING SQUIRREL

The northern flying squirrel (Glaucomys sabrinus) is a seldom observed nocturnal tree squirrel. It occurs throughout the boreal forests of Alaska, preferring open stands of mixed deciduous-coniferous forests. The range of this species in Alaska is poorly defined since it is so seldom observed.

Flying squirrels forage at night both in the trees and on the ground. Their diet includes arboreal lichens and buds, leaves, seeds, fruits and nuts as well as insects, birds and eggs when available. It also sometimes feeds on carrion.

Flying squirrels produce one litter per year which averages three young usually born in May. This squirrel is generally quite sociable and is often found together in small groups.

Although flying squirrels are often caught in marten traps they are of no value as a furbearer. Consequently many trappers consider them a nuisance.

Units 9 and 17

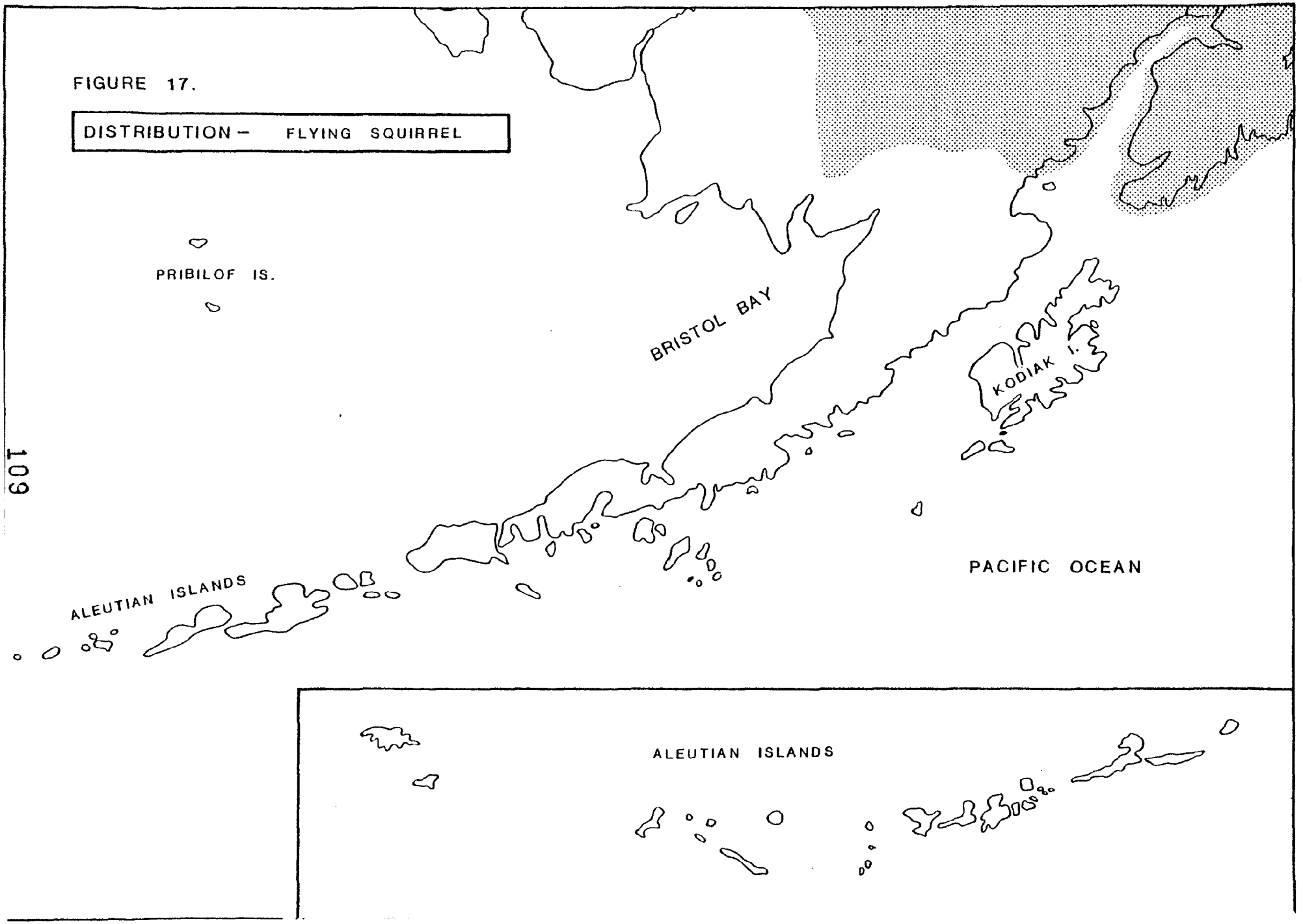
Flying squirrels probably occur throughout the forested areas in the northern portions of Units 9 and 17. No other information is available on the status of this species in these units.

Unit 10

Flying squirrels do not occur in Unit 10.

FIGURE 17.

DISTRIBUTION – FLYING SQUIRREL



PORCUPINE

Porcupines (Erthizon dorsatum) occur throughout most of the state of Alaska. They are absent or rare on the northern slope of the Brooks Range, the Seward Peninsula, the delta regions of the Yukon and Kuskokwim Rivers and most coastal islands. The porcupine is primarily a forest animal. In Alaska it inhabits both conifer and deciduous forests as well as willow thickets along water courses. It does, however, occasionally wander far from timbered areas.

Porcupines feed primarily on the cambium layer (inner bark) of spruce, birch and aspen during the winter. In summer their diet consists of a variety of green vegetation including the leaves, buds and twigs of forbs, shrubs and trees. Porcupines are solitary animals and are most active during nocturnal periods. They utilize natural cavities or depresssions for shelter and nesting. Porcupines generally breed during November. Following a sixteen week gestation period they produce a single young. Natural predators of the porcupine include wolves, coyotes, fox lynx and wolverines.

Units 9 and 17

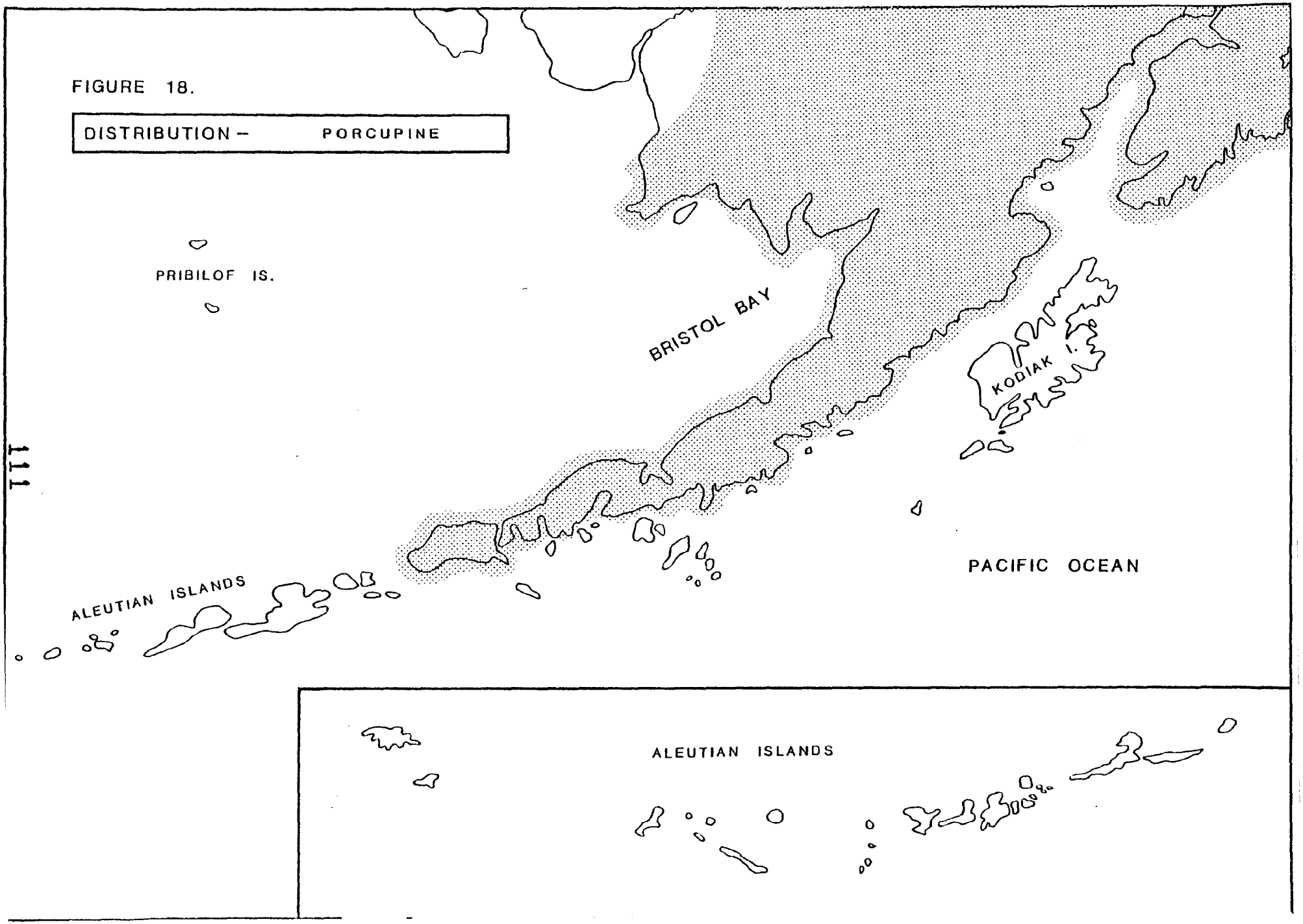
Porcupines occur throughout both Units 9 and 17. They inhabit the entire Alaska Peninsula where they are found far from timbered areas. No other information is available on their status in these units.

Unit 10

Porcupines do not occur in Unit 10 except (according to Manville and Young, 1965) on Unimak Island.

FIGURE 18.

DISTRIBUTION – PORCUPINE



SNOWSHOE HARE

Two species of hare occur in Alaska, the snowshoe hare and the tundra hare. The snowshoe or varying hare (Lepus americanus) is the most common and widespread of these species. It occurs in suitable habitat throughout the state. Snowshoe hares are absent from the lower portion of the Alaska Peninsula, the northern portion of the Arctic Coast and most islands. They are relatively sparse in the southeastern portion of the state. During population lows they are also rare north of the Brooks Range and in the tundra areas of the Seward Peninsula and in the lower Kuskokwim Delta.

Snowshoe hares inhabit a variety of habitat types including subalpine areas, brush lands, white spruce-birch communities, black spruce communities and riparian areas. Habitat types most preferred include riparian areas with an abundance of willow, and aspen and birch communities with brushy understories of willow, alder, highbush cranberry and wild rose. Disturbances such as fire or logging, which increase the abundance of brushy understory species providing cover, usually enhance snowshoe hare habitat.

Snowshoe hares feed on succulent grasses, buds, twigs, and leaves during the summer. During winter they consume the twigs and needles of spruce and the bark and buds of many hardwood species. Hares are generally nocturnal, but forage most actively during dawn and dusk periods. During years when hare populations are high they often cause extensive range damage by girdling the bark of willows and other browse species. This range deterioration often affects the range conditions for other species such as moose and deer.

The snowshoe hare generally has two or sometimes three litters per year. It breeds for the first time at about one year of age and has a gestation period of approximately 36 days. The first litter, usually averaging four young is born around the middle of May. Females breed shortly after the birth of a litter. The young are usually born on the surface of the ground in an unlined natural depression usually concealed by vegetative cover. Hares, in contrast to rabbits, are fully furred at birth with eyes open.

The snowshoe hare is a cyclic species. Population peaks usually occur approximately every ten years. During these peaks population densities sometimes average over 2,000 hares per square mile. Local hare abundance however, may sometimes vary substantially from the general pattern over a larger geographical area. When populations are high snowshoe hares are often found occuring in marginal habitat where none occurred during population lows.

Snowshoe hares are an important food resource for many furbearers. They are the primary prey of the lynx whose populations fluctuate in response to the hare cycle. Hares are also prey for red fox, mink, weasels and great horned owls.

Although snowshoe hares are of little commercial value, during population highs they constitute an important resource for sport hunting and for subsistence use. Most sport hunting occurs during the fall and winter months. This pressure is usually concentrated along road systems near villages and towns. Such harvests however, do not appear to substantially affect overall hare populations.

Unit 9

Snowshoe hares occur throughout suitable habitat in the upper

portion of Unit 9. They probably do not range far from the timberline any where in this unit. No other information is currently available on the status of the snowshoe hare in Unit 9.

Unit 10

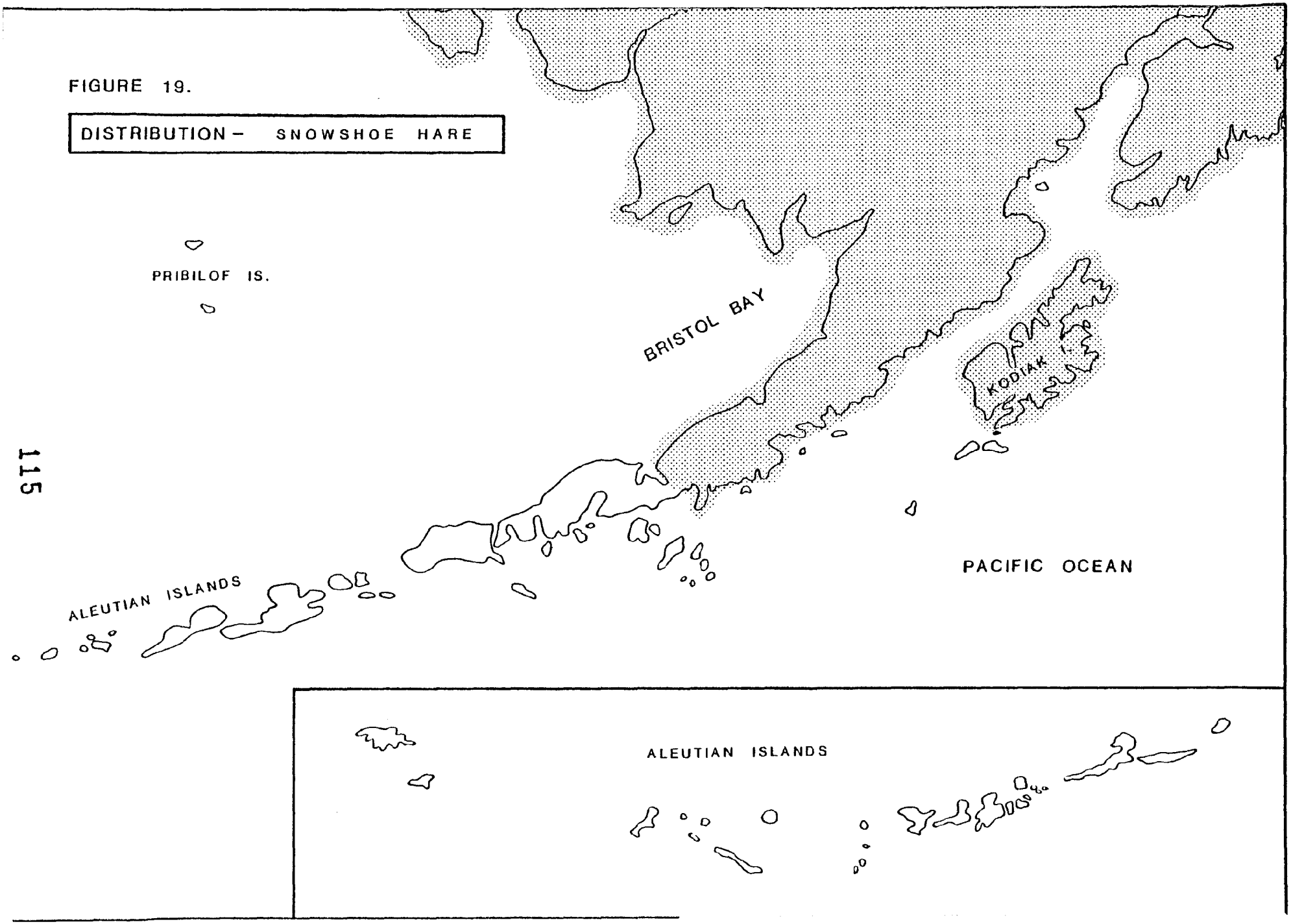
Snowshoe hares do not occur in Unit 10.

Unit 17

Snowshoe hares are present in suitable habitat throughout Unit 17. Specimens have been collected at Nushagak, Lake Aleknaguk, Ekuuk, and Kakwok River. As in Unit 9, they probably do not range far from timber. No other information is available on their status in this unit.

FIGURE 19.

DISTRIBUTION – SNOWSHOE HARE



TUNDRA HARE

The tundra hare (Lepus othus) is the less common of the two hare species which occur in Alaska. It is distributed over most of the western coast of Alaska including the Alaska and Seward Peninsulas (Anderson, 1974). It may also occur in limited numbers along the western Arctic Coast and the northwestern slope of the Brooks range. The primary habitat of the tundra hare consists of windswept rocky slopes and upland tundra. Tundra hares usually avoid wooded areas and bottomlands. Although they are often abundant in the western coastal portion of their range, periodic fluctuation in their population numbers occur similar to the snowshoe hare.

The tundra hare has been relatively unstudied. Thus little information is available on its status in Alaska. Tundra hare appear to feed primarily on low growing tundra shrubs, the most important being willow. According to Anderson (1974) parturition in this species generally coincides with the disappearance of snow cover, usually in May. The tundra hare produces only one litter per year, usually numbering six to seven young. The primary predators of tundra hares include the red fox, golden eagle, snowy owl and arctic fox (Anderson, 1974).

The tundra hare is harvested locally by residents for meat and secondarily for the fur. Although the pelts are not commercially valuable, the fur is used locally for mittens and children's garments. Harvest of this hare is by herding and killing with clubs or by gun or snare. The statewide harvest is unknown.

Units 9 and 17

Tundra hares occur in suitable habitat through both Units 9 and 17.

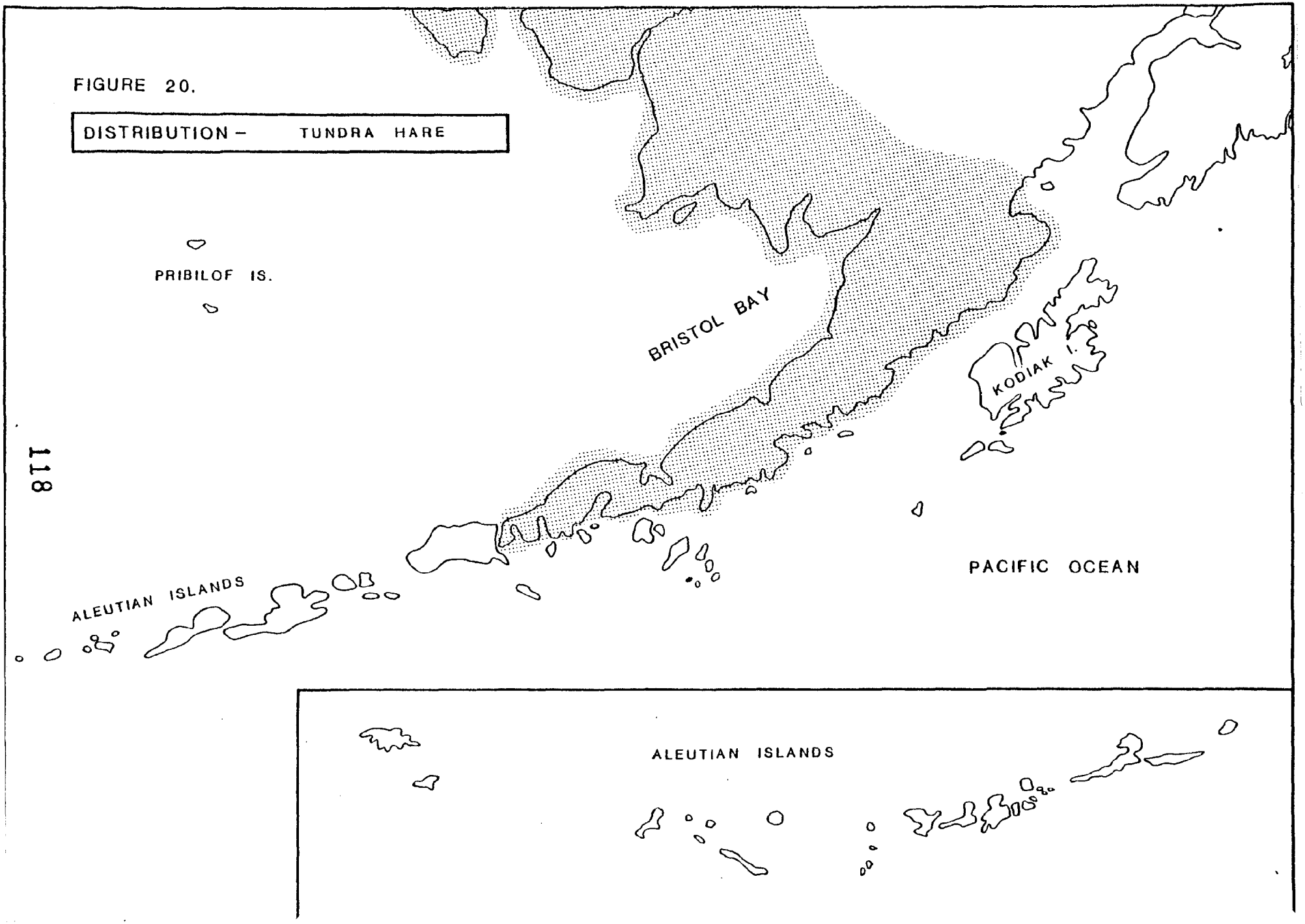
Murie (1959) reported observing tundra hares inhabiting alder thickets in this region. No further information is available on their status in these units.

Unit 10

Tundra hares do not occur in Unit 10 except possibly (according to Manville and Young, 1965) on Unimak Island.

FIGURE 20.

DISTRIBUTION – TUNDRA HARE



WILLOW PTARMIGAN

Willow ptarmigan (Lagopus lagopus) are the most widely distributed species of ptarmigan in Alaska. They occur in suitable habitat throughout most of the state. They are absent from several coastal islands, the broad forested valleys of the interior and the dense forests of southeastern Alaska. Willow ptarmigan breed close to timberline often partially within the fringe of the coniferous forest woodland, along stream courses and in riparian shrub communities, usually between 2,000 and 2,800 feet elevation (Jerry McGowan, A.D.F.&G., Game Biologist, Fairbanks, pers. comm.). This species prefers wetter habitats than either the rock or white-tailed ptarmigan. Tall shrubs also appear to be an important feature of good willow ptarmigan habitat.

The primary food of the willow ptarmigan consists of willows. During the summer they forage primarily on leaves of willow shrubs. Throughout the winter the buds, twigs and catkins of willow provide over four-fifths of their diet. Other items consumed during the year consist of invertebrates, berries and the flowers and shoots of many herbaceous plants.

During April male ptarmigan establish and defend a breeding territory. Females arrive later and select a mating area and mate. By late May or early June they have laid their first eggs. Eggs begin to hatch in late June or early July. Male willow ptarmigan, unlike the other two species of ptarmigan, remain with the female to help care for the young. By late summer ptarmigan families group together to form large flocks. By October the sexes separate as the females move to lower elevations and the males remain near their breeding range. The sexes remain

segregated throughout winter until the following breeding season.

Willow ptarmigan populations are characterized by marked fluctuation in population densities with seven to nine years between peaks. Although these patterns may be evident over a large geographical area, local population densities often vary from the general pattern.

Willow ptarmigan are harvested more heavily than either of the other two ptarmigan species. Sport hunting, which is mainly confined to the areas around major cities and road systems, generally accounts for fewer birds than does the subsistence harvest. The total harvest is greatly influenced by the local density of birds and the abundance of alternative game.

Units 9 and 17

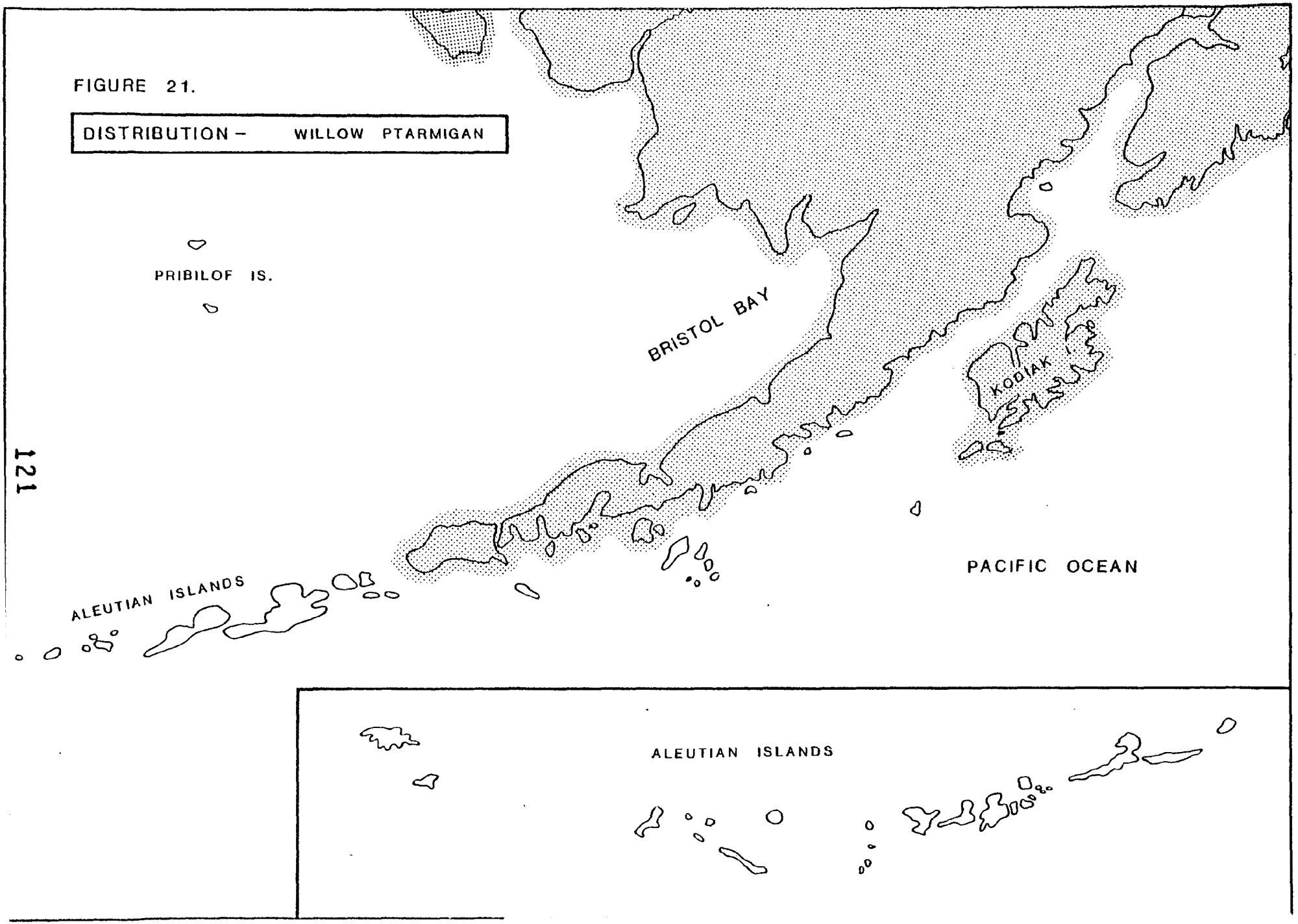
Willow ptarmigan are present in suitable habitat throughout Units 9 and 17, particularly in lower elevations and the area extending north and east of Lake Clark. Population highs occurred during the early 1960's and mid 1970's. These birds are harvested by local residents for recreation and subsistence.

Unit 10

Willow ptarmigan are present in Unit 10 only on Unimak Island. No other information is available on their current status there.

FIGURE 21.

DISTRIBUTION – WILLOW PTARMIGAN



ROCK PTARMIGAN

Rock ptarmigan (Lagopus mutus), although not as widely distributed as willow ptarmigan, occur over much of the state. They do not occur on the northern Arctic Slope, the offshore islands of the Bering Sea, the Yukon-Kuskokwim Delta, the forested interior valleys, the central portion of the Alaska Peninsula or the islands of southeastern Alaska. Their preferred breeding habitat is the mountainous tundra area, with scattered shrubs and herbaceous vegetation, from timberline to approximately 3,500 feet elevation (Jerry McGowan, A.D.F.&G., Game Biologist, Fairbanks, pers. comm.). Although the range of this species sometimes adjoins that of the willow ptarmigan it generally occurs in higher elevations which are usually drier and rockier.

During fall, winter and spring rock ptarmigan feed almost exclusively on the buds and catkins of dwarf birch. Throughout summer a variety of green herbaceous vegetation, insects, berries and seeds make up most of their diet. During April males select and defend a breeding territory. Females arrive later and begin laying their eggs during late May and early June. By late June and early July the eggs begin to hatch. Once incubation is in progress most males move toward the higher ridge tops. By late August females and chicks also move to higher elevations where they join the males in large flocks. During late September females move down to lower elevations near the forest edge while males remain on the breeding range throughout the winter. At this time flocks of each sex move in search of food in a nomadic fashion.

Like the willow ptarmigan, rock ptarmigan populations display periodic fluctuations in numbers. Human harvest of rock ptarmigan is generally lighter than for willow ptarmigan. Hunting pressure is

relative to population density.

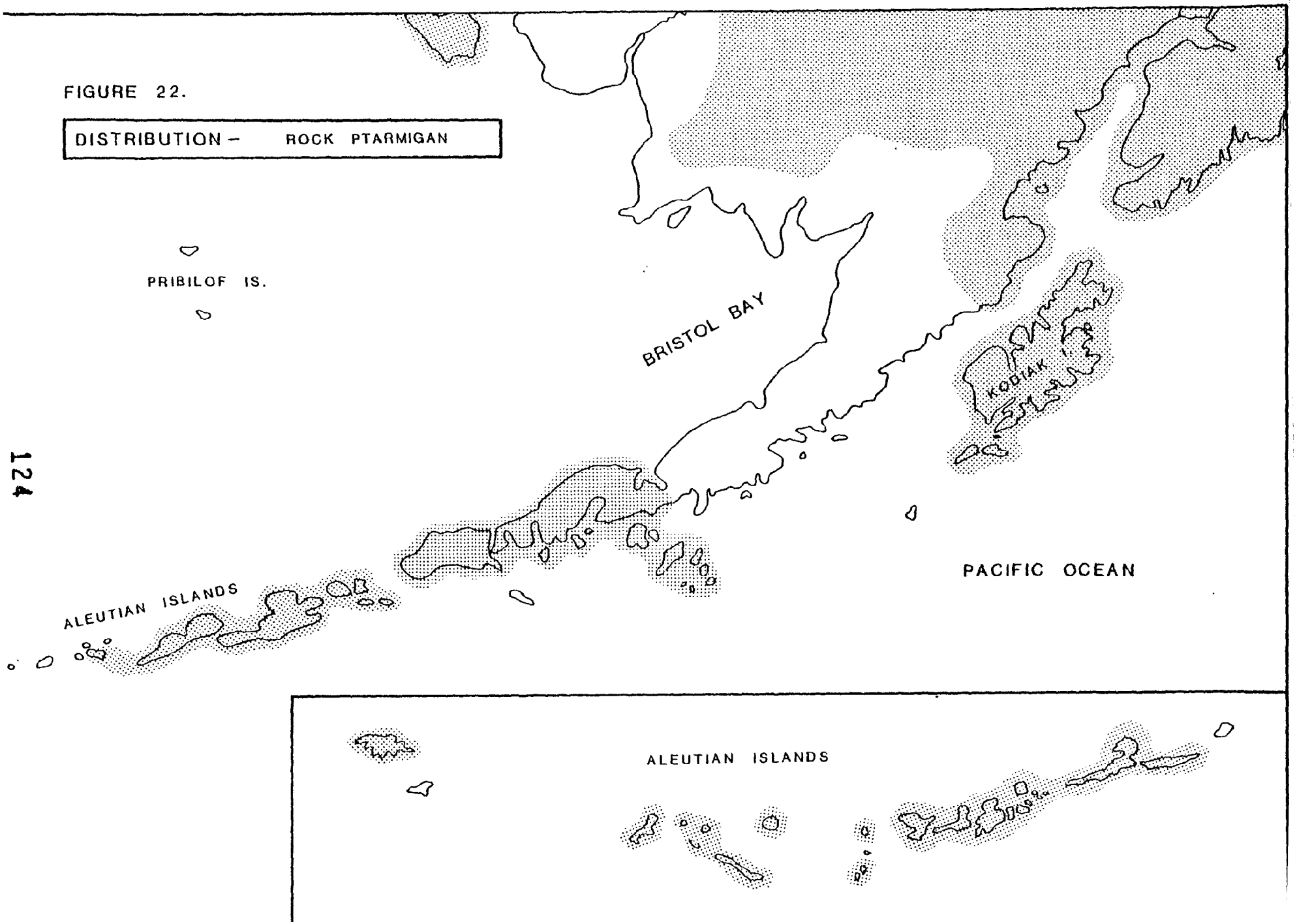
Units 9, 10 and 17

The distribution of rock ptarmigan in Unit 9 is limited to the mountainous northern region primarily along the Aleutian Range north of Becharof Lake. They also occur however, on the lower portion of the Alaska Peninsula in Unit 9, west of Port Moller. In Unit 17 they are limited to the higher elevations primarily in the northern portion. Rock ptarmigan occur on most of the major islands in the Aleutians from Unimak to Attu.

Abundance indices indicate peaks in numbers during the early 1960's and mid 1970's. The birds are used by local residents for recreation and subsistence throughout these units.

FIGURE 22.

DISTRIBUTION – ROCK PTARMIGAN



WHITE-TAILED PTARMIGAN

Of the three species of ptarmigan, the white-tailed ptarmigan (Lagopus leucurus) has the most limited distribution in the state. It occurs primarily in the mountains of southcentral and southeastern Alaska. They inhabit rugged, sparsely vegetated areas above timberline from 3,500 feet to over 5,000 feet (Jerry McGowan, A.D.F.&G., Game Biologist, Fairbanks, pers. comm.).

White-tailed ptarmigan forage on a wider variety of plants than do the other two species. During the summer they feed on insects and the tender leaves, buds and flowers of alpine plants. In fall they consume seeds and berries while during winter the diet changes to buds and twigs.

The reproductive biology of the white-tail is similar to the other two species of ptarmigan. Breeding behavior begins in April and eggs are hatched by July. This species is not as migratory or nomadic as are the other two species of ptarmigan. Their populations are also not as prone to drastic fluctuations in numbers as are either the willow or rock ptarmigan.

Because these birds are more inaccessible, less information is available on their biology. Also because of this inaccessibility they sustain a much lower harvest than do willow or rock ptarmigan.

Unit 9 and 17

White-tailed ptarmigan occur only in the moutainous regions in the northern portions of Units 9 and 17. The southern limit of their

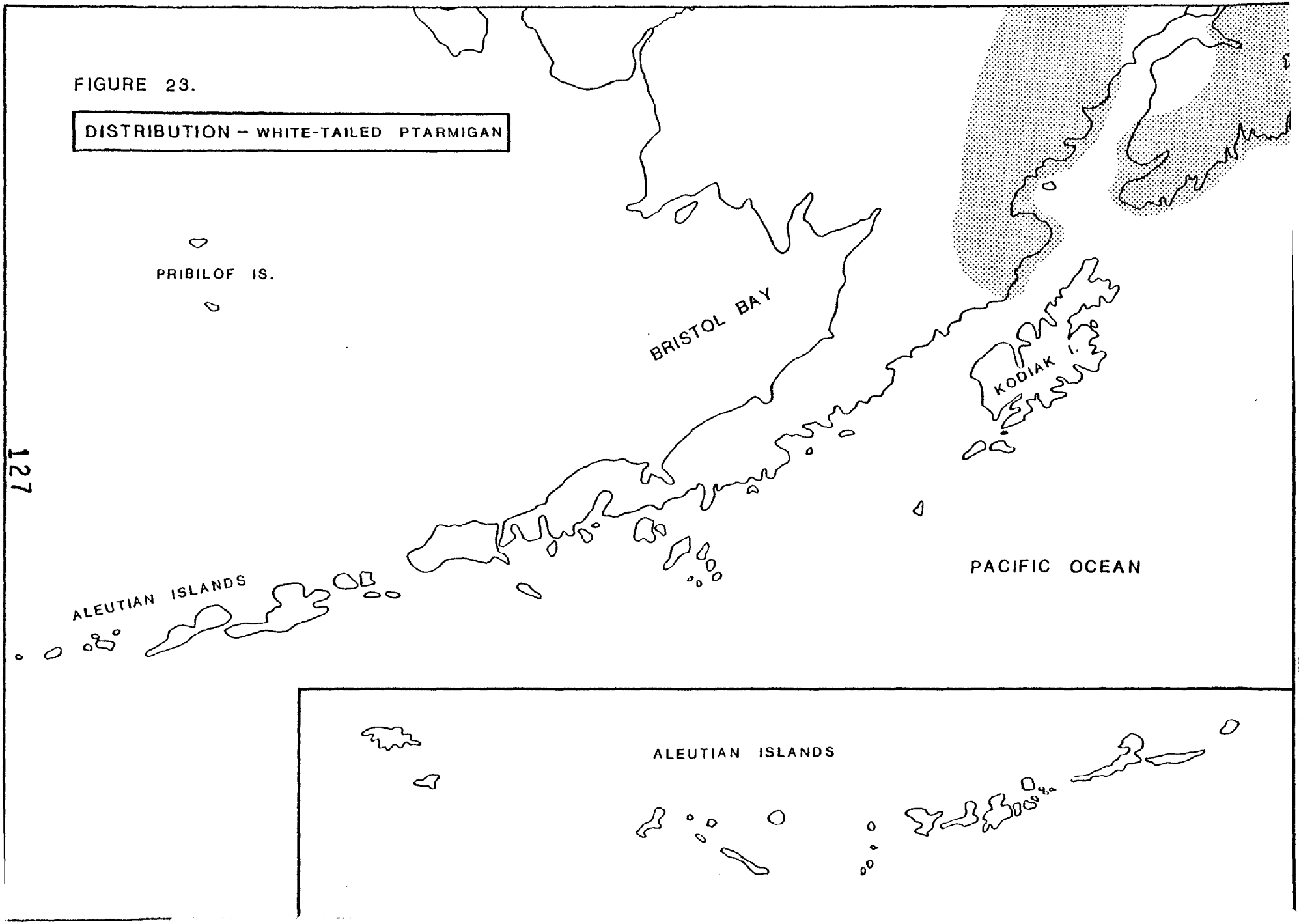
distribution appears to be in the region of the Katmai National Monument where they occur in limited numbers. No other information is available on their status in these units.

Unit 10

White-tailed ptarmigan do not occur in Unit 10.

FIGURE 23.

DISTRIBUTION – WHITE-TAILED PTARMIGAN



SPRUCE GROUSE

Spruce grouse (Canachites canadensis) occur throughout most of the forested portions of the state. They inhabit mature white spruce-birch woodlands, black spruce bogs and in the southern portion of southeastern Alaska, Sitka spruce-hemlock forests. Throughout their range spruce grouse commonly occur along roadsides where they search for grit which aids in their digestion.

During the winter spruce grouse forage almost exclusively on spruce needles. In summer and fall they feed on cranberries, blueberries, crowberries, various seeds and the flowers and leaves of herbaceous plants. Breeding activity usually begins in April with egg laying in May. Five to nine chicks are hatched in June. The male does not participate in incubation or rearing of the young, but during September often associates with several females forming family flocks. By October these flocks disband and small groups settle in dense spruce stands for the winter. When abundant, spruce grouse are extensively hunted for recreation and subsistence.

Unit 9 and 17

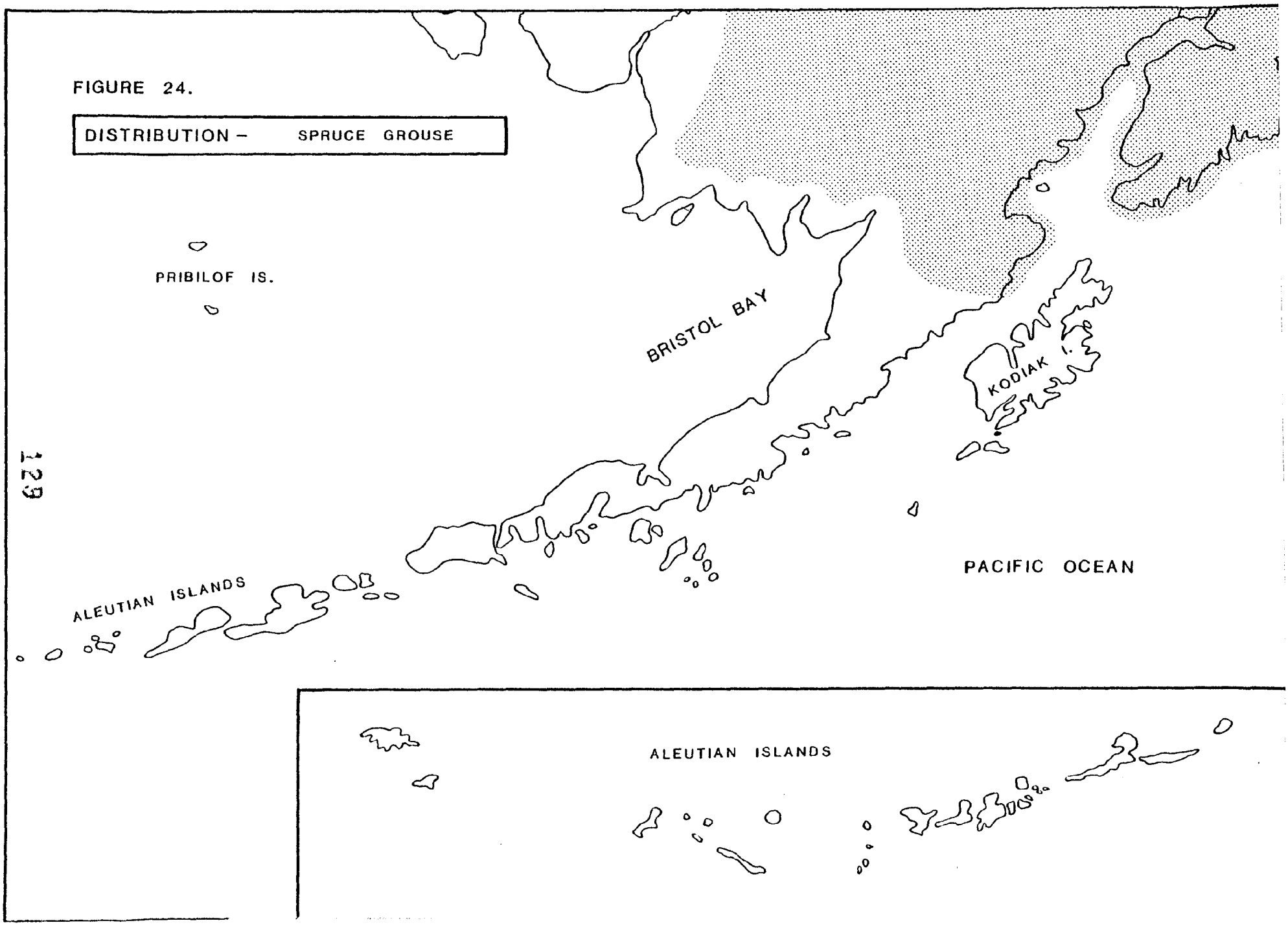
Spruce grouse occur throughout most of Unit 17 and Unit 9 north of the Naknek River. Within these units spruce grouse populations often undergo erratic fluctuation in numbers. Although their populations have recently declined in this region, they now appear to be relatively stable.

Unit 10

Spruce grouse do not occur in Unit 10.

FIGURE 24.

DISTRIBUTION – SPRUCE GROUSE



RUFFED GROUSE

Ruffed grouse (Bonasa umbellus) occur only in central Alaska and in a small portion of the southeastern mainland. They inhabit forested regions along major river drainages. Preferred habitat includes deciduous woodlands interspersed with spruce, on relatively dry, well drained, south facing slopes. Like spruce grouse they commonly frequent roadsides where they seek grit.

During spring, usually in April, male ruffed grouse establish territories by drumming with their wings on the tops of logs. Few ruffed grouse nests have been found in Alaska. Females and chicks usually remain together in shrubby moist areas near the woodland fringe until late September. Following breeding however, males remain segregated from the females and chicks. Ruffed grouse do not form flocks as do ptarmigan or sharp-tailed grouse. Populations of ruffed grouse display fluctuations in numbers similar to other grouse. Hunting pressure for this species is light in Alaska.

Units 9 and 17

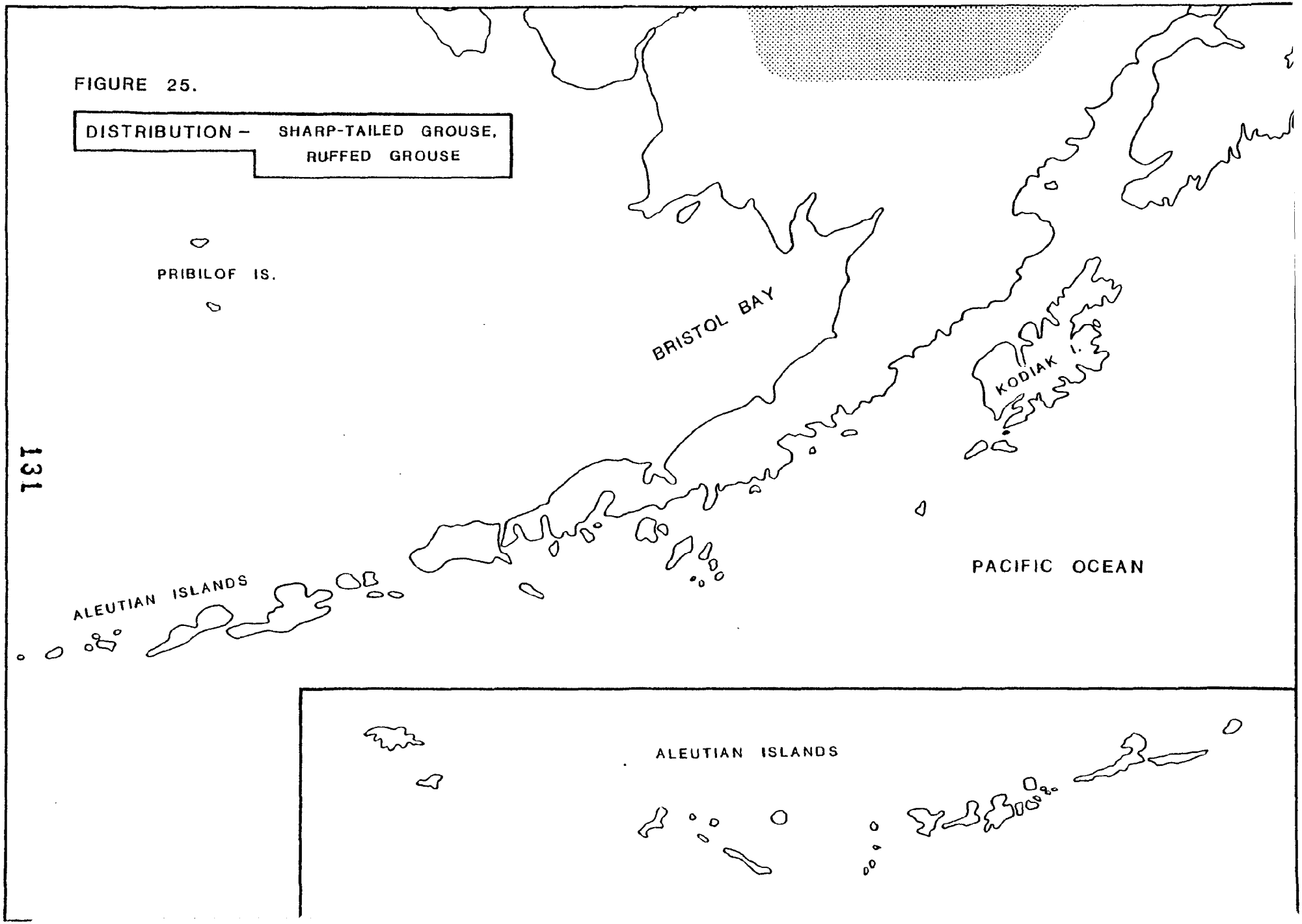
Ruffed grouse may occur in the extreme northern portions of Units 9 and 17. No other information is available on their status.

Unit 10

Ruffed grouse do not occur in Unit 10.

FIGURE 25.

DISTRIBUTION – SHARP-TAILED GROUSE, RUFFED GROUSE



SHARP-TAILED GROUSE

Sharp-tailed grouse (Pediocetes phasianellus) are the least common of Alaska's upland game birds. Their occurrence within the state is limited primarily to the central interior. They inhabit a variety of forest and brushland situations associated with open to sparse canopy coverage. In the subarctic they appear to prefer burned-over areas, scrubby woodlands at timberline and muskegs. Open grassy areas are important features of the breeding grounds.

Breeding activities begin in April or May as the males perform their courtship display on communal breeding grounds. Females often nest far from the breeding grounds and take the sole responsibility of incubation and caring for the young. During fall flocks are formed, but as winter approaches females and young leave the breeding area where the males remain throughout the winter. Sharp-tailed grouse feed on berries, seeds, insects, buds and catkins during the fall and winter. The summer diet in Alaska is unknown. As in other species of grouse, sharp-tailed populations fluctuate in numbers. The harvest of sharp-tailed grouse is relatively light throughout their range in Alaska.

Unit 9 and 17

Sharp-tailed grouse may occasionally occur in the extreme northern portions of Units 9 and 17. No other information is available.

Unit 10

Sharp-tailed grouse do not occur in Unit 10.

FURBEARERS - SMALL GAME - UPLAND GAME

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MARINE MAMMALS

Marine mammal populations in Alaska have been subjected to human utilization of varying intensities for many centuries. Remains of marine mammals in middens indicate the coastal dwelling natives utilized the resource to a high degree. Historical records indicate that hunting pressure prior to the early 1900's was so intensive that seal, sea lion and sea otter populations in much of Alaska were reduced to low levels. Pressure on seals and sea lions declined sometime after the turn of the 19th century, because natives were no longer dependent upon them for subsistence and white man turned to more economically attractive materials. As a result, seal and sea lion numbers increased. In 1911, sea otters were included in the Fur Seal Treaty and all hunting, except for natives using aboriginal means, was made illegal. Very few otters were harvested over the next 40 years and in many areas numbers began to increase. With the exception of several species of whales, marine mammal populations are considered to be near or at carrying capacity over much of their range.

In 1972, the United States Congress passed major domestic legislation setting U.S. foreign and domestic policy for the management of all marine mammals. This legislation took the form of The Marine Mammal Protection Act of 1972. In Alaska, this act has done little more than to place a moritorium on the taking of marine mammals.

Most marine mammals inhabit a very special environment - the near shore community. This environment is extremely susceptible to disturbance. In particular, petro-chemical developments along our

coast will inevitably result in the contamination of some marine ecosystems. Degradation of marine habitats, whether resulting from chronic low-level contamination or massive spills, may impact marine mammal populations by lowering ecological productivity as well as by direct injury to animals.

The western portion of the Alaska Peninsula and the Aleutian Islands contain the largest numbers and variety of marine mammals to be found anywhere in the world. After over 100 years of exploitation, the sea otter remained in small groups that began to spread and today occupy a major portion of the Aleutian Islands and the Alaska Peninsula. This area contains more sea lions than anywhere else in Alaska. Their present population probably exceeds 200,000 animals. The harbor seal occupies all of the Alaska Peninsula, Aleutian Islands, and Bristol Bay areas. Major pupping areas at Port Heiden and Port Moller annually support over 5,000 animals each. The Pribilof Islands have long been known for the millions of fur seals that inhabit the islands for a few months each year to pup and breed. Whales are common throughout the area. These large mammals move through the Aleutian passes on their annual migrations. The beluga or white whale is a year round resident of Bristol Bay and the Bering Sea.

Sea lions were once extensively used by coastal dwelling natives for subsistence purposes. The flesh was eaten, the intestines were used to make waterproof clothing and the hides were used for boots and boat coverings. White man harvested them for oil and hides. Today, there is no subsistence use of the resource. Before The Marine Mammal Act of 1972, a few adult sea lions were taken by commercial fishermen for shrimp or crab bait and an occasional animal was taken for food.

The only major use of the resource was a limited harvest of young animals for the fur industry.

There is currently no established use of sea otters. Traditional use by Alaska natives ceased during the period of commercial hunting and subsequent closures. While the federal closure from 1911 to 1960 allowed for such use, there was no conflict when the state laws prohibiting any use went into effect in 1960. The present estimate of sea otters in Alaska is 100,000 to 125,000 (Alaska Department of Fish and Game, 1973).

Little is known about harbor seal numbers prior to the 1920's. Bounty records and commerical harvest information indicate that the population continued to expand in spite of a continuing harvest.

Harbor seals have long been used for subsistence purposes by natives. Today, there is essentially no subsistence use of this resource. Commerical harvesting of harbor seal skins reached its peak in 1965 and continued to decline each year thereafter. All harvesting of harbor seals ceased with the advent of the Marine Mammal Act of 1972.

Because the fur seal is a migratory species that moves through international waters, its management on the Pribilof Islands is under federal jurisdiction. With international agreements, protection and wise management, the Pribilof fur seals have increased from a low point of about 216,000 animals in 1912 to their present level of over 1 1/4 million animals.

HARBOR SEAL

The Alaska Peninsula and Aleutian Islands extend over 1,000 miles from east to west and contain thousands of square miles of good seal habitat. The harbor seal population throughout this area is estimated to exceed 125,000 animals (Alaska Department of Fish and Game, 1973).

Harbor seals found south of Arctic Alaska have long been utilized by coastal residents for foot gear, articles of clothing and souvenirs. Until the 1960's the number utilized for such purposes was small and only a small part of the available yearly harvest was needed to satisfy the demand. Formerly, seals taken in excess of those needed for domestic uses were hunted for bounty payment.

In 1962-63 Alaskan harbor seals entered the European fur market, a market which annually consumes up to 500,000 seal skins. High prices were paid for raw seal skins, stimulating a great deal of interest in harvesting the animals. In 1964, an average prime adult skin was worth $20.00 to the hunter; choice pelts brought as much as $50.00; pup skins averaged about $17.00 each (Alaska Department of Fish and Game, 1964).

Two areas, Port Heiden and Port Moller, received moderate to heavy hunting pressure in the 1960's, Table 1. Port Heiden sustained an annual harvest of 1,500 to 3,000 seals with no apparent effect on the population. Harvesting at Port Moller was less intense with 1,000 to 1,500 seal taken annually. The south side of the Alaska Peninsula, the Shumagan Islands and the Sanak Island area received little or no hunting pressure. The Aleutian Islands and Pribilof Islands also received little or no harvest.

Table 1. Harbor Seal pup harvest, 1965-1968.

Year	Port Heiden	Port Moller
1965	4,000 (Includes Port Moller)	
1966	3,100	2,300
1967	2,278	1,435
1968	2,180	1,091

All commercial harvesting of harbor seals ceased with the advent of the Marine Mammal Act of 1972.

Harbor seals have not been studied extensively in the Alaska Peninsula, Aleutian Islands or Bristol Bay areas. Direct population enumeration has been done only in a few selected places. The secretive nature of the animals coupled with the broad expanses of habitat they are found in make direct population estimates difficult.

In June, 1975 the National Marine Fisheries Service conducted a series of marine mammal surveys along the Alaska Peninsula and into Bristol Bay (Fiscus & Braham, 1976). Harbor seals were observed throughout the area, but definite conclusions on abundance and specific use of areas could not be determined, Table 2. Future surveys will be conducted to determine site specific use, traditional breeding grounds and their relationship to commercial development in the Bering Sea.

The harbor seal population throughout the Aleutian Islands is thought to be at or near maximum levels (Alaska Department of Fish and Game, 1973). Because of inaccessibility and lack of observations, no population estimates are available.

The Pribilof Islands of St. Paul and St. George have small populations of harbor seals. The largest known concentration of harbor seals in the

Pribilofs are found on Otter Island. Johnson (1976) estimated the peak population to be 1,300 animals.

Table 2. Observations of harbor seals - June 1975. 1/

Unalaska Island	757	
Baby Islands (Five Islands)	178	
Krenitzin Islands		
Akun Is., Poa Is.	20	
Rootok Is.	68	
Avatanak Is.	44	
Rock North of Kalyaga Is.	75	
Aiktak Is.	50	
Alaska Peninsula (north)		
Cape Layard	75	
Cape Lapin	125	p
North Isonotski Is.	258	p
Cape Krenitzen	110	p
Kudiakof Is.	41	
Izembeck Lagoon	75	
Bar North of Kudiakof Is.	1,923	p
Amak Is.	14	
Cathedral Rock	29	p
Cape Leiskof	96	p
Nelson Lagoon	565	p
Lagoon Point	716	p
Port Moller	10,076	p
Cape Seniavin	10	
Seal Is.	1,137	
Port Heiden	10,047	p
Cinder River	2,867	p
Ugashik Bay	196	p
Egegik Bay	50	
North Bristol Bay, Calin Pt. and vicinity	90	

p Counts made from photographs

1/ Source - Fiscus, C. H. and H. W. Braham, baseline characterization: Marine Mammals, Nat. Mar. Fish., Ann. Rpt., Res. Unit 67, 1976.

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FUR SEAL

The Northern Fur Seal (Callorhinus ursinus) breeds in the summer and fall on the Pribilof Islands in the Bering Sea. Other fur seal rookeries occur on the Commander Islands beyond the western end of the Aleutians and on Robben Island in the U.S.S.R. During the winter and spring, northern fur seals are widely dispersed over the southern Bering Sea, the North Pacific Ocean, and as far south as California. Johnson (1975) estimates the Pribilof Island population at 1,300,000 animals.

In early May, adult male fur seals, many of which have remained in the southern Bering Sea all winter, begin to arrive at rookeries on St. Paul, St. George and Sea Lion Rocks in the Pribilof Islands. A month later, adult females which have wintered as far south as California begin to arrive and form harems within these territories. The harem within a male's territory may number up to 100 females, but averages about 45. Younger animals between the ages of two and six begin to arrive in June and haul out in large groups separate from the harem areas. Yearlings do not arrive until fall and many may remain at sea.

Females bear a single pup in the harems in late June or July, and breed again within about a week after giving birth. They then alternately nurse the pup and feed offshore for two to three months. The pups are abandoned when the southward migration begins in October and November. By the end of December, the rookeries are empty.

After the seals have left the rookeries in fall, they feed and migrate throughout the southern Bering Sea, passes in the Aleutian Islands, and the entire Pacific continental shelf of the United States and Canada. Water quality requirements for fur seals in these areas

are probably similar to those for sea lions and harbor seals.

Fur seal rookeries, which in Alaska include only certain beaches in the Pribilof Islands, are essential to the maintenance of the species. Abundant supplies of food, primarily squid and smaller school fish such as herring, saury and lantern fish, must be available within a 150 mile radius of the rookeries for lactating females and younger animals. With well over a million seals in the area, the demand for food is tremendous.

Some commercially important food species are consumed by fur seals throughout their range; the major foods of fur seals are not generally utilized as fresh seafood by the United States fishery, but are fished extensively by foreign fisheries. Some of these species are: squids, hake, anchovy, herring, sandlance, capelin, walleye pollock, Atka mackerel and deepsea smelt (Lander and Kajimmra, 1976).

Almost immediately after their discovery in 1786, the Pribilof rookeries became a source of sealskins for the fur markets of the world. By the mid-1800's the herd had been almost annihilated. Then, in 1867, Alaska was purchased by the United States and legislation was passed to protect the fur seals of the Pribilof Islands.

Early pelagic sealing had a devasting effect upon the fur seal herd. Almost a million skins were taken on the high seas from 1879 to 1909, and many of the seals shot or speared in the open sea were not recovered. The effect on the Pribilof herd was disastrous, because females made up 60 to 80 percent of the pelagic catch.

After extended diplomatic negotiations and a long series of ineffectual bilateral agreements, the United States, Great Britain (for Canada), Japan, and Russia concluded a Convention in 1911, for the protection of the fur seals of the North Pacific. Pelagic sealing was prohibited

except by aborigines with primitive weapons. Each country with fur seal rookeries agreed to share 30 percent of its annual take of sealskins - Canada and Japan each to receive 15 percent of the sealskins from the Pribilof Islands and the 15 percent of those from the Commander Islands; and Canada, Russia, and the United States each to receive 10 percent of the pelts from Robben Island.

In 1957, a new interim North Pacific Fur Seal Convention was concluded by Canada, Japan, the Union of Soviet Socialist Republics, and the United States, similar in form to the 1911 Convention. The new convention, as amended by a protocal in 1963, has as its principal objective the achievement of maximum sustainable yield of fur seals in the North Pacific. It provides for a Fur Seal Commission comprised of representatives of the four Governments to coordinate research and management for the northern fur seal. It also provides that Canada and Japan each shall receive 15 percent of the sealskins taken commercially by the United States and the U.S.S.R. Seventy percent of the net proceeds from skins sold by the United States is paid to the State of Alaska.

Fur seal habits are such that a program of wise utilization is readily devised; however, the success of the program depends on international cooperation because the seals live much of the time outside territorial waters. In Alaska, with few exceptions, fur seals come ashore only on the Pribilof Islands, and always on about the same date each year. Because seals are highly polygymous and the sexes are born in equal numbers, it is possible to take many males without adversely affecting the productivity of the herd. The young males, whose pelts are the most valuable, habitually haul out in areas apart from the breeding animals in the harems, so they are easily obtained.

The number of seals killed each year has varied for a number of reasons. From 1911 to 1917, seals were killed only by the residents of the Pribilof Islands for use as food. Commercial killing for skins was resumed in 1918. From 1918 to 1922, harvests of seals were high in realtion to population size because of the accumulation of males. The kill declined after the excess males were removed, but thereafter steadily increased until 1940. From 1940 to 1955 it averaged about 66,000 males annually. Since then, the kill of males has varied from a high of 96,000 in 1956 to a low of 28,000 in 1973, Table 3. Part of the difference between these extremes resulted from an extended season in 1956 which made available a larger proportion of the 3-year-old group, but recent fluctuations are caused primarily by variations in year class survival.

Beginning in the mid-50's some female seals were taken to bring the herd to a level of maximum sustained yield, Table 3.

After the animals are harvested, the skins are removed, washed, blubbered and cured in salt. They are then packed in barrels for shipment to a processing plant. The U.S. Government has a contract with an independent fur company for dressing, dyeing and selling the skins at public auction.

Most of the processed skins are sold to buyers from West Germany and Italy. A recent economic study by the National Marine Fisheries Service indicates no increasing or decreasing trend in demand (Lander and Kajimura, 1976).

The North Pacific Fur Seal Commission (1975) reported that in addition to fur, the fur seal has provided mixed feed for fish, poultry and fur-bearing animals, fertilizers, glycerin for munitions, oil for

tanning and oriental pharmeceuticals. Recent trends suggest that the fur seal resource should also be considered in terms of their educational and aesthetic significance.

Table 3. Kill of fur seals on the Pribilof Islands 1871-1975. A dash (-) indicates no data available to present authors. 1/

Year	Male	Females
1871	102,960	-
1872	108,819	-
1873	109,117	-
1874	110,585	-
1875	106,460	-
1876	94,657	-
1877	84,310	-
1878	109,323	-
1879	110,511	-
1880	105,718	-
1881	105,063	-
1882	99,812	-
1883	79,509	-
1884	105,434	-
1885	105,024	-
1886	104,521	-
1887	105,760	-
1888	103,304	-
1889	102,617	-
1890	28,859	-
1891	14,406	-
1892	7,509	-
1893	7,390	-
1894	15,033	-
1895	14,846	-
1896	30,654	-
1897	19,200	-
1898	18,047	-
1899	16,812	-
1900	22,470	-
1901	22,672	-
1902	22,386	-
1903	19,292	-
1904	13,128	-
1905	14,368	-
1906	14,476	-
1907	14,964	-
1908	14,996	-
1909	14,368	-
1910	13,586	-
1911	12,006	-
1912	3,191	-
1913	2,406	-
1914	2,735	-
1915	3,947	-
1916	6,468	-
1917	8,170	-
1918	34,890	-

continued

Table 3. (continued) Kill of fur seals on the Pribilof Islands 1871-1975. A dash (-) indicates no data available to present authors. 1/

Year	Male	Females
1919	27,764	57
1920	26,568	80
1921	23,605	76
1922	31,063	93
1923	15,716	204
1924	17,053	166
1925	19,750	110
1926	22,035	96
1927	24,912	30
1928	31,039	60
1929	40,023	45
1930	42,449	51
1931	49,462	62
1932	49,232	104
1933	54,471	79
1934	53,408	60
1935	57,061	235
1936	52,227	219
1937	55,010	170
1938	58,165	199
1939	60,312	161
1940	64,940	323
1941	92,802	2,211
1942	150	0
1943	116,407	757
1944	47,533	119
1945	76,391	573
1946	64,028	495
1947	61,153	294
1948	69,893	249
1949	70,553	337
1950	59,925	279
1951	60,503	186
1952	63,670	200
1953	65,824	845
1954	63,224	658
1955	64,727	743
1956	96,057	27,632
1957	46,219	47,426
1958	47,866	31,100
1959	30,191	28,060
1960	36,327	4,312
1961	82,798	43,849
1962	53,680	43,760
1963	42,386	43,952
1964	48,980	16,452
1965	42,123	10,434
1966	52,472	481

continued

Table 3. (continued) Kill of fur seals on the Pribilof Islands 1871-1975. A dash (-) indicates no data available to present authors. 1/

Year	Male	Females
1967	55,720	10,096
1968	45,625	13,335
1969	38,678	230
1970	42,121	120
1971	31,795	103
1972	37,314	79
1973	28,457	25
1974	32,976	51
1975	29,093	55

1/ From Lander and Kajimura, 1976. Status of northern fur seals. Sci. Conf. Mar. Mamm. Bergen, Norway.

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SEA OTTER

In 1742, the men from Vitus Bering's expedition returned to the Kamchatka Peninsula from their historic voyage of discovery of Alaska. They brought with them sea otter furs that initiated an era of exploitation which almost led to the extinction of the sea otter. The early Russian settlement of Alaska was, in fact, largely a result of the sea otter industry. In 1867, when the numbers of sea otter had diminished, Alaska was sold to the United States and the few conservation measures that had been instituted by the Russians in their final years of occupation were dropped by the Americans. Hunting intensified and sea otter became alarmingly scarce. Between 1867 and 1911, over 107,000 were harvested in Alaskan waters (Lensink, 1962). Finally, in 1911 when so few animals were left (in many areas they were completely exterminated) that it was no longer profitable to hunt them, they were given complete protection under the Fur Seal Treaty.

From the signing of the Fur Seal Treaty in 1911 until the State of Alaska assumed management authority for sea otters in 1960, Alaska natives were allowed to hunt sea otters using aboriginal means, but no other hunting was allowed. After 1960, Alaska State laws prohibited all hunting by all individuals regardless of race. The sea otters experimentally harvested between 1962 and 1972 by the State of Alaska were taken under the authority of a scientific collecting permit.

In 1962 and 1963 a total of 491 sea otters were harvested at Amchitka by the State in an attempt to determine the feasibility of harvests and to collect information on reproduction, sex and age composition, and distribution of sexes. None were harvested between 1964 and 1966 while

efforts were directed at developing a transplant program. In 1967 sea otter studies were accelerated and the harvest program resumed. Harvests were conducted only on islands that supported populations that were at or near the carrying capacity of the habitat and were no longer contributing to the repopulation of other areas. All harvesting was done by state employees under the supervision of biologists. The harvest program was suspended after 1970 because of lack of funds.

The removal of animals from a population for transplants to other areas or for scientific and display purposes has the same effect on that population as a harvest. A summary of all otters removed from various Alaskan populations since the State of Alaska assumed management authority is presented in Table 4. Some of the animals removed were transplanted to other parts of Alaska and therefore did not cause a reduction in the overall otter population. Others were transplanted to areas outside of Alaska.

Even after the harvest program had ceased, an effort was made to continue to annually remove approximately 300 sea otters from the Amchitka Island population through transplant captures and scientific collections, in order to study the effects of a sustained removal of that magnitude. This program was temporarily interrupted in November, 1971 when a nuclear test killed an estimated 1,000 to 1,350 sea otters.

Between 1967 and November, 1971, a total of 1,436 sea otters were removed from Amchitka, an average of 287 per year. Over 1,200 of these were taken from the southeastern half of the island. The only apparent effect on the population was a slight reduction in an area where transplant captures were concentrated and an increase in the number of subadult animals in that area. All evidence suggests that harvesting increased productivity and that the population could sustain a harvest of

Table 4.
Numbers of sea otters transplanted 1955-1970.

Release	Site	1955	1956	1959	1965	1966	1968	1969	1970	1971	1972	Total
Aleutians	Attu Is.		5									5
Pribilofs	Otter Is.	19[1]										19
	St. Paul Is.			7								7
	St. George Is.						57					57
Southeast Alaska	Yakutat Bay					10						10
	Khaz Bay (Chichigof Is.)				23	20	93	58				194
	Yakobi Is.						30					30
	Biorka Is.						48					48
	Barrier Is.						55					55
	Heceta Is.						51					51
	Cape Spencer						25					25
British Columbia	Vancouver Is.							29	14		46	89
Washington								29[2]	30			59
Oregon									29	63		92
Total		19	5	7	23	30	359	116	73	63	46	741

1) None believed to have survived.
2) At least 13 died shortly after release.
1955 to 1959 by USFWS (31 sea otters), 1965 to 1972 (706 sea otters) by A.D.F.&G. In some cases one or two of the above animals died near the time of release.

two to three times that level if the hunting pressure was evenly distributed around the island.

There are currently no established uses of sea otters. Traditional use by Alaska natives ceased during the period of commerical hunting and subsequent closures. While the federal closure from 1911 to 1960 allowed for such use, there was no conflict when the state laws prohibiting any use went into effect in 1960.

Most population estimates of sea otters have been based on aerial surveys made from fixed-wing aircraft. Kenyon (1969) made estimates based on the assumption that he saw 50 to 75 percent of the sea otters from the air. He used these estimates to provide a comparative picture of the status of sea otter populations throughout Alaska but recognized that the actual numbers might be low. Lensink (1960) made an estimate of the population of Amchitka Island, based on counts from shore, that were three to four times Kenyon's estimate based on aerial surveys. A recent series of comparative surveys and information gathered during harvests demonstrate that estimates based on aerial surveys are extremely low (Estes, 1973). The variability in factors influencing this type of count is so great that the results are not reliable for population estimates or for determining short-term fluctuation in dense populations. However, aerial counts are useful to determine general distribution and abundance and to follow large changes in population size. These factors should be considered when interpreting the following population estimates.

South side of the Alaska Peninsula (Cape Igvak to Unimak Pass)

Surveys along the south side of the Alaska Peninsula have been fragmentary and most those made were done under less than ideal

conditions. Weather tends to be poor along the south shore where squalls form along the mountains. Areas where an aircraft can refuel are north of the mountains and there are relatively few passes, therefore range of the aircraft is a problem. Also there is much shallow water offshore in the area from Shumagin Islands to Sanak Island. Coverage of this area is difficult and many animals are undoubtebly missed. Despite these problems and a lack of continuity, a fairly good picture has emerged on the recovery of sea otter populations in this area.

Reports from various individuals are available from the 1930's and 1940's. Major surveys by the Fish and Wildlife Service in 1951 (Jones), 1957 (Lensink), 1962 and 1965 (Kenyon and Spencer) covered at least portions of the area. In 1969, the southern Shumagin Islands were counted by the Alaska Department of Fish and Game. Another survey by the A.D.F.&G. in 1970 covered most of the rest of the area.

There are three distinct population nuclei in the area. These are centered around Sutwik Island, the Shumigan Islands and the Sanak-Sandman Reefs.

Sutwik Island

Reports of sea otters near Sutwick Island are available since 1936. This population was far removed from other populations and is probably a remnant left after hunting ceased. In 1951, Jones counted 388 between Cape Kumliun and Cape Kunmik. Most were near Sutwick Island. In 1957, 889 were counted. Nineteen of these were between Cape Kunmik and Cape Providence indicating some northeastward expansion. In 1962, 949 were seen with individuals straying as far as Cape Igvak and one between there and Cape Kuliak. In the 1970 survey, 1,766 were counted betwen Castle Cape and Cape Kunmik, with the majority being seen in Kujulik

Bay. The total count for the Sanak Island area during the 1970 survey was 1,912.

There is still room for expansion in both directions from this population. The greater movement to the northeast is probably the result of better habitat. The population around Kujulik Bay is very dense and a large movement of animals may occur if competition for food becomes serious. Otherwise, we should expect to see continued steady expansion into adjacent areas for a number of years (Schneider, 1970). The present sea otter population for the Sanak area is estimated to be from 8,000 to 10,000 animals (K. Schneider, A.D.F.&G. pers. comm.).

Shumigan Islands

Recent surveys have not been adequate enough to show if otter numbers have increased in the last decade. However, major changes in distribution have occurred which are very similar to the pattern mentioned in the Sanak-Sandman population.

There were occasional reports of sea otters in the Shumagins in the 1930's. In 1947 Scheffer estimated that 500 lived around Simeonof Island. In 1953, Hooper counted 633 around Simeonof and Little Koniuji Island. A 1957 survey showed 1,829. Most of these were in the southern islands. Five individuals were scattered in the northern islands and one was on the mainland shore near Elephant Point. A 1962 survey totaled only 1,352. The animals were scattered from 149 to 338 indicating a continued northward expansion.

In 1969, 1,510 were counted in the southern islands under relatively poor conditions. An additional 286 were counted in the northern islands in 1970, and 23 were seen along the mainland north of the Shumigans.

There is a very clear expansion of the population from a center

near Simeonof. Substantial numbers now occur on all the islands and repopulation of the mainland is occurring. The population in the northern islands should continue to increase. In general, it appears that the southern islands and reefs have become fully populated and the northern areas are just developing significant populations. The entire area may be completely repopulated in the next 10 years. The present estimated population is from 8,000 to 10,000 sea otters.

Sanak Island - Sandman Reefs

Small numbers of sea otters have been reported at Sanak Island since 1922. No reports came from the Sandman Reefs until 1942. In 1948, 27 were sighted at Cherni Island. An aerial survey in 1951 showed 65 around Sanak and 97 in the Sandman Reefs. In 1957, 251 were seen around Sanak and 508 around the Sandman Reefs. In addition, two were seen in the Pavlof Islands, however few were on the mainland. In 1962, 548 were counted in the Sanak area and 638 in the Sandman Reefs. None were reported from the mainland or Pavlof Islands. Much of the increase was in the northern area around Deer Island. In the 1970 survey, which was made under relatively poor conditions, 239 were seen in the Sanak area and 568 plus in the Sandman Reefs.

A remnant population probably remained along the south side of Sanak Island in the early 1900's. By the late 1940's they began spreading into the Sandman Reefs. This northward expansion has continued to the present time. There is still unoccupied or sparsely populated habitat along the mainland shore and in the Pavlof Islands. There should be continued expansion of this population for a number of years although the numbers around Sanak Island and the western Sandman Reefs may have already reached a peak. The present total population is estimated to be

from 8,000 to 10,000 otters.

With the arrival of substantial numbers in the Pavlof Islands, this population is probably on the verge of mixing with the Shumagin Island population. No doubt some individuals have moved back and forth in the past, but the two populations are almost continuous at the present time.

As in past surveys, few otters were seen around the north side of Sanak Island and Caton Island. This is probably poor habitat for otters. The main population is around the south and west sides (Schneider, 1970).

Fox and Krenitzin Islands (Unimak Pass to Samalga Pass)

The islands from Unimak Pass to Samalga Pass contain large areas of good sea otter habitat. At present, several small concentrations exist in this group of islands and increasing numbers of scattered individuals are being seen, nevertheless much of the habitat is not occupied. Large populations to the east are expanding and it is likely that significant repopulation of the Fox Islands will begin as these populations outgrow their present habitat.

In August of 1975, the Alaska Department of Fish and Game counted 316 sea otters in the Fox and Krenitzin Islands. This was a considerable increase over the 41 observed by Kenyon in 1965. It is clear that there has been a substantial increase in numbers. Concentrations of otters in the vacinity of Tigalda Island, Umnak Pass, Vsevidof Island and Samalga Island appear to be large enough to be considered premanently established. If they follow the pattern of other similar groups, they sould increase rapidly over the next few years (Schneider, 1975).

Islands of Four Mountains (Samalga Pass to Amukta Pass)

The Islands of Four Mountains consist of a number of small, steep-sided islands. There is a limited amount of habitat suitable for sea otters. In 1969, several otters were reportedly sighted there but subsequent surveys by air and boat have failed to locate any. As the populations in the eastern Andreanof Islands reach a peak, repopulation of the Islands of Four Mountains will probably occur and a small population may build up there. The scarcity of good habitat will probably limit the population to a few thousand animals.

Andreanof Islands (Amukta Pass to Tanaga Island)

The Andreanof Islands contain large areas of excellent sea otter habitat. Early exploitation reduced the population almost to the point of extinction in this island group.

U. S. Fish and Wildlife Service and Alaska Department of Fish and Game surveys have provided an excellent record of the repopulation of this island group, and much of our knowledge of how sea otter populations expand is from this area. A population will usually build up to a very high density exceeding the carrying capacity in one area before animals will move into adjacent areas of vacant habitat, then a large number will move in a short period of time to the next island.

The Andreanof Islands are being repopulated in this stepwise manner. Tanaga probably was populated by excess animals from the Delarof Islands in the 1930's. When Tanaga's population peaked, large numbers moved to Kanaga. Kanaga's population peaked, then animals moved to Adak. In this way, each island from west to east has had a rapid increase, then

a decline as animals move to the next island. At present, this spearhead of expansion has reached the west end of Atka Island. Smaller numbers have been found on the south side of Atka and Amlia Islands and around Seguam Island.

At present, the western Andreanofs, including Tanaga, Kanaga, Adak, and Kagalaska, have populations that probably equal or exceed the pre-1742 expansion to new areas. The islands between Kagalaska and Atka also have very high populations which are contributing to the repopulation of Atka. At the present rate of expansion, the island group should be completely repopulated within 10 to 15 years. The present population is over 35,000 and is increasing (K. Schneider, pers. comm.).

Delarof and Rat Islands (Tanaga Island to Buldir Island)

The Rat and Delarof Islands contain much excellent sea otter habitat. Russian exploitation reduced the population of these islands to a very low level, but small populations survived in both island groups. The first substantial recovery of the sea otter from early exploitation was noted in 1935. By 1947, the Amchitka population reached a peak and exceeded the carrying capacity of its habitat. Subsequently, the population declined, probably as a result of overutilization of food species. A similar situation has occurred at most of the other islands in both groups.

The present total population of the Rat and Delarof Islands combined is estimated at between 23,000 and 32,000 sea otters (K. Schneider, pers. comm.). Extensive studies by the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game indicate that these islands are unlikely to support larger populations on a sustained basis.

Aerial and ground sruveys conducted by Estes (1973) on Amchitka Island has provided the most recent population counts from this island group. Based on fixed-wing, helicopter and shore counts, he estimated the Amchitka population to be about 7,000 animals. It is unlikely that the pre-1742 population was significantly larger than the present population.

Near Islands (Buldir Island to Attu Island)

Sea otters were completely exterminated from the Near Islands. In 1956 the U.S. Fish and Wildlife Service relocated five otters from Amchitka to Attu, but it is not known if any of these survived. The first survey to reveal positively that otters were re-established was made in 1965 when 27 were seen at Attu (Kenyon, 1969). The present population is in excess of 350 (J. Estes, USFWS, pers. comm.). This number should increase and eventually the population may reach densities similiar to that presently found in the Rat Islands.

North Side of Alaska Peninsula (Unimak Pass to Port Heiden)

Vast areas of shallow water exist north of Unimak Island and into Bristol Bay. A large, unique population of sea otter lives in this area. Based on 1976 surveys, Schneider (pers. comm.) estimates 17,000 sea otter between Otter Point and Cape Lieskof. The animals apparently seldom come ashore and have been seen as much as 26 miles offshore. Pods of up to 1,000 sea otters are seen from three to ten miles offshore, particularly in the Amak Island area. The eastern limit of distribution of the population fluctuates depending on the severity of sea ice conditions. On the average, sea otters are abundant as far east as Port Moller and smaller numbers are found to Port Heiden. Scattered individuals may

occur beyond that point. Because the population may be scattered over thousands of square miles, its size is difficult to estimate, but it probably is in the neighborhood of 15,000 to 20,000 and has a potential to increase during periods of mild winters (K. Schneider, pers. comm.).

Pribilof Islands

The Pribilof Islands are near the edge of the sea ice in winter and probably are at the northern limits of potential sea otter range in the Bering Sea. Old records indicate that a population of at least 5,000-7,000 sea otters may have existed there when the islands were discovered by the Russians. Early exploitation completely exterminated this population and natural repopulation has not occurred. In 1959, seven otters were transplanted there but none have been seen since 1961. In 1968, 57 otters were released at St. George Island by the Alaska Department of Fish and Game. There is some evidence that a few individuals have reached St. Paul Island from the Alaska Peninsula, perhaps by traveling with the retreating ice pack. Reports indicate that at least small numbers still survive there. If this population persists, it should eventually increase to pre-exploitation levels.

Table 5 . Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

Location	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
ALASKA PENN.																		
Cape Kuliak - Cape Igvak		0				1				7								
Cape Igvak - Cape Kumlik		19				22				139								
Aniakchak Bay & Amber Bay	8	6				47				197								
Sutwik Area	355	581				109				14								
Kujulik Bay & Cape Kumlik	12	103				684				1,253								
Cape Kumliun										101								
Inivikshak Is.	13	180				86				62								
Nakchamik Is.										5								
Chignik Bay										118								
Castle Bay & Cape Kupreanof										16								
Penn. to Paulof Bay										23								
Paulof Bay to Unimak Bay										141								

continued

Table 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

Location	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
SHUMIGAN IS.																		
Inga Is.		2				4				184								
Popof Is.		2								52								
Korovin Is.										46								
Karpa Is.										4								
Andronica & the Haystacks		1							75									
Nagai Is.		149				338			232									
Spectacle Is.									8									
Wendel Is.		268				105			27									
Turner Is.									6									
Twins		7																
Near Is.		3				14			150									
Peninsula Is.						3			15									
Big Koniuji Is.		220				222			296									
Little Koniuji Atkins		430				225			290									
Simeonof Is.		455				294			329									

continued

ble 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

cation	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
rd Is.		160				38			76									
ernabura		132				79			6									
NAK-SANDMAN																		
snesenski Is.		2								4								
olnoi Is.										2								
perechnoi Is.										29								
lgoi Is.										67								
loi Is.										2								
ter Iliasik Is.										16								
ner Iliasik Is.										2								
erni Is.		271				259				495								
ubbing Rocks		33				2				12								
ose Is.	97	76				82				7								
er Is. & ter Reefs		123				295				54								
nak Is.	65	251				548				239								

continued

Table 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

Location	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
Scotch Cap to Cape Sarichef			75															
Cape Sarichef to Cape Mordvinof							10										1	
Cape Mordvinof to Otter Point							58	152								1	19	
Otter Point to Moffet Point		786				811	2,765		330	2,157	20	273	500	79		198	2,585	Estimate 17,173
Moffet Point to Cape Lieskof							20				38	24	1	2		24		
Cape Lieskof to Cape Kutuzof							39				74	60	18	1				
Cape Kutuzof to Reindeer Creek											5	40			3			
Reindeer Creek to Cape Greig												4						
Cape Greig to Cape Chichagof															4			
FOX-KRENITZIN ISLANDS																		
Igamak																	5	

continued

Table 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

Location	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
Tigalda		5			11	3	32		49							59	5	
Avatanak							2										4	
Kootok									2								1	
Akun									3								3	
Akutan									1									
Unalga & Baby Is.						2												
Unalaska (except W. end)	1															2	4	
Umnak Pass									6							74	60	
Vesvidof Is.									9								52	
Umnalga - W. end Umnak					6	10	9		27								111	
E. side Umnak																	3	
ANDREANOF ISLANDS																		
Kanaga				902		898	1,059	3,049										
Tobrof				57			32											
Kanaga				1,822		846	1,054	2,619	153									

continued

Table 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

Location	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
Adak				1,718		2,260	1,336		343									
Great Sitkin						325	710											
Aziak									4									
Tanaklak									4									
Asuksak									7									
Kanu									35									
Tagadak									21									
Igitkin									190									
Ulak									15									
Chugul									119									
Amak						94	392		164									
Little Tanaga						214	509		203									
Kagalaska				1		251	298											
Tagalak									68									
Fenimore Pass									42									
Ikiginak									33									
Oglodak									9									

continued

Table 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

Location	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
Atka Pass									7									
Atka				33		50	228		464									
Amlia				83		91	159		140									
Seguam				14		23	28		97									
DELAROF ISLANDS																		
Gareloi				41			83		5									
Unalga				51			16		9									
Kavalga				275			155		118									
Sea Otter Pass									36									
Ogliuga & Skagul				112			144		105									
Ulak				352			107		55									
Amatignak				102			70		68									
Ilak				183			32		6									
RAT ISLANDS																		
Buldir							15											
Kiska				1,127			1,229											

continued

ıble 5 . (continued) Sightings of Sea Otters - Alaska Penninsula, Aleutian Islands and Bristol Bay.

ıcation	1951	1957	1958	1959	1960	1962	1965	1968	1969	1970	March 1971	Oct. 1971	March 1972	May 1972	1973	June 1975	Aug. 1975	1976
ıgula				47			56											
ıramid, Davidof, ıvostov				33			39											
ttle Sitkin				50			135											
ıt				270			326											
ıchitka				1,560			1,144	2,302		3,927	3,241		4,042					
ımisopochnoi				393			203											
AR ISLANDS																		
ıattu							4										20	
tu							13											350
ıemya							10											

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SEA LION

The Northern, or Steller's sea lion (Eumetopias jubatus) are members of the family Otariidae which includes sea lions and fur seals. They differ from the common seals Phocidae in that they have hind flippers that can be turned forward and used in a more four-footed method of movement on land, have external ears, and are found almost exclusively in a marine environment. They are the only sea lion found in the Gulf of Alaska, throughout the Aleutian Islands and in Bristol Bay.

Sea lion pups are most commonly born during late May and June, with the majority of pupping occurring during the first two weeks in June. Usually only one pup is produced, but twinning occurs rarely. The average weight at birth is 44 pounds. Females eventually weigh 600 to 800 pounds, and males may grow as large as 2,400 pounds.

Breeding activity begins in late May when mature bulls begin defending territories on the coastal rookeries. Females may move about the territories, but all intruding males are challenged. On large rookeries, males generally have 14-17 females within their defended areas. Most females breed within a week or ten days after giving birth, with the peak of breeding activity occurring in Mid-June.

Not all sea lions go to rookery areas during the breeding season. Large numbers of bulls occupy male hauling grounds, generally located adjacent to rookeries. Also, males and females without pups may gather on hauling grounds where males also defend territories and engage in breeding activities. Territorial behavior by males begins to decrease around the first of July and by mid-July most breeding activity has ended.

Pups are capable of swimming within hours after birth, but most do not venture into the water until they are at least a month old.

By late July, rookery populations begin to decline as some territorial bulls and females without pups leave the area. Hauling grounds that contained few or no sea lions during the summer gradually begin to attract more animals, but the number using each hauling ground varies from day to day and month to month.

As many as 25% of adult females fail to produce a pup each year. In addition, more than half the new pups die in their first year. Drowning, abandonment, malnutrition and predation are the major causes of death. Killer whales, sharks and men prey on adults as well as pups.

Sea lions are generally shy animals and rush to the water when approached by man, except during the June breeding season. During that month, sea lions on rookeries show great reluctance to leave the land. Although most females will finally flee when a man approaches too closely, some become very protective of their pups and refuse to leave their sides. Similarly, many males continue to defend their territories against all intruders, including men.

During winter, some sea lions move into the more protected waters of bays and inland passages. They use hauling grounds that may have been unoccupied in summer and often follow predictable feeding patterns, such as moving into herring spawning areas in spring.

Although sea lions live in the marine environment, they occasionally ascend freshwater rivers for short periods of time. They seem to thrive best in remote island areas with extensive shallow water and rocky bottoms highly productive with fish life.

Offshore rocks exposed through all stages of the tide are important

as resting areas. Sea lions are excellent swimmers and range widely in search of food. They are uncommon in glacial areas where the water is turbid, as they prefer relatively clear waters.

Sea lions eat a wide variety of foods including rockfish, sculpin, cod, greenling, sand lance, smelt, salmon, halibut, flounder, octopus, squid, shrimp and crab.

Sea lions have long been considered an enemy of fishermen because of their dietary preference for fishes. But few quantitative data are available concerning the extent of predation on commercially exploited fishes.

Populations of sea lions have been exploited by man throughout history. The earliest harvest records of sea lions comes from middens near native village sites and show that sea lions were used extensively.

Commercial interest in sea lions brought about harvests of pups for their pelts. Over 45,000 sea lions pups were recorded harvested from Alaskan rookeries from 1959 through 1972 (Calkins et al. 1975), Table 6. The average price paid to the hunter for sea lion pup skins was about $8.00. All harvesting of sea lions ceased with the advent of the Marine Mammals act of 1972.

Surveys by the Alaska Department of Fish and Game biologists and information from other marine mammal biologists indicate that there are over 100 different rookeries and hauling areas in the Alaska Peninsula, Aleutian Island and Bristol Bay areas. Sea lion rookeries and haul out areas are found on a variety of different substrates ranging from sand to beaches with boulders up to 10 yards in diameter, to bedrock. These areas are often found on exposed points or isolated small islands.

Sea lions usually inhabit offshore rocks and islands that are

Table 6. Sea lion harvests in Alaska.

Island	Ref. No.	1959	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Marmot Is.	320	137			1,024	1,650	2,675	2,150	2,516	2,365		1,800
Sugarloaf Is.	325		4,000	1,500	2,005	1,400	2,180	1,958	2,692	1,008		
Akutan Is.	148				1,659	857		80		2,159	2,250	1,627
Atkins Is.	215				259							379
Round Is.	166				574							
Ugumak Is.	165	179								525	1,064	2,184
Jude Is.	206	39			72							556
Chowiet Is.	241	10										
Total		630	4,000	1,500	5,593	3,907	4,855	4,198	5,208	6,057	3,314	6,546

seldom visited by man, but human activities may cause animals to leave rookery areas. Vania, (1971), found that when the harvesting of pups began, a gradual decline occurred in the number of adults that utilized a rookery. When harvesting was closed, adult numbers again increased. Since rookery and haul out areas are vital to the well-being of sea lions, careful planning must be made before these areas are disturbed by man.

Although breeding females and mature territorial bulls are strongly tied to rookeries, Sandegren(1970) observed considerable movement to and from a rookery. Some territorial bulls went to sea occasionally while others remained on the rookery for over 60 continuous days. Females tended to make periodic trips to sea, probably for feeding purposes, but cows about to give birth, who have just given birth, or are estrous were reluctant to leave the rookery. Peak numbers of animals are usually ashore about midday (Mathisen and Lopp 1963 and Sandegren 1970). Stormy weather, high surf, high tides, disturbance and high solar radiation all appear to cause animals to return to the water. Numbers of animals found hauled out are usually greatest during summer (Mathisen and Lopp 1963). Population estimates based on rookery and hauling ground counts must be considered minimal as some animals will almost certainly be in the water at any given time.

Because of their dependence on land, particularly during the breeding season, population enumeration on rookeries and hauling grounds through aerial and ground surveys are possible. Such surveys, though subject to error, provide at least a minimum estimate of the number of sea lions which may use a particular rookery or hauling ground.

Repetitive surveys of selective rookeries indicate that in most areas of Alaska sea lion populations are at or near the maximum levels attainable within the ecological limits of the habitat. Greater expansion of the population in the future is not anticipated.

Little change has occurred in the population status of sea lions from that reported in Alaska's Wildlife and Habitat. However, several additional rookeries and hauling grounds have been found and recent surveys have revealed seasonal changes in population numbers. Table 7 lists these areas.

Table 7 Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1/]	1965[2/]	1969[3/]	June 1975[4/]	March 1976[5/]	June 1976[6/]
Attu	1	Attu Is. (Cape Wrangell)	5,000		6,900			
	2	Attu Is. (Chirikof Pt.)	10	4,000	1,500			
	8	Attu Is. (Chichagof Harbor)			900			
	3	Agattu Is. (Gillian Pt.)	3,000		750			
	4	Agattu Is. (Otkriti Bay)	100	1,300				
	5	Agattu Is. (Cape Sabak)	3,300		8,635			
	6	Alaid Is. (West End)	1,500	2,500	2,500			
	7	Shemya (Rocks off N. Shore)	2,500	2,000	650			
Kiska	17	Buldir Is. (South Shore)	2,500	3,500	4,350			
	18	Kiska Is. (Cape St. Stephan)	1,000					
	19	Kiska Is. (Vega Pt.)	400					
	21	Kiska Is. (Sirius Pt.)		1,485	65			
	20	Tanadak	50					
Rat Islands	22	Segula (Gula Pt.)			133			
	23	Segula (Chugul Pt)			115			
	24	Little Sitkin (Patterson Pt.)			335			
	25	Rat Is. (Eastern Pt.)	750	650	305			
	26	Amchitka Is. (Bird Rk.)	50					

continued

Table 7. (continued) Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1]	1965[2]	1969[3]	June 1975[4]	March 1976[5]	June 1976[6]
	27	Amchitka Is. (Islet off Chitka Pt.)	50					
	28	Amchitka Is. (Ivakin Pt.)	300	710	750			
	29	Amchitka Is. (East Cape)	200					
	30	Amchitka Is. (St. Makarius Islet)	50					
	31	Amchitka Is. (S.W. Islets and Rks.)	600					
	32	Semisopochnoi Is. (Rks. off S.W. shore)	500		0			
	33	Semisopochnoi Is. (Pochnoi Pt.)	2,000	1,100	1,120			
Gareloi Is.	43	Amatignak Is. (Nitrof Pt.)	200	0	1			
	44	Amatignak Is. (Knob Pt.)	50	0	0			
	45	Ulak (S. Pt.)	1,500	300	1,195			
	46	Unalga (Dinkum Rks.)	350	520	0			
	47	Gareloi (S. shore)	2,500	100	0			
	48	Skagul (Rks. off S. Pt.)	500		2			
	49	Tag Is.	400	100	1,412			
	50	Ugidak Is.	400		0			
	51	Gramp Rk.	700	75				
	52	Tanaga Is.	100	130	356			
Adak	62	Tanaga Is. (Cape Sasmik)	75					
	63	Adak Is. (Argonne Pt.)	1,000		0			
	64	Adak Is. (Hook Pt.)	1,500		20			

continued

Table 7. (continued) Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1]	1965[2]	1969[3]	June 1975[4]	March 1976[5]	June 1976[6]
	65	Adak Is. (Cape Yakak)	800	610				
	70	Adak Is. (Cape Moffett)	50		6			
	67	Little Tanaga (Tana Pt.)	450	281				
	68	Great Sitkin Is. (Swallow Head)	650		440			
	69	Kanaga Is. (Cape Miga)			260			
Atka	78	Anagaksik Is.	700	475	145			
	79	Igitkin Is. (S.W. Pt.)	700					
	80	Kasatochi Is. (North Pt.)	200		1,200			
	81	Ikiginak Is.	500		0			
	82	Atka (North Cape)	550					
	83	Atka (Cape Korovin)	100	4,900				
	84	Salt Is.	100					
	85	Sagchudak Is.	1,200		360			
	86	Amtagis Is.	800					
	87	Koniuji Is. (N. Pt.)			15			
Seguam	96	Amlia Is. (Cape Misty)	750					

continued

Table 7. (continued) Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1]	1965[2]	1969[3]	June 1975[4]	March 1976[5]	June 1976[6]
	97	Amlia Is. (Rks. in Sviechnikof Hbr.)	800	3,700				
	101	Amlia Is. (Agligadak Pt.)	700					
	98	Agligadak Is.	250		120			
	99	Sagigik Is.	100					
	100	Tanadak Is.	20		260			
	102	Seguam Is. (S.W. Pt.)	150		125			
	103	Seguam Is. (Lava Pt.)	150		640			
	104	Seguam Is. (Saddle Ridge Pt.)	25	4,400	35			
	105	Seguam Is. (Wharf Pt.)	100		233			
	106	Seguam Is. (Moundhill Pt.)			169			
Amukta	115	Amukta Is. (High Rk.)	600					
	116	Amukta Is. (Amukta Pt.)	150					
	117	Chagulak Is. (Chagulak Pt.)	100		120			
	118	Yunaska Is. (East shore)	800	350	895			
	119	Carlisle Is. (N.W.Pt.)	100	250	175			
Samalga Is.	124	Chuginadak (Concord Pt.)	700		341			
	125	Adugak Is.	1,000	400				
	126	Ogchul Is.	2,000					

continued

Table 7. (continued) Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1]	1965[2]	1969[3]	June 1975[4]	March 1976[5]	June 1976[6]
Umnak	131	Uliaga Is. (N.W. shore)	500		400			
	132	Kagamil Is. (North Pt.)	75		20			
	133	Umnak Is. (Cape Aslik)	450			285		
	134	Bogoslof Is.	1,000					
	135	Fire Is.	100					
	136	Cape Chagak				20		
Unalaska	140	Umnak Is. (Cape Idak)	600					
	141	Unalaska (Cape Izigan)	150					
	142	Unalaska (Spray Cape)	200					
	143	Unalaska (Cape Starichkof)	100			100		
	144	Unalaska (Pt. Tebenkof)	200			172		
	145	Unalaska (Cape Kalekta)	10					
	146	Unalaska (Whalebone Cape)	1,000					
	147	Egg Is.	0			180		
	148	Akutan Is. (Lava Point to Cape Morgan)	15,700			3,109		
Unimak	158	Akutan Is. (Northern Head)	714					

continued

Table 7. (continued) Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1/]	1965[2/]	1969[3/]	June 1975[4/]	March 1976[5/]	June 1976[6/]
	159	Akun Is. (Akun Head)	2,000					
	160	Akun Is. (Billing's Head)	100			748		
	161	Tanginak Is.	600			470		
	162	Tigalda Is. (Rk. off W. end)	10					
	163	Tigalda Is. (Rk. off N.E. end)	750			80		
	164	Aiktak Is.	600	100		1		
	165	Ugamak Is.	13,400	10,975		3,940		
	166	Round Is.	6,000					
	167	Unimak Is. (Cape Sarichef)	200					
	168	Unimak Is. (Oksenof Pt.)	4,000		4,000			
	169	Akutan Is. (Cascape Bight)				1,675		
	170	Akutan Is. (Battery Pt.)				30		
	171	Akun Is. (Jackass Pt.)				20		
	172	Rootok Is.				118		
	173	Unimak Is. (Cape Lutke)				22		
False Pass	174	Rock Is.				25		
	178	Bird Is.						90

continued

Table 7. (continued) Summary of Sea Lion Rookery and Hauling Ground Counts.

Quadrangle	Ref. No.	Location	1959[1/]	1965[2/]	1969[3/]	June 1975[4/]	March 1976[5/]	June 1976[6/]
	179	Sanak Is. (South Rock)	1,000		1,200			600
	180	Cherni Is.					0	0
	181	Clubbing Rocks	200				0	620
	182	Pinnacle Rock					125	900
Simeonof Is.	190	Nagai Is. (Saddlers Mistake)					20	375
	191	Twins					0	0
	192	Chernabura Is. (Pt. Farewell)					150	1,150
	193	Simeonof Is.					1	0
Cold Bay	200	Amak Is.	350			1,095		
	201	Sea Lion Rocks	2,000	4,100	7,500	2,006		
Hagemeister Is.	298	The Twins				50		
Nushagak Bay	305	Round Island				325		

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WALRUS

A small segment of the Pacific walrus (Odobenus rosmarus divergens) population remains in or returns to the Bering Sea during ice free periods. Their most southern occurrence is on Amak Island near Cold Bay. In April 1962, Kenyon (1965) recorded about 100 walrus hauled out on the east shore of Amak Island. In May 1965 he saw five walrus near the west shore of the island and an additional 75 off Cape Glazenap, near the mouth of Izembek Lagoon. In 1969, (K. Schneider A.D.F.&G., pers. comm.) observed 80-100 walrus near the east shore of Amak Island. These observations suggest that the walrus is a regular visitor to the southwestern corner of Bristol Bay.

The Walrus Islands State Game Sanctuary in northern Bristol Bay is composed of Round Island, Crooked Island, High Island, Summit Island, The Twins, Black Rock and adjacent waters. Although walrus frequent all of these islands, Round Island is the most commonly used hauling ground.

From August 16 to September 25, 1975 the Alaska Department of Fish and Game stationed personnel on Round Island with the objectives of preventing illegal harvest, to gain information on numbers and to record fluctuations in numbers. Walt Cunningham (A.D.F.&G., memo, 1975) recorded peak numbers of animals on the island on September 1 of 6,150 to 7,150 and on September 12 of 8,250. A series of aerial photographs taken on September 3 revealed 5,943 walrus. The walrus appear to leave the island for feeding forays and numbers decline to less than 1,000 individuals followed by a build-up as they return.

Walrus seem to be extremely susceptible to disturbance from boats and aircraft. Planes, even if high, seem to alert walrus. When

aircraft come within 300-500 feet, the animals panic (Walt Cunningham, A.D.F.&G., memo, 1975).

Miscellaneous observations on cetaceans are included here only to indicate their presence and possible relative abundance. In most cases, there is no more information than a collection of sightings; no population estimates can be made, nor can distribution be clearly defined.

Beluga or White Whale (Delphinapterus leucas)

The beluga is a common inhabitant of the waters of Bristol Bay. There is, however, a dearth of factual information on the animals. Belugas have been studied in Alaska since 1954, but these investigations have dealt primarily with food habits and with methods of controlling depredations on commercially valuable salmon in the Bristol Bay area. Knowledge of their life history and ecology in Alaska is incomplete.

In Alaska, belugas commonly occur from Cook Inlet westward to Bristol Bay, northward along the Alaskan coast and eastward into arctic Canada. A Bristol Bay population of 1,000 to 1,500 individuals appears to be resident throughout the year. The degree of interchange between this population and that of the northern Bering Sea, if any, is not known.

The diet of belugas during the spring and summer months is probably the best known aspect of beluga biology in Alaska. The belugas examined by Brooks (1954, 1955, 1956, 1957) contained five species of salmon as well as smelt, flounder, sole, sculpin, blenny, lamprey, two types of shrimp, and mussels. Since this study was conducted during the summer months (May to August), it is possible that a greater number of food species enter the beluga's diet at other times of the year.

Belugas traditionally have been used as a source of meat, muktuk and oil for both humans and dogs by residents of certain villages on the Bering Sea and Arctic Ocean coasts and along rivers that belugas periodically ascend. The demise of the sled dog as a result of the introduction of the snowmachine and the availability of alternate food sources through the development of a cash economy and welfare measures have greatly reduced the demand for beluga products.

The ecology of the beluga has not been studied in detail. They are known to concentrate in certain estuaries when a specific food source such as smelt or salmon is concentrated there, and it is possible that the belugas significantly influence some fish populations. The relationships between belugas and red salmon have been studied in some detail in Bristol Bay where commercial fishermen feel that beluga predation is a significant factor influencing red salmon runs. Studies indicate that large numbers of salmon smolts are eaten by belugas as they migrate to the sea in concentrated schools, and that a lesser number of adult salmon are eaten as they ascend the rivers to spawn. Predation on smolt is probably the most important influence. The importance of this predation depends on the size of the salmon run and how predation by belugas is viewed in relation to other mortality factors; however, a conflict does exist between belugas and the commerical fishing industry in Bristol Bay and perhaps in several other areas.

The feasibility of transmitting underwater sound to prevent belugas from entering certain river systems where they prey upon salmon has been explored and indications are that the method is possible and practical. In some areas this technique may greatly reduce predation on salmon.

It is uncertain whether belugas were ever harvested commercially in Alaska. Whaling stations operated at Port Armstrong, Port Hobron

and at Akutan Island, prior to 1940, but the Alaskan Fishery and Fur Seal Industries Reports make no mention of belugas being a part of the whale harvest.

Blue Whale (Balaenoptera musculus)

Blue whales are distributed from the Aleutian Islands south at least to the waters off Mexico. In about September they concentrate in the eastern Gulf of Alaska and southeast of the Aleutian Islands. Blue whales are rarely found in the Bering Sea. With the arrival of winter in the North Pacific, they reverse the migration routes and return to their tropical and subtropical grounds.

Right Whale (Balaena glacialis)

Early in this century, the slow swimming right whale was nearly exterminated by hunters who took advantage of its slow speed and the fact that its carcass floated. These animals were harvested for their great yield of whalebone and oil.

The distribution of right whales is poorly known. When they were still a prime quarry of whalers, they were most frequently found in the summer from Vancouver Island throughout the Gulf of Alaska to the eastern Aleutian Islands and even into the Bering Sea. In recent years they have been seen from the northern Gulf of Alaska as far south as Baja, California, but they are very rare.

Sperm Whale (Physeter catodon)

Sperm whales are widely distributed in the North Pacific. During the winter, they are generally below 40 degrees N. latitude. In summer, they may be found anywhere in the North Pacific, though the major

grounds are in the southwestern Bering Sea and the northern Gulf of Alaska.

Gray Whale (Eschrichtius robustus)

Pressures from whaling nearly brought this species to extinction around the turn of the century, but it was protected by international agreement in 1946, and its population is increasing. There were an estimated 10,000 animals in 1970 (Leatherwood et al., 1972).

Gray whales are migratory. The vast majority of the animals spend from about May through November feeding on small crustaceans in the waters of the Bering and Chukchi Seas. From December through January, they move southward to the breeding grounds along the coast of Mexico.

From June 17 to 20, 1975, Fiscus and Braham (1976) sighted 84 gray whales along the northern coast of the Alaska Peninsula.

Giant Bottlenose or Baird's Beaked Whale (Berardius bairdi)

Though not very abundant, Giant bottlenose whales are distributed from St. Matthew Island in the Bering Sea south to California.

Goose-beaked or Cuvier's Beaked Whale (Ziphius cavirostris)

The goose-beaked whale is found from the Bering Sea south to Baja, California.

Minke Whale (Balaenoptera acutorostrata)

Minke whales, also known as little piked whales or sharp-headed finners, are the smallest of the baleen whales, reaching a length of approximately 33 feet.

Fiscus and Braham (1976) saw four minke whales in the vicinity of Unalaska Island in June of 1975.

Killer Whale (Orcinus orca)

Killer whales are found in the Bering Sea, Aleutian Islands and the entire Pacific Ocean. In Alaska, they are most abundant near the Aleutian Islands. Killer whales feed on large fishes and other marine mammals.

Dall's Porpoise (Phocoenoides dalli)

The Dall porpoise prefers the cold waters found off the coasts of Alaska, Canada and the Pacific Northwest. It is seldom seen south of 35 degrees N. Latitude. Murie (1959) reported seeing Dall porpoises in the Aleutian Islands. He did not see them in the Bering Sea and said they were not plentiful along the Alaska Peninsula.

Harbor Porpoise (Phocaena phocaena)

The harbor porpoise inhabits bays, harbors, river mouths and relatively shallow inshore waters. Though it may travel in school of nearly a hundred individuals it is more often seen in pairs or in small groups of five to ten individuals. This porpoise occurs north to Pt. Barrow and is abundant in the Bering Sea.

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WATERFOWL*

WATERFOWL RECREATION AND SUBSISTENCE USE

Waterfowl Sport Hunting

Waterfowl sport hunting statistics in Alaska are generated from a combination of two sources. Total duck harvest, number of days, snipe and crane harvest and goose harvest by species are calculated from an annual mail survey of about 10% of all hunting license buyers in Alaska. Duck species composition information is derived from a U.S. Fish and Wildlife Service survey where hunters send in duck wings.

Relatively few waterfowl hunters actually reside in the Bristol Bay - Aleutian Islands region. Average duck stamp sales for the five year period 1971-75 have been about 875 (5.6% of total state sales). Of this total about 740 were sold on the Alaska Peninsula and in Dillingham, while the remaining 135 were sold in the Aleutian Islands. However, due to the excellent waterfowl hunting available on the north side of the Alaska Peninsula (especially for geese) substantial numbers of hunters travel from the Anchorage area, the Kenai Peninsula and from Kodiak to hunt. This travel is almost exclusively done by aircraft. For example, Reeve Aleutian Airlines annually sponsors two special charters to Cold Bay from Anchorage, taking about 65 hunters on each of the hunts. Pilot Point is another popular area for out-of-region waterfowl hunters who travel there primarily by private light aircraft or by charter from King Salmon.

A much smaller amount of hunting effort and bird harvest occurs in the Aleutians Islands and around local villages on the south side of the Alaska Peninsula and north side of Bristol Bay. A combination of

* This entire section by Dan Timm, A.D.F.& G.

fewer birds, limited facilities, the expense involved to hunt and inclement weather conditions preclude much hunting in these areas.

The average season take per hunter of geese on the Alaska Peninsula is the highest in Alaska. Over 41% of the total goose kill in Alaska occurs in the Bristol Bay area, primarily at Cold Bay and Pilot Point. Only about 1% of the state goose harvest occurs in the Aleutian Chain. Total goose harvest in the Bristol Bay-Aleutian Islands region comprises about 43% of the state's total goose harvest.

Ducks are much less sought after in this region than geese. About 4.5% of the state's total duck harvest occurs on the Alaska Peninsula while less than 1% of the total harvest occurs on the Aleutian Chain, for a regional total of about 5% of the state's annual duck harvest. On the Alaska Peninsula an average of 5.7% of the total waterfowl hunting days in Alaska occur, while on the Aleutian Chain about 1% of the total days occur.

Over 80% of the annual duck harvest on the Alaska Peninsula is comprised of pintails, green winged teal, mallards, and wigens. Gadwall annually comprise 5% to 10% of the duck harvest, which constitutes the major harvest area for this species in Alaska. Although all of the above species of dabblers are taken, in the Aleutian Islands the majority of harvest is comprised of sea ducks which include eiders, scoters, harlequins, mergansers and old squaw.

Species composition of geese shot on the Alaska Peninsula has been 53% Canada, 30% emperor, 15% brant and the remainder being comprised of snow geese and white-fronted geese. About half of the Canada geese killed are the small cackler subspecies. The emperior goose harvest represents over 90% of the sport hunter harvest of the species in Alaska. On the Aleutian Chain nearly all of the geese shot are emperors. A few

Canada geese are taken on Unimak Island incidental to bear and caribou hunting. Since 1973 the season has been closed on Canada geese in the Aleutian Chain, except Unimak Island, to protect the rare and endangered Aleutian Canada goose.

Table 1 shows the four year 1972-1975 average sport hunting statistics for three major hunting areas on the Alaska Peninsula, totals for the Bristol Bay area, totals for the Aleutian Islands and what statewide totals have been during this time period. As shown in this table, nearly 20% and 14% of the statewide goose kill occurs at Izembek Lagoon and Pilot Point, respectively. The importance of these two areas to waterfowl hunters in Alaska cannot be over emphasized. A growing number of out-of-state hunters are also using these and other areas on the north side of the Peninsula. Both crane and snipe harvest in the region is relatively insignificant. An average of 40 and 125 birds, respectively, are shot each year.

It is estimated that waterfowl hunters in the Bristol Bay area spend an average of $192,800 each year. The meat from the birds which are harvested has a calculated value of $48,750, for a total value of $241,550. On the Aleutian Chain it is estimated that hunters annually spend $15,300 in pursuit of waterfowl. The birds which are harvested are worth $2,950 in meat value for a combined total of $18,250. Combined dollars spent waterfowl hunting and dollar meat values equal a total of $259,800 - the amount which waterfowl hunting is "worth" in this region. This equals about 10% of the total dollars generated by waterfowl hunting in Alaska.*

* Alaska Department of Fish and Game, 1976.

Table 1 . Waterfowl sport hunting statistics by location, Bristol Bay - Aleutian Islands.

Five Year Average	Izembek Lagoon	Pilot Point	Port Heiden	Other Areas Bristol Bay	Total Bristol Bay	Total Aleutian Is.	Statewide Totals
Hunter Days	735	1,255	75 (est)	1,045	3,110	610	54,120
Ducks Shot	665	1,555	175 (est)	1,300	3,695	615	84,260
Geese[1/]	No species data available by area.						
Canada	-	-	-	-	3,375	0[2/]	10,185
Emperor	-	-	-	-	1,925	175	2,295
Brant	-	-	-	-	880	0	1,320
White-fronted	-	-	-	-	70	0	865
Snow	-	-	-	-	155	0	640
Total Geese	2,135	250 (est)		1,105	6,405	175	15,305
Cranes Shot	-	-	-	-	40	0	830
Snipe Shot	-	-	-	-	125	0	2,945

1/ 1972-75, four year average.

2/ Season has been closed on Canada geese since 1973.

Nonconsumptive Recreational Use

Nonconsumptive recreational use of waterfowl and sea birds or any wildlife is a difficult entity to quantify under most circumstances. Under highly controlled situations such as national parks, visitor days can be measured and outdoor activities evaluated by questionnaires. In the Bristol Bay - Aleutian Islands area, only descriptions of the nonconsumptive values can be provided. Probably few, if any, people travel to this region specifically to view waterfowl or sea birds. The one exception may be Round Island in the Walrus Island group. A special use permit is required from the Department of Fish and Game to visit this island where large numbers of walrus and spectacular numbers of sea birds on steep cliff nesting colonies occur. A visit to Round Island is, however, an expensive and arduous trip, and consequently few people utilize the area.

The King Salmon area in the spring and the Cold Bay area in the fall and spring both offer exceptional waterfowl viewing opportunities. In late April and early May the King Salmon River is one of the first water areas to become ice free. Consequently, tens of thousands of whistling swans, ducks and geese congregate in the immediate vicinity of, and even in the town of King Salmon. Local residents of King Salmon and Naknek are annually treated to several weeks of excellent bird viewing as are visitors to these towns during this time period. The Department of Fish and Game has considered recommending a stretch of the King Salmon River for critical habitat designation.

On Izembek Lagoon the U.S. Fish and Wildlife Service has closed an area to hunting adjacent to the Air Force radar site north of Cold Bay. This area affords exceptional viewing opportunities of the hundreds of thousands of waterfowl which stay in the lagoon for about two months each fall. The viewing area is easily accessible from Cold Bay by vehicle. However, due to the remoteness of Cold Bay few people except for local residents, waterfowl hunters during the fall, and occasional transient visitors utilize the viewing area. Good viewing opportunities are also available during the spring. However, numbers of birds are far fewer in the spring than fall, and thus viewing is not as spectacular.

Fair to good waterfowl and other bird viewing opportunities are available in sometimes year round situations at almost every village and town in the Bristol Bay - Aleutain Islands region. Most of the villages are located on the sea coast and practically all have tide flats nearby. For many residents of this region a spring or fall just wouldn't be the same without the arrival and departure of waterfowl and other birds.

Subsistence Use

The Migratory Bird Treaty between the United States and Great Britain for Canada allows for the taking of alcids and their eggs any time of the year for food and clothing, but not for sale. These special provisions apply only to Eskimos and Indians, but it has been assumed that Aleuts enjoy these same provisions. Historically, Aleuts living in the Aleutian Chain depended to some degree on alcids and alcid eggs for survival. A pure subsistence life style no longer exists in this

region as a cash economy has gradually replaced one of pure subsistence. However, the legal harvest of alcids and illegal spring and summer harvest of waterfowl and other birds still occurs in the Bristol Bay - Aleutian Islands region.

There have been no systematic or comprehensive studies done to ascertain the magnitude of subsistence hunting in this region. However, it is known that varying amounts of illegal hunting occurs, depending on the individual village. Estimates (and they are purely estimates) are that perhaps a total of 10,000 ducks, 3,000 geese, 300 swans and less than 100 sandhill cranes are annually taken in this region outside of the legal waterfowl season. In addition an unknown, but probably substantial number of alcid eggs are picked each year in the Aleutian Islands. Subsistence hunting in this region is probably not adversely effecting the welfare of any species or population of waterfowl or other birds.

WATERFOWL PRODUCTION

Bristol Bay Uplands

Since the mid-1950's the U.S. Fish and Wildlife Service has been conducting estimates of the breeding duck populations in Alaska. They annually count birds over flight lines replicated each year, covering most of the major duck breeding habitat in Alaska. Because the paths flown are the same each year, estimates of breeding ducks are comparable and lend themselves to long range average estimates. Most of the aerial counts on the Alaska Peninsula are conducted over upland areas below 500 feet MSL. No such aerial surveys have been conducted in the Aleutian Islands because censusing there would be a very difficult and expensive

proposition.

The major waterfowl production habitat in the Bristol Bay area is formed on an outwash plain north of the Alaska Peninsula - Aleutian Mountain Range and in the valleys of the Kvichak and Nushagak Rivers. The rolling heath uplands are liberally dotted with lakes and ponds of varying size. The major duck production areas encompass about 9,200 square miles.

In Table 2 the results of 19 years of aerial surveys in the Bristol Bay area are presented along with estimates of the number of breeding ducks in the Aleutian Islands. As can be seen in Table 2, in the Bristol Bay area about 50% of the breeding duck population is comprised of dabblers and divers while sea ducks and mergansers comprise the remainder. The total estimated breeding duck population is 377,800 birds, or 33.1 ducks per square mile. Good estimates of the actual number of ducklings produced in this area are not available. However, a reasonable assumption for both the Bristol Bay area and Aleutian Islands is that dabblers produce 0.9 young per adult, divers 0.7 young per adult and sea ducks 0.5 young per adult. Using these production figures we can calculate the average annual fall flight from the Bristol Bay area to be 622,500 ducks. Most of the dabblers travel south to lower Pacific Flyway wintering areas. The exception is most mallards which probably remain in Alaska to overwinter. Except for goldeneyes and buffleheads, most of the divers also travel to lower Pacific Flyway wintering areas. Very few of the sea ducks and mergansers from the Bristol Bay area travel outside of Alaska.

A conservative estimate of the number of breeding ducks in the Aleutian Chain is 148,000 (Table 2). These include 19,000 dabblers of which an estimated 10,000 are common teal. These are the only

Table 2. Bristol Bay - Aleutian Islands average breeding duck populations, population densities, and estimated fall duck flights, 1957-1975, 19 year average.

	Bristol Bay (From USFWS Surveys)	Aleutians 1/	Total
Pintail	51,200	5,000	56,200
Mallard	14,000	3,000	17,000
Am. Wigon	10,700	0	10,700
G-W Teal	10,700	10,000 (common)	20,700
Gadwall	3,500	1,000	4,200
Shoveler	500	0	500
SUBTOTAL DABBLERS	90,300	19,000	109,300
Scaup	87,100	3,000	90,100
Goldeneye	10,000	0	10,000
Bufflehead	1,300	0	1,300
Canvasback	100	0	100
SUBTOTAL DIVERS	98,500	3,000	101,500
Harlequin 1/	50,000	100,000	150,000
Scoter	76,000	0	76,000
Old Squaw	54,500	1,000	55,500
Merganser	6,800	5,000	11,800
Eider	1,700	25,000	26,700
SUBTOTAL SEA DUCKS	189,000	131,000	320,000
TOTAL ALL DUCKS	377,800	148,000	530,800
Ducks per sq. mile	33.1		
Est. Fall Flight 2/	622,500	237,700	860,200

1/ No surveys made - estimates only.

2/ Production assumed to be: dabblers - 0.9 yg/ad.
divers - 0.7 yg/ad.
sea ducks- 0.5 yg/ad.

common teal in North America. These teal are apparently year-round residents of the Aleutian Chain. Probably the only diving ducks breeding in the Aleutian Chain are an estimated 3,000 greater scaup. An estimated 131,000 sea ducks and mergansers summer here and the bulk of this population is comprised of harlequin ducks. A substantial number of common eiders also occur. Possibly all of these 131,000 sea ducks and their progeny remain in Alaska throughout their life. Using the productivity estimates provided earlier the total annual fall duck flight from the Aleutian Islands is 237,700 birds.

As can be seen in Table 2 the combined Bristol Bay - Aleutian . Islands breeding duck population is estimated at 530,800 birds. Of this total dabblers and divers each comprise 20% while sea ducks and mergansers represent the remainder. The total estimated fall flight after production is 860,200 ducks.

Summering geese in the region are rare, but do include the estimated 1,500 rare and endangered Aleutian Canada geese which breed exclusively on Buldir Island at the western end of the Aleutian Chain. These geese will be discussed in the section on rare and endangered species. White-fronted geese prehaps number 1,000 in the fall flight. These birds are found in low densities primarily north and west of Naknek Lake. These whitefronts are most likely part of the Pacific Flyway population which winters in central California. Canada geese or any other species of geese are not known to breed in the region.

The U.S. Fish and Wildlife Service estimates that there is an average annual fall flight of 10,600 whistling swans from the Bristol Bay area. The highest whistling swan nesting densities occur generally north of Port Heiden and around the Peninsula to the Nushagak River

Valley. Whistlers generally nest in upland heath in low densities. Swans banded in this area have tended to migrate to and winter primarily in central California.

A small population of swans are apparently permanent residents of the Unimak Island - Cold Bay area. These birds number about 300 and nest primarily on Unimak Island. Fish and Wildlife Service personnel have captured and measured a few birds and found that body measurements were intermediate between whistling swans and trumpeter swans. However, sample size is small.

There is a small population of the Asiatic whooper swan wintering in the Aleutain Islands. It is possible that whooper swans also breed in this area, but no records of this exist. The Aleutians are the only place where wintering whooper swans in North America are found.

A very few trumpeter swans may nest here, primarily in the brush transition zone between heath and spruce forest in the Kukaklek Lake area.

GENERAL WATERFOWL DISTRIBUTION

North Side of Alaska Peninsula

The importance of the north side of the Alaska Peninsula as a fall and to a lesser degree spring staging and resting area for waterfowl cannot be over emphasized. All or nearly all of North America's black brant, and essentially the world's population of emperor geese and cackling Canada geese utilize areas on the north side of the Peninsula. Additionally many hundreds of thousands of snowgeese, white-fronted geese, lesser Canada geese, sandhill cranes, dabbling and diving ducks and sea ducks are present during fall and spring months. Gulls, terns, shorebirds and other birds number in the millions. The largest

waterfowl concentrations occur in eight large estuaries.

Part of the Alaska Department of Fish and Game's outer continental shelf studies entail the delination and characterization of coastal bird habitats. During October 1975 an aerial survey was conducted over the north side of the Peninsula and habitat types were delinated. In Table 3 the results of this survey are depicted for the major estuaries except Izembek Lagoon. Coastal habitats were catagorized according to major vegetation - substrate types. Both the shoreline distance encompassed by each habitat type and the total area in hectors of each habitat are presented in Table 3. Also included are the total sizes of each estuary.

Although not included in Table 3, Izembek Lagoon contains the largest eelgrass bed in the world and has extensive exposed flats at low tide comprised of a mixture of sand and detritus eelgrass material. Large expanses of beachrye and sedgemeadow are present above mean high tide.

In Table 4 the habitats along the outside coast of the north side of the Peninsula are quantified. Sandy beach is the most abundant habitat type. Sedgemeadow generally above mean high tide is the most frequently encountered vegetation.

Numerous surveys during the spring and fall have been conducted along the north side of the Peninsula, primarily in the major estuaries. Table 5 presents a summary of various aerial surveys conducted through 1974, before OCS studies were initiated. Data in Table 5 represents counts of both ducks and geese, but do not represent complete counts for each area. Two areas on Unimak Island and one area on the north side of Bristol Bay are also included in Table 5. During October 1975 the first comprehensive aerial survey of birds along the north side of the Peninsula was conducted. The results of bird counts related to habitat type in which the birds were observed is summarized in Table 6. Only the

major estuaries are included in Table 6 while in Table 7 these data are summarized for outer beaches along the north side of the Peninsula. It must be emphasized that surveys such as these must be taken as indicators of relative bird abundance rather than precise estimates of bird populations. These surveys merely give an indication of bird numbers present at one time at one place. During migration, birds are continually coming and going, areas and the total number of birds which use each area during a given fall or spring are many times that indicated by these aerial surveys.

During October 1976 surveys similar to those conducted in 1975 were flown on the north side of the Peninsula. The results of those counts are presented in Table 8. In 1976 only the major estuaries were surveyed, not the outside coast. Data for 1976 are broken down by species of birds by area.

During spring and fall migration on the Peninsula, dabbling ducks, whistling swans, snow geese, cackling Canada geese and most species of shorebirds are more abundant in the estuaries from Seal Islands north. From Port Moller south through Izembek Lagoon, black brant, lesser Canada geese and Steller's eiders are more common. Scoters and emperor geese are common on all of the estuaries.

During the winter, bird numbers are only a fraction of what they are during other periods of the year due to ice cover. However, Port Moller and Izembek Lagoon during milder winters have several thousand emperor geese and tens of thousands of Steller's eiders present. Figure 1 depicts the major estuaries along the north side of the Alaska Peninsula and other prominent geographic locations.

Table 3. Quantity of various habitat types for the major estuaries of the north side of the Alaska Peninsula.

	Habitat Types												
	Distance in Kilometers						Area in Hectares						
Estuary	Sandy Beach	Gravel Bench	Rocky Beach	Mud/Sedge Meadow Ecotone	Mud/ Beach Rye Ecotone	Total	Sedge Meadow	Sand	Beach Rye	Mud Flat	Total	Estuary Area*	Possible Estuary Influence
Egegik	13.4	0	0	11.8	0	25.2	3833.3	0	51.8	4327.9	8213.0	9764.4	0
Ugashik Bay	50.9	0	0	118.5	4.5	173.9	8282.9	2416.5	4009.3	3056.2	17764.9	19281.1	5128.2
Cinder River	16.2	0	0	71.1	12.5	99.8	4662.0	385.9	2305.1	5027.2	12380.2	10800.4	0
Port Heiden	30.0	0	0	61.6	14.3	105.9	7964.3	598.3	1087.8	11106.1	20756.5	27255.0	0
Seal Islands	31.1	0	0	58.7	33.8	123.6	3952.4	1383.0	823.6	1551.4	7710.4	9521.0	0
Port Moller Total Estuary	216.7	65.7	10.9	40.3	0	333.6	3095.0	2463.0	543.9	37135.9	40621.1	75370.1	11940.1
Port Moller (East)	55.8	49.3	7.1	2.9	0	115.1	261.6	157.9	0	13014.9	13424.4	31883.4	0
Herendeen/ Mud Bays Deer Is.	73.8	16.4	3.8	0	0	94.0	1201.7	0	0	8218.2	9419.9	27350.8	0
Nelson Lagoon	87.1	0	0	37.4	0	124.5	1631.7	2305.1	543.9	13286.9	17767.6	16135.9	0

*Includes open water portion

Table 4. Quantity of various habitat types for the outside beach of the north side of the Alaska Peninsula.

Section of Beach	Habitat Types: Distance in Kilometers			Habitat Types: Area in Hectares		
	Sandy Beach	Rocky Beach	Gravel Beach	Sedge Meadow	Beach Rye	Mud Flats
Cape Horn to Naknek River	16.45	0	0	2874.9	0	0
Naknek River to Bishop (at Egegik Bay)	67.1	0	0	1509.9	0	0
Goose Point (at Egegik Bay) to Smoky Point (at Ugashik Bay)	67.1	0	0	3703.7	854.7	543.9
South Spit (at Ugashik Bay) to Meshik (at Port Heiden)	97.7	0	0	699.3	2393.2	0
Strogonof Point (at Port Heiden) to Entrance Point (at Port Moller)	134.6	0	9.0	1090.4	1963.2	0
Lagoon Point (at Nelson Lagoon) to Moffet Point (at Izembek Lagoon)	109.0	0	0	2356.9	543.9	233.1
Cape Galzenap (at Izembek Lagoon) to Cape Krenitzin (at Bechevin Bay)	36.7	0	0	0	0	0
Chunak (at Bechevin Bay) to Otter Point (at Unimak Island)	25.2	0	0	0	0	0

Table 5. Ducks and geese* found in estuaries of the north side of the Alaska Peninsula and Unimak Island by aerial survey.

Location	Date of Survey 10-23-68	5-13-69	10-6-69	12-15-69	3-3-70	6-29-70	8-25-70	9-24-70	10-8-70	9-14-71	10-4-71
Egegik	170	1397	43,580	-	0	1671	-	-	-	-	4478
Ugashik	2550	1145	70,190	-	1000	1142	2128	7362	75,850	3408	19,300
Cinder River	50,000	5200	115,000	1250	500	869	7271	20,195	25,450	3498	38,313
Port Heiden	41,000	4800	99,350	405	-	2499	5355	118,800	56,190	5762	51,765
Ilnik	38,500	3110	16,500	1156	-	3038	4460	16,965	7400	7906	39,812
Port Moller	3177	3641	-	7025	-	1461	-	35,770	44,962	6630	444,655
Hook Lagoon	-	-	-	-	-	81	1510	4550	-	-	-
Kvichak River	-	-	-	-	-	-	245	-	-	-	-
Urilia Bay	-	-	-	-	-	-	-	-	-	-	17,000
Swanson Lagoon	-	-	-	-	-	-	-	-	-	-	9365

* The total does not represent a complete count of each area and the experience of observers to estimate numbers varied. All counts were from a fixed-wing aircraft.

Table 6. Total number of birds observed in estuaries during aerial surveys of the north side of the Alaska Peninsula, October 1975.

Estuary	Sedge Meadow	Mudflat	Beach	Open Water	Total
Egegik (transects*)	460	2,836	2,195	188	5,679
Ugashik (transects*)	12,609	4,567	2,124	1,145	20,445
Cinder River (transects**)	1,576	9,824	61	15,680	27,141
Port Heiden (transects*)	2,713	3,989	233	4,535	11,470
Seal Islands (total count)	3,134	2,968	6,989	12,993	26,084
Port Moller (total count)	0	116	3,915	9,117	13,148
Herendeen Bay (total count)	0	25	1,158	8,513	9,696
Mud Bay - Deer Island (total count)	0	4,827	857	11,678	17,362
Nelson Lagoon (total count)	2,535	13,126	3,122	45,213	63,996
Izembek Lagoon (total count)	---	---	---	---	342,507

* Not complete coverage: 200 meters on either side of aircraft along transects.

** One side of aircraft only due to recorder malfunction.

Table 7. Total number of birds observed during aerial surveys along beach of the north side of the Alaska Peninsula, October 1975.

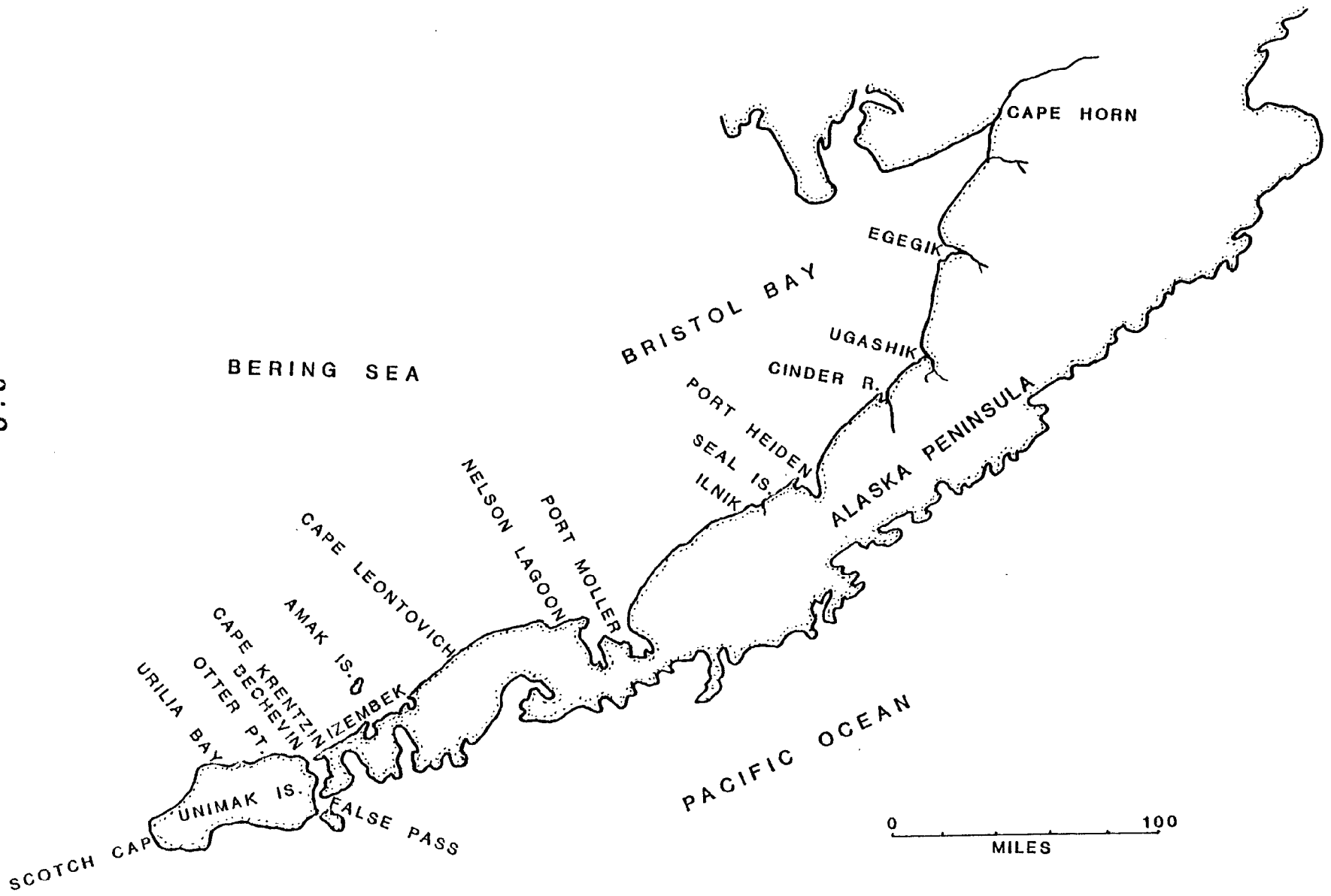
Section of Beach	Sandy Beach	Open Water	Mouth of Stream
Naknek River to Smoky Point	2,238	2,836	735
South Spit to South End of Cinder River	439	5,604	
South End Cinder River to Ilnik*	1,442	413	40
Ilnik to Cape Leontovich	1,192	19,975	368
Cape Leontovich to Cape Krenitzin	2,076	2,858	93
Chunak Point to Otter Point	549	187	44
Total	7,936	31,873	1,280

*Right side of aircraft only because of recorder malfunction.

Table 8. Summary of bird observations in estuaries of the Alaska Peninsula, aerial surveys, October 13-16, 1976.

	Ugashik	Cinder R. Hook Lagoon	Port Heiden	Seal Is.	Mud Bay	Nelson Lagoon	Izembek Lagoon
Loons (unid)	1						1
Large loon	2	2	1			15	18
Small loon			1	5			2
Grebe (unid)	1	1	1			8	6
R.N. Grebe		1				3	2
Cormorants (unid)		10	2				26
Swans	4	59	98	6			2
Geese (Dark)	35		230	250	175		
Canada	11,774	10,744	4,791	1,364	80	41	29,733
Brant			14				99,349
Emperor	422	3,601	4,073	10,102	3,418	14,220	5,507
Snow	545	2,250					2
Duck (unid)	77	808		114		3	931
Dabbler Ducks (unid)	6,046	2,371	5,667	812	135	1,418	462
Mallard	581	126	60	483		14	552
Pintail	259	1,718	834	5,966	959	495	2,068
G-W Teal	80	3	99				
Am. Wigeon	41	6		3			10
Diving Ducks	173	76	75	6			
Scaup	17	11				1	136
Goldeneye	52		3				
Bufflehead		3	5	5			
Sea Ducks (unid)	28	512	12,017	1,801	218	10,316	4,816
Oldsquaw	1		85	75		72	20
Harlequin							4
Eiders (mixed)			76		1	84	1,690
Steller's		249	460	943	3,011	17,294	15,532
Large eider (unid)	4	31	73			637	55
Common		1	195	25		80	4
Scoter (unid)	1,367	5	10,817	108	102	782	1,232
W-W scoter	45	3	51	1		23	18
Surf scoter		12	5			25	
Common scoter	38	99	320	2	372	1,447	123
Merganser (unid)	4						1
R-B Merganser	20						
Eagles (Q-ad, M-im)	2-M	1-Q,1-M	4-Q,2M	3-Q,3-M			6-Q,6-M
Gyrfalcon			1				
Ptarmigan	46						
Large shorebirds	85		503				20
Yellowlegs	7						
Medium shorebirds	907	1,858	3,559	841	3,700	2,651	4,908
Small shorebirds	1,375	15,805	3,466	1,860		19,148	4,346
Mixed shorebirds	1,113	1,500		1,500			3,800
Jaeger (parasitic)				2			
Gulls (unid)	285	1,769	337	2,000	1,500	652	529
Large gulls (unid)	18	70	305	92		9	
Glaucous-winged	161	625	190	1,579	385	3,656	4,055
Herring	3						
Small gull	175	1	2	40		132	546
Mew	209	7	157	10		46	59
Bonaparte's	16		31	1			62
Kittiwake	123	1	55	200		359	977
Sabines	1	15					
Murre						3	
Small alcid						2	1
Pigeon guillemot			1				
Raven	2	2	5	2			14
Passerine - small	7	132	65			8	
Snow bunting		35		25		50	4

Figure 1. North side of Alaska Peninsula - Scotch Cap to Cape Horn.



North Side of Bristol Bay

In Table 9 the various habitat types on the north side of Bristol Bay are quantified. These represent the same habitat classifications which were used on the north side of the Alaska Peninsula. There are no large estuaries in this area similar to those found on the Peninsula. Thus, there are no large waterfowl concentrations present. However, there are a number of small estuaries and exposed inter-tide flats which in the aggregate are important to migrating waterfowl and shorebirds for resting and feeding purposes. The most important of these are located at the head of Nanvak Bay, in Osviak Bay, at the mouth of the Kanik River, in Tvativak Bay, a small marsh on the east side of Protection Point, and on the west Nushagak Flats in Nushagak Bay. In Table 10 the results of five aerial surveys conducted on these areas in 1970 and 1971 are presented. Bays and river mouths receive extensive use by waterfowl and shorebirds during both spring and fall migrations. During spring migration migrant birds may be delayed while waiting for favorable winds or the ice to melt to the north. When these conditions are present bird concentrations on the coastal areas can be spectular for a few days. The map depicted in Figure 2 lists the prominent geographical land marks and locations of the more important bird habitat in this area.

Offshore Bird Distribution in Bristol Bay

Probably the first offshore water bird surveys flown in Bristol Bay were conducted by personnel of the U.S. Fish and Wildlife Service and the Alaska Department of Fish and Game in October 1969. Because the survey aircraft was single engine, surveys were conducted only up to twelve miles from shore. Figure 3 depicts the transects flown and general area of coverage for this survey which extends from Unimak

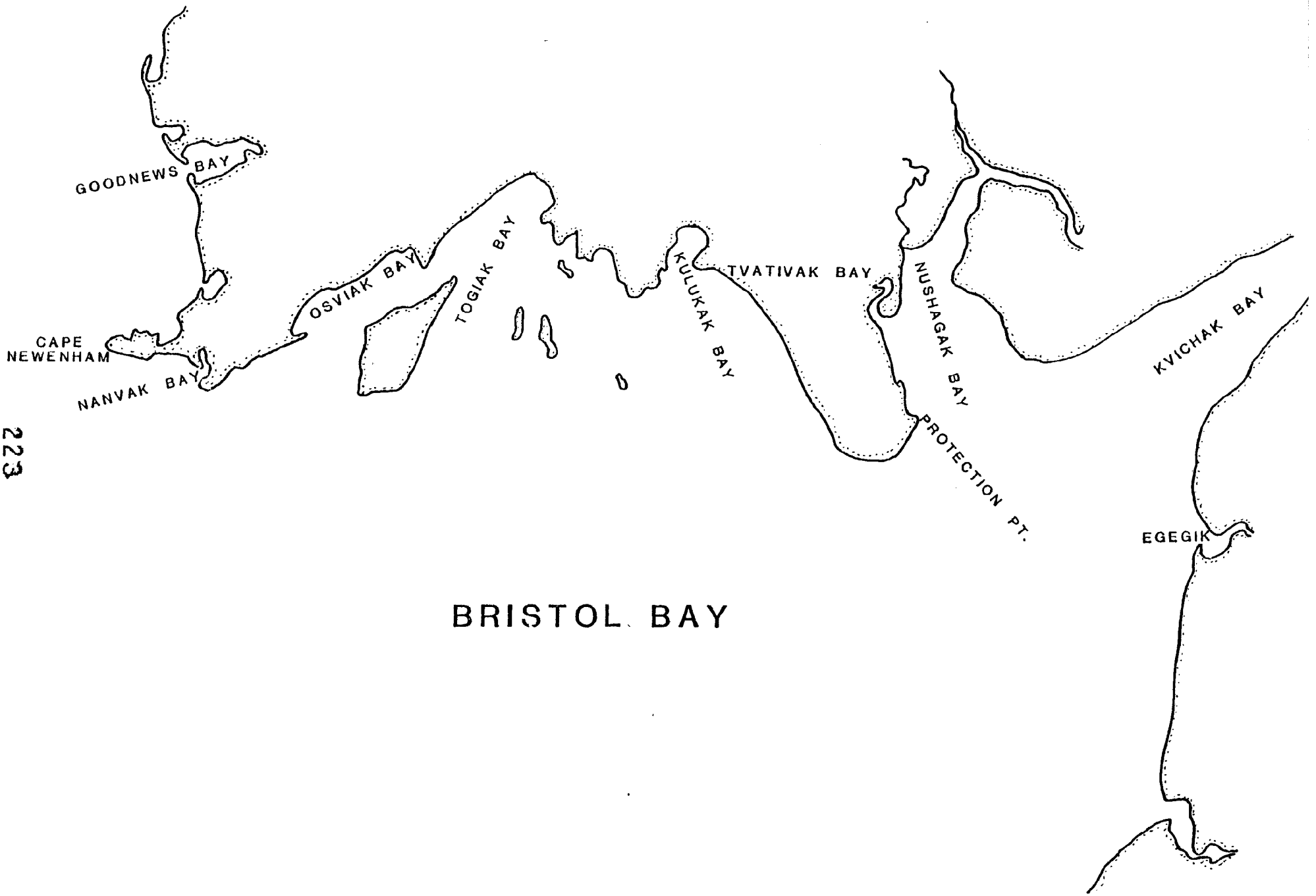
Table 9. Quantity of various habitat types for the beach of the north side of Bristol Bay, Kuichak River to Cape Newenham and Walrus Islands.

	Shoreline in Miles											Area in Square Miles				
	Mud	Mud & Sand	Sand	Gravel	Rock	Sand & Rock	Gravel & Rock	Rock & Sand	Sand & Gravel	Gravel & Sand	Rock & Gravel	Mud Flats	Sand Flats	Mud & Sand Flats	Mixed Forbes (Inter-tidal)	Elymus
Cape Horn to Etolin Point	24.7	3.5	34.1									10.25	27.38	19.78	19.69	
Etolin Point to Dillingham	81.3	0	16.7									23.80	0	4.62	59.38	
Dillingham to Cape Constantine	95.0	3.3	30.1									45.10	.05	0	55.27	
Cp. Constantine to Tvativak Bay	0	0	40.8	0	2.6	0	3.8					3.54	.27	0	21.57	
Tvativak Bay to Right Hand Point	0	0	12.2	0	2.1	9.0	3.6	0.9			1.4	0.94	.24	0	9.45	
Right Hand Point to Togiak	5.1	0	7.6	0.9	10.9	0.7	5.1		9.4			0.24	0	0	5.78	
Togiak to Tongue Point	0	0	13.8		1.6	0.3			4.3						0.61	0.71
Tongue Point to Asigyukpak Spit	0	0	24.1		2.1		1.9		9.6						2.73	1.21
Asigyukpak Spit to Cape Newenham	0	0	17.2	1.1	18.7				0.3	0.6	5.3				2.64	
Hagemeister Is.	0	0	48.4	3.0	6.5	1.4	0.6	2.7	0.2		1.5			3.92	0.69	3.31
Summit Is.			1.4		1.5		3.5									
High Is.			1.3		1.6	1.3	2.8				3.1					0.07
Crooked Is.			3.6	0.8	4.3	0.4	1.2				1.5				0.09	
Round Is.				1.2	1.7		1.7									
Total	206.1	6.8	251.3	7.0	53.6	13.1	24.2	3.6	23.8	0.6	12.8	83.87	27.94	28.32	177.90	5.30

Table 10. Ducks and geese found in bays of the north side of Bristol Bay by aerial survey.

Location	Date of Survey 5-4-70	6-30-70	8-24-70	6-7-71	9-8-71
Nanvak Bay	-	-	3467	200	2000
Osviak Bay	-	-	-	24	500
Kanik River	30	-	1804	-	-
Tvativak Bay	43	-	400	-	-
Protection Point	50	705	282	-	-
W. Nushagak Flats	1073	681	236	-	-

Figure 2. North Bristol Bay - Cape Newenham to Kvichak River.



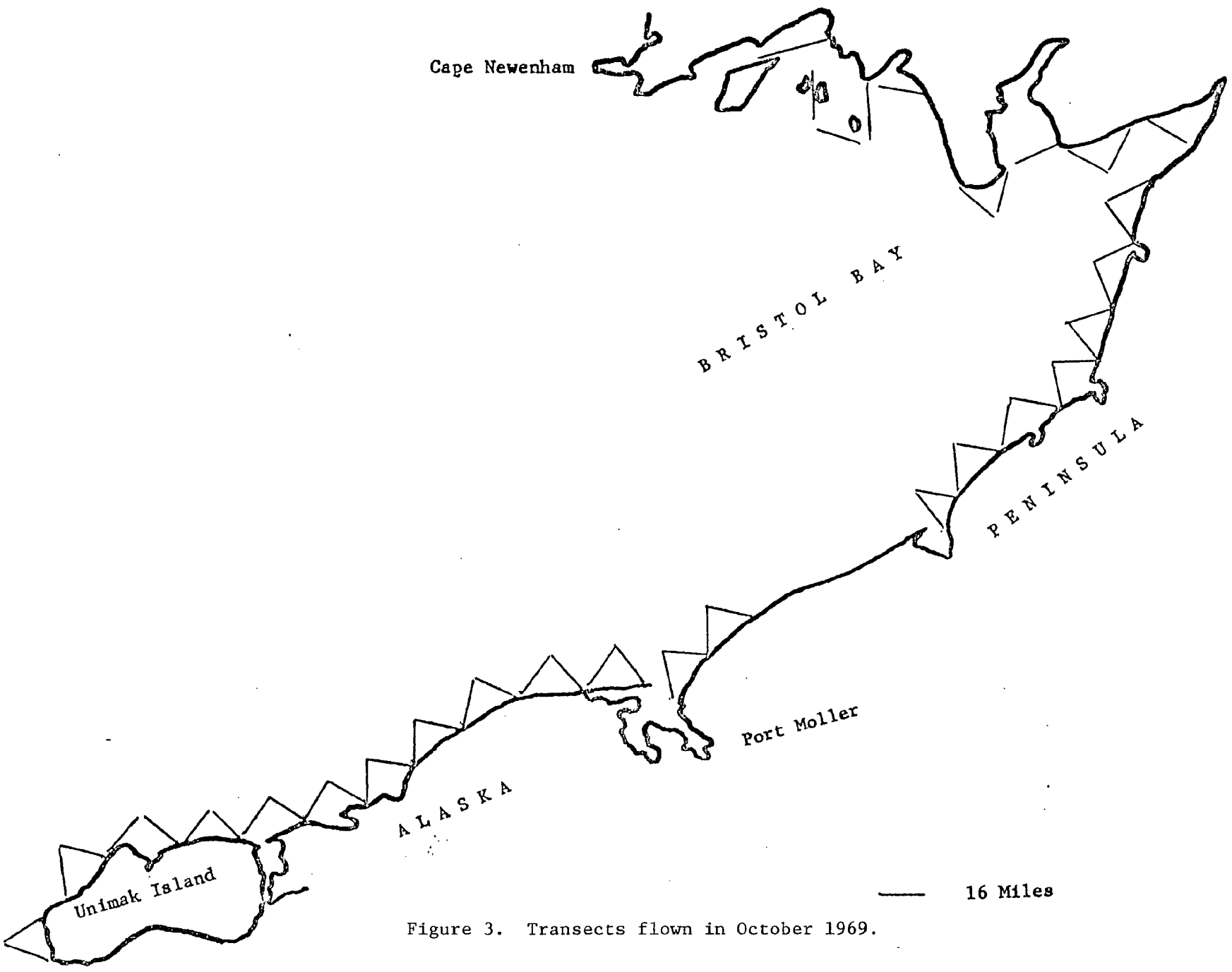


Figure 3. Transects flown in October 1969.

Island around Bristol Bay to Hagemeister Island. The eastern Bering Sea, including Bristol Bay, is one of the largest congregation areas for water birds in the world. Because waters of Bristol Bay are rich in small food species, the area is used by millions of migrant birds bound to and from vast Arctic nesting areas of Siberia, Alaska and Canada; as well as being a wintering area for tens of millions of Arctic nesting species and southern hemisphere nesting birds. It is also a wintering area for millions of locally raised sea birds.

The 1969 survey sampled a calculated total area of 8,064 square miles of water inside of the twelve mile limit. An indicated 47.8 birds per square mile were present, with a sampling error of 27.5%, providing a total expanded population of 385,700 birds of all species. Because this was the initial aerial survey of sea birds in Alaska, population data are minimal. In Table 11 data from this survey are broken down by catagory and birds observed. Various species of waterfowl comprised the bulk of the bird population; scoters comprised 47% of the total birds observed and 88% of the total waterfowl.

During late July and early August 1969, personnel of the U. S. Fish and Wildlife Service made bird observations from aboard a large research vessel. Total bird counts were attempted along known transect lines as depicted in Figure 4. All birds seen either side of the ship for pre-established distances were tallied. Data were analyzed by species by 20 mile segments for each transect. Figure 5 depicts relative bird densities by species for each 20 mile transect in the survey. The most abundant birds by far were slenderbilled shearwaters, followed by

Table 11. Bristol Bay Waterbird Survey - October 1969
99, 8-Mile Segments

	Range	Average Number	Frequency	% of Frequency	Total Birds	% of Total Birds	Birds per Sq. Mi.	Expanded Population
Loons	0-2	1.5	4	4%	6	.06	.03	242
Grebes	0-2	1.5	4	4%	6	.06	.03	242
Tube-Nosed Swimmers	0-9	2.7	34	34%	93	.98	.47	3,790
Cormorants	0-6	2.1	16	16%	33	.35	.17	1,371
Waterfowl	0-738	74.1	68	69%	5,036	53.14	25.43	205,068
Shorebirds	0-549	53.8	36	36%	1,937	20.45	9.78	78,866
Gulls	0-196	20.5	86	87%	1,759	18.57	8.88	71,608
Alcids	0-88	9.2	62	63%	573	6.05	2.89	23,305
Unidentified	0-6				30	.32	.15	1,210
Total	0-747	75.4	96	97%	9,473	99.98	47.83	385,701

Range = Least and greatest number seen on any one segment
Average number = Average number of sightings on segments where sightings occurred
Frequency = Number of segments in which sightings occurred
% of frequency = % of total segments where sightings occurred
Total birds = Total all segments
% of total birds = Composition of each order in total bird count
Birds per sq. mi. = 9,473 birds seen divided by 198 square miles in the sample
Expanded population = Birds per square miles multiplied by 8,064 sq. mi. in area

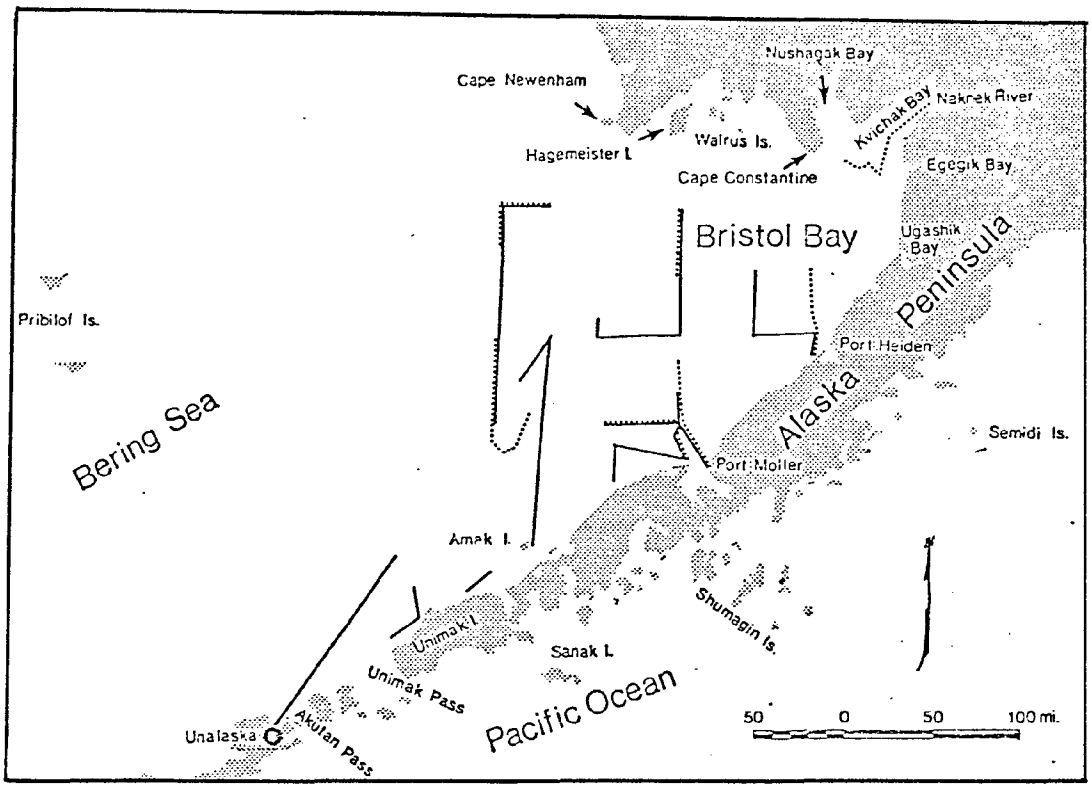


Figure 4. Transects along which observations of pelagic birds were made in Bristol Bay for the periods 13 to 31 July (solid line) and 1 to 20 August (broken line) 1969. Gaps between transects represent areas for which observations were not made.

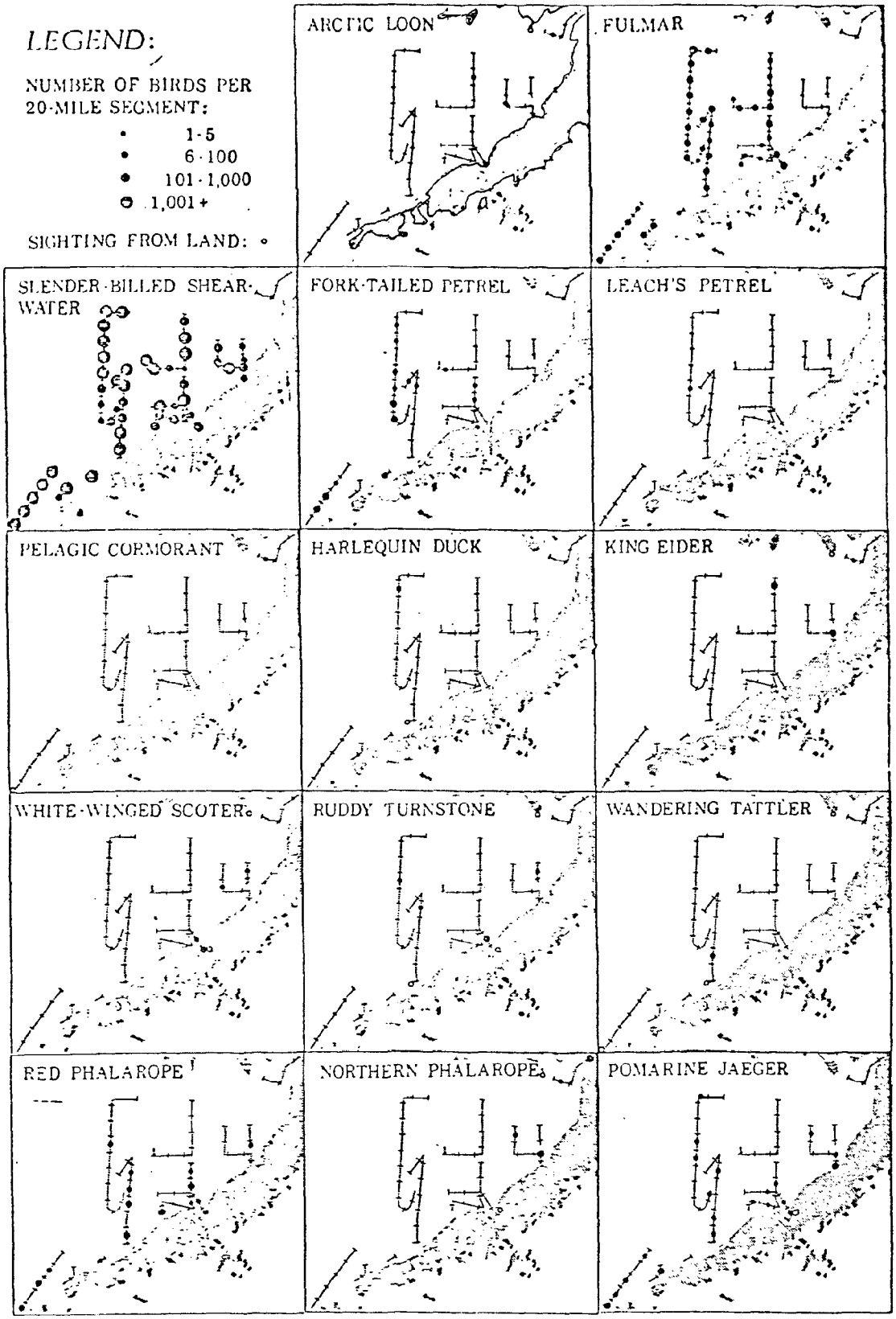


Figure 5. Distribution and numbers of birds observed in Bristol Bay along 20-mile segments and sightings of birds from land, 13 July to 20 August 1969.

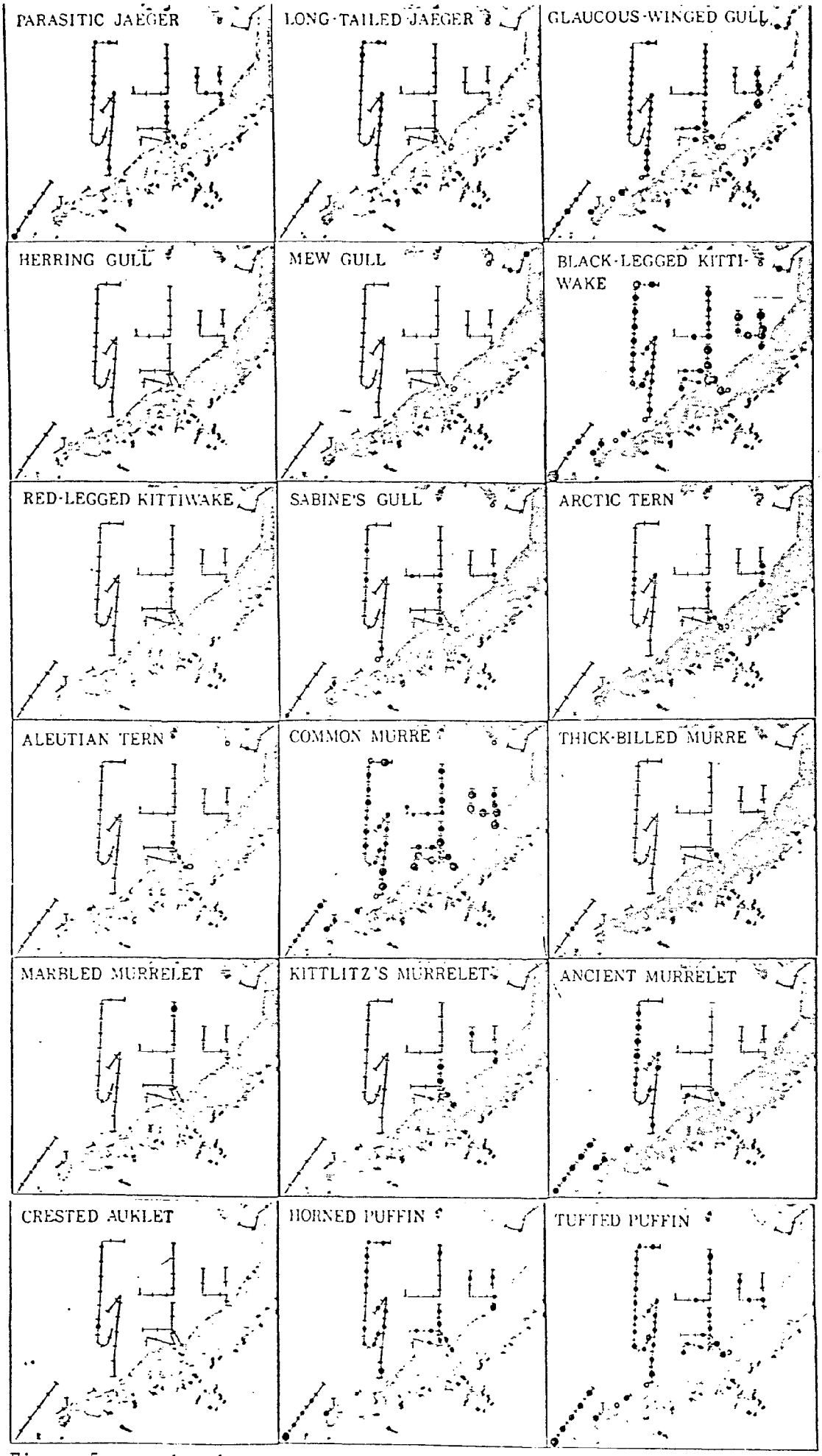


Figure 5. continued.

black-legged kittiwakes, fulmars, common glaucous-winged gulls, and various other alcids. Shearwaters are a southern hemisphere nesting bird found in New Zealand, Australia and Tasmania, and spend the southern hemisphere winter, which is summer in Alaska, in Bristol Bay and other areas of the Bering Sea and parts of the Gulf of Alaska.

In early May 1972 the first extensive aerial survey of birds and mammals in Bristol Bay was made by personnel of the Fish and Wildlife Service and Alaska Department of Fish and Game. Transect lines were flown north and south on loran frequencies and were spaced ten nautical miles apart. Each transect was then broken into ten nautical mile segments. Data were recorded by individual segments. Figure 6 depicts the transects flown, individual segments within each transect, average densities of birds by category and what the expanded total population of that catagory was for the entire bay. Table 12 summarizes these data by providing average densities of birds by category and what their respective total calculated populations were. The largest category of birds observed were ducks with a total population of 691,082. Over 67% of these birds were eiders, and king eiders comprised most of these. Over the entire Bay, an average of 52.1 birds per square nautical mile were observed. The greatest concentrations of birds occured in the northeastern end of Bristol Bay and along coastal areas.

During April 9-13, the survey depicted in Figure 6 was replicated by personnel of the U.S. Fish and Wildlife Service. The results of this survey are presented in Table 13. The total expanded population by species or category of birds is presented in the far right-hand column of Table 13. Due in part to changes in survey design, the total calculated populations of many birds are significantly larger than

Table 12. Calculated populations and densities of birds and mammals in Bristol Bay, May 1972.

Group/Species	Average Density (birds or mammals per square mile)	Expanded Population
Loons	0.1	3,452
Petrels, Fulmars, Shearwaters (tube-nosed swimmers)	0.7	19,125
Cormorants	0.3	7,891
Geese/Swans	1.5	40,771
Ducks	25.1	691,082
Hawks, eagles, owls	trace	219
Shorebirds	trace	986
Gulls, Kittiwakes, terns, jaegers	13.4	368,036
Alcids	10.9	299,098
Passerines	trace	109
Unident.	0.2	7,069
Whales	trace	1,424
Walrus(1)	0.6	16,823
Seals	0.2	5,918
Sea Otter	trace	1,096
Misc. & unident sea mammals	trace	153
Total Birds		1,437,838
Total Mammals		25,414

(1) All walrus were sighted on the pack ice, well out from shore. Figure 3 shows a typical walrus group found in open leads of the Bristol Bay ice pack in May.

Table 13. Calculated total populations of birds in Bristol Bay, April 9-13, 1973.

Species	Numbers Observed (Seat location)*		Total Observed in transect	Total Observed x Conversion**
Alcid	Left	8		
	Right	148	156	17,940
Alcid, small	Left	328		
	Right	406	734	84,410
Bird, unidentified	Left	0		
	Right	21	21	2,415
Cormorant	Left	3		
	Right	8	11	1,265
Duck, unidentified	Left	6		
	Right	77	83	9,545
Duck, brown	Left	8		
	Right	0	8	920
Eagle, bald	Left	0		
	Right	1	1***	--
Eider	Left	483		
	Right	106	544	62,560
Eider, common	Left	14		
	Right	1	15	1,725
Eider, king	Left	10,070		
	Right	6,143	16,213	1,864,495
Eider, spectacled	Left	1		
	Right	0	1	115
Eider, Stellers	Left	99		
	Right	686	785	90,275
Fulmar	Left	12		
	Right	13	25	2,875
Goldeneye	Left	3		
	Right	1	4	460
Guillemot	Left	14		
	Right	3	17	1,955

Table 13. continued

Species	Number Observed (Seat location)		Total Observed in transect	Total Observed x conversion factor
Gull	Left	281		
	Right	195	476	54,740
Gull, glaucous	Left	28		
	Right	1	29	3,335
Gull, glaucous-winged	Left	214		
	Right	239	453	52,095
Gull, herring	Left	1		
	Right	0	1	115
Gull, large	Left	0		
	Right	1	1	115
Gull, mew	Left	1		
	Right	0	1	115
Gull, Sabines	Left	10		
	Right	0	10	1,150
Kittiwake	Left	23		
	Right	14	37	4,255
Loon	Left	0		
	Right	1	1	115
Merganser, red-brested	Left	0		
	Right	1	1	115
Murre	Left	4,509		
	Right	3,272	7,781	894,815
Murrelet	Left	187		
	Right	1	188	21,620
Old Squaw	Left	217		
	Right	293	510	58,650
Pintail	Left	10		
	Right	10	20	2,300
Ptarmigan	Left	3		
	Right	0	3***	--

Table 13. continued

Species	Number Observed (Seat location)		Total Observed in transect	Total Observed x conversion factor
Puffin	Left	3		
	Right	0	3	345
Raven	Left	1		
	Right	0	1***	--
Sandpipers	Left	0		
	Right	50	50	5,750
Scoter	Left	608		
	Right	995	1,603	184,345
Scoter, common	Left	0		
	Right	10	10	1,150
Scoter, surf	Left	0		
	Right	2	2	230
Scoter, whitewing	Left	38		
	Right	225	263	30,245
Shorebirds	Left	14		
	Right	153	167	19,205
Tern	Left	3		
	Right	0	3	345

Category totals:

Species	
Loons	115
Tube-nosed swimmers	2,875
Cormorants	1,265
Geese/Swans	0
Ducks (81% King Eider)	2,307,130
Raptors	0
Shorebirds	24,955
Gulls, Kittiwakes, Terns, Jaegers	116,265
Alcids	1,021,085
Passerines,other	Trace
Unidentified birds	2,415

* There were two observers on each side of the aircraft. Both observations on each side were taken into account in the results.

** Bristol Bay acreage = 27,780,858 acres
Transect acreage = 242,393 acres
Conversion factor = 115

*** Not expanded by conversion factor.

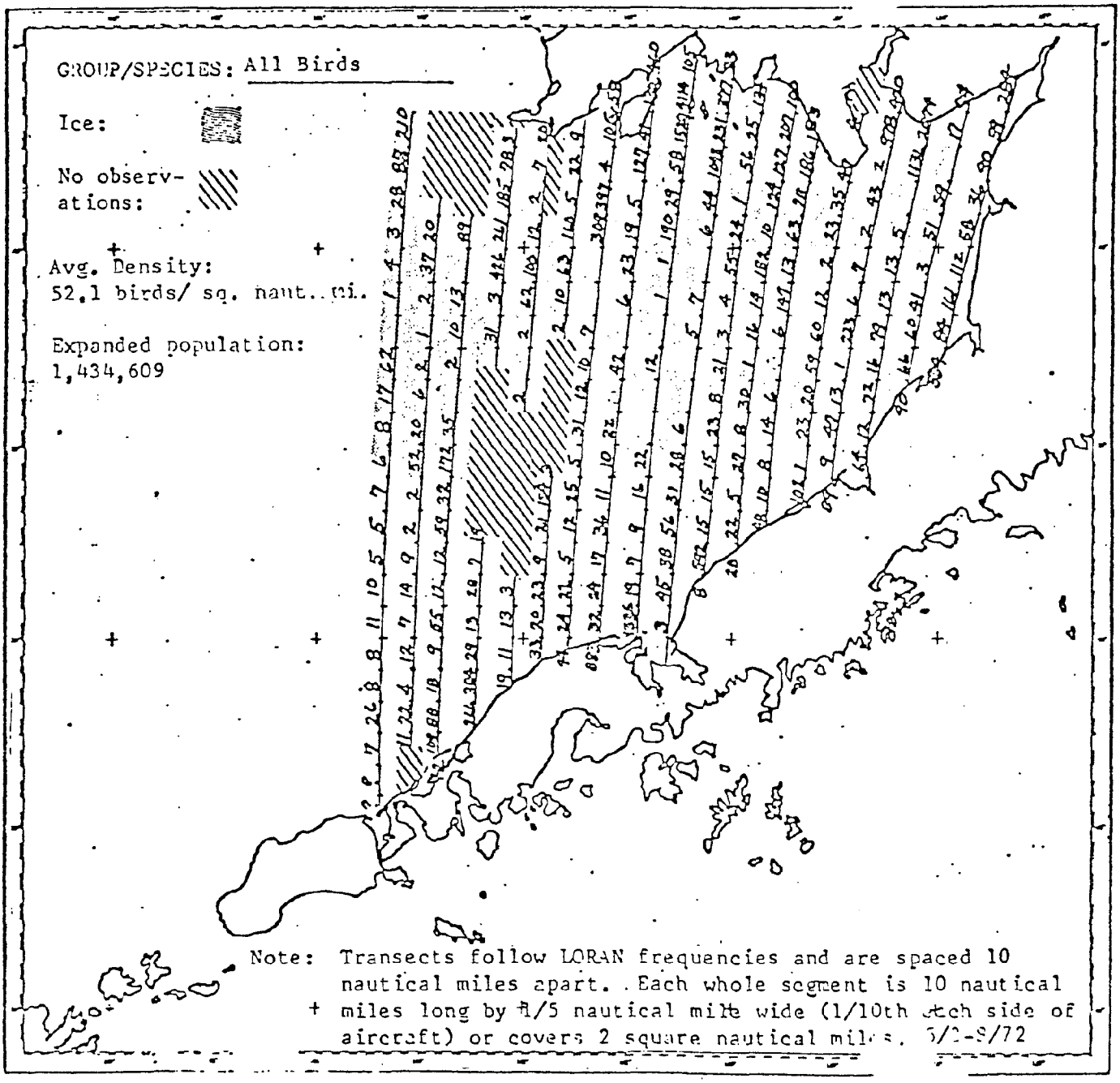
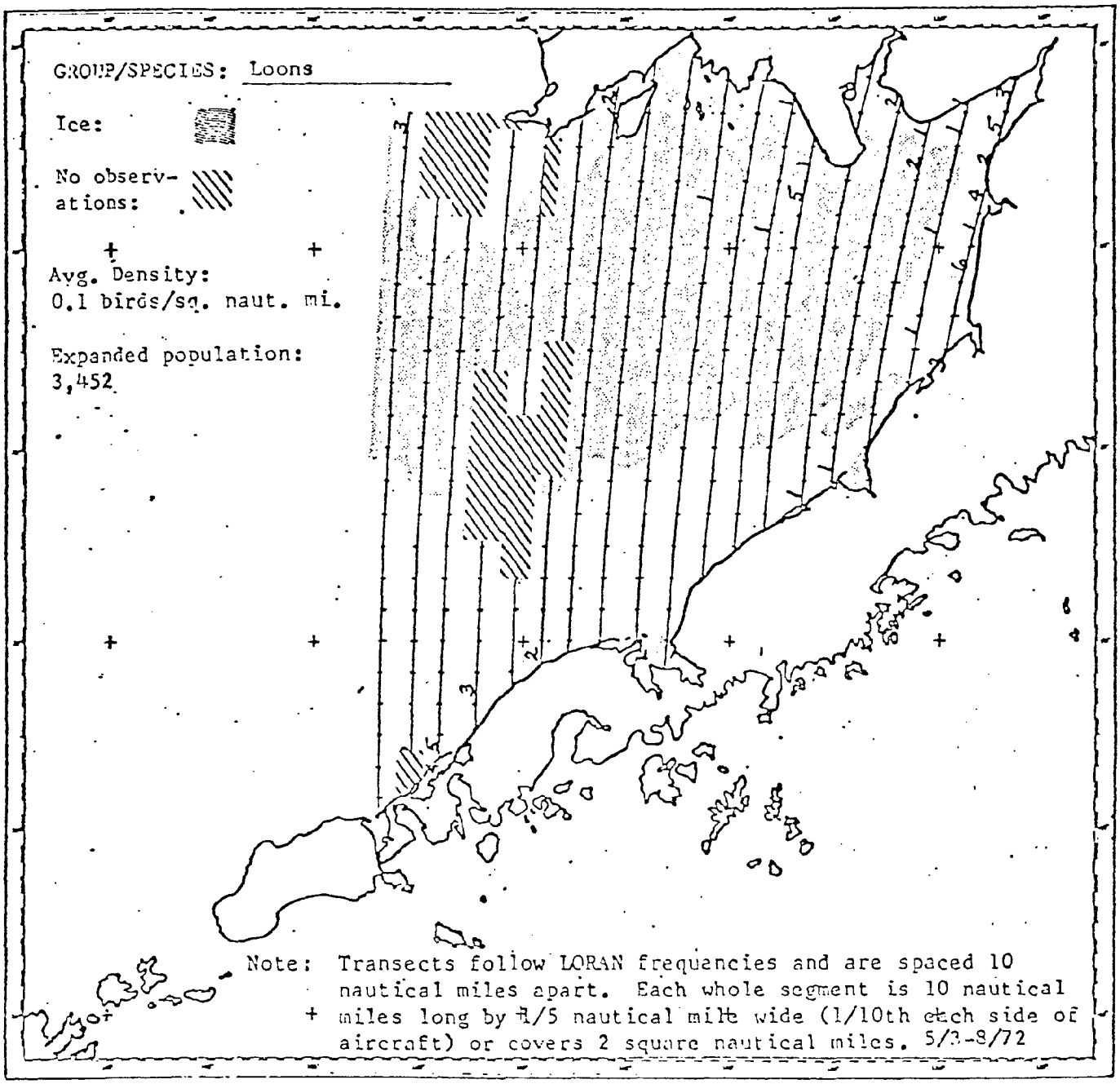


Figure 6. Per square mile densities of birds in Bristol Bay, May 1972.



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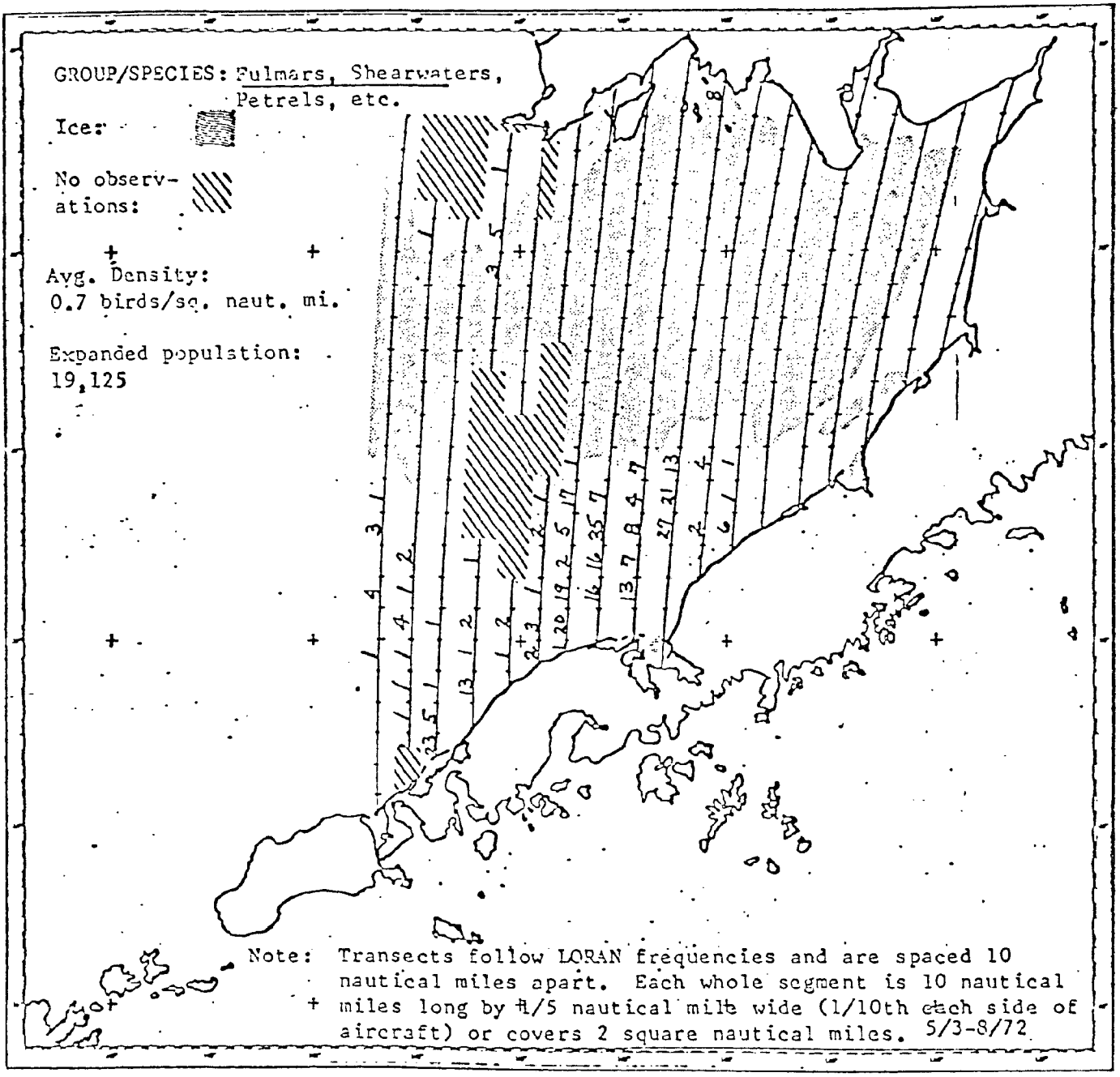

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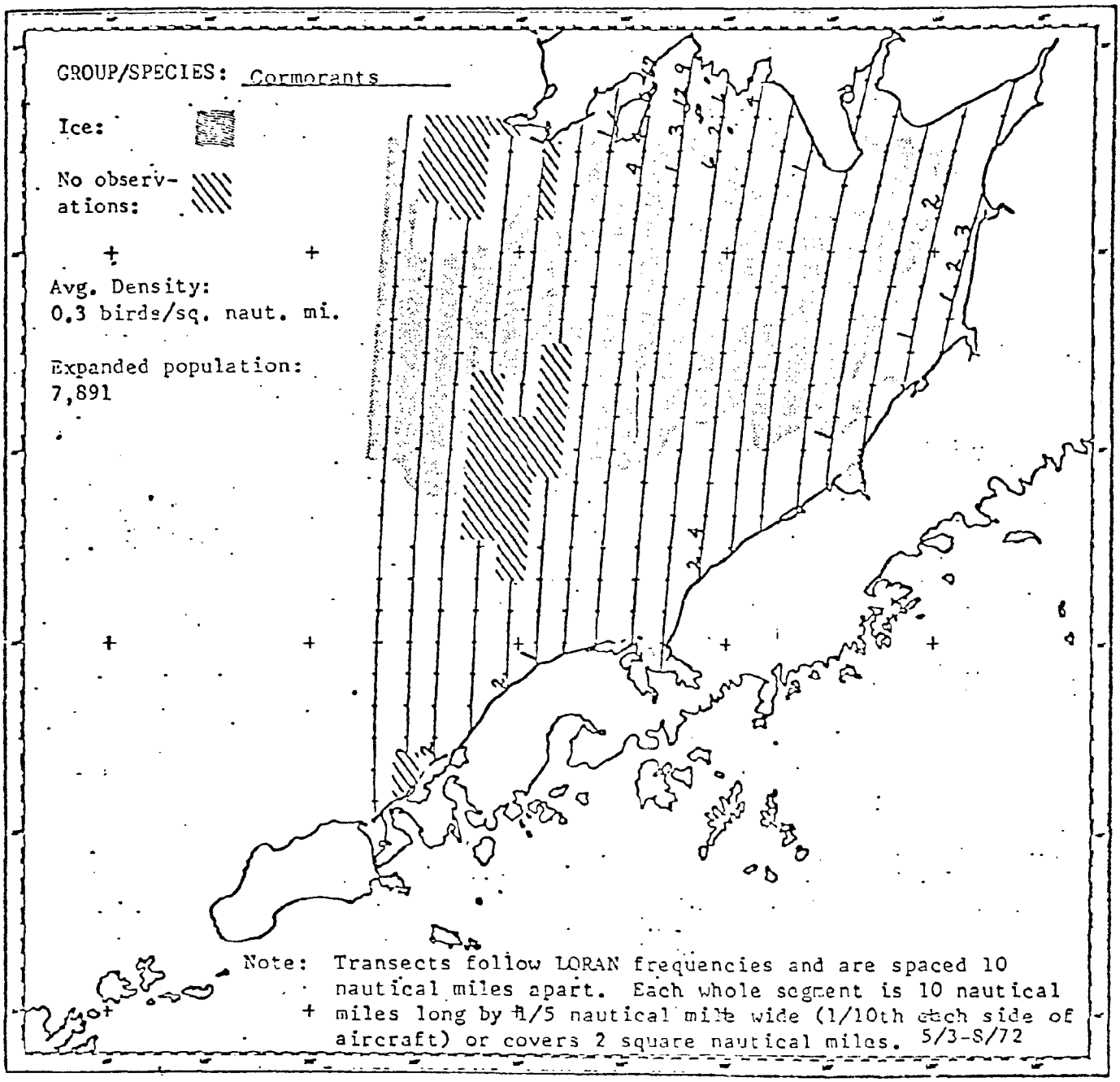

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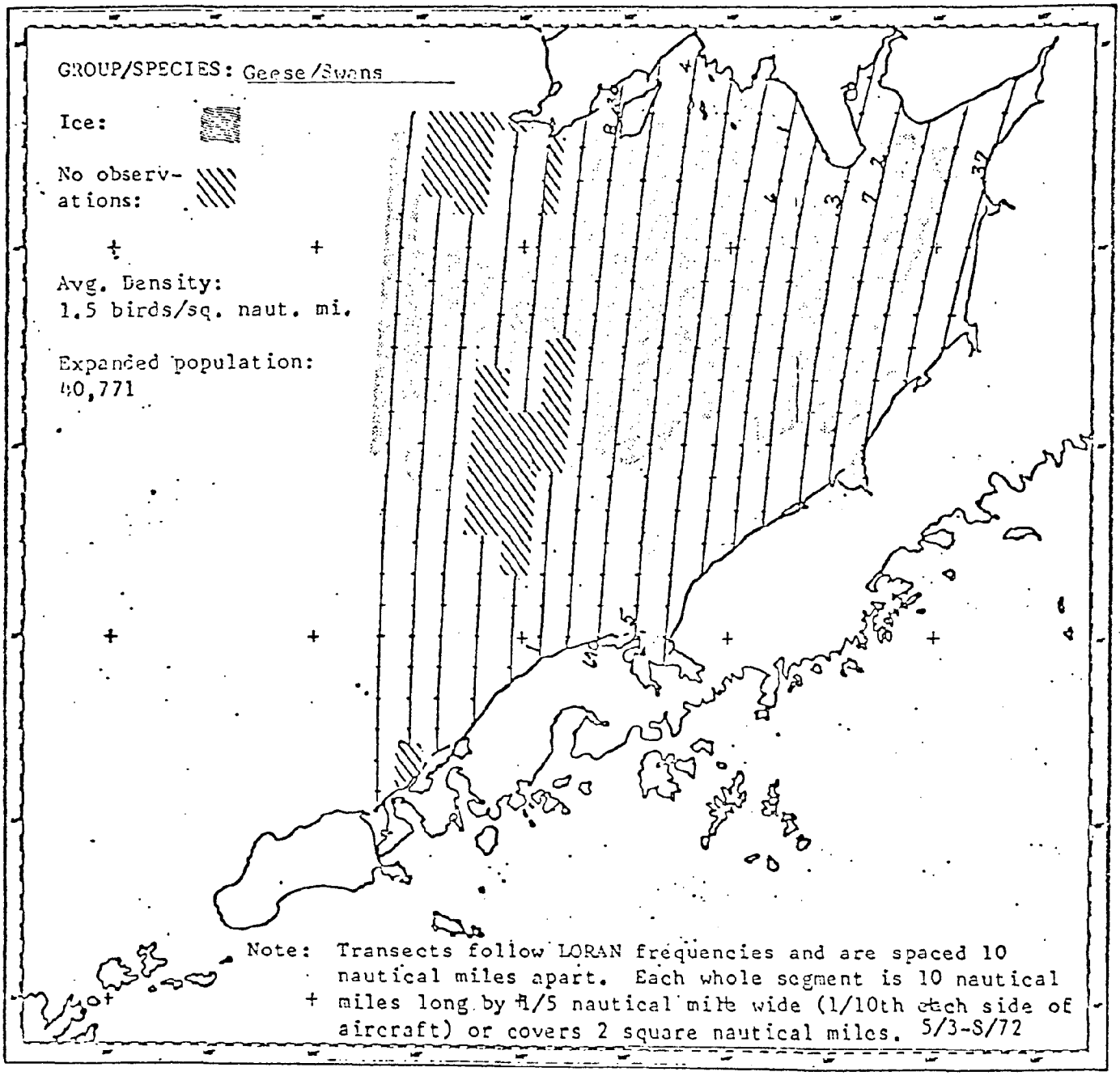

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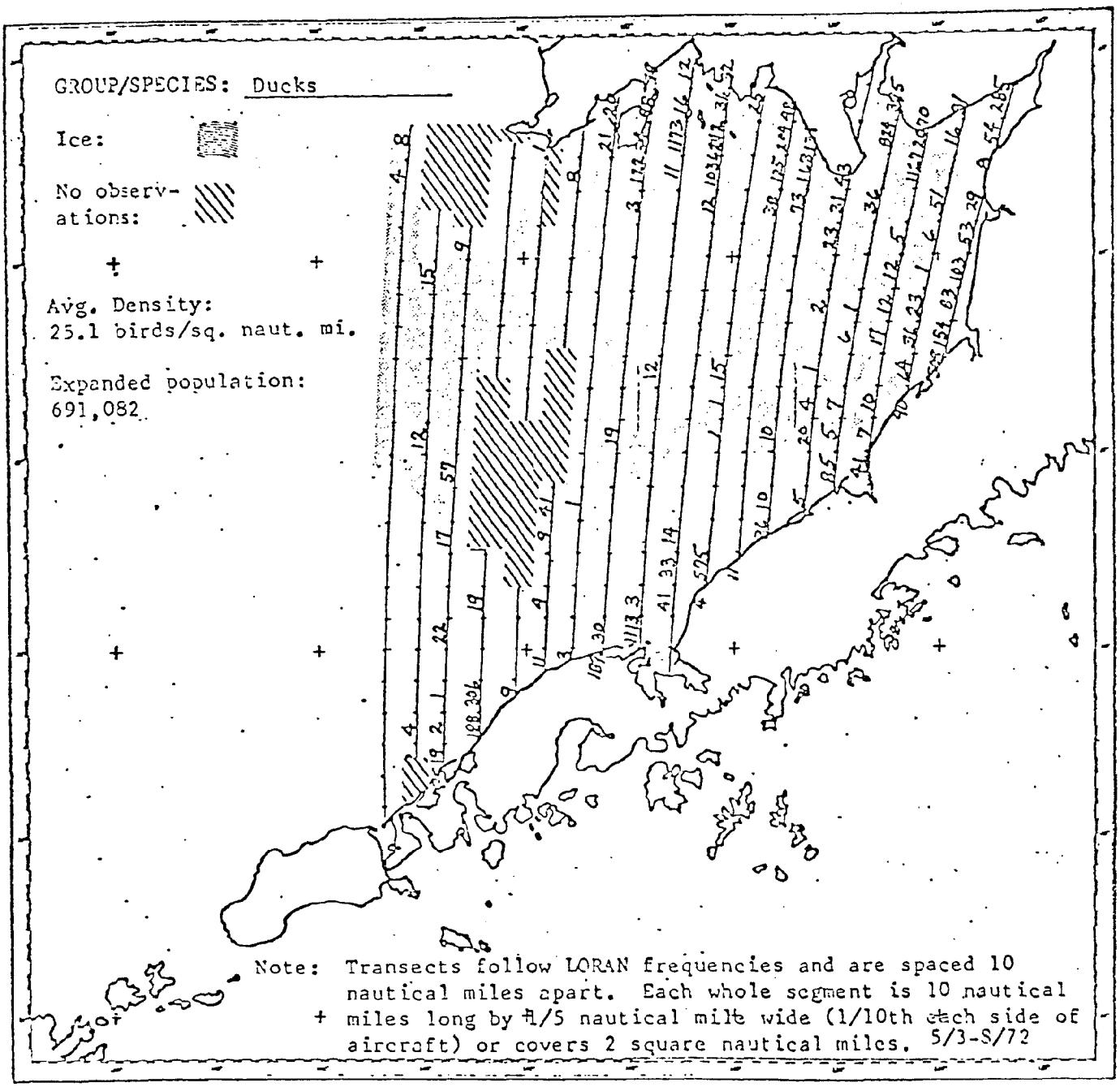

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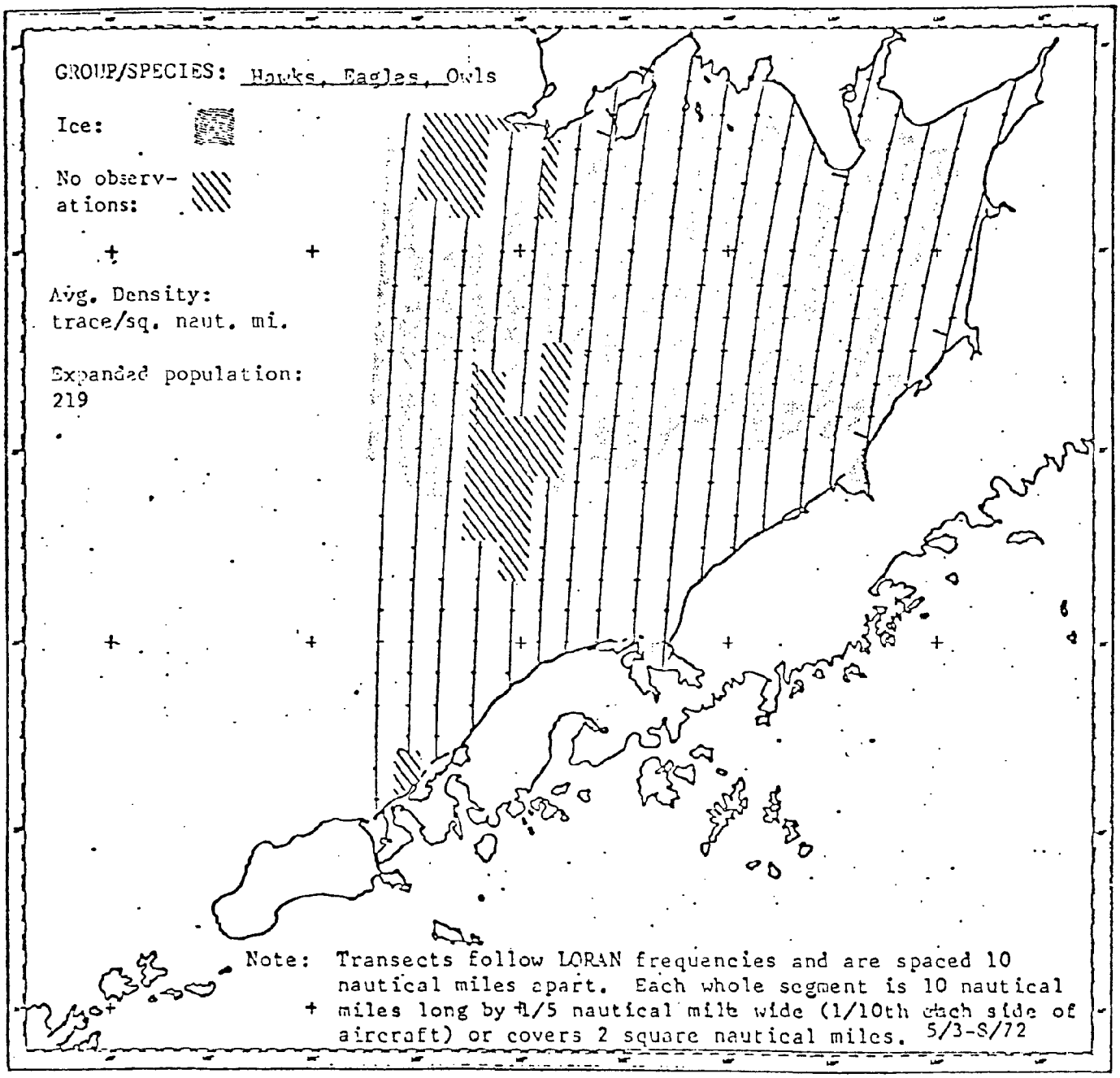

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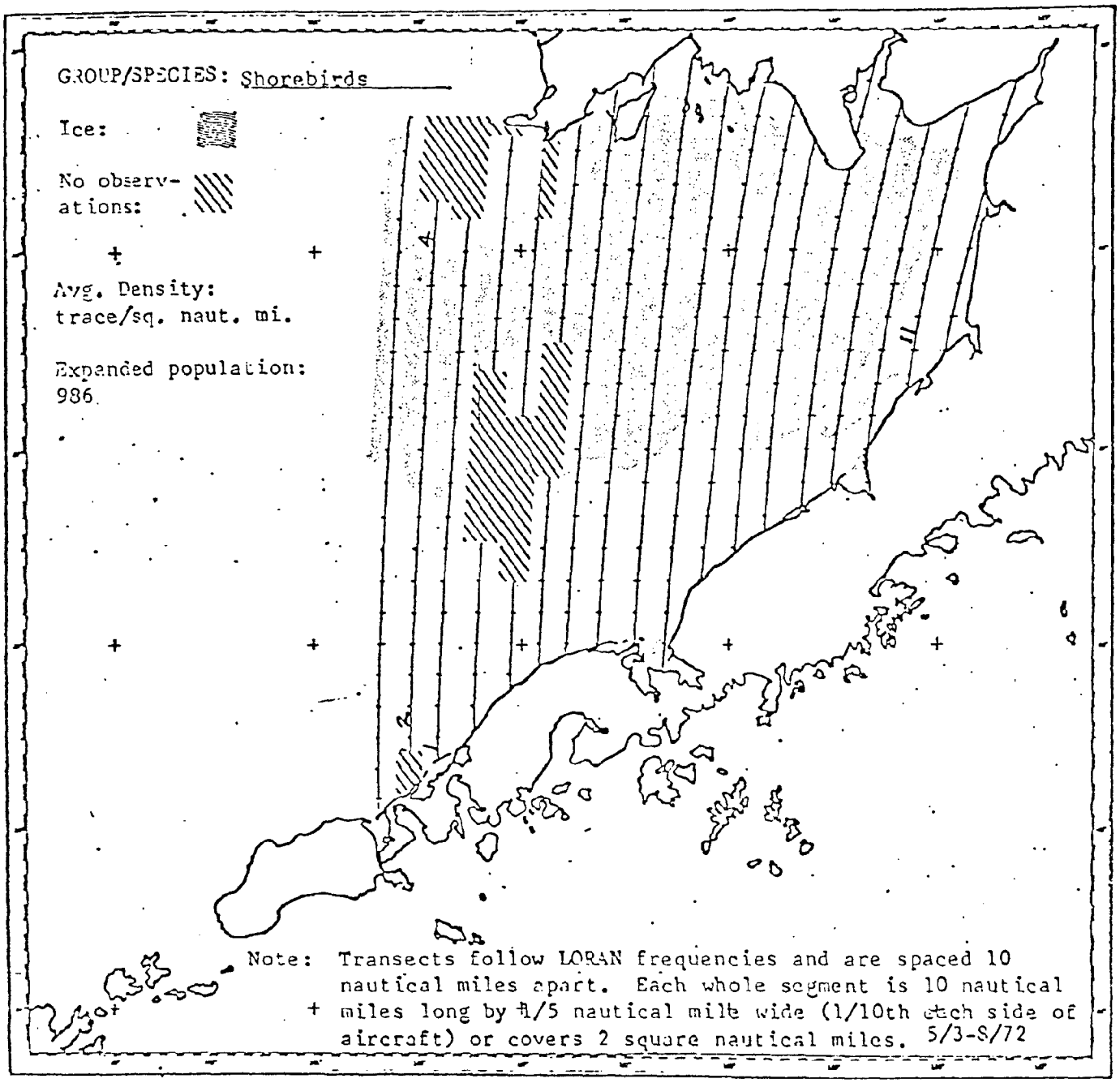

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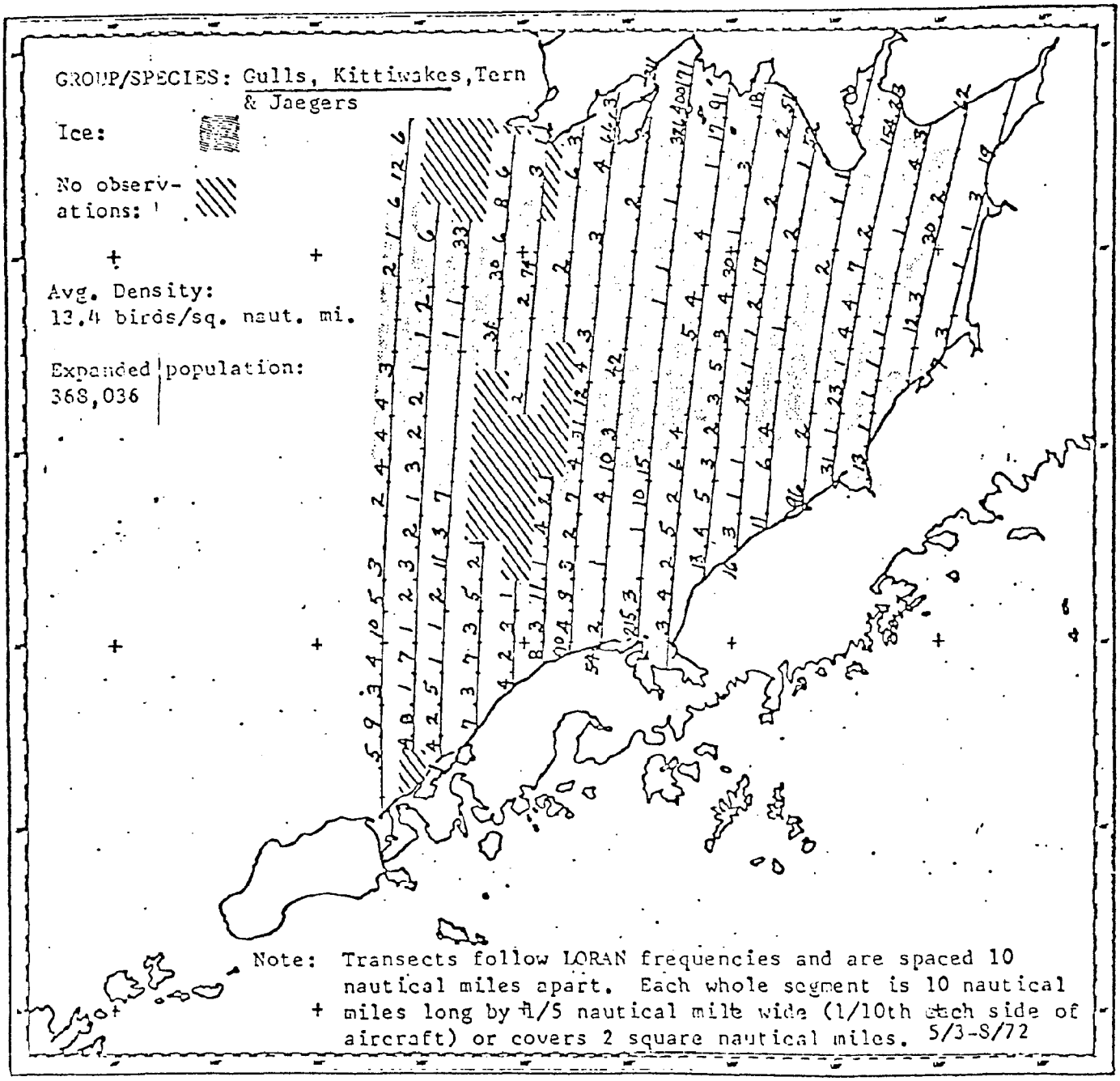

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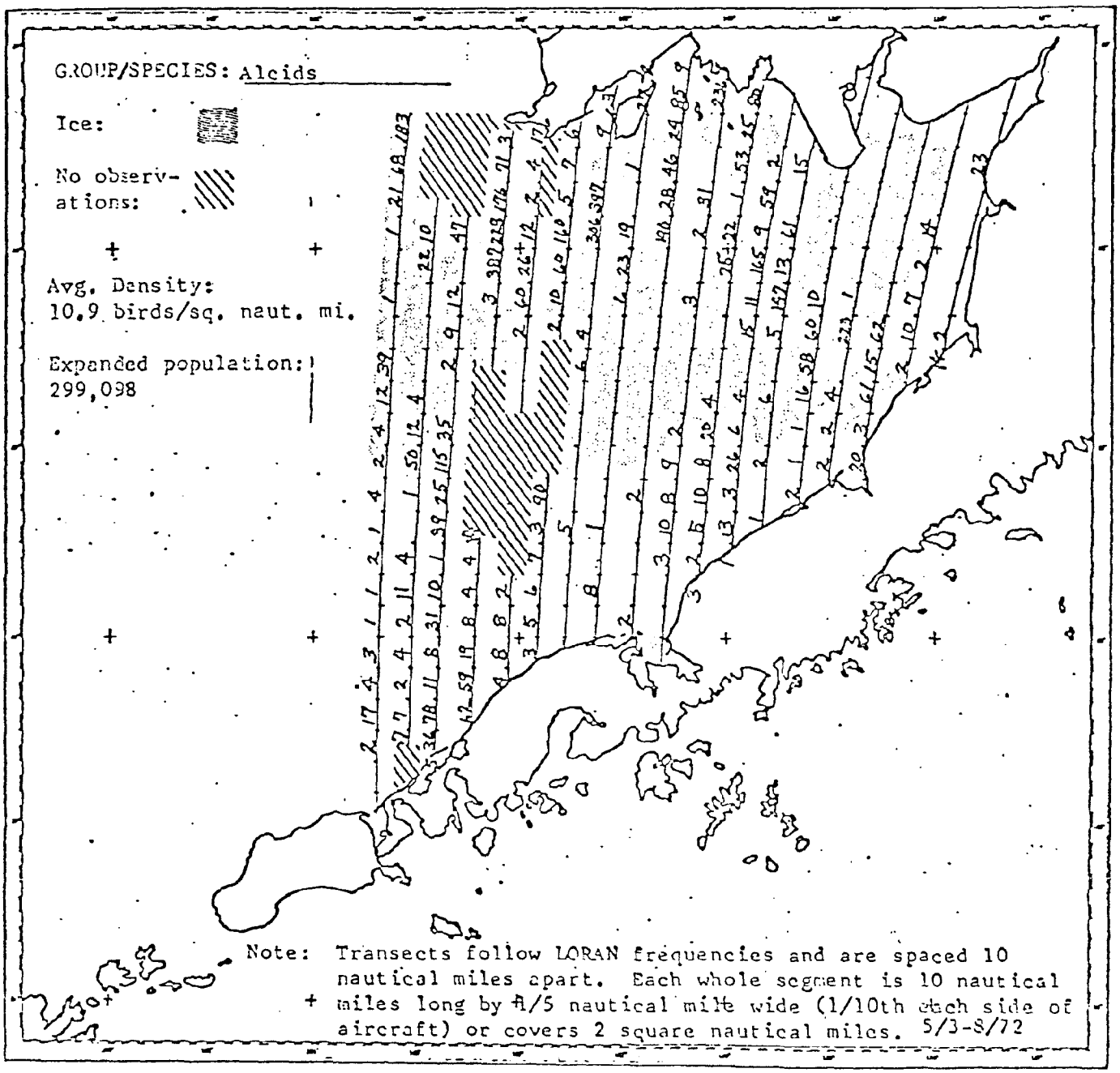

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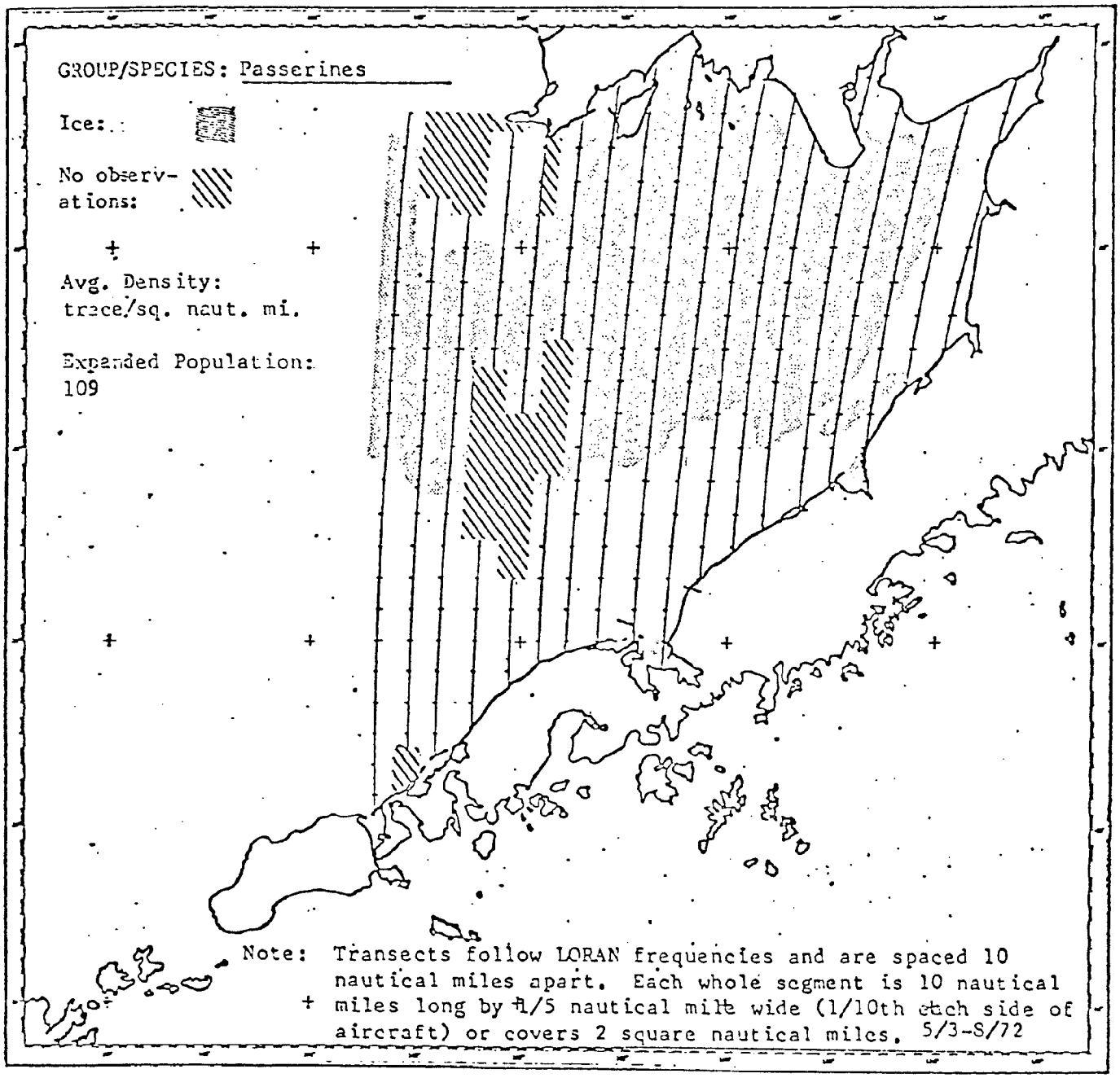

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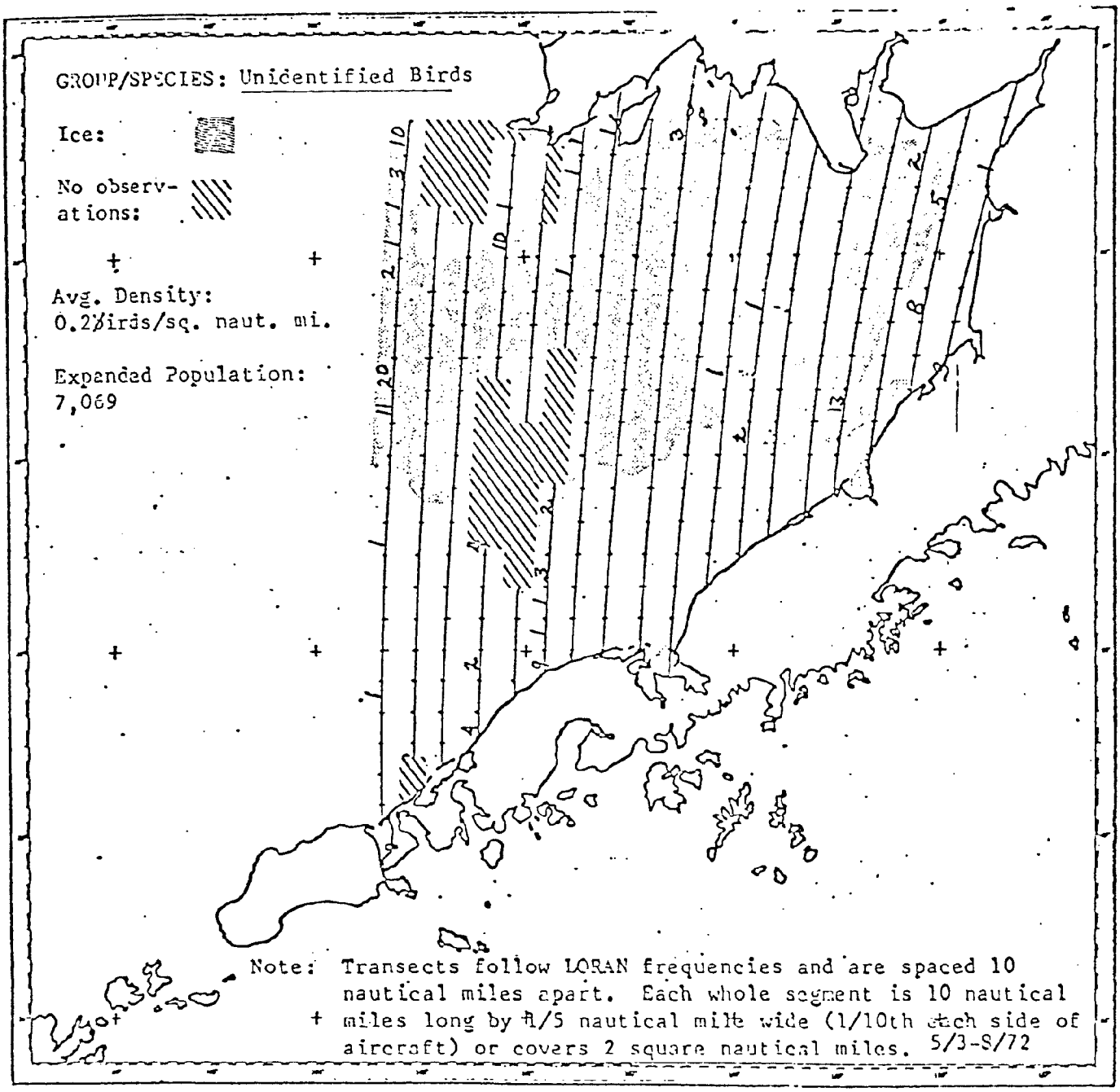


Figure 6. continued.

those calculated from the 1972 survey. For example, in 1973 two observers counted on each side of the aircraft versus one on each side in 1972. We believe the 1973 survey more accurately reflects bird populations in Bristol Bay during early spring. The 1973 calculation of 1,864,500 king eiders seems realistic after observing the tremendous concentrations of king eiders which sit in flocks of sometimes several square miles in size. For the 1973 survey, data as depicted in Figure 6 for the 1972 survey are not available. However, it can be assumed that general bird distributions were similar in 1973 to 1972, in relation to pack ice and the coastal areas. In 1973 average bird density was 125.9 birds per square nautical mile. These bird densities were from two to three times greater than those observed in 1972, and reflects a more realistic projection of bird numbers during late winter and early spring in Bristol Bay.

During July 30-31, 1976 personnel from the Department of Fish and Game conducted an open water aerial survey from the west end of Unimak Island north along the Alaska Peninsula to Port Moller. Aerial transects were flown from the coastline seaward to about the 80 meter depth contour. Figure 7 depicts the transect lines flown and area of coverage. The number of birds observed on five transects in the Port Moller area were significantly fewer than those observed on transects to the south. Therefore, data for these five transects were analyzed separately. In Table 14 the area sampled, the total size of the area for which bird populations are projected, and the average number of birds observed per transect for both the Port Moller area and Unimak-Izembek are presented. For the Port Moller area 148 birds per transect were observed while over 2,000 birds were observed per transect in the more southern area. In Table 15 densities of birds per kilometer squared by species and

Figure 7. Aerial transects for marine mammal/bird survey, southern Bristol Bay, July 30-31, 1976.

Table 14. Transect number and area, approximate area covered, and mean number of birds observed on a pelagic bird survey in the Unimak-Izembek and Port Moller regions of Bristol Bay, July 30-31, 1976.

	No. of Transects	Area of Transects-Km^2	Approx. area Surveyed-Km^2	$\bar{x}$ No. Birds per Transect
U-I	34	126.2	10,045	2160
PM	5	13.9	1,555	148
Total	39	140.1	11,600	1903

Table 15. Densities and expanded population size of sixteen species of birds observed on pelagic bird surveys in the Unimak-Izembek and Port Moller regions of Bristol Bay July 30-31, 1976.

Species	Part A Density: Birds/Km^2 * U-I	PM	Total	Part B Expanded Population Size: U-I	PM	Est. No. Birds** Total
ShWa	554.6	24.6	502.1	5,570,957	38,253	5,824,360
Murr	13.4	12.8	13.4	134,603	19,904	155,440
Kitt	7.3	5.0	7.1	73,329	7,775	82,360
GWGu	3.6	5.3	3.8	36,162	8,242	44,080
SmAl	1.5	0.2	1.4	15,068	311	16,240
Scot	0	5.0	0.5	0	7,775	5,800
Corm	0.5	0	0.4	5,023	0	4,640
TuPu	0.3	0	0.2	3,014	0	2,320
Phal	0.2	0	0.2	2,009	0	2,320
Tern	0.2	0.5	0.2	2,009	778	2,320
SaGu	0.1	0	0.1	1,005	0	1,160
Jaeg	Tr	0	Tr	1,193	0	1,379
GlGu	Tr	0	Tr	1,193	0	1,379
Petr	Tr	0	Tr	1,193	0	1,379
RTLo	Tr	0	Tr	1,193	0	1,379
PaEi	Tr	0	Tr	1,193	0	1,379
Combined	581.9	53.4	529.5	5,845,185	83,037	6,142,200

* Based on actual area and bird numbers observed.

** Based on approximate area covered by survey and the calculated densities of Part A.

Species key:

Shearwater	Tern
Murre	Sabine gull
Kittiwake	Jaegar
Glaucous-winged gull	Glaucous gull
Small Alcid	Petrel
Scoter	Red-throated loon
Cormorant	Pacific Eider
Tufted Puffin	
Phalarope	

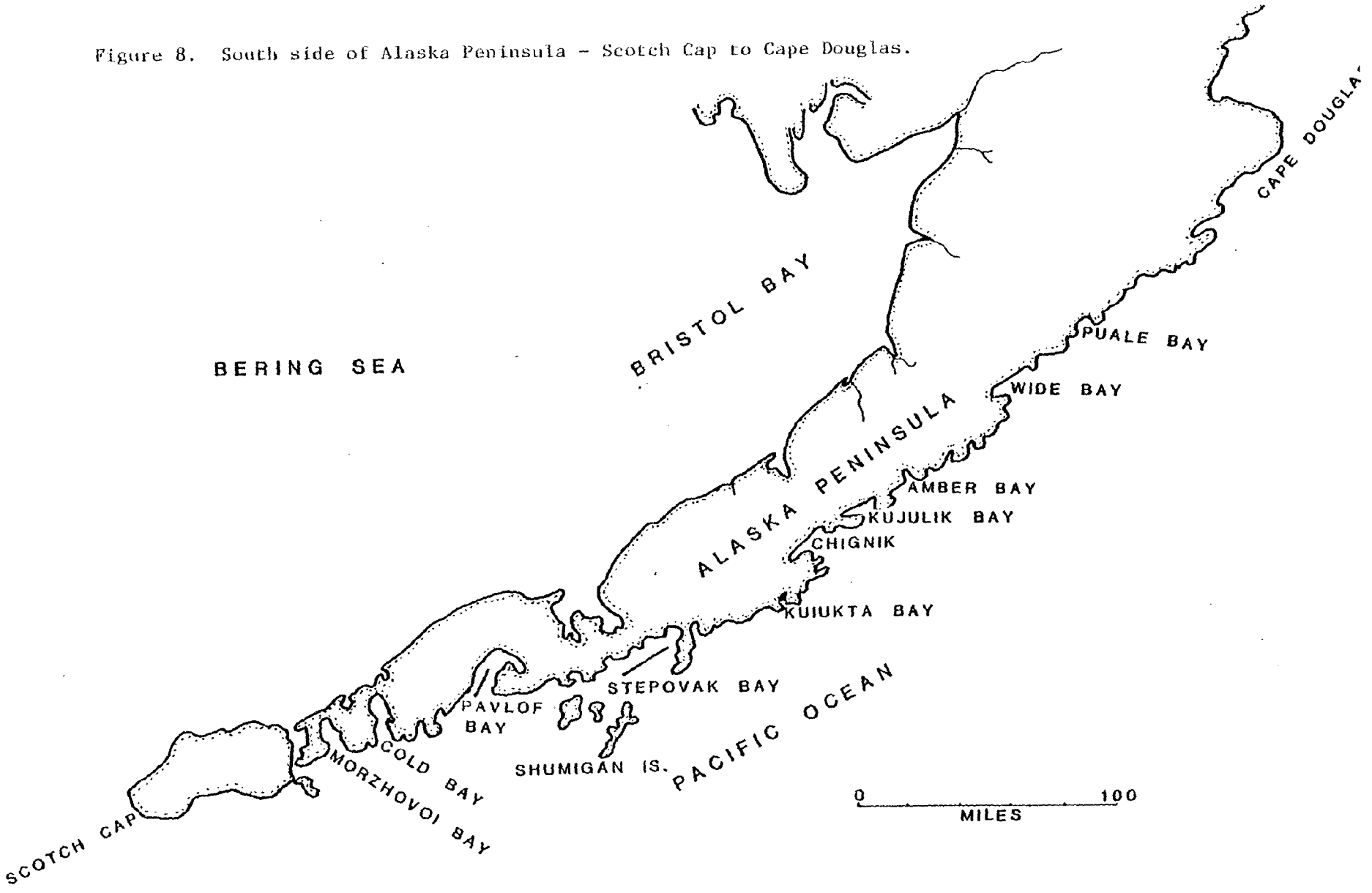
total expanded population size for each species are given. The most abundant birds were shearwaters, with a calculated population of over 5.75 million within the 11,600 square kilometer area. This figure seems realistic as the total number of shearwaters in the northern hemisphere has been estimated at over 100 million birds. The total calculated population of all species within the survey area was 6,142,200 birds.

All projected bird populations derived from pelagic aerial surveys must be considered minimal because of several factors. For safety reasons a twin engine aircraft is necessary to conduct surveys. Thus, the minimum safe flying speed when counting is usually over 100 knots. Even with two observers on either side of the aircraft birds are missed at this airspeed. Also, some species of birds - in particular small alcids -tend to dive at the approach of an aircraft. Many times all that an observer sees is an expanding ring of waves where an unknown bird or perhaps animal has just dove beneath the surface of the water. After prolonged periods of counting observers become fatigued and their efficiency at seeing birds decreases. Whenever possible observers are rotated and counting time is kept to a minimum. However, this is not always possible. Regardless, data from aerial and boat surveys are the best estimates of bird abundance and distribution within Bristol Bay.

South Side of Alaska Peninsula

Because this area is exposed to the open ocean and experiences extremely inclement weather conditions, few coastal bird surveys have been conducted either by aircraft or boat. Many of the bays (Figure 8)

Figure 8. South side of Alaska Peninsula - Scotch Cap to Cape Douglas.



and estuaries are surrounded by steep mountains which create unpredictable and often treacherous wind currents, thus making air surveys difficult even on the best of days.

Two aerial surveys were conducted by the Department of Fish and Game in late March of 1970 and mid-October of 1972. The results of these surveys are presented in Table 16. Only ducks and geese were recorded in both surveys. The bulk of ducks observed were various species of sea ducks including scoters, eiders, harlequin and old squaw. All of the geese observed were emperors. There are, however, a few Canada geese and possibly 2,000 brant wintering on Sanak Island.

During the summer the south side of the Alaska Peninsula is not conducive to waterfowl and shorebird nesting or molting, but the topography does provide ideal nesting cliffs for sea birds. Known sea bird colonies are listed at the end of this report. The extent of use by other bird species using these coastal areas and the litoral zone is mostly unknown. During the winter, warm ocean currents keep this area relatively ice free, which results in substantial use by wintering birds. Data in Table 16 for the March 1970 survey substantiates this use. However, quantitative information on sea birds in near shore areas is not available, but numbers are probably substantial.

Few estuaries are present on the south side of the Peninsula for use as resting and feeding areas for migrating birds. However, many of the birds observed during the mid-October survey (Table 16) were dabblers indicating that some use is made of protected bays which are present in this area. Near the western end of the Alaska Peninsula a few large, shallow estuaries occur that are heavily used by migrating birds. These include Morzhovoi Bay and Kinzarof Lagoon.

Table 16. Ducks and geese found in bays of the south side of the Alaska Peninsula by aerial survey.

Location	Date of Survey 3/20-23/70	10/11-12/72
Puale Bay		685
Portage Bay		184
Wide Bay	462	631
Agripina Bay area	465	200
Chiginagak Bay area	505	352
Yantarni Bay area	623	141
Amber Bay	465	240
Aniakchak Bay	1145	449
Cape Kumlik	198	
Sutwik Island	263	
Kujulik Bay	3915	391
Cape Kumlium	250	
Hood Bay	20	
Chignik Bay	430	35
Chignik Lagoon		1153
Castle Bay	95	287
Castle Cape to Seal Cape	65	
Kuiukta Bay	5	
Mitrofania Bay & Island	38	
Ivanoff Bay	65	1043
Stepovak Bay	42	862
Grub Gulch Bay		241
Clark Bay		104
Orzinski Bay	124	85
American Bay		62
Chichagof Bay		76
Dorenoi Bay	295	32
Balboa Bay	510	
Beaver Bay	123	224
Shumagin Islands	4086	
Canoe Bay		1362
Pavlof Bay		715
Pavlof Islands	1118	
Deer Island	345	
Sandman Reefs	412	
Sanak Islands	2762	
Cold Bay	462	3057
Morzhovoi Bay	2925	4439
Otter Cove	434	

During October 1976 an aerial survey around the western end of the Alaska Peninsula was conducted. The results of this survey are presented in Table 17.

Aleutian Islands

Until the early 1970's little quantitative information was available regarding bird distribution in the Aleutian Islands. Surveys had been conducted, but primarily incidental to other data gathering operations. With the advent of outer continental shelf studies in late 1974, and an accellerated U. S. Fish and Wildlife Service refuge program, an impressive volumn of data has been collected. However, most of this information has been gathered for the area of Unimak Island west through the Islands of the Four Mountains. Much data has recently been gathered by the U. S. Fish and Wildlife Service which has placed stationary observers on various islands. Unfortunately, at this time most of these data have not been analyzed. Data should be available in six months to one year.

The largest waterfowl concentrations in the Aleutian chain occur during the winter months. Nearly all of the world's population of emperor geese - estimated at about 150,000 birds - spend the winter in the Aleutian Islands, on practically every island in the Chain. Large numbers of sea ducks and mergansers including scoters, eiders, old squaw, harlequins, and two species of mergansers are also present during winter months. Many of the rare Asiatic species which have been recorded in Alaska are commonly or occasionally found in the Aleutians. These include species such as the garganey, tufted duck, pochard, Chinese spot-bill duck, falcated teal and whooper swans. Also present in near

Table 17. Miscellaneous bird observations on habitat mapping flights on Alaska Peninsula and Aleutian Shelf, October 1976.

Alaska Peninsula October 16	Em Go	Bl Br	Ca Go	Eide	Scot	Dabb	Lari	Shor	Corm	Murr	ShWa	Fulm	SmA
Bechevin Bay													
Hook Bay	117	2900											
St. Catherine Cove	151	10	5175			3000		300	25				
Hotsprings Bay	715												
Traders Cove	515		825			125							
Nichols Point							6000		75				
Isanotski Straits							5500						
Morzhovoi Bay	465	3125									10K's		
Thinpoint Cove	35												
Old Man's Lagoon	50		1250										
Kinzarof Lagoon	595	2400	1400										
Lenard Harbor	70												
Belkofski Bay							2400						
Bear Bay	55												
Volcano Bay							230						
Duschkin Bay	180												
Long John Lagoon	95				150								
Long Beach							65						
Black Point	91												
Chinaman Lagoon	65					50							
Jackson Lagoon	270						55	350					
Canoe Bay	306												
Deer Island	106												
Aleutian Islands October 25-27													
Unimak				74	108				10				
Ugamak							250						
Round	20												
Kaligagan	75												
Tigalda	50												
Avantanak	5												
Akun							40						
Akutan Pass										Pres	Pres	Pres	Pre
Unalga									50				
Egg	60												
Unalaska	810				15					25			
Umnak	936			238	26			1185		Pres			
Adugak	35												
Samalga	695							350					

Key to abbreviations:

Em Go	Emperor Goose	Lari	Larids	SmAl	Small alcids
Bl Br	Black Brant	Shor	Shorebirds	10 K's	Tens of thousands
Ca Go	Canada Goose	Corm	Cormorants	Pres	Present
Eide	Eiders-mixed	Murr	Murres		
Scot	Scoters-mixed	ShWa	Shearwaters		
Dabb	Dabblers-mixed	Fulm	Fulmars		

shore waters during winter months are tremendously large numbers of foraging sea birds which in the spring nest in the Chain or areas to the north.

Unimak Pass is a well known migration corridor for literally tens of millions of sea birds. The bulk of the birds are shearwaters from the southern hemisphere which travel north through the pass in the spring and south through the pass in the fall. Unimak Pass is also apparently a major migration route for various species of marine mammals, especially whales. During September 1976 the Fish and Wildlife Service had an observer at Cape Sarachef on the western end of Unimak Island who watched Unimak Pass and recorded birds and animals in migration. During some periods up to 70,000 shearwaters per hour passed at Sarachef, going south.

In Table 17 the results of a bird survey around some of the eastern Aleutian Islands on October 25-27, 1976 are presented. The relatively small numbers of birds observed probably indicates that full migration was not yet in full swing.

Resident bird populations in the Aleutian Islands have experienced some drastic changes in distribution, numbers and species composition since man first visited the islands. Some of the changes resulted from natural causes such as volcanic action, storms and tidal waves. However, the introduction of blue foxes to many of the islands virtually eliminated several breeding species. Rats from ship wrecks have been introduced on many of the islands which also resulted in a probable reduction some species.

The Aleutian common teal apparently breeds and winters exclusively in the Aleutian Chain. Conservative estimates place this population at

1,000 birds. For more coverage of the common teal and other species refer to Alaska's Wildlife and Habitat, 1973.

RARE AND ENDANGERED SPECIES

Arctic peregrine falcons are classified rare and endangered by the federal government in the State of Alaska. However, Arctic peregrines are not known to nest in this region and probably only occasionally migrate through. The Peales peregrine falcon is the race which nests and is abundant in the Bristol Bay - Aleutain Islands region.

The Aleutian Canada goose (Branta canadensis leucopareia) is classified rare and endangered by both the Federal Government and the state of Alaska. The Aleutian Canada is a subspecies of white-cheeked goose which breeds exclusively on Buldir Island in the western Aleutian Islands. Apparently all Aleutian Canadas have a white neck ring at the base of their black neck. The presence of this white ring on all Aleutian geese may be the single distinguishing characteristic between this subspecies, lesser Canada geese and cackling Canada geese.

Aleutain Canada geese migrate from Buldir Island to central and southern California where they overwinter. There have been no positive sightings of these geese between the eastern Aleutian Islands and Cresent City, California. Fall 1976 observations of Aleutian Canadas in the Aleutain Islands were made on Kiska and Unalga Islands and at Cape Sarachef on the western end of Unimak Island. Whether the geese continue around the Gulf of Alaska or fly across the Gulf of Alaska is unknown. Also, spring migration northward may occur around the Gulf of Alaska, or possibly the birds take a transoceanic route and reach mainland somewhere between Cook Inlet and the Aleutian Chain. As more geese

are colored marked in future years and when radio transmitters are placed on the birds, a better picture of their migration routes and areas of use will develop.

An Aleutain Canada Goose Recovery Team has been formed to recommend and implement procedures to delist the birds from Endangered to Threatened and eventually to a safe status. This team is comprised of personnel from the U.S. Fish and Wildlife Service, Alaska Department of Fish and Game and the California Department of Fish and Game. The recovery team has written a recovery plan and parts of this plan have been implemented. The plan states that the Aleutian Canada goose can be delisted from Endangered to Threatened when an additional two Aleutian Islands have a population of at least 50 nesting pairs of Canada geese per island. When three such islands exist the subspecies will no longer be Threatened.

New nesting populations will be established by the release of birds on islands scheduled for reintroduction. Birds will be raised in captivity at the Patuxent Research Center in Maryland and on Amchitka Island where a goose holding facility has been constructed. A combination of goose release techniques and subsequent follow-up studies will be employed.

Islands scheduled for reintroduction of geese include Agattu, Nizki-Alaid, Amchitka and Kanaga. Because introduced foxes were the original cause of decline of this subspecies, the elimation of foxes from islands scheduled for reintroduction is paramount. During the summer of 1976 foxes were completely elimated from Nizki-Alaid and reduced in numbers on Agattu to less than ten animals. Foxes were removed from these two islands by trapping and shooting. During the

1950's and early 1960's foxes were completely removed from Amchitka Island by poison. The recovery team has requested the use of poison on Agattu and on other islands, but as yet permission has not been received. Kanaga Island has a large population of foxes which must be removed if geese are to be reintroduced there. Without the use of poison this may be impossible.

Eagles may be a problem to captive reared and released geese. There are no eagles on Agattu and Nizki-Alaid, but substantial eagle populations exist on Kanaga and Amchitka. Various release techniques and other measures will be employed to hopefully preclude the eagle problem.

Canada goose hunting in the Aleutian Islands has been closed since 1973 to protect Aleutian geese. However, should these birds appear in other areas and a real or potentional danger of hunter harvest exists, the Canada goose season in those areas would probably have to be closed. For example, large areas of northwestern and north-central, and central California have been closed to Canada goose hunting.

As major Aleutian Canada use areas are identified those areas will be considered for designation of critical habitat under federal law. However, before critical habitat designation is applied the area would have to have a demonstratable quality which makes it critical for the survival of geese. When an area is classified as critical habitat the so designated lands may be purchased, leased or otherwise controlled. On such lands it is against federal law to use federal funds for projects which will adversely effect the geese. Whether any project would adversely effect birds is determined by the director, of the U.S. Fish and Wildlife Service. Such projects could include roads, airports,

dredge and fill, etc.

There are a minimum of 1,275 Aleutian Canada geese. These birds were counted in north-central California during November 1976. It is certain that other use areas in Alaska besides the Aleutian Islands will be identified in the future. Considerable effort has been expended in the Cold Bay area trying to identify Aleutian Canada geese in the fall and spring, but to no avail. Aleutian Canadas probably do not use this area. The best guess is that birds utilize the coast or near shore islands off the coast along the south side of the Alaska Peninsula, probably both in the spring and fall. However, this is only speculatation.

LAND CLASSIFICATION

Refuges

There are a number of state and federal refuges in the Bristol Bay-Aleutian Islands which are for waterfowl and/or sea birds. By Alaska statue the federal refuges in this area are also state refuges. The areas with both state and federal refuge designation include: Semidi Islands, Simeonof Island, Bogoslof Island, all of the islands in the Aleutian Chain with the exception of the following seven islands - Akun, Akutan, Sanak, Tigalda, Umnak, Unalaska and Sedanka. Uplands in the Izembek National Wildlife Refuge at the western end of the Alaska Peninsula are both state and federal refuge. In addition, the inter-tidal and submerged lands in Izembek Bay are classified state refuge, but not federal refuge. The state of Alaska has jurisdiction over most of the inter-tidal land in the state below mean high tide. The state of Alaska has also designated Walrus and Round Islands as state refuges -

these are not federal refuges.

Sea birds are the primary species protected on the Semidis, Simeonof, Bogoslof and most of the Aleutian Islands. On some of the Aleutian Islands significant populations of waterfowl also exist and Buldir Island is the home of Aleutian Canada geese. The tide lands of Izembek National Wildlife Refuge and some of the surrounding uplands are critical to the survival of several hundred thousands of ducks and geese. Although Walrus and Round Islands were designed refuge for walrus, large sea bird colonies are also present.

Wilderness Areas

Two of the federal refuges are in wilderness classification. These are Bogoslof Island and Simeonof Island. The U.S. Fish and Wildlife Service has proposed that part of Izembek National Refuge, nearly all of Unimak Island, are most of the Aleutian Island refuge be placed in wilderness designation. However, portions of several islands would be deleted for military, Native and other uses which preclude wilderness designation. Federal wilderness designation precludes nearly all human acitvities that would alter the land surface from its present pristine condition.

Critical Habitats

There are both state and federal legal classifications of critical habitat. There are five areas on the Alaska Peninsula which are classified as critical under state statute. These include the inter-tidal, submerged and near coastal uplands in the following areas: Port Heiden, Port Moller, Cinder River, Egegik Bay and Pilot Point. Although there

are currently no critical habitats so designated by federal law, the following areas have been recommended by the Aleutian Canada Goose Recovery Team for nomination: Buldir Island, Agattu Island, Nizki-Alaid Islands, Amchitka Island and Kanaga Island. Buldir Island, is, of course, the sole nesting area for the rare and endangered Aleutian Canada goose. The other islands are planned sites for reintroduction of Aleutian Canada geese.

Unfortunately, few studies in Alaska have been made which identify percisely why an area is critical or very important for waterfowl or other birds. We can usually say that many birds occur where they do and generally why they occur there. The mere presence of large bird numbers dictates the area's importance to those birds. Inter-tidal areas with broad mud flats and sedge-grass flats that flood at high tides are, taken as a whole, essential to the survival to many waterfowl, shore birds and indirectly to many sea birds in this region. A reasonable generalization is that the bigger such inter-tidal zones are, the greater their importance. A major reason for inter-tidal flat's importance is the quantity of food that is produced. For example, Izembek Lagoon has the largest eelgrass bed in the world and one expert on eelgrass believes that more nitrates and nitrites are produced in Izembek than the rest of Bristol Bay combined. Tidal action produces a constant interchange of nutrients and organic matter to produce varied plant and animal life in inter-tidal areas. Fresh water streams associated with these flats produce brackish water which is more productive than either salt or freshwater singularly. Varying tides create a ecotone or transition of plant and animal communities from mud (most frequently flooded), to grass-sedge, to finally upland heath (never flooded). The species of

plants and animals within the ecotone are often different and thus create diverse food sources for birds.

Another critical function which inter-tidal areas fulfill is that they provide places for birds to use during spring and fall before and after inland nesting areas are ice and snow free. Because the nesting season in Alaska is short, it is imperative that waterfowl arrive on breeding grounds ready to nest as soon as conditions allow. If inter-tidal areas were not available, waterfowl and shorebirds would have to over-fly from their wintering grounds to their nesting areas. Likewise during the fall, inter-tidal areas serve as a safe resting and in some cases critical feeding area for the birds to gain strength and body fat for their long flight south after their inland nesting areas have become ice covered.

There are eight areas in this region which are critical to the survival to large numbers of birds and in some cases species and sub-species of birds. These areas are: Buldir Island, Izembek Lagoon, Port Moller (includes Nelson Lagoon and Herendeen Bay), Ilnik Lagoon (also called Seal Island), Port Heiden, Cinder River, Pilot Point, and Egegik Bay.

Buldir Island, as discussed previously, is critical to the survival of the rare and endangered Aleutian Canada goose.

Izembek Lagoon, at the tip of the Alaska Peninsula, is vital to the welfare of the entire North American population of black brant which is over 95% of the world's population. Most brant arrive at Izembek by mid-September, but do not leave until early November or late October. During these weeks brant gain several pounds by eating eelgrass in the lagoon. If this eelgrass was not available, brant would be unable to

make the long transoceanic flight between Cold Bay and their wintering areas. Izembek also annually hosts about 100,000 lesser Canada geese during mid-September to late October. Almost all the emperor geese in the world travel through the Izembek area during the fall on their way to their Aleutian Island wintering areas. Total population size is perhaps 150,000, while peak numbers at Izembek may reach 75,000. Dabbling duck populations have been estimated up to one-quarter million birds, but most recently peak populations have been about 10,000 dabblers. An estimated 50,000 plus Steller's eiders annually undergo a mid-September feather molt in Izembek Lagoon. These birds are part of a large population of Steller's eiders which molt each fall along the Alaska Peninsula and remain to overwinter wherever open water exists in Bristol Bay or the Gulf of Alaska. Most Steller's eiders originate from the Lena River area in Russia, about 127° E. latitude. In addition, Izembek annually hosts tens of thousands of shorebirds, gulls, and other species of birds. During the spring far fewer, but still significant numbers of birds utilize Izembek Lagoon and the other estuaries along the north side of the Alaska Peninsula for much shorter time periods.

The largest numbers of emperor geese and Steller's eiders can be found in Port Moller during the fall. Canada geese are uncommon here during both spring and fall, while black brant are uncommon during the fall but fairly common during the spring for short time periods. Large numbers of sea ducks, dabblers, shorebirds, gull, and other bird species are found in Port Moller both in spring and fall.

Although not designated as critical habitat by state statue, Ilnik Lagoon is critical habitat for large numbers of emperor geese, dabblers, Steller's eiders and other sea ducks, shore birds, gulls and

other species of birds.

Port Heiden is heavily used by various species of sea ducks and large numbers of cackling Canada geese. Large numbers of dabblers, shore birds, gulls, etc. also frequent the area both spring and fall. Pilot Point and the Cinder River Delta are the major cackling Canada goose areas in the fall. Snow geese from Russia's Wrangell Island use these areas extensively for short time periods during the fall. White-fronted geese from the Yukon Delta, on their way to California in the fall, may stop for a day or two, but in the spring are abundant in both of these areas. Many species of dabblers, sea ducks, diving ducks, shorebirds, gulls and whistling swans are also abundant both spring and fall.

Egegik Bay hosts significant numbers of the same waterfowl species as are found in Pilot Point and Cinder River estuaries, except numbers both spring and fall are usually fewer.

SEABIRDS

The most mumerous wildlife resource in the Alaska Peninsula-Aleutian Island-Bristol Bay area is pelagic birds. These areas serve as major breeding grounds for such species as black-legged kittiwakes, murres, crested, least, whiskered and parakeet auklets, fulmars, pelagic and red-faced cormorants, petrels, and horned and tufted puffins. Many of these birds once played an important part in the life of Aleuts, who ate their eggs and flesh and used their skins for clothing.

The relationship of sea birds, especially murres, to the overall ecology of arctic seas is an important one. Seabirds provide a vital link in the ecology of the species which are their food. The birds excrement, rich in potash, is important to the growth and abundance of all marine organisms. In turn, these organisms provide food for small fish which are eaten by adult fish which in turn become seabird food. It is said that seabird colonies could be fertilizing factories of the northern seas (Alaska Department of Fish and Game 1973).

Pelagic bird nesting surveys have been conducted by the U.S. Fish and Wildlife Service in recent years. Table 18 presents the results of these surveys. It is important to note that the enumerations are minimum figures and that the actual numbers are in all probability much greater.

Table 18. Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
35-E	329	31013	Unnamed Is.	Horned Puffin	500
				Tufted Puffin	6,000
	330	31012	Nakchamik Is.	Glaucous-Winged Gull	300
34-E	331	30001	Chankliut Is.	Cormorant	700
				Black-Legged Kittiwake	500
				Murre	3,000
32-E	332	28004	Falmouth Harbor	Glaucous-Winged Gull	1,400
	333	28003	Sea Lion Rocks	Glaucous-Winged Gull	150
	334	28008	Eagle Harbor	Glaucous-Winged Gull	700
	335	28023	Andronica Islet	Glaucous-Winged Gull	600
	336	28024	Andronica Spires	Black-Legged Kittiwake	250
				Horned Puffin	300
	337	28021	Andronica West Bay	Pigeon Guillemot	30
				Horned Puffin	200
	338	28022	Andronica East Bay	Pigeon Guillemot	200
				Horned Puffin	300
	339	28025	Andronica Light	Glaucous-Winged Gull	50
				Tufted Puffin	6,000
	340	28028	Dark Cliffs	Cormorant	1,200
				Glaucous-Winged Gull	2,400
	341	28029	High Is.	Glaucous-Winged Gull	2,000
				Horned Puffin	500
				Tufted Puffin	6,000

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
32-E	342	28034	Kordvin Bay	Sea Birds	Present
	343	28040	Guillemot Is.	Cormorant	300
				Glaucous-Winged Gull	300
	344	28035	Henderson Is.	Glaucous-Winged Gull	300
				Pigeon Guillemot	20
				Horned Puffin	200
				Tufted Puffin	300
	345	28033	Gull Is.	Pigeon Guillemot	20
				Horned Puffin	150
				Tufted Puffin	300
	346	28027	Round Is.	Cormorant	80
				Glaucous-Winged Gull	2,400
				Black-Legged Kittiwake	9,000
				Horned Puffin	4,000
				Tufted Puffin	4,000
	347	28026	Quartz Pt.	Glaucous-Winged Gull	400
	348	28030	Bay Pt.	Red-Faced Cormorant	5,000
				Black-Legged Kittiwake	13,000
				Murre	6,000
				Pigeon Guillemot	1,000
	349	28010	Jude Island	Pigeon Guillemot	3,000
	350	28010	Kennedys Is.	Glaucous-Winged Gull	1,200
				Pigeon Guillemot	50
				Tufted Puffin	500
	351	28017	Omega Is.	Pigeon Guillemot	150

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
32-E	352	28016	Egg Is.	Glaucous-Winged Gull	500
	353	28014	Wosnesenski Is.	Red-Faced Cormorant	1,200
				Pigeon Guillemot	200
				Tufted Puffin	5,400
	354	28009	Clay Is.	Glaucous-Winged Gull	1,000
				Black-Legged Kittiwake	200
	355	28011	The Pinnacle	Red-Faced Cormorant	600
				Tufted Puffin	1,000
	356	28015	Ulkondi Is.	Cormorant	60
				Glaucous-Winged Gull	100
				Tufted Puffin	500
	357	28038	Round Is.	Black-Legged Kittiwake	1,500
				Pigeon Guillemot	100
				Tufted Puffin	400
	358	28037	Ivan Is.	Cormorant	600
				Glaucous-Winged Gull	3,000
				Pigeon Guillemot	300
				Horned Puffin	300
				Tufted Puffin	300
	359	28026	Gull Is.	Tufted Puffin	100
	360	28032	Lump Is.	Pigeon Guillemot	50
				Tufted Puffin	250
	361	28031	Flat Is.	Tufted Puffin	200
	362	28006	E. Dolgoi Entrance	Glaucous-Winged Gull	500
				Pigeon Guillemot	100

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
32-E	363	28007	Dolgoi Harbor	Glaucous-Winged Gull	250
				Pigeon Guillemot	100
				Tufted Puffin	6,000
	364	28005	Entrance Is.	Glaucous-Winged Gull	200
	365	28001	Iliasik Is.	Cormorant	1,100
	366	28002	Iliasik Passage	Glaucous-Winged Gull	500
33-E	367	27026	Seal Cape	Cormorant	2,200
	368	27025	Brothers Is.	Glaucous-Winged Gull	1,500
				Black-Legged Kittiwake	8,000
				Murre	10,000 (off shore)
				Horned Puffin	1,500
				Tufted Puffin	45,000
	369	27024	Mitrofania Is.	Cormorant	300
				Glaucous-Winged Gull	700
				Pigeon Guillemot	4,000
				Horned Puffin	35,000
				Tufted Puffin	6,000
	370	27021	Spitz Is.	Glaucous-Winged Gull	2,000
				Black-Legged Kittiwak	18,000
				Murre	200,000
				Horned Puffin	1,500
				Tufted Puffin	12,000
	371	27023	Pinusik Is.	Cormorant	50
				Glaucous-Winged Gull	4,000
				Black-Legged Kittiwake	500
				Tufted Puffin	9,000
	372	27022	Chaichi Bay	Glaucous-Winged Gull	3,000
				Tufted Puffin	13,000

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
33-E	373	27019	Leader Is.	Glaucous-Winged Gull	1,200
				Tufted Puffin	3,500
	374	27018	Noon Pt.	Glaucous-Winged Gull	100
				Horned Puffin	100
				Tufted Puffin	3,000
	375	27020	Grub Gulch Is.	Black-Legged Kittiwake	Present
	376	27017	Fox Cape	Glaucous-Winged Gull	1,200
				Tufted Puffin	4,000
	377	27016	Kupreonof Pt.	Glaucous-Winged Gull	300
				Black-Legged Kittiwake	400
				Horned Puffin	1,000
				Tufted Puffin	3,500
	378	27015	Bluff Pt.	Cormorant	1,700
				Tufted Puffin	3,000
	379	27010	Nagai Island	Sea Birds	Present
	380	27013	Cape Thompson	Cormorant	600
				Black-Legged Kittiwake	4,800
				Horned Puffin	600
				Tufted Puffin	1,200
	381	27011	Koniuji Pt.	Pigeon Guillemot	4,000
				Parakeet Auklet	1,000
				Tufted Puffin	2,000
	382	27012	Peninsula Is.	Pigeon Guillemot	2,500
				Tufted Puffin	35,000
	383	27008	Bendel Is.	Cormorant	50

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
33-E	384	27009	Bendel Ranch	Glaucous-Winged Gull	2,500
	385	27002	Unnamed Bay	Unidentified Auklet	Present
	386	27001	South Big Koniuji	Unidentified Puffin	Present
	387	27005	Koniuji Strait	Pigeon Guillemot	3,000
				Parakeet Auklet	10,000
				Crested Auklet	50,000
				Horned Puffin	140,000
	388	27004	Hall Is.	Cormorant	50
				Glaucous-Winged Gull	400
				Black-Legged Kittiwake	200
				Pigeon Guillemot	1,500
				Parakeet Auklet	4,000
				Tufted Puffin	2,000
	389	27003	Yukon Harbor	Crested Auklet	10,000
	390	27006	Heredeen Is.	Glaucous-Winged Gull	5,000
				Parakeet Auklet	9,000
				Horned Puffin	500
				Tufted Puffin	9,000
	391	27007	Atkins Is.	Pigeon Guillemot	2,500
				Parakeet Auklet	5,000
				Horned Puffin	500
				Tufted Puffin	8,000
30-B	392	26006	Saddler Peak	Horned Puffin	500
	393	26003	West Saddler Cove	Cormorant	200
				Tufted Puffin	8,000

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
30-B	394	26004	Saddler's Mistake	Glaucous-Winged Gull	2,000
	395	26002	Mountain Pt.	Tufted Puffin	8,000
	396	26005	East Saddler Cove	Glaucous-Winged Gull	3,000
	397	26007	Near Is.	Cormorant	40
				Glaucous-Winged Gull	2,500
				Black-Legged Kittiwake	6,500
				Murre	200
				Horned Puffin	2,000
				Tufted Puffin	18,000
	398	26008	Twins	Red-Faced Cormorant	2,000
				Glaucous-Winged Gull	500
				Black-Legged Kittiwake	6,500
				Murre	200
				Horned Puffin	2,000
				Tufted Puffin	18,000
	399	26001	Bird Is.	Cormorant	6,000
				Black-Legged Kittiwake	43,000
				Murre	24,000
29-D	400	25018	Hunter Is.	Sea Birds	Present
	401	25019	Rona Is.	Glaucous-Winged Gull	1,500
				Pigeon Guillemot	200
				Horned Puffin	200
				Tufted Puffin	6,000
	402	25017	Sarana Is.	Sea Birds	Present
	403	25012	Rose Is.	Glaucous-Winged Gull	1,000
	404	25011	Sushilnoi Is.	Glaucous-Winged Gull	600
				Tufted Puffin	7,000

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
29-D	405	25010	Buyan Rocks	Glaucous-Winged Gull	500
				Pigeon Guillemot	100
				Horned Puffin	400
				Tufted Puffin	4,000
	406	25013	Patton Is.	Red-Faced Cormorant	250
				Glaucous-Winged Gull	300
				Pigeon Guillemot	100
				Horned Puffin	300
				Tufted Puffin	2,000
	407	25008	Midun Is.	Glaucous-Winged Gull	1,500
				Black-Legged Kittiwake	3,000
				Murre	6,000
				Horned Puffin	3,000
				Tufted Puffin	12,000
	408	25002	Island 83	Black-Legged Kittiwake	12,000
				Murre	6,000
				Horned Puffin	2,000
				Tufted Puffin	10,000
	409	25001	Island 38	Glaucous-Winged Gull	100
				Pigeon Guillemot	50
				Tufted Puffin	2,500
	410	25006	Fawn Is.	Pigeon Guillemot	150
				Horned Puffin	300
				Tufted Puffin	2,500
	411	25005	High Is.	Red-Faced Cormorant	2,000
				Glaucous-Winged Gull	300
				Common Murre	300
				Pigeon Guillemot	200
				Horned Puffin	40,000
				Tufted Puffin	20,000

continued

Table 18. (continued) Known Sea Bird Colonies - South Side Alaska Peninsula.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE
29-D	412	25007	Let Is.	Glaucous-Winged Gull	1,000
				Horned Puffin	3,000
				Tufted Puffin	10,000
	413	25009	Sozavereka Is.	Glaucous-Winged Gull	300
				Pigeon Guillemot	400
				Horned Puffin	10,000
				Tufted Puffin	1,500
	414	25020	Umga Is.	Red-Faced Cormorant	80
				Pigeon Guillemot	300
				Horned Puffin	3,000
				Tufted Puffin	22,000
	415	25015	Egg Is.	Glaucous-Winged Gull	1,400
				Horned Puffin	1,500
				Tufted Puffin	3,000
	416	25016	Kenmore Head	Red-Faced Cormorant	1,000
	417	25004	Sanken Is.	Red-Faced Cormorant	600
				Pigeon Guillemot	100
				Horned Puffin	1,000
				Tufted Puffin	7,000
	418	25003	Palisade Cliff	Red-Faced Cormorant	300
				Glaucous-Winged Gull	500

* Lensink, C. J. and J. C. Bartonek. 1976. Prelimary catelog of seabird colonies and photographic mapping of sea bird colonies. Draft Annual Rpt. U.S.F.W.S. Anchorage, Alaska 138 pp.

Table 19. Known Sea Bird Colonies - Bristol Bay.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE	NESTING PAIRS
28-D	419	24004	Unimak Is.	Red-Faced Cormorant	50	
	420	24002	Avatanak Is.	Tufted Puffin	50,000	
	421	24003	Akun Is.	Sea Birds	Present	
	422	24001	Rootok Is.	Tufted Puffin	100,000	
	423	24005	Unimak Is.	Red-Faced Cormorant	200	
	424	24006	Sea Lion Pt.	Red-Faced Cormorant	800	
	425	24007	Cave Pt.	Red-Faced Cormorant	1,000	
	426	24008	Cape Mordvinof	Red-Faced Cormorant	Present	
				Black-Legged Kittiwake	Present	
				Horned Puffin	Present	
				Tufted Puffin	Present	
32-E	427	28041	Nelson Lagoon	Mew Gull		150
	428	28042	Cannery Is.	Arctic Tern		500
	429	28043	Lagoon Pt.	Arctic Tern		500
	430	28044	Kudobin Is.	Glaucous-Winged Gull		3,900
				Tufted Puffin		15
	431	28045	Gull Is.	Glaucous-Winged Gull		50
				Black-Legged Kittiwake		25
				Pigeon Guillemot		15
				Horned Puffin		18
				Tufted Puffin		25

continued

Table 19. (continued) Known Sea Bird Colonies - Bristol Bay.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE	NESTING PAIRS
	432	28046	Entrance Pt.	Arctic Tern	200	
				Aleutian Tern		500
	433	28047	Egg Is.	Glaucous-Winged Gull		25
31-D	434	29001	North Isanotski Is.	Aleutian Tern	Present	
	435	29003	Sea Lion Rock (S.E.)	Cormorant	Present	
				Black-Legged Kittiwake	Present	
				Murre	Present	
				Horned Puffin	Present	
				Tufted Puffin	Present	
	436	29004	Sea Lion Rock (N.W.)	Cormorant	Present	
				Black-Legged Kittiwake	Present	
				Murre	Present	
				Horned Puffin	Present	
				Tufted Puffin	Present	
	437	29005	Is. in Izembek Lagoon	Aleutian Tern	Present	
34-E	438	30002	Cape Seniavin	Cormorant	1,500	
				Black-Legged Kittiwake	3,500	
				Common Murre	500	
	439	30003	N.E. from Cape Seniavin	Cormorant	100	
				Black-Legged Kittiwake	100	
				Common Murre	100	
	440	30004	Seal Is.	Glaucous-Winged Gull		1,500

continued

Table 19. (continued) Known Sea Bird Colonies - Bristol Bay.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE	NESTING PAIRS
	441	30005	Crescent-Shaped Is.	Cormorant		6
				Glaucous-Winged Gull	Present	
				Common Eider	Present	
	442	30006	Chistiakof Is.	Cormorant	50	
				Glaucous-Winged Gull	5,000	
				Common Eider	Present	
43-D	443	39001	Pinnacle Rock	Cormorant	Present	
	444	39002	Castle Rock	Cormorant	120	
				Horned Puffin	200	
	445	39003	Cliff E. of Bird Rock	Cormorant	110	
				Tufted Puffin	10	
	446	39004	Bird Rock	Glaucous-Winged Gull	500	
				Black-Legged Kittiwake	10,000	
				Murre	200,000	
				Tufted Puffin	5,000	
	447	39005	Cape Newenham	Cormorant	110	
				Glaucous-Winged Gull	Present	
				Black-Legged Kittiwake	17,400	
				Murre	30,300	
				Horned Puffin	222	
	448	39007	Oracle Mt. Cliffs	Cormorant	180	
				Black-Legged Kittiwake	6,350	
				Murre	15,300	
	449	39008	Gap Mt. Cliffs	Cormorant	70	
				Black-Legged Kittiwake	5,500	
				Murre	10,000	

continued

Table 19. (continued) Known Sea Bird Colonies - Bristol Bay.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE	NESTING PAIRS
	450	39009	Tokomanak Mt. Cliffs	Cormorant	220	
				Black-Legged Kittiwake	8,210	
				Murre	12,010	
	451	39010	Cape Pierce	Cormorant	453	
				Glaucous-Winged Gull	10	
				Black-Legged Kittiwake	26,535	
				Murre	35,320	
				Pigeon Guillemot	100	
				Parakeet Auklet	120	
				Horned Puffin	262	
				Tufted Puffin	61	
	452	39011	Shaiak Is.	Cormorant	276	
				DBL-Crested Cormorant	Present	
				Pelagic Cormorant	Present	
				Glaucous-Winged Gull	4,150	
				Black-Legged Kittiwake	14,320	
				Murre	53,800	
				Pigeon Guillemot	190	
				Parakeet Auklet	230	
				Horned Puffin	50	
				Tufted Puffin	8,500	
				Common Eider	200	
	453	39013	S.W. Hagemeister	Black-Legged Kittiwake	750	
				Murre	1,000	
	454	39016	Cliff "Hill 825"	Cormorant	300	
	455	39017	E. Hagemeister Is.	Cormorant	100	
	456	39018	Offshore Rock - Hagemeister	Cormorant	30	
				Glaucous-Winged Gull	20	

continued

Table 19. Known Sea Bird Colonies - Bristol Bay.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE	NESTING PAIRS
	457	39020	Aeolus Mt. Cliff S.	Cormorant	200	
				Black-Legged Kittiwake	300	
	458	39021	Aeolus Mt. Cliff N.	Cormorant	500	
				Black-Legged Kittiwake	1,000	
	459	39022	Cliff "Hill 365"	Cormorant	250	
				Glaucous-Winged Gull	20	
	460	39023	Offshore Is.	Glaucous-Winged Gull	100	
	461	39024	High Is. S. End	Cormorant	472	
				Glaucous-Winged Gull	50	
				Black-Legged Kittiwake	42,400	
				Common Murre	17,800	
				Pigeon Guillemot	2	
	462	39025	The Twins (Little)	Cormorant	200	
				Black-Legged Kittiwake	50,000	
				Murre	200,000	
	463	39026	The Twins (Big)	Cormorant	1,100	
				Glaucous-Winged Gull	450	
				Black-Legged Kittiwake	8,000	
				Murre	521,000	
				Tufted Puffin	4,100	
	464	39027	Black Rock	Common Murre	10,000	
	465	39030	Cliff 1.5 Mi. S.E. Nunavachak L.	Pelagic Cormorant	100	
	466	39031	Cliff 2.5 Mi. S.E. Nunavachak L.	Pelagic Cormorant	100	

continued

Table 19. (continued) Known Sea Bird Colonies - Bristol Bay.*

MAP NO.	COLONY NO.	USFWS NO.	NAME	SPECIES	COLONY ESTIMATE	NESTING PAIRS
44-D	467	40001	Round Is.	Cormorant	2,350	
				Glaucous-Winged Gull	43	
				Black-Legged Kittiwake	49,170	
				Murre	72,030	
				Pigeon Guillemot	44	
				Parakeet Auklet	534	
				Least Auklet	1,150	
				Whiskered Auklet	536	
	468	40005	Rock in Kulukak Bay	Comorant	200	
	469	40006	Offshore Is.	Glaucous-Winged Gull		200
	470	40007	Offshore	DBL-Crested Cormorant	50	
	471	40008	Kulukak Pt.	Cormorant	300	
	472	40009	Promontory "Hill 835"	Cormorant	100	
	473	40010	Unnamed Lake, Nushagak Pt.	Cormorant	1	
				Glaucous-Winged Gull		75
	474	40011	Kikertalik L.	DBL-Crested Cormorant	800	
				Glaucous-Winged Gull		1,000
	475	40012	Lake "57"	DBL-Crested Cormorant		100

* Lensink, C. J. et. al. 1976. Preliminary catalog of sea bird colonies and photographic mapping of sea bird colonies. Draft Quarterly Rpt. U.S.F.W.S., Anchorage, Alaska.

Table 20. Known Sea Bird Colonies - Aleutian Islands. *

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
17-B	476	Cape Wrangell	Pelagic Cormorant	13,200
			Murre	15,000
	477	Cape Wrangell -	Murre	1,500
		Kresta Pt.	Kittiwake	3,000
			Cormorant	13,400
	478	Earle Cove	Cormorant	2,600
	479	Kresta Pt. -	Kittiwake	1,000
		Goltsov Pt.	Cormorant	6,400
			Glaucous-Winged Gull	500
	480	Goltsov Pt. -	Kittiwake	700
		Chichagof Pt.	Tufted Puffin	500
			Cormorant	8,000
			Gull	500
	481	Cooper Is.	Cormorant	1,500
			Gull	500
			Horned Puffin	1,000
	482	Gibson Is.	Cormorant	3,000
			Glaucous-Winged Gull	1,000
			Tufted Puffin	5,000
	483	Khlebnikof Pt.	Cormorant	4,200
			Horned Puffin	2,000
	484	Hodikof Pt. -	Cormorant	1,000
		Buchanan Pt.	Red-Faced Cormorant	1,000
	485	Hoppe Is.	Cormorant	6,400
			Kittiwake	1,000

continued

Table 20. (continued) Known Sea Bird Colonies - Aleutian Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	486	Chirikof Pt.	Cormorant	2,000
			Horned Puffin	2,500
			Tufted Puffin	2,500
			Kittiwake	1,000
	487	McCloud Head	Cormorant	6,000
			Kittiwake	500
	488	McCloud Head S.W.	Red-Faced Cormorant	500
			Horned Puffin	2,000
	489	Savage Is. E.	Tufted Puffin	5,000
			Cormorant	1,000
	490	Savage Is. W.	Horned Puffin	1,000
			Murre	800
			Cormorant	2,000
			Glaucous-Winged Gull	400
	491	West Arm	Cormorant	600
	492	Chuniksak Pt.	Glaucous-Winged Gull	500
	493	Abraham Bay	Cormorant	1,000
	494	Etienne Head	Pelagic Cormorant	2,300
			Tufted Puffin	1,600
			Horned Puffin	1,000
			Glaucous-Winged Gull	700
			Kittiwake	500
			Murre	1,000
	495	Alaid Head	Glaucous-Winged Gull	200
			Cormorant	5,600
			Tufted Puffin	800

continued

Table 20. (continued) Known Sea Bird Colonies Aleutian Islands. *

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	496	Alaid Is.	Kittiwake	1,000
	497	Hammerhead Is.	Cormorant	6,200
	498	Shemya Is.	Pelagic Cormorant	1,000
			Tufted Puffin	500
	499	McDonald Pt. -	Tufted Puffin	4,200
		Aga Cove	Horned Puffin	1,400
			Cormorant	5,100
			Kittiwake	5,000
			Murre	1,000
	500	Aga Cove S.	Tufted Puffin	900
			Cormorant	1,100
			Murre	500
	501	Cape Sabak	Kittiwake	4,000
			Murre	5,000
	502	Jewel	Murre	1,000
			Tufted Puffin	2,200
	503	Karab Cove E.	Murre	3,000
	504	Karab Cove W.	Kittiwake	6,000
			Murre	7,600
	505	Otkriti Bay	Murre	3,300
	506	2.5 Mi. E. Nile Pt.	Tufted Puffin	4,000
			Horned Puffin	800
	507	Gillon Pt.	Cormorant	600
	508	Gillon Pt. N.	Cormorant	800

continued

Table 20. (continued) Known Sea Bird Colonies Aleutian Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	509	W. Cove S.	Cormorant	600
	510	Ameria Bay	Tufted Puffin	500
18-B	511	Buldir W. Is.	Black-Legged Kittiwake Murre	5,000 15,000
	512	Northwest Pt.	Auklet	22,000
	513	Buldir N. Shore	Glaucous-Winged Gull Least Auklet	5,000 18,000
	514	East Cape N.	Red-Legged Kittiwake	15,000
	515	East Cape S.	Thick-Billed Murre	15,000
	516	Sirius Pt. W.	Tufted Puffin	1,000
	517	Sirius Pt.	Least Auklet	125,000
19-B	518	Segula Is.	Least Auklet Crested Auklet	65,000 5,000
	519	Khvostof Is. W.	Tufted Puffin	2,500
	520	Khvostof Is. N.	Tufted Puffin	2,500
	521	Khvostof Is. E.	Tufted Puffin	900
	522	Khvostof Is. S.	Tufted Puffin	640
	523	Pyramid Is.	Tufted Puffin	1,500
	524	Davidof Is. S.	Tufted Puffin	1,840

continued

Table 20. (continued) Known Sea Bird Colonies - Aleutian Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	525	Is. No. of Davidof Is.	Tufted Puffin	700
	526	Davidof Is. N.	Tufted Puffin	1,200
	527	Davidof Is. E.	Tufted Puffin	1,600
	528	N. E. Pt. - Semisopochnoi Is.	Cormorant	700
	529	Pochnoi Pt.	Common Murre	500
	530	Sugarloaf Head	Tufted Puffin Common Murre	200 100
	531	Semisopochnoi Is. S.W.	Tufted Puffin Common Murre	1,200 100
	532	Semisopochnoi Is. W.	Tufted Puffin	800
20-B	533	Gareloi Is. N.W.	Cormorant Horned Puffin Tufted Puffin	1,900 2,200 3,000
	534	Gareloi Is. N.E.	Tufted Puffin Horned Puffin Cormorant	2,800 2,400 1,250
	535	Gareloi Is. N.E.	Auklet	22,000
	536	Gareloi Is. S.E.	Auklet	45,000
	537	Gareloi Is. S.	Black-Legged Kittiwake Murre	1,500 700
	538	Gareloi Is. S. W.	Fulmar	2,600

continued

Table 20. (continued) Known Sea Bird Colonies - Aleutian Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	539	Gareloi Is. S. W.	Fulmar	600
	540	Unalga Is.	Tufted Puffin	2,200
			Crested Auklet	150,000
			Parakeet Auklet	500
	541	Tag Is.	Glaucous-Winged Gull	1,500
	542	Ulak Is. N. W.	Tufted Puffin	675
			Cormorant	300
	543	Pratt Cove	Tufted Puffin	500
			Horned Puffin	500
	544	Tanadak Is.	Glaucous-Winged Gull	500
	545	Ulak S.	Tufted Puffin	2,500
			Horned Puffin	500
	546	Ulak S.	Horned Puffin	500
			Tufted Puffin	1,500
	547	Amatignak	Horned Puffin	500
21-B	548	Bumpy Pt.	Tufted Puffin	850
	549	Gusty Bay	Tufted Puffin	1,300
	550	Pt. Aries-Cape Sudak	Tufted Puffin	550
	551	Bobrof Is. S.	Tufted Puffin	3,000
			Horned Puffin	3,000
	552	Redan Pt.	Tufted Puffin	3,500

continued

Table 20. (continued) Known Sea Bird Colonies - Aleutian Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	553	Bobrof Is. N. E.	Horned Puffin	300
	554	Bobrof Is. E.	Tufted Puffin	1,000
			Horned Puffin	1,000
	555	Cape Tusik	Tufted Puffin	800
			Common Murre	300
	556	Cape Yakak	Tufted Puffin	500
	557	Turrent Pt.	Pelagic Cormorant	800
			Red-Faced Cormorant	300
	558	Is. S. W. of Crone Is.	Red-Faced Cormorant	900
	559	S. End Crone Is.	Tufted Puffin	1,810
			Horned Puffin	700
	560	Islet S. E. of Crone Is.	Glaucous-Winged Gull	500
	561	Is. N. of Elf Is.	Pelagic Cormorant	750
	562	Is. in Boot Bay	Tufted Puffin	1,500
			Horned Puffin	700
			Pigeon Guillemot	500
	563	Islet E. of Boot Pt.	Pigeon Guillemot	700
	564	Head Rock	Cormorant	300
	565	Azamis Cove	Cormorant	300
	566	Great Sitkin Is.	Cormorant	3,000

continued

Table 20. (continued) Known Sea Bird Colonies - Aleutian Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
22-B	567	Cape Ruth-Moss Pt.	Cormorant	300
	568	Anagaksik Is.	Puffin	6,400
			Pigeon Guillemot	4,200
	569	Ulak Is.	Parakeet Auklet	3,000
			Common Murre	1,000
			Tufted Puffin	20,000
			Red-Faced Cormorant	800
	570	Oglodak Is.	Auklet	50,000
	571	Kasatochi Is.	Auklet	22,000
	572	Koniuji Is.	Auklet	5,000
			Kittiwake	10,000
			Murre	5,500
	573	Cape Tadluk	Cormorant	500
	574	Sadatanak Is.	Tufted Puffin	500
23-B	575	Tanadak Is.	Glaucous-Winged Gull	700
	576	Moundhill Pt.	Cormorant	600
24-B	577	Chagulak Is.	Parakeet Auklet	11,400
			Whiskered Auklet	700
			Fulmar	450,000
			Black-Legged Kittiwake	28,500
			Glaucous-Winged Gull	3,500
			Tufted Puffin	12,000
			Murre	111,500
			Red-Faced Cormorant	1,600

continued

Table 20. (continued) Known Sea Bird Colonies - Aleutain Islands.*

MAP NO.	COLONY NO.	NAME	SPECIES	COLONY ESTIMATE
	578	Yunaska Is. W.	Whiskered Auklet	2,000
	579	Yunaska Is. Bold	Red-Faced Cormorant	500
	580	Yunaska Is. Knob	Tufted Puffin Horned Puffin	2,000 1,000
	581	Herbert Is. S. E.	Puffin	1,600
	582	Herbert Is. N. E.	Whiskered Auklet	500
	583	Carlisle Is. N.	Tufted Puffin	300
25-B	584	South Cove	Tufted Puffin	300
	585	Concord Pt.	Red-Faced Cormorant	500
	586	Applegate Cove	Tufted Puffin	200
	587	Chuginadak Is. N.	Tufted Puffin	300
	588	Kagamil Is. S. W.	Murre	285,000
	589	Kagamil Is. W.	Red-Faced Cormorant Tufted Puffin	1,000 1,000
26-B	590	Uliaga Is. S.	Tufted Puffin Horned Puffin	6,000 4,000
	591	Uliaga Is. E.	Puffin	10,000

* Sekora, P. 1973. Aleutian Islands National Wildlife Refuge Wilderness Study Report. Preliminary Draft. 409 pp.

APPENDIX A

Life Histories

MOOSE

The moose (Alces alces) is the largest member of the deer family in the world; and the Alaska form (Alces alces gigas) is the largest of all subspecies.

Adult males in prime condition that have been weighed indicate that 1,000-1,6000 pounds is the usual range; females weigh 800-1,200 pounds. Only bulls have antlers. The largest moose antlers in North America come from Alaska. In Alaska, trophy class bulls are found throughout the state, but the largest come from the Alaska Peninsula, lower Sisitna Valley and Kenai Peninsula. Moose produce trophy-size antlers when they are six or seven years old and may continue to produce large antlers until they are 13 or 14. In the wild, moose may live more than 20 years.

Moose are long legged, short bodied, have a drooping nose, a "bell" or dewlap under the chin, and no apparent tail. They are colored a variety of brindle browns, shading from pale yellow to almost black, depending upon the season and the age of the animal. The hair of newborn calves is generally an orange-brown that fades to a lighter rust color within a few weeks. Newborn calves weigh 28-35 pounds and grow to over 300 pounds within five months.

Moose have adapted well to man's incursions and where they have been given protection from excessive exploitation, they and man have coexisted in close association. In Alaska, they occur in suitable habitat from the Stikine River in the Panhandle to the Colville River on the Arctic Slope. Moose are most abundant in second growth birch forests, timberline plateaus and along the major rivers of southcentral and interior Alaska.

Moose are generally sedentary animals, but seasonal movements associated with breeding, partutition and treks to favored forage areas may cover 20-40 miles. A tagged moose is known to have moved 60 miles.

In mountainous areas, bulls spend most of the summer and early fall at or above timberline, while cows with calves prefer more dense cover at lower elevations. Cows move toward timberline during the rut and the bulls meet them about halfway. The sexes separate after the breeding season; and groups of 10-20 bulls at or above timberline are common.

Both sexes are sexually mature at 16 months on the best ranges. Breeding begins in late August when the larger bulls shed their antler velvet and begin pre-rut behavior. This includes antler polishing, a cessation of feeding activities, jousting with similar-sized males, calling and seeking receptive females. Males exhaust the entire reserve of fat accumulated during the summer months during the rut. This may include 20-25% of their total weight, and they enter the winter exhausted. Most breeding takes place from September 15 to October 10, with most females conceiving during the first estrus cycle. Calves are born in late May and early June after a gestation period of approximately 240 days.

About 90% of the females over two years old breed every year. Cows generally produce a single calf the first time they breed, but thereafter up to 60% produce twins depending upon the quality and quantity of available food. Triplets occur rarely, perhaps once every 1,200-2,000 births. Most calves are born in swampy muskeg areas. A cow moose will defend her newborn calf vigorously.

The reddish-brown calves weigh 25-35 pounds at birth. Thereafter, they grow at a fast rate, reaching 300-400 pounds four months later. A little milk plus vast quantities of willow leaves, sedges, pond weeds and a sampling of most everything green except spruce trees produces

animal tissue at a prodigious rate. Calves are weaned in the following fall about the time the mother reenters estrous.

Newborn calves may represent 40-50 percent of a moose population in the spring, but mortality is great, and by November their number often has been reduced by half. Many calves die during the six weeks following birth. Mortality factors include predators, malnutrition and abandonment.

Unlike species dependent upon pristine wilderness or climax vegetation, moose are adaptable to many situations. They thrive on transitional vegetation such as that which follows forest fires, clear-cut logging operations, land clearing for agricultural purposes, highway right-of-way clearing, receding glaciers and braided river beds. Their annual habitat requirements are broad but include the following: breeding grounds, winter feeding areas, calving grounds and summer feeding areas.

During fall and winter, moose consume great quantities of willow, birch and aspen. They may establish a hedge or browse line six to eight feet above the ground by clipping all the terminal shoots of favored food species. When food supplies become critical, moose may eat food that have little nutritional value. The young terminal tips and bud ends and leaves contain most of the nutrients. But when shortages exist, moose will consume the older two-year growth. Occasionally, they will even resort to feeding on some three-year old growth. Since there is little food value in this material, the survival chances of the animals may be lowered.

Spring is the time for grazing, and moose utilize a variety of foodstuffs, particularly sedges, equisetum (horsetail), pond weeds and grasses. In some areas they feed on vegetation in shallow ponds all summer; in other situations forbs, and leaves or birch, willow, alder and aspen are the main summer diet.

Wolves may take a considerable number of calf moose in late May and June. Since there is total overlap of the distribution of wolves and moose, wolves must be considered major users of the moose resource. Black bears and brown bears both eat moose calves but their impact upon populations has never been thoroughly evaluated.

The winter period is crucial not only to the survival of adults and young of the year, but also to the survival of the following year's calves through abortion of fetus or resorption by the cow. Winter food shortages result in malnutrition and may cause losses to the population. Some losses may not be directly caused by the malnutrition but result from diseases or parasites that attack undernourished moose.

Internal parasites that affect moose include liver flukes, tapeworms and other roundworms, stomach flukes and lungworms. The winter or moose tick, is the only external parasite that is a serious health hazard to moose. Other diseases reported in moose include blindness, Bang's disease, tuberculosis, arthritis and necrotic stomatitis.

Automobile collisions kill some moose, especially in winter when moose refuse to leave the easy travelled route of a snow-plowed highway. Moose also prefer to move along plowed railroad right-of-ways rather than flounder through deep snowdrifts. During winters with exceptionally deep snow, as many as 200 moose have been killed by the Alaska Railroad.

Moose may move into residential areas and occupy yards, gardens and similar sheltered areas during severe winters. They often become such nuisances that they have to be destroyed.

CARIBOU

The barren ground caribou (Rangifer tarandus) is generally associated with the arctic tundra, mountain tundra and northern forests of North America, Russia and Scandinavia. This species has been a distinctive part of the Alaskan fauna for thousands of years and is resident throughout the state except for the Southeastern Panhandle and most offshore islands.

Caribou are large, rather stout deer with large, concave hooves that spread widely to support the animal in snow and soft tundra and function well as paddles when it swims. Caribou are the only members of the deer family in which both sexes grow antlers. Antlers of adult bulls are large and massive; those of adult cows are much shorter and are usually more slender and irregular. In late fall caribou are clove-brown in color with a white neck, rump and feet, and often a white flank stripe. The hair of newborn calves is generally reddish-brown, but may range from pale beige to dark brown. Newborn calves weigh approximately 13 pounds and may double their weight in 10-15 days. Adult bulls weigh 350-400 pounds; however, weights of 700 pounds have been recorded in the Aleutian Islands. Mature females average 175-225 pounds.

The shedding of velvet in late August and early September by large bulls marks the approach of the rutting season. The bulls cease feeding and show increasing aggressiveness that soon results in combat. Fights between bulls are seldom violent and injuries are uncommon. The peak of the breeding period in Alaska varies somewhat between herds, but most occur in October. Most yearlings are capable of breeding, but the first breeding usually occurs at an age of 28-29 months. By late October adult males have exhausted their summer accumulation of fat and once

again begin feeding. Bulls start to shed their antlers after the rut and most adult males are "bald" by January. Pregnant cows and young animals retain their antlers until May or June, but non-pregnant females usually shed their antlers in April.

As the spring migration begins, females and many calves of the previous year congregate as they move to the calving area. In late May or early June a single calf is born. Newborn calves can walk within an hour and after a few days can outrun a man and swim across lakes and rivers.

Like most herd animals, the caribou must keep moving to find adequate food. This distributes feeding pressure and tends to prevent overgrazing. Caribou are not as likely to starve to death as moose or deer because if food is not available in one area, they move to another.

In summer, caribou eat a wide variety of plants, apparently favoring the leaves of willow and dwarf birch, grasses, sedges and succulent plants. As autumn frost kills off plants and foliage, they switch to lichens ("reindeer moss") and dried sedges. After a winter of lichens and dried food, caribou seek out the first new growth of spring.

The Alaskan caribou is largely a mountain animal, associated with areas above or near timberline, but its movements are extensive and unpredictable. Areas known for many years to have great numbers may suddenly be abandoned as the herd changes migration pattern. Such irregularities even today cause privation among the native people in Alaska and Canada who depend upon caribou for food.

Annual caribou migrations are generally directional, long-distance treks occurring in spring and early summer as cows and young move to traditional calving grounds and then to summering areas. The bulls and some young animals follow far to the rear and scatter widely during

the summer. In the fall and early winter, the herd assembles for the rut and then moves to wintering grounds.

There are more than 600,000 wild caribou in Alaska distributed in 13 more or less distinct herds. At present, most of the herds are healthy, but the future can only bring a decrease in numbers. As civilization encroaches and the back country is developed, more and more valuable caribou habitat will be lost.

DALL SHEEP

The Dall Sheep (Ovis dalli) is the northernmost species of wild sheep in North America.

The most striking physical characteristic of the Dall sheep is its white coat. In Alaska, a few sheep have dark tails or a sprinkling of dark hairs on other parts of their bodies, but most are entirely white. The white coat may vary in appearance from snow-white through yellowish to brown, depending upon dirt and staining. The hairs are brittle and hollow and the coat may be thicker than three inches during winter, forming an excellent insulating barrier against the cold.

Mature rams weigh 150 to 160 pounds, with some individuals exceeding 200 pounds. Ewes average about 110 pounds and occasionally reach 130 pounds. Rams are about 35 inches tall at the shoulder and ewes about 30 inches. Older Dall sheep rams have massive curling horns while ewes and young rams have short, slender, slightly curled horns. These horns, like claws, hooves, and finger nails, grow from the skin and are composed of a material called keratin, quite different from the bony antlers of deerlike animals. Horns continue to grown throughout the life of the animal unlike antlers which are shed and regrown annually. During spring, summer and early fall when food is available and nutritious, horns grow regularly. In late fall and winter, however, horn growth is retarded, probably becuase of changes in body chemistry during the rut and the winter scarcity of food, a factor which causes the sheep to utilize stored body fat. This periodic arresting of the regular growth rate results in a pattern of "annual rings" which appear as slightly deeper constrictions among the corrugations which encircle the horn.

As rams mature, their horns grow in an ever-increasing curl, reaching a 3/4 curl in four to five years and a "full curl" or more in seven to eleven years.

Dall sheep inhabit parts of all major mountain ranges in Alaska, including the Kenai, Chugach, Wrangell, Talkeetna, Alaska and Brooks Ranges as well as the White Mountains and Tanana Hills. Their range in Alaska extends from about 60 degrees north latitude in the southern Kenai Mountains to almost 70 degrees in the Sadlerochit Mountains north of the Brooks Range, and from the DeLong Mountains in the western Brooks Range to the Canadian border. They are also found in the Yukon and Northwest Territories of Canada.

Dall sheep are almost exclusively limited to the alpine zone, although they may range into the lower brush and timber zones locally or seasonally. Since the alpine is a relatively stable climax vegetational zone, sheep distribution is also relatively stable.

Within the general alpine zone, sheep have specific requirements for suitable escape terrain adequately dispersed throughout feeding areas. Cliffs and rugged rock outcrops are necessary sanctuaries from predators, and sheep are rarely found in otherwise suitable habitat where such terrain cannot be easily reached.

Rams segregate themselves from the ewes and lambs during late spring and summer, although both sexes may be using the same slopes. Ram groups often seek higher and more rugged terrain as the summer progresses possibly to escape insects or to seek newly-emergent vegetation.

By October, both sexes begin to congregate on winter range. This may be a rugged slope where a particularly good southern exposure assures snow-free conditions, or a series of high, exposed ridges where winter winds remove snow.

Breeding begins in late November and continues through mid-December. Rams do not gather harems, but circulate freely between groups of females, seeking ewes in estrus. Most fighting between rams takes place prior to the rut and appears to help equal-sized rams determine social dominance. Dominance between unequal rams is generally established by horn display rather than by fighting. Ritualized horn clashing is not, as many believe, over the possession of ewes during the breeding season, although some slashing and shoving does occur during chases of estrus females.

Some females are sexually mature at 18 months, but most mature at 30 months and breed annually thereafter. Even very old ewes, 13 to 15 years old, continue to breed. Dall sheep have a life expectancy of 15 to 20 years.

Lambing occurs from mid-May through mid-June after a gestation period of about 175 to 180 days. Ewes ordinarily have a single lamb, but twins or triplets will occasionally occur. The female selects the privacy of the most inaccessible crags to give birth. Lambs weigh five to six pounds at birth and reach 60 to 70 pounds by their first year. The survival of lambs is variable, but generally low. Lambs are precocious offspring and begin feeding on vegetation within a few days after birth. By mid-August the young are quite independent, but will remain with the ewe until the following spring.

Sheep feed primarily on grasses, leafy ground plants, mosses, and lichens found on alpine slopes and ridges. Some browsing of willow occurs during the winter. They can generally dig down through snow for food, but exceptionally deep snow or icing conditions which prevent them from reaching food can cause starvation.

As winter progresses, deep or wind-crusted snow restricts movements

and feeding to small portions of the normal range. Thus, winter range may be merely a series of high ridge tops only a few yards in width by a few hundred yards in length, with the remaiing forage covered by concrete hard, wind-packed snow and ice. In extreme winters it may consist of perhaps only the one slope in the herd's entire range, which receives adequate winter sun and wind to keep forage exposed.

The most important habitat requirement seems to be acceptable winter climate. Sheep depend upon cold temperatures, wind and moderate snowfall in order to survive the winter. Continued cold keeps the snow light and powdery, while high winds remove it from alpine ridges, exposing the low winter forage. Warm, wet snows that do not blow away will prevent sheep from reaching winter feed. Winter climate must also be consistent within tolerable bounds. If only one winter out of ten, for example, produces a sufficiently heavy wet snow to cover all forage for more than a short time, this could prevent the establishment and survival of a sheep herd in an otherwise suitable area. Thus, Dall sheep may occur on one alpine range while not occupying an adjacent and apparently similar range with subtle differences in winter climate, terrain, or forage composition.

As spring arrives and the snow begins to melt at lower elevations, the sheep move down to make use of earliest growing vegetation. With retreating snow, sheep feed back up the slopes, following the emergent vegetation. At this time, rams begin to leave winter and spring ranges and move away from the ewe herds toward their summering grounds. After lambing, the ewe/lamb herds also move out to the same or different summer ranges. It is at this season that use of natural mineral licks seems most important to the sheep. Natural mineral licks are present

on most Dall sheep ranges. Study has revealed that the licks are essential, but reasons for use by sheep are not fully understood. Large licks are obvious and well used for long periods by sheep in some areas, but in other areas are absent or small and used only periodically.

Sheep in Alaska are generally in good supply throughout their range. They have not always been so plentiful, for at various times since 1900, severe winters and market hunting have reduced numbers drastically. The chief natural predators are wolves. Usually sheep can easily outdistance their pursuers in rugged cliffs and steep "escape" terrain, but when deep snow, malnutrition, or disease prevent or slow escape, predators exact their toll. Although lynx, coyote, wolverine and even bear are known to take sheep, they are not important predators. During early prospecting and mining days in Alaska, market hunters depleted populations in certain areas. Now, however, hunting in most areas is restricted to trophy animals (males with 3/4 curl or larger horns). Weather is perhaps the most important element affecting sheep numbers. They are occasional victims of snow slides, avalanches, falls, parasites and diseases.

BROWN-GRIZZLY BEAR

The brown-grizzly bears (Ursus arctos) are the largest animals of the genus, with the Alaskan brown-grizzly bears the largest of all carnivores. Most taxonomists now believe that the brown bear and grizzly bear are all of a single species. Brown bears on the Kodiak-Afognak Island group are a reproductively isolated population with distinctive cranial features, and are considered a separate subspecies. However, reference to the brown bear implies southern coastal populations; whereas, reference to the grizzly bear indicates northern and interior Alaska populations.

The brown bear resembles its close relative the black bear, Ursus americanus. The brown bear, however, is usually large, has a more prominent shoulder hump and longer, straighter claws. Other characteristics such as the shape and relative massiveness of the head help to differentiate these species. Color is not a reliable key in differentiating these bears for both species have many color phases.

Mature males weigh between 500 to 900 pounds with extremely large individuals weighing as much as 1,400 pounds. Females weigh one-half to three-quarters as much as equivalent aged males in given locales. An extremely large brown bear may have a skull approaching 18 inches in length. Such a bear when standing on its hind feet is about nine feet tall. Inland, bears are usually smaller than coastal bears; perhaps because they lack the rich supply of fish.

The Alaska brown-grizzly bear is common over most of the state. They inhabit the Alaskan Peninsula, Kodiak and Afognak Islands, Montague and Hinchinbrook Islands in Prince William Sound and Baranof, Chichagof and Admiralty Islands in southeastern Alaska.

Although there are no precise data on the abundance of brown-grizzly bears in the state, there is a general understanding of the species' status. Numerous attempts to determine the abundance of brown-grizzly bears in various areas have met with little success except to yield minimum estimates and to provide information on their relative abundance.

Brown bears are probably as abundant as during earlier times, except where they have been displaced by man. Definite reductions in bear numbers have occurred near human population centers. A marked reduction has occurred on the Chiniak portion of Kodiak Island, where conflicts between livestock interests and brown bears are common.

Tagging studies have shown that bear movements are confined to limited areas and movements in excess of 30 miles are unusual. Burns and Hensel, (1972) state that in the Kodiak National Wildlife Refuge the size of individual activity areas, established by eight bears, averaged 5.5 square miles and four bears used two activity area each that averaged 5.7 square miles in size. Activities were associated with food gathering and winter denning. Fixed frequency and location indicated that the 14 bears studied spent 50 percent of their time in lowland habitat.

The breeding biology of brown-grizzly bears is reasonably well known. Both sexes usually attain sexual maturity at 3 1/2 to 4 1/2 years. Females mature as early as 2 1/2 years while others are 6 1/2 years old at first breeding. Males are usually sexually mature by 4 1/2 years of age.

Matings take place from May through July with the peak of activity in early June. Brown bears generally do not have strong mating ties, but individual bears have been observed remaining with their mates for over a month. The hairless young, weighing less than a pound, are born the following January or February in a winter den. Litter size ranges

from one to four cubs; two are most common.

The large size attained in several months' growth by coastal brown bear cubs compared to interior cubs suggests the differences are largely caused by environment rather than by genetics. A richer food supply, particularly protein-rich salmon, is generally available to coastal bears. The foraging period of coastal bear cubs is also several months longer than that of interior bear cubs which spend more time denning.

The gestation period, usually about 245 days, includes a relatively long period of delayed implantation. Implantation usually occurs in October or November.

The cubs remain with their mothers through their second year of life. Female brown bears give birth to a new litter every two or three years. There is strong evidence that the usual interval between litters is three years.

Maximum life span in the wild is unknown, though captives have lived to be 30 years old. Age determinations of wild bears using tooth cementum aging techniques suggest that some bears reach their late 20's.

Cub and yearling litters observed in summer average slightly in excess of two, suggesting a high survival rate for cubs from conception to family breakup. However, it is possible that natural mortality affecting litters may most often involve the entire litter rather than individual cubs, thereby masking the true extent of mortality.

During winter, bears experience a period of dormancy which they spend in dens. During this time their body temperature drops, and their general metabolic rate is reduced. This is not considered complete hibernation since they do occasionally emerge from their dens to forage, particularly during spells of warm weather and during years when food is scarce prior to denning.

Bears usually enter dormancy in November and December and emerge during April or May. The den is often a natural shelter between tree roots or rocks or may be an excavation dug by the bear itself. Dens are most common at high elevations near timber-line, but may be found anywhere from sea level to alpine areas. On the Alaska Peninsula and Kodiak, dens are usually located in the alder, willow and grass zone, and are often lined with grass and leaves.

The precise habitat requirements of brown-grizzly bears are unknown, but they are seemingly most at home in open tundra and grassland areas. Even where they occur in forested areas, as in southeastern Alaska, substantial mountain meadows, muskegs, sedge flats, and other grassland areas are present. Perhaps the best indication of habitat requirements is the fact that the most dense populations occur in lush grassland communities, as on Kodiak Island and Alaska Peninsula. Grassland types appear especially critical for bears during the spring, when other high quality foods are scarce.

The brown-grizzly bear is an opportunist and will feed on game or domestic animals when it is available. The brown bear is probably not a significant predator on big game species except possibly during spring when the young are most vulnerable. Bears are fond of carrion and will feed on carcasses of any animals they come across. Some instances of cannibalism have been recorded. As a rule, animal matter constitutes a lesser but important portion of the grizzly bear's diet. An exception is coastal areas where abundant salmon comprise a major segment of the summer and early fall diet.

Bears often congregate where food is abundant, and may be seen fishing side by side in salmon streams. On July 28, 1970, thirty-one brown bears were seen fishing at McNeil River falls at one time.

Human activities are the most significant mortality source. Sport hunting is presently the most important human-related mortality factor, but there is also a high mortality of nuisance bears near inhabited areas. Often situations attractive to bears, such as garbage dumps and free-ranging livestock, are responsible for conflicts ending in the bear's death. Factors limiting remote and unexploited populations are largely unknown. Of all Alaska's wildlife, brown-grizzly bears are probably least compatible with human activities. Without special consideration, their numbers will be markedly reduced where substantial and sustained human occupation and confrontation occur. Even with protection, a certain amount of conflict and consequent attribution of bears can be expected. The whole history of the species on this continent has followed this pattern, and today grizzly bears have disappeared from most of their former range in the contiguous United States and Central America. Their numbers have been markedly reduced over much of Canada and in small portions of Alaska. The brown bear in Europe has suffered a similar fate.

The eventual survival of the brown-grizzly bear may not depend entirely on the designation of vast tracts of unspoiled "wilderness", as shown by conflicts occurring in large national parks. Instead, the future of the bear lies in the reassessment of human values to include reasonable co-existence with it. Bears are not constant competitors and the major conflicts usually have resulted from improper land planning and classification, marginal economic pursuits, and basic misunderstanding of bears and their behavior.

BLACK BEAR

The black bear (Ursus americanus), the smallest of the North American bear, is bulky in build and is quite variable in size depending on sex, age and time of year. As adults, black bears stand about 26 inches at the shoulders and measure about 60 inches from nose to tail. An average adult male in summer weighs 180-200 pounds, with few exceeding 300 pounds. Female average weight is somewhat lighter than males. Fall specimens weigh 20 to 30 percent more than equivalent spring specimens. The usual color of the black bear is jet black with a distinctive brown muzzle and a small white chest patch.

In Alaska, black bears are distributed over about three-fourths of the state with no consistent records of the species north of the Brooks Range, on the Seward Peninsula, the Kuskokwim Delta, the Alaska Peninsula south of the Branch River, or on the islands in Southeastern Alaska north of Frederick Sound. They are also absent from some of the large islands of the Gulf of Alaska, notably Kodiak, Montague, and Hinchinbrook.

The black bear is a forest species, and in Alaska it's distribution coincides closely with distribution of forests. It has a decided preference for open forests rather than heavy timber and maximum populations generally occur in areas of broken habitat types. Semi-open forest areas composed primarily of fruit-bearing shrubs and herbs, lush grasses and succulent forbs are particularly favored. Expansive open areas are generally avoided by black bears.

Very little is known of the abundance of the black bear in Alaska. Areas of high relative abundance are known to occur, such as Prince of Wales Island in Southeastern Alaska. Elsewhere in the state black

bear numbers are likely to be more sparse than in the southern climates where foraging seasons are longer and richer food complexes (fish) will favor greater densities.

Black bears have very poor eyesight, but their senses of smell and hearing are well-developed.

Both sexes attain sexual maturity at approximately 3 1/2 years, though females may not breed until 5 or 6. Breeding takes place from about mid-June through mid-July.

Gestation lasts approximately 7 months, however almost no active embroyonic growth occurs during the first half of pregnancy. This is due to a delay in the implanting of the embryo (delayed implantation). Implantation of the embryo occurs in early December. Following first conception, breeding occurs during alternate years unless the cubs are lost or spearated from the mother prior to or during the following breeding season.

Young are born during late January or February while the mother is in the winter den. At birth the cubs weigh only 8 to 10 ounces, the eyes are closed and they have little hair. The normal litter is two, but a litter of three or four is not uncommon. Litter sizes observed in late summer and early fall suggest a low cub mortality. Upon emerging from the den in May the cubs weigh about five pounds and are covered with fine woolly hair. Cubs are very precocious. Black bear cubs as young as five months have survived with no maternal care.

Cubs are normally weaned by September when they are eight months old. They apparently remain with their mother through the first hibernation period following their birth.

The life expectancy of black bears in the wild is unknown, but is probably much shorter than the 25 years attained by some captive bears.

The winter-denning period of the black bear is variable as to time and duration depending upon location and the animal's physical condition. Denning in Alaska will usually begin in October and extend through April and into May. Females with cubs usually emerge from dens later and den earlier than single bears. This is not considered true hibernation as they do occasionally emerge from their dens. Warm weather, particularly if flooding of the den results, is often associated with bears leaving dens for a short period. A few black bears have been seen moving about in deep snow.

The location selected for dens varies considerably. Most black bears favor dens dug beneath logs, or in holes dug into hillsides, although a few bears over-winter with little or no shelter at all. Some bears will spend considerable amounts of time constructing elaborate dens lined with leaves, ferns and other vegetable matter.

The diet of the black bear in Alaska is imprecisely known and is variable depending on the portion of the state in which they live. Bears are omnivorous and are opportunistic when it comes to food, and simple food availability is one of the most important factors governing food habits.

Upon emergence in the spring, grasses, sedges, and other early-appearing herbaceous plants appear to constitute the bulk of the diet. After mid-July and throughout the fall a variety of berries such as blueberry, low bush cranberry, high bush cranberry, elderberry and Arctic blueberry become the most important food utilized by Alaska's interior black bears. However, in areas where salmon occur, black bears food habits change to salmon as they become available.

Animal food, however, constitutes only a minor portion of the black bears total food intake. It consists of less than 15 percent of the annual diet, is apparently taken whenever it is obtainable, and is frequently carrion. Invertebrates (particularly insects) along coast areas are also sought by bears. The black bear will take an occasional prey animal, but is of little significance as a predator. Black bears, as with most bears, have been known to be cannibalistic.

Although quite wary of man, some black bears frequent garbage dumps in populated areas, often being encouraged as tourist attractions. Such bears frequently raid human dwellings, which results in a wasteful mortality of these nuisance animals.

Mortality factors affecting bear populations are for the most part unidentified. In accessible and inhabited areas, hunting and other human activities are the most significant. Relatively unexploited populations appear naturally limited by other, unidentified factors.

Parasitic infestations of black bear are generally low. Endoparasites, such as roundwarms, tapeworms, lungworm, hookworms and filariid worms are common. Trichinae give the most cause for public concern, as most bears are infected by this parasite. All bear meat should be well-cooked before eating.

HARBOR SEALS

The harbor seal (Phoca vitulina) is a member of the family Phocidae that includes "true" seals, They differ from their nearest relatives the sea lions, fur seals and walruses in that they have no external ears, have flippers that cannot be turned forward and may be found in a marine, estuarine or fresh water environment. In Alaska, it is known also as the common or spotted seal. It is the only hair seal (phocid) found in southern Alaska and the Aleutian Islands. From Bristol Bay north, it shares its range with bearded seals (Erignathus barbatus) ribbon seals (Histriophoca fasciata) and ringed seals (Pusa hispida).

Harbor seals usually occur in close proximity to the coast although sightings of animals a mile or two offshore are not unusual. Spalding (1964) did not consider the harbor seal a pelagic species and states that they are seldom found more than five miles from shore. Bigg (1969) supports this as he states that "harbor seals live mainly along the coast." However, it is apparent from observations made by the National Fisheries Service during pelagic fur seal investigations that individual animals occasionally do occur some distance offshore. They made a number of sightings, nearly all of single animals, up to 50 miles offshore. Seals thrive equally well in areas with rocky or muddy ocean bottoms. Unlike sea lions and sea otters, which prefer relatively clear water, harbor seals occupy both clear and turbid waters. They are able to catch fish in silt-laden glacial streams and at the bases of glaciers extending to the sea.

Haul-out areas include offshore rocks, sandbars and beaches of

remote islands. Floating ice pans calved from glaciers are used for hauling out when available. During winter, ice shelves which form at the heads of bays are frequently used as hauling platforms.

The average weight of the adult harbor seal is about 200 pounds and length is five to six feet. Their color varies greatly, but is basically a bluish-grey on the back with a scattering of black spots and irregular white rings and loops; the belly is silvery-white with scattered dark spots. Occasionally, there are marked differences in coloration between seals of two different bays or fiords.

From southeastern Alaska to the Aleutian Islands, harbor seals give birth between late May and mid-July, with most pups being born during the first three weeks of June. Birth occurs on sandy beaches or remote reefs and rocks or on glacial ice pans. Usually one pup is born, but twinning does occur. Newborn pups are about 35 inches long and weigh about 28 pounds. The pups are able to swim almost immediately after birth and often take to the water before the next high tide covers their birth place. Pups are usually weaned after three to four weeks.

In northern Alaska pupping occurs on drifting sea ice during the first part of April. Pups are born with a long white coat which is retained for several weeks. Apparently they do not enter the water until the fetal coat is replaced by their first coat of adult-like hair.

Female harbor seals attain sexual maturity when three or four years old. Mating usually occurs in July, shortly after the females have stopped nursing their pups. Delayed implantation occurs and embryonic development is retarded for about two months. The period of active fetal development is about 8.5 months. These seals are relatively long-lived, and some survive longer than 30 years in the wild.

The most common foods eaten by harbor seals are fish and crustaceans. K. Pitcher (A.D.F.&G., Anchorage, AK., pers. comm.) reported that as of September 1, 1975 he had analyzed stomach contents from 161 seals collected in the Prince William Sound-Copper River Delta area. Dominant species included Alaska pollock (Theragra chalcogramma), herring (Clupea harenigus), eulachon (Thaleichthys pacificus), and octopus (Octopus sp.). Other species identified included shrimp (Pandalus sp.), squid, salmon (Oncorhynchus sp.), sand lance (Ammodytes hexaptenus) and starry flounder (Platichythys stellatus). This wide variety of food items indicates that seals will take what is most readily available at the time of feeding.

Other than man, their only major predators appear to be killer whales and sharks, although some may be taken by eagles and wolves. Some mortality does occur when rookery areas are disturbed during pupping. This disturbance increases the rate of abandonment of pups. Very few cases of severe pathology have been observed in harbor seals. Almost all adult seals have roundworms and spiny-headed worms.

Seals tolerate moderate boat traffic through their marine habitat and some disturbance. Although seals may be able to tolerate low levels of pollution, large amounts of oil or other toxic substances in water would be detrimental by harming seals and their food supply.

In arctic Alaska the harbor seal has long been a source of food and clothing for the Indian and Eskimo. However, in southern waters his habit of plundering fishermen's nets has resulted in considerable persecution by fisheries interests. They were regarded as a nuisance and as a result, in 1927 a $2.00 bounty was placed on all seals. In 1939, this was increased to $3.00. This $3.00 bounty was retained until 1967 when the Alaska Legislature eliminated the bounty in southern Alaska. During that 40-year period over one million dollars was spent on bounties. As a whole, the bounty system did not control seal numbers.

In 1962-63, Alaskan harbor seals entered the European fur market, a market which annually consumes up to 500,000 seal skins. High prices were paid for raw seal skins, stimulating a great deal of interest in harvesting the animals. In 1964, an average prime adult skin was worth $20.00 to the hunter; choice pelts brought as much as $50.00; pup skins averaged about $17.00 each (Alaska Department of Fish and Game, 1964). The estimated yearly harvest in Alaska, south of Bristol Bay, climbed from about 6,000 to 10,000 seals prior to 1963 to over 50,000 in 1965. The market prices of seal hides then dropped, resulting in a significant decline in hunting pressure. The seal harvest in 1966 dropped to less than 30,000 and continued to decline each year thereafter.

Widespread public concern for the welfare of harbor seals and other marine mammal populations has been demonstrated in recent years. The Marine Mammals Protection Act of 1972 (Public Law 92-522) was a misguided result of this concern. In general, this act placed a moritorium in the taking of all marine mammals and placed the responsibility for their management under federal jurisdiction.

NORTHERN FUR SEAL

In 1786, three years after his search began, Gerassim Pribilof, navigator in the service of Imperial Russia, came upon the islands that now bear his name and found fur seals along the beaches in seemingly uncountable numbers. Almost immediately, the teeming rookeries became a source of sealskins for the fur markets of the world. Today the northern fur seal (Callorhinus ursinus) breeds on the Pribilof Islands, St. Paul, St. George and Sea Lion Rocks, in the eastern Bering Sea, the Commander Islands, Bering and Tyleni, in the western Bering Sea, and on Robben Island off Sakhalin U.S.S.R. Small colonies have become established in the Kuril Islands between Kamchatka and Hokkaido and on San Miguel Island off California.

The fur seals physical features are adapted to meets its needs. It has unusually large flippers compared with other seals and sea lions. The fur which has over 300,000 hairs per square inch, is so impermeable to water that the skin always remains dry. The fur seal's eyes are relatively large. The nostrils can be closed, and the external ears are small, tightly rolled cylinders with a narrow, waxy orifice that prevents the entrance of water. A fish or squid held by the 36 teeth has no chance to escape. Pups weight from 10 to 12 pounds at birth. Mature females weigh 95 to 110 pounds while a bull may weigh from 400 to 600 pounds. While at sea, the females and young males are a gray color. Pups are black when born, but become gray in September. Males over six years old are predominantly brownish-black, but they vary greatly and may also be dark gray and reddish brown. An adult male develops a short busy mane on his shoulders and neck.

Fur seals are opportunistic feeders and appear to feed on whatever

species are available. Food habit studies have revealed that the principal foods of fur seals throughout their range are Pacific herring, northern anchovy, Pacific saury, Pacific hake, walleye pollock, rockfish, Atka mackerel, Pacific sand lance, deepsea smelt and nine species of squid.

From their oceanic wintering grounds, the forerunners of the annual summer migration appear at the islands early in April or May. These are the large breeding bulls who come ashore to fight among themselves for possession of a rookery or breeding area. About the first of June the breeding females begin to appear from the sea and join the bull seals in their harem areas. Each bull may collect as many as 40 females in his harem.

Within a few days after their arrival, each pregnant female gives birth to one pup, after a gestation period of between 11 and 12 months. Females bear their first pup when three years old, but the males do not mature to the extent that they are able to acquire harems until they are six or seven years old. Five days after giving birth the females are impregnated, usually in a single mating.

The pup remains on shore while the mother makes trips to sea to feed. Feeding excursions may last 5 to 14 days, but averages eight days. Females nurse only their own offspring, which they recognize by a combination of location, sound and smell. By the time the young are ready to leave the rookery in November, the larger ones weigh over 30 pounds. Nursing ends abruptly when the female leaves the islands to migrate southward. The pups must also leave the islands then to find their own food.

The southward migration begins in Ocotber and November and by

the end of December, the rookeries are empty. The seals disperse over the southern Bering Sea, the North Pacific Ocean and as far south as California, Some migrate eastward to Japan and the Okhotsk Sea. Unless sick or injured, fur seals rarely land from the time they leave their rookery islands until they return the following spring or summer.

For over one hundred years the fur seal was hunted on land and sea with little or no regulation of take. In 1911 the Fur Seal Treaty was signed by the United States, Canada, Japan and Russia. This treaty prohibited pelagic sealing and provided for a Fur Seal Commission comprised of representatives of the four governments to coordinate research and management of the fur seal. It also provided that the United States would harvest surplus seals from the Pribilof Islands, with a percentage to be returned to the other countries. Seventy percent of the seal skins sold by the United States is paid to the State of Alaska.

Because seals are highly polygamous and the sexes are born in equal numbers, it is possible to take many males without adversly affecting the productivity of the herd. The number of seals harvested each year has varied. From 1940 to 1955 the harvest averaged about 66,000 males annually. Since then, the harvest has varied from a high of 96,000 to 1956 to a low of 28,000 in 1973.

In addition to providing fur garments, the fur seal has provided feed for poultry, fish and fur-bearing animals, fertilizers, glycerine, tanning oil and pharmeceuticals. They are also an educational and aesthetic resource.

SEA OTTER

The sea otter (Enhydra lutris) lives in shallow water areas along the shores of the North Pacific. Once, its range extended from southern California north through the Aleutian Islands to the Kamchatka Peninsula and south to the northern islands of Japan. In 1742, Vitus Bering's men returned with sea otter pelts from the historic voyage of discovery of Alaska. These rich furs stimulated excited interest, initiating an era of exploitation which almost wiped out the sea otter. Finally, in 1911 when so few animals were left (in many areas they were completely exterminated) that it was no longer profitable to hunt them, sea otter were given full protection under the Fur Seal Treaty. Recovery has been slow, but today the population has grown until there are 100,000 or more sea otters in Alaska from the Aleutians to Prince William Sound. Small populations also exist in Russia's Commander Islands and Kurile Islands, and in California. The Alaska Department of Fish and Game has transplanted sea otter to unoccupied areas of their former range, particularly southeastern Alaska.

Although sea otter are called marine mammals, they are actually members of the weasel family (Mustelidae) and are related to mink and land otter rather than to seals, seal lions and walrus. Adult males weigh 70 to 80 pounds with some individuals weighing 100 pounds. Females average 40 to 60 pounds. Adults reach a length of 4 1/2 feet. The hind feet are webbed and are used for swimming. While the toes on the fore feet are short and stiff, the animal is able to use them deftly to handle objects such as food. Sea otter are adapted to ocean life. On land their gait is clumsy and they are easily run down by a man.

Probably because of this vulnerability, they are seldom found more than a few yards from water.

In water they are graceful and powerful swimmers capable of quickly covering considerable distances above or beneath the surface. When chased they sometimes swim porpoise style, alternately swimming underwater and arcing above the surface for air.

The fur, which is possibly the finest in the world, consists of a very dense fine underfur of inch-long fibers and very sparce guard hairs. The underfur ranges from brown to almost black. Guard hairs may be black, pale brown, or silver. Older animals often develop a silvery head. This combined with the prominent whiskers lead to the nickname of "Old Man of the Sea".

Unlike seals, which rely on a heavy layer of blubber for protection against the cold North Pacific waters, the sea otter must depend upon air trapped in its fine dense fur for maintaining body temperature. If the fur becomes soiled or matted by material such as oil, the insulating qualities are lost resulting in loss of body heat and eventually death. For this reason otter spend much time cleaning and rubbing their fur to keep it clean.

Perhaps the most characteristic behavior of sea otter is their habit of swimming on their backs. In this position they propel themselves with their hind flippers, using them alternately like paddles. They may be seen in shallow off-shore areas, often in kelp beds, floating on their backs, feeding, preening or sleeping.

Sea otter mate at all times of the year, and their young may be born at any time; however, there appear to be more born in late spring and in summer than any other time of the year. Like other marine mammals they have only one pup during each breeding cycle. Pups weigh three to

five pounds at birth and are light brown in color. The female cares for the pup except when diving for food. When traveling, sleeping or preening, the pup usually rides its mother's chest as she floats on her back. The pup may weight 25 pounds when weaned and looks almost as big as its mother.

Recent studies suggest that females won't mate while they have pups with them. As a result they probably average one pup every two years.

Sea otter do not migrate and seldom travel far unless an area has become overpopulated and food is scarce. They are gregarious and may become concentrated in an area, but they do not normally form herds. An exception is pods of up to several hundred animals which occasionally form off-shore. They do not appear to defend territories and there is little, if any, aggressive behavior. The killer whale is the only likely natural enemy. Evidence suggests that sea otters may live for 15 to 20 years.

Fish, sea urchins, rock oysters, crabs, mussels, various other mollusks and octopus make up the normal diet of sea otter. They usually dive to the bottom in five to fifty feet of water, although sometimes deeper, and return with several pieces of food, roll on their backs, place the food on their chests and eat it piece by piece using their forepaws. Occasionally one will crack clams by hitting them together or even by placing a rock on its chest and pounding the clam against it. In the wild, sea otters never eat on land.

The search for food is one of the most important daily activities of sea otters, as large amounts are required to sustain the animal in healthy condition. Early morning and late afternoon and evening hours are usually spent hunting for food while the midday period is spent

cleaning their fur and resting. Feeding dives generally last less than one minute although some otter are capable of staying under water for five minutes or more.

Since 1911, it has been illegal to kill sea otter or to even posses a hide without a permit. They are protected by an international treaty on the high seas and by State and Federal laws in territorial waters.

SEA LION

The Northern, or Steller's sea lion (Eumetopias jubatus) is a member of the family Otariidae which includes sea lions and fur seals. It differs from the common seal family Phocidae in that it has hind flippers that can be turned forward and used in a more four-footed method of movement on land, has external ears, and is found almost exclusively in a marine environment.

Sea lion pups are most commonly born during late May and June, with the majority of pupping occurring during the first two weeks in June. Usually only one pup is produced, but twinning occurs rarely. The average weight at birth is 44 pounds. Females eventually weigh 600 to 800 pounds, and males may grow as large as 2,400 pounds.

Breeding activity begins in late May when mature bulls begin defending territories on the coastal rookeries. Females may move about the territories, but all intruding males are challenged. On large rookeries, males generally have 14-17 females within their defended areas. Most females breed within a week or ten days after giving birth, with the peak of breeding activity occurring in Mid-June.

Not all sea lions go to rookery areas during the breeding season. Large numbers of bulls occupy male hauling grounds, generally located adjacent to rookeries. Also, males and females without pups may gather on hauling grounds where males also defend territories and engage in breeding activities. Territorial behavior by males begins to decrease around the first of July and by mid-July most breeding activity has ended.

Pups are capable of swimming within hours after birth, but most do not venture into the water until they are at least a month old.

By late July, rookery populations begin to decline as some territorial bulls and females without pups leave the area. Hauling grounds that contained few or no sea lions during the summer gradually begin to attract more animals, but the number using each hauling ground varies from day to day and month to month.

As many as 25% of adult females fail to produce a pup each year. In addition, more than half the new pups die in their first year. Drowning, abandonment, malnutrition and predation are the major causes of death. Killer whales, sharks and men prey on adults as well as pups.

Sea lions are generally shy animals and rush to the water when approached by man, except during the June breeding season. During that month, sea lions on rookeries show great reluctance to leave the land. Although most females will finally flee when a man approaches too closely, some become very protective of their pups and refuse to leave their sides. Similarly, many males continue to defend their territories against all intruders, including men.

During winter, some sea lions move into the more protected waters of bays and inland passages. They use hauling grounds that may have been unoccupied in summer and often follow predictable feeding patterns, such as moving into herring spawning areas in spring.

Although sea lions live in the marine environment, they occasionally ascend freshwater rivers for short periods of time. They seem to thrive best in remote island areas with extensive shallow water and rocky bottoms highly productive with fish life.

Offshore rocks exposed through all stages of the tide are important

as resting areas. Sea lions are excellent swimmers and range widely in search of food. They are uncommon in glacial areas where the water is turbid, as they prefer relatively clear waters.

Sea lions eat a wide variety of foods including rockfish, sculpin, cod, greenling, sand lance, smelt, salmon, halibut, flounder, octopus, squid, shrimp and crab.

Sea lions have long been considered an enemy of fishermen because of their dietary preference for fishes. But few quantative data are available concerning the extent of predation on commercially exploited fishes.

Populations of sea lions have been exploited by man throughout history. The earliest harvest records of sea lions come from middens near native village sites and show that sea lions were used extensively.

Commercial interest in sea lions brought about harvests of pups for their pelts. Over 45,000 sea lions pups were recorded harvested from Alaskan rookeries from 1959 through 1972 (Calkins et al. 1975). The Marmot Island and Sugarloaf Island rookeries contributed 31,070 of this total. The average price paid to the hunter for sea lion pup skins was about $8.00. All harvesting of sea lions ceased with the advent of the Marine Mammals act of 1972.

WALRUS

Walruses are the largest Pinnipeds in Arctic and Subarctic seas. They are most commonly found in relatively shallow water areas, close to ice or land. Their geographical range completely encircles the Polar Basin. Two forms are presently recognized: the Pacific walrus (Odobenus rosmarus divergens), and the Atlantic walrus (Odobenus rosmarus rosmarus). The groups may be regarded as closely related, but geographically separated subspecies.

The present population of the Pacific subspecies is estimated at between 85,000 and 95,000 animals. They are the main stay of several Eskimo villages; their flesh is used for food, their skins as boat coverings, the intestines for making rain gear. In the American sector of the Bering and Chukchi Seas, walruses occur seasonally from Bristol Bay to Point Barrow. Most of the animals undertake a northward spring migration, and retrace their route south during the fall. These movements are directly related to the seasonal advance and retreat of the sea ice. A small number of bulls remain in the Bristol Bay area throughout the summer, and it is thought that they do not rejoin the main herds until the latter move south to their wintering areas, usually in late December or January.

The generic name for the walruses--Odobenus (meaning toothwalker), refers to one of their most prominent characteristics--the tusks. These tusks, which are elongated upper canine teeth, are present on both males and females. The body form is basically seal-like, and they have flexible hind flippers, (they can be rotated forward), a thick, heavy neck, and a broad muzzle containing many short, heavy bristles. They are huge animals: adult bulls often approach two tons in weight and even the

females may exceed one ton. Adult bulls can be recognized by their larger size, broad muzzle, heavy tusks, and the presence of numerous large tubercles (bumps) on the neck and shoulders.

Walrus calves are most commonly born in late April or early May, during the spring migration. They weight 85 to 140 pounds at birth. Calves are dependent upon their mothers for at least eighteen months, and occasionally for as long as two and one-half years. Most females do not begin to breed until six or seven years of age. Mating occurs during February and March, but growth of the fetus does not begin until about mid-June. This delay in fetal growth occurs, as far as is known, in all the Pinnipeds. The total gestation period, from conception to birth, is about 13 months. However, the actual period of fetal growth is about 10 months. Most cows do not breed again until the year following the birth of their last calf. Thus, calves are produced in alternate years by females in their prime. Calves are produced less frequently by the older females.

The age of an individual walrus (except for very old animals) can be determined by the number of rings or "annual layers" observed in cross-section of the teeth. In the older animals, some of the rings laid down during the first few years of life are worn away. However, examination of teeth has shown that walrus can potentially reach an age of 35 years. Due to rather constant, significant and selective hunting pressure, as well as other factors, it is doubtful that very many walruses die of old age.

Walruses feed mainly on bottom-dwelling invertebrates found on the relatively shallow and rich Bering-Chukchi Seas. The major food is clams, and several different kinds are utilized. Only the protruding extremity is eaten, the "foot" of some types of clams, and the siphons

of others. It is believed that these parts are torn away from the rest of the clam by strong suction--a method of feeding for which the mouth of the walrus seems ideally designed. The mouth is narrow, with an unusually high roof, strong thick lips which are not deeply cleft along the side of the face (the gape is extremely limited), and a thick, piston-like tongue. The tusks are probably not used to any great extent during feeding. Other food items include snails, crabs, shrimp, worms, and occasionally seals. The food is located by brushing the sea-bottom with the broad, flat muzzle.

Walrus hunting is conducted from all of the Eskimo villages near which the animals occur. However, the bulk of the annual harvests (usually around 1,700 walrus) is taken from the villages in, and near, Bering Strait, mainly Gambell, Savoonga, King Island and Little Diomede Island. Hunting loss is very high, and at least on animal is lost for each one retrieved. The total annual kill in Alaska is approximately 3,400 animals. The harvesting of females is limited by regulation. Some walruses are also taken by Siberian Eskimos.

The most favorable period for hunting walrus is during the spring and summer when the animals are passing the villages on their way north. Hunting is good on St. Lawrnece Island during May, and progressively later at the more northerly locations. Walruses reach the vicinity of Wainwright and Barrow during late July or early August.

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