A FISH AND WILDLIFE RESOURCE INVENTORY

OF WESTERN AND ARCTIC ALASKA

1977

VOLUME I - WILDLIFE

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VOLUME 1 - WILDLIFE

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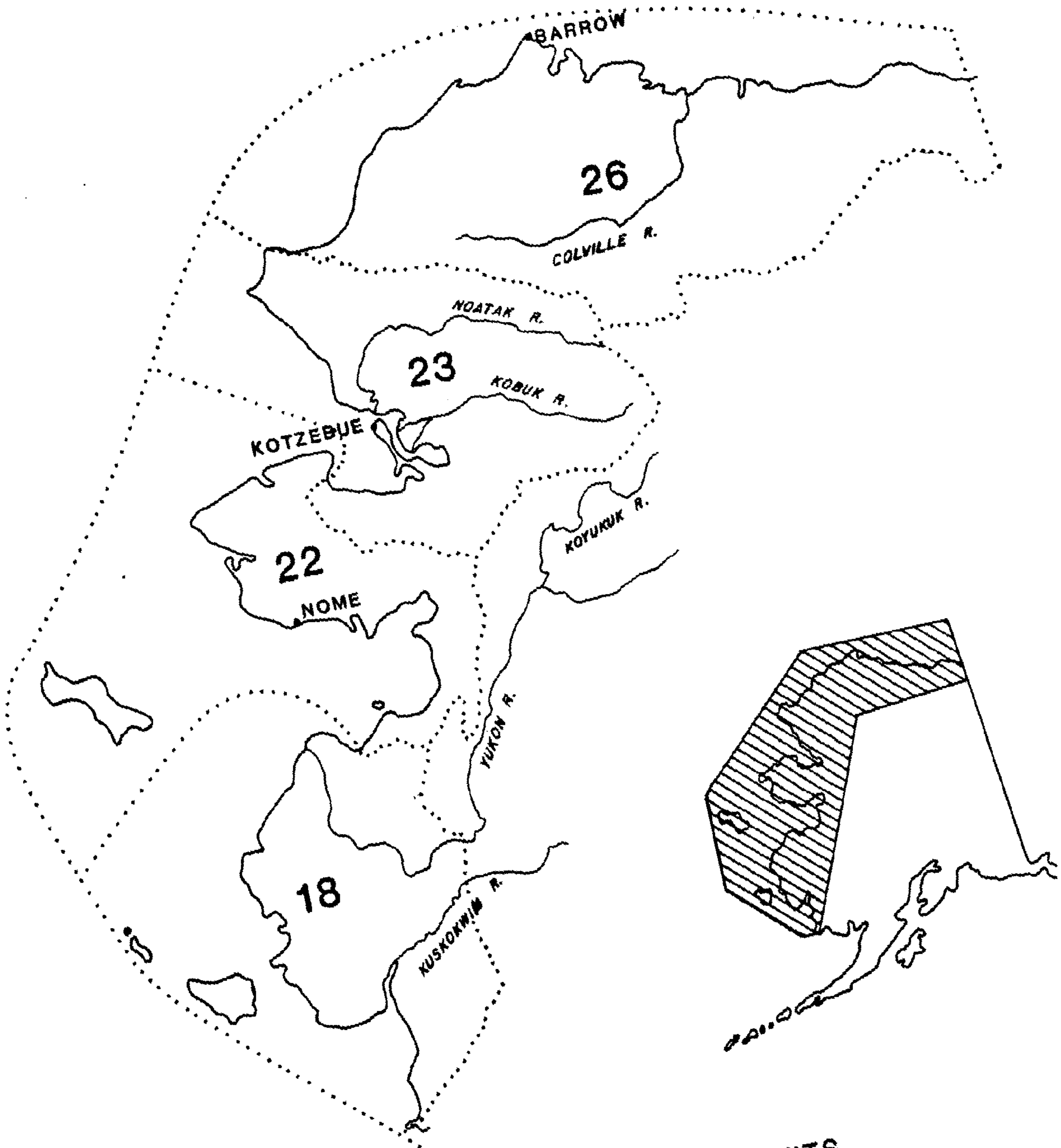

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INTRODUCTION

The Western, Northwestern and Arctic portions of Alaska (Game Management Units 18, 22, 23 and 26) extend from Cape Newenham north and east some 1,500 miles to the Canadian border. Most large terrestial mammals do not abound here as compared to more interior areas because of lack of suitable habitat. However, the Yukon-Kuskokwim Delta is one of North America's outstanding waterfowl and furbearer areas and the highly productive Bering and Chukchi Seas contain marine mammals whose total number is estimated to exceed two million animals.

Most of Unit 18 is composed of the vast Yukon-Kuskokwim Delta. To the north the unit extends into the hills bordering the Yukon River, while to the south the Kilbuck Mountains form the boundary. The edge of the boreal forest coincides roughly with the eastern boundary; the unit extends westward beyond the coast to include Nunivak and St. Matthew Islands and smaller coastal islands.

Trees are absent over most of the Yukon-Kuskokwim Delta. Willows and alders are the only large woody plants, and they gradually become scarce and virtually disappear toward the coast, leaving only diminutive alpine willows, sedges and other tundra vegetation. In summer the delta teems with life. In winter its surface is a cold and quiet place.

Along the inland border of Unit 18 the land rises to benchlands, hills and low mountains. Here, physiography and climate are perceptibly different than on the coast and subtle changes in plant and animal communities are apparent. Willows and shrubs are larger, some tree species are present in local areas, and large mammals such as moose and brown bears are present all year rather than seasonally, or never, as on the delta. Tundra persists into the higher hills and mountains, however.

In spite of these variations, Unit 18 as a whole is typically coastal tundra country dominated by a northern maritime climate; the distribution and abundance of its fauna reflect this fact.

Unit 22 is made up of a large portion of the Seward Peninsula and the drainages into Norton Sound, plus St. Lawrence Island and Little Diomede Island. The Seward Peninsula is largely Arctic coastal tundra with some mountainous outcrops. Forest cover extends west only to the Peninsula's base and seldom persists above 500 feet elevation.

The Norton Sound area is primarily coastal tundra, but mixed forests closely approach the sea along major drainages. The hills separating Norton Sound from the Yukon drainage are mostly treeless, with subalpine and tundra plant communities predominating. Forest cover extends well into the hills along major streams in central Unit 22. To the south, coastal tundra again predominates.

A subarctic maritime climate prevails throughout the unit, but is less severe in eastern Norton Sound than on the exposed Seward Peninsula and southern Norton Sound. Seasonal sea ice is present from late October through early June.

Within Unit 23 ecological communities differ greatly. From Cape Lisburne south to Goodhope River on the Seward Peninsula's north coast, Arctic coastal tundra and an Arctic marine climate prevail. Seasonal sea ice persists from October through June. Cool, moist summers and cold, dry winters typify the climate. In contrast, the inland drainages of the Noatak and Kobuk Rivers strongly resemble rivers of Interior

Alaska. Temperature ranges are more extreme than in coastal areas, and the vegetation is similar to that of Interior Alaska, though more restricted in distribution. Tree species are particularly restricted in distribution on the Noatak River, which begins and ends in treeless tundra.

The Delong, Baird, Schwatka and Waring Mountains, all western extensions of the Brooks Range, separate major drainages and increase the diversity of ecological communities within Unit 23.

Unit 26, the largest game management unit in Alaska, includes the north slope of the Brooks Range, the Arctic foothills and the Arctic coastal plain.

Vegetation composition and distribution are strongly affected by the severe Arctic coastal climate, although this influence is diminished with increasing distance from the coast and increasing elevation. Only a few scattered clumps of trees (primarily cottonwood) are found in the entire unit. Larger species of brushy willows do occur along most drainages. Their distribution is spotty in the foothills and plains, but more consistent in the mountain valleys.

Wet tundra and sedge stands are most common on the coastal plain where there is little slope and continuous permafrost. Lakes and ponds are exceedingly numerous. The foothill vegetation is generally characterized by vast stands of cottongrass. Subalpine conditions prevail in the mountain valleys, and alpine tundra persists to about 2,500 feet elevation.

This report was originally intended to support a series of maps which identified seasonal distribution and movements, high density areas, critical habitat zones and areas of particular concern. Since funding for the cartographic portion of this report was not available, we have attempted to provide information relative to big game, furbearers, small game, waterfowl and marine mammals in narrative form. Narrative accounts and life histories are restricted to information specific to area and species. General life histories for big game may be found in the Appendix. 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 inhabit 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 variable, 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 by 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 for much of the southeastern portion and the 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 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. Cows in less than optimum condition may not breed, however, until they are two and one-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 a distance of from 20 to 40 miles during the year, they are generally considered sedentary compared to species such as caribou or elk. In general, moose prefer forest habitats in early to mid-successional stages of development such as those resulting from fire or timber harvest.

Unit 18

Moose populations in Unit 18 have declined over the last 15 years. Heavy hunting pressure originating primarily from Bethel, along with scarcity of good habitat, keeps the moose population depressed. The total population in Unit 18 is about 500 animals. The annual harvest is about 50, most of which is for domestic use. Populations could be increased through harvest manipulation, application of wolf control and range management programs. Increased productivity would result in increased human use.

Unit 22

Historical information suggests that moose were virtually absent on the Seward Peninsula 40 years ago. They were found here in the late 19th century but were apparently extirpated during the gold rush in the early 1900's. There was limited immigration during the 1940's and 50's, but it wasn't until the decade of the 1960's that a significant population proliferated. Improved compliance with game regulations effected through increased enforcement aided the establishment of moose during this time. By the late 1970's, they had expanded their range into most of the suitable habitat, and local subpopulations began to increase dramatically. In the Kuzitrin River drainage the minimum observed population increased from 142 animals in 1972 to 526 in 1975. Although moose are rapidly approaching their range's carrying capacity, the population still seems to be increasing. In the spring of 1975, the Unit 22 population was estimated at between 2,500 and 3,000 animals.

Present natural mortality is low and directed primarily at calves. A few adult moose are taken by wolf predation, but winter kill and poor range conditions account for most of the natural mortality.

Large-scale population fluctuations in the immediate future will be dependent upon range conditions, predation and hunting pressure. If the annual increment is not cropped, a decrease in herd size can be expected in the future. Development of gas and oil reserves, and perhaps hard rock minerals, is likely to occur within the next decade and severe impacts could result, especially if winter habitat is altered.

In the winter, over 90 percent of the Seward Peninsula moose move to the major river valleys, an extremely important habitat -- even more so than in most other areas of the state. Winter ranges are located primarily within one-half mile of rivers on the lower two-thirds of the drainages. Over 70 percent of the moose in Unit 22 are supported by the Kuzitrin, Serpentine, Nuikluk, Koyuk, Agiapuk and Unalakleet River systems. Calving areas are also located mainly within the bottomland of the lower two-thirds of the drainages, and moose generally follow these drainages when moving between winter and summer ranges. If these critical habitats were destroyed or altered, carrying capacity would be drastically decreased, perhaps resulting in a tenfold or more reduction of moose.

The annual harvest is not well documented because a large percentage of the Unit 22 hunters are rural residents who do not complete and send in harvest tickets to comply with the regulations. The reported harvest between 1963 and 1972 has averaged only 58 animals annually and was never higher than 72 (Table 1). The total reported kill during the 1976-77 season was 240 moose, but the total annual kill is estimated at 350 animals.

Local residents take more than 90 percent of the annual kill, about one-half of which is harvested by rural domestic-use hunters (Table 2). "Outside hunters" probably account for less than 5 percent of the annual kill, being discouraged by high transportation costs and lack of awareness that moose hunting in this area is good. As Alaska's human population expands, it is inevitable that more nonlocals will participate in the harvest. Hunters go afield in August, but success is low due to heavy cover, poor accessibility and unfavorable moose distribution. Most of the harvest occurs in September with the initiation of rutting activity and the increased movement of bulls. Some animals are taken after freezeup in November and December when they are accessible by snowmachine.

Local utilization is undoubtedly the dominant use of moose in Unit 22 at the present time. The harvest is split about 50/50 between residents from the outlying villages and hunters from Nome. Village hunters probably account for more than one-half of the late winter kill. Almost all the meat is utilized by the hunter, members of his family or close friends.

Table 1 Historical moose harvest in Unit 22 (from harvest ticket data).

Year	Male	Female	Unknown	Total
1963	68	1	0	69
1964	57	0	0	57
1965	55	3	2	60
1966	52	1	1	54
1967	56	0	1	57
1968	33	1	1	35
1969	69	1	2	72
1970	70	0	1	71
1971	59	0	1	60
1972	44	0	0	44
1973	103	32	1	136
1974	149	72	1	222
1975	136	0	2	138

Table 2 Unit 22 moose harvest, by area, 1974.

Area	Male	Female	Total
Shishmaref	18	4	22
Agiapuk	6	3	9
Nome	25	1	26
Kuzitrin	63	56	119
Fish	15	6	21
Koyuk	11	0	11
Unalakleet	8	2	10
Unknown	3	1	4

Unit 23

Moose have occupied the Noatak-Kobuk area for the last 30 years or more, but it has only been within the last 15 years that substantial increases in their numbers have occurred. It appears that moose approach the range carrying capacity throughout much of their distribution in Unit 23, but there is some indication that local subpopulations may have experienced recent declines in some drainages. In most areas, though, particularly on the fringe of their distribution (middle Noatak and Wulik Rivers), moose numbers are still increasing. The 1975 population in Unit 23 was estimated to be over 4,000 animals.

Mortality factors are similar to those in Unit 22, but Unit 23 has a much higher incidence of wolf predation. Calf survival is much lower (15 percent) in areas where wolf numbers are relatively high. Yearlings comprise about 30 percent of the population on the lower Noatak, an area where wolves are scarce. On the upper Kobuk, where wolves are more abundant, 15 to 20 percent or less of the moose population is short yearlings.

Mineral developments and road construction may contribute to future population declines. A Nome to Fairbanks road has been proposed, and if built, a shift in human population to the western part of the state could be expected, which in turn would cause a considerable increase in hunting pressure. Oil, gas and hard rock mining development, accompanied by haul roads, will create more management problems and may make it impossible to maintain present moose densities.

Unit 23 winter range is not nearly as critical to moose survival as that in Unit 22, but certain habitats would indeed be critical for the maintenance of the species in large numbers. Major river valleys which provide important winter range and calving areas are the lower half of the Noatak and Kobuk River drainages and most of the Buckland and Selawik River drainages. Migration patterns are similar to those in Unit 22, but there is more lateral movement in and out of the foothills rather than direct travel up and down the river systems.

The annual moose kill reported on harvest tickets has been slightly over 100 animals in the last few years. Analysis of data from these harvest ticket returns shows a steady increase in the harvest since 1972. These data, though, do not reflect trends in hunting pressure. Instead, they mainly indicate a direct correlation to the amount of effort expended to gain compliance with the required reporting system. A regional corporation subsistence survey (1974) listed the annual kill at 317 animals, a figure which is certainly minimal. The actual harvest is estimated to be about 400 moose per year.

Local residents take more than 80 percent of the annual harvest, while hunters from outside the unit account for about 5 percent (Table 3). Domestic use is the primary objective of moose hunting in the area and accounts for about 80 percent of the harvest. Moose are earnestly pursued in August and September when they are considered to be the best eating. Hunting pressure declines after this time because of poorer meat condition following the rut, the onset of winter and the fact that caribou are usually available as a substitute.

Table 3. Unit 23 moose harvest, by area, 1974.

Area	Male	Female	Unknown	Total
Wulik	2	0	0	2
Lower Noatak	20	4	1	25
Remainder of Noatak	5	2	1	8
Lower Kobuk	7	2	0	9
Middle Kobuk	8	3	0	11
Upper Kobuk	16	4	0	20
Kotzebue area	2	1	0	3
Selawik	5	6	1	12
Buckland	4	1	0	5
Candle	3	1	0	4
Unknown	5	0	0	5

Unit 26

Moose populations have increased from very low densities in the 1920's and 30's to a present level of between 1,000 and 1,400 animals; numbers have probably increased by one-fourth in the past 15 years.

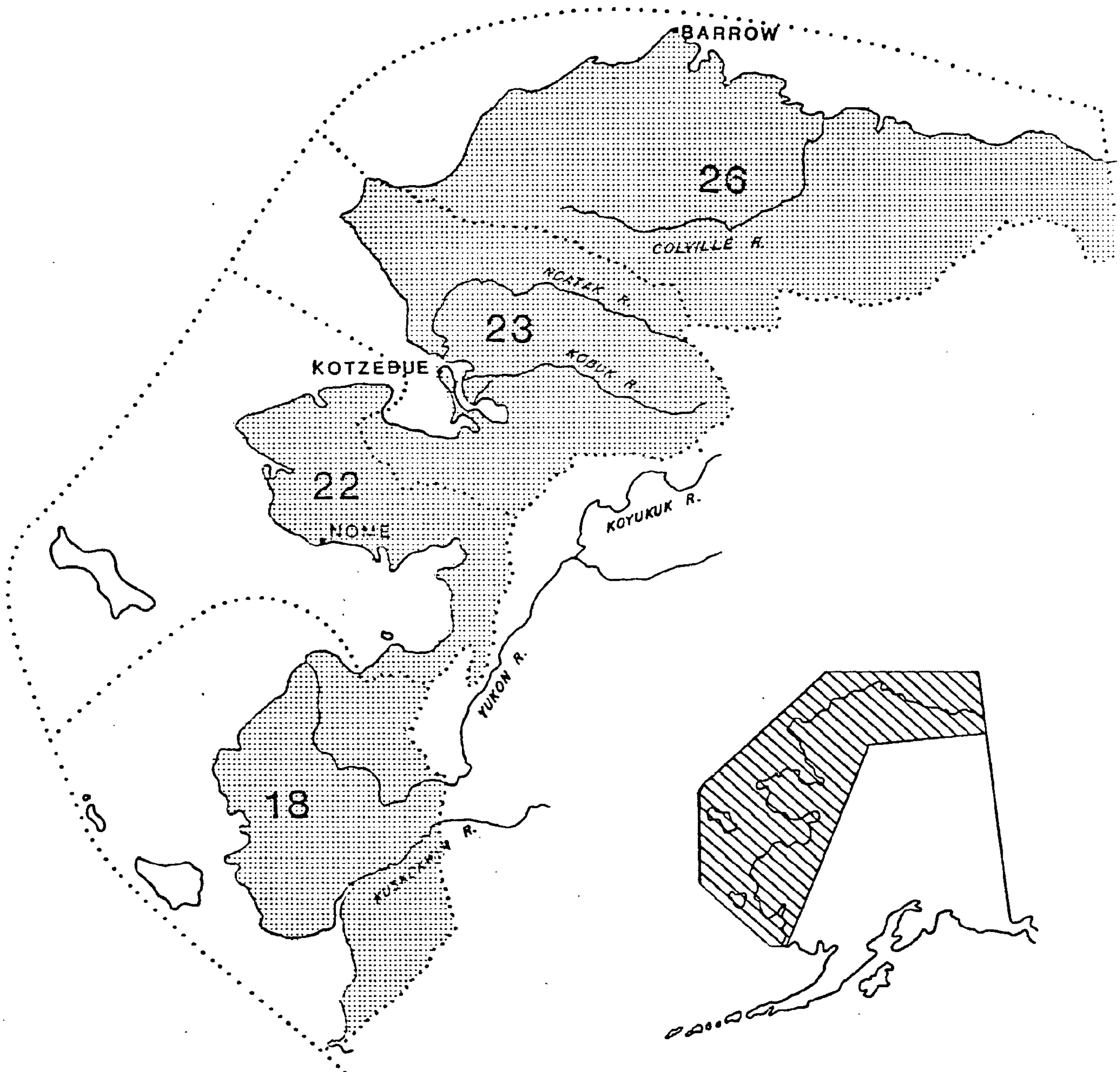
The most critical habitat for moose includes all areas on major rivers vegetated by dense willow stands. These rivers include Kongakut, Canning, Cache Creek, Kavik, Gilead Creek, Echooka River, Sagavanirktok, Ribdon, Toolik, Itkillik and the Colville with its major tributaries.

The level of harvest for moose in Unit 26 is 75 animals annually, with approximately 5 to 6 percent of the population taken (Table 4.). Sport use accounts for 80 to 90 percent of the moose harvest and 10 to 20 percent is domestic use. A few moose are taken by subsistence hunters in Unit 26. Most of these (approximately 20 to 50) are taken in late summer, winter and spring by hunters from the villages along the Colville, Canning and Hulahula Rivers.

Table 4. Unit 26 moose harvest, by sex, 1963-1975.

Year	Male	Female	Unknown	Total
1963	13	0	0	13
1964	13	0	0	13
1965	0	0	1	1
1966	12	0	0	12
1967	5	0	0	5
1968	15	4	1	20
1969	25	6	1	32
1970	26	7	2	35
1971	33	3	2	38
1972	17	0	0	17
1973	24	7	0	31
1974	49	8	0	57
1975	33	2	0	35

Figure 1.
MOOSE



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CARIBOU

(WESTERN ARCTIC HERD)

UNITS 21, 22, 23, 24, 25 and 26*

The northwestern portion of Alaska is seasonally occupied by the majority of the Western Arctic caribou herd in late fall, winter and early spring. Some caribou are present in the region in all seasons of the year. The Western Arctic herd's winter movements bring it into the Interior region from the lower Koyukuk River eastward to Wiseman and the western tributaries of the Chandalar River. This herd reached a low level in the late 1800's and then increased through the 1900's and in 1970 contained at least 242,000 caribou. A substantial decline has since occurred and the herd numbered about 60,000 in the fall of 1976.

Although caribou utilize a variety of habitats throughout the year, much of their time is spent on alpine and arctic tundra. Timbered areas are used extensively as winter ranges but are abandoned as the snow melts.

Central to the habitat requirements of any caribou population is a suitable calving area. Calving grounds generally constitute a "center of habitation" for all caribou populations, and their occupation is the most consistent facet of otherwise vacillating and unpredictable distribution and movement patterns. The characteristics which distinguish calving areas are not well known but probably relate to such factors as availability of new green vegetation following snow melt, ease of movement, high visibility, mimimum exposure to insects and wolf avoidance.

* (Jim Davis, A.D.F.& G., Fairbanks, Alaska, pers. comm.)

Almost any vegetated habitat can be and has been used by caribou for winter range, but the greatest use is made of timbered areas, especially spruce-lichen associations. With dentition adapted for eating soft, leafy vegetation, caribou in winter are dependent on lichens, sedge and decumbent shrub vegetation as is available. Lichens are slow-growing plant forms requiring up to 100 years for development of stands that can provide forage in significant quantities. Caribou utilize extensive areas for winter range, often using different areas in successive years as an adaptation to the very slow recycling capability of lichen ranges. The mobility and seasonally wide-ranging characteristics of caribou are two of the mechanisms evolved by the species to accomodate the limitations of the arctic environment.

The huge caribou herds that have occupied various portions of Alaska in historic times have likely occurred because of the existence of extensive uninterrupted habitat that allows emigration/immigration. Although parceling or isolating blocks of suitable caribou habitat by creating transportation corridors, industrial complexes, human settlements, etc. will not eliminate caribou altogether, these changing patterns of land use will likely preclude the continued existence of the truly high caribou populations that have occurred in the past and are now typified by the Western Arctic herd. Based on this, it might be concluded that there is a vast difference between what is critical to a truly huge caribou herd as contrasted to what is critical for the continued existence of caribou, regardless of how few in an area.

The total habitat of the herd can be considered prime caribou habitat on a comparative basis with other caribou habitats in the state.

Within the last 100 years, only in the Fortymile and Porcupine herds has habitat allowed these animals to reach high numbers comparable to those of the Western Arctic herd.

The primary winter range of the herd lies south of the Brooks Range along the northern fringe of the boreal forest. This winter range extends from the Waring Mountains, Baird Mountains and lower Koyukuk River eastward to the Wiseman area and includes the entire Kobuk River Valley. In addition, some caribou winter in the mountains of the Brooks Range, in the foothills of the western coastal area and on the Arctic Slope.

The major calving area has remained unchanged for decades and is located along the headwaters of the Colville, Ketik, Meade and Utukok Rivers. The calving area is perhaps the most consistently used portion of the total habitat.

Caribou movements and seasonal distribution can be largely correlated with different vegetation types. Normally, a rapid northward movement in April and May brings most of the cows to the dry tundra calving grounds in the foothills of the Arctic Slope at the time most snow has disappeared and the first green shoots and buds of cotton grass appear. The calves are born in late May and the first half of June. In late June and early July, the population concentrates in the foothills and mountains where the willows, birches and forbs first yield an abundance of new growth. Soon after, most of the herd disperses onto the coastal tundra where the new growth of sedges and willows is beginning to develop. In late August and early September, as the tundra vegetation withers and the first snow falls, most of the population moves south. In most winters, however, some small segments of the herds spend the winter in windswept regions of the coastal tundra and foothills.

The Western Arctic herd, as with most caribou herds, experiences different densities or degrees of aggregation at various seasons of the year. Typically, the animals are most aggregated in late June and early July during what is termed post-calving aggregation. During this period 80 to 90 percent of the animals in the entire herd may congregate in an area containing only 50 to 100 square miles. Such dense groups normally occur for only a few days. Other periods when the animals are densely aggregated include fall migration and rut and spring migration and during calving. Lowest densities occur during late July to early September and during winter.

During spring migration, the most direct routes from winter range to the calving grounds are usually taken. On the west end of the Brooks Range major movements occur northward parallel to the Kelly, Kugururok, Nimiuktuk and Anisak Rivers. To the east caribou move north along the John River and parallel drainages. After reaching the summit of the Brooks Range, they swing west, heading directly for the calving grounds.

In mid-June caribou begin leaving the calving area and join into increasingly larger masses. This marks the start of a counter-clockwise movement that takes the animals southwest to the high country of the Kukpowruk, Kukpuk and Wulik Rivers. By the first of July, they attain their highest degree of aggregation. They then swing east through the DeLong Mountains and adjacent foothills and through the mountain valleys of the north slope of the Brooks Range. It is not uncommon when this eastward movement starts for a portion of the herd to split off and begin a northeast drift along the coast. As this movement progresses, dispersal begins. Although the tendency is to shift northward onto the Arctic coastal plain, some animals remain in the mountains all summer.

During summer, after the post-calving concentration, movements are essentially random. Portions of the herd may be found anywhere west of the Sagavanirktok River from the summit of the Brooks Range to the beaches of the Arctic Ocean and the Chukchi Sea.

Fall migration occurs when the animals that are normally dispersed over the entire Arctic Slope begin a leisurely drift toward treeline in late August. By September only a few animals remain on the Arctic coastal plain and major movements are directed toward the Anaktuvuk Pass-Killik River area, the Aniuk-Nimiuktuk River area and along the Chukchi Sea coast. As the breeding season approaches, bulls move to rejoin the cow segment of the herd. By late September both sexes and all ages are fully represented in most large groups. The rut begins in early October as the animals move onto the south slope of the Brooks Range. Migration continues, but at a slow pace, until the end of the breeding period. After the rut, the tempo of movement increases until the wintering grounds are reached.

Despite their physiological and morphological adaptations for coping with the arctic environment, caribou populations have always fluctuated numerically. Some areas in the state with few or no caribou now bear evidence in well-worn trails of large populations in the past. Among many interrelated natural factors limiting caribou population growth, weather and predation are the more important factors operating directly on small populations, while weather and disease and emigration induced perhaps by social stress are most important to large populations. If a caribou population exceeds the threshold limits imposed by year-to-year mortality, production of young can rapidly outstrip predation and spectacular herd growth may occur on good ranges. Equally spectacular declines may occur when carrying capacity of the range is exceeded. Density related stress may cause emigration to new ranges, and reduced food quality and quantity and disease may serve to lower calf production and survival.

The most critical time of year for caribou is the period just prior to and including calving. For those caribou that have overwintered, the availability of new forage is most important in meeting increased energy demands called for by migrations to calving areas and by calving itself. Long-lasting, deep, late winter snow can stress caribou. Newborn calves are susceptible to large-scale mortality if severe weather strikes during the short one-week period when calves are born. Predation on calves is an important factor and, together with weather-induced newborn calf mortality, determines in large part whether annual increments are positive or negative. In affected populations, brucellosis and a retained placenta condition can reduce the number of viable young born.

To the extent of dependency of caribou upon climax vegetation, conditions favoring progression of vegetation through the successional series to climax stages, or the maintenance of climax vegetation, favor caribou. As fires rarely occur in this region, overgrazing by caribou and reindeer are the primary forces depleting ranges. Reindeer were present in the area primarily prior to 1940. Since then few have been in the area and little competition with caribou has resulted.

Caribou in Arctic Alaska are faced by the effects of tremendous industrial growth from the petrochemical industry and a sizeable growth in human population. Aside from the inevitable increase in demands on the caribou resource by consumptive and nonconsumptive users, by far the most important consequence of development will be alteration of habitat and disturbance of caribou during critical periods. The long-term effects of dissecting the caribou range with the Trans-Alaska pipeline, the inevitable construction of a gas pipeline from Prudhoe Bay and the strong possibility of development of oil production facilities in Naval Petroleum Reserve #4, with attendant oil and gas line construction or similar projects, are impossible to predict but almost certainly will mean constricted and reduced caribou populations in the future. Disturbance of calving caribou by resource development, construction or transportation activities may cause substantial mortality, and disruption of critical migrations may result in disorientation and fractioning of populations. Impacts of necessary development and unavoidable conflicting land uses on caribou must be minimized to the greatest extent possible.

Consumptive use of Arctic caribou, historically below productive capacities of these populations, is now affecting the status of at least one important population, the Western Arctic herd. Although maintenance of caribou populations in the region is a necessity, if domestic dependency of local residents upon caribou is to be satisfied in the future, excessive harvests and resistance to regulated use in the region may result in substantial declines in caribou numbers. Recreational harvests in the region have been relatively minor but may increase as access improves and resource development brings new people into the area. Competition among consumptive users will increase and will be further intensified by creation of national parks or other management systems where consumptive use is excluded or limited. Use of Arctic caribou populations must be equitably allocated among the various users, and harvest levels must be controlled under the sustained yield principle if consumptive use is to be maintained.

A revival of interest in maintaining domestic reindeer herds in Arctic Alaska has the potential for serious conflicts with caribou in the region. The sedentary nature of reindeer can result in severe overutilization of ranges, reducing the carrying capacity of the area for both reindeer and caribou. In addition, unless closely herded, reindeer herds suffer attrition of animals which run off with passing caribou, necessitating construction of fences to maintain the reindeer herds intact. Finally, runaway reindeer which join caribou populations may serve as vectors of disease and when incorporated into caribou populations may introduce undesirable genetic characteristics into the wild caribou stocks.

Experience of large-scale and largely unsuccessful reindeer herding attempts along much of northwestern, western and southwestern Alaska during the early to mid-1900's suggests that reindeer herding should be limited to areas where caribou and reindeer will not come into contact and where caribou will not need to forage in the foreseeable future.

Predation is at times detrimental to the welfare of caribou populations. This is most often the case when caribou populations are small and predator populations are large or where human utilization of caribou populations requires restriction of take to annual surpluses or less, thereby bringing use by humans into competition with use by predators. To the extent that competing uses are not compensatory, predator populations must be managed as well as human utilization to insure the maintenance and enhancement of all caribou populations.

Caribou in Arctic Alaska have received heavy domestic use by native residents throughout history. The abundance or scarcity of caribou has been suggested as the principal factor determining if early day natives could live inland or if they had to retreat to the coast where the more stable marine resources could be utilized. The overwintering and occurrence of whalers in the area in the late nineteenth century was the first time any substantial use of caribou occurred by other than natives of the area. Even today, domestic use of caribou by local residents accounts for over 95 percent of the use by humans. Sport harvest has been negligible to date because of the prohibitive transporation problems, but this barrier is rapidly disappearing. Construction of the Trans-Alaska Pipeline has prompted the closure of a corridor five miles wide on either side of the pipeline and a closed area in the Prudhoe Bay development area.

Domestic users harvest most caribou via snow machines, with boats being of secondary importance. Although dog teams were the primary transportation means until the late 1960's, they are rarely used today. Most sport hunting relies on aircraft as the principal transportation means. There is presently much concern that the increasing human population and general use of snow machines is resulting in excessive utilization of caribou.

Harvest for this herd is difficult to determine. From 1963 through 1975, an average of about 25,000 animals were taken per year. Caribou in this general area have been relied upon heavily by native people for as far back as historical records go. Yearly harvest before the 1960's were likely lower than after the 1960's.

The sport harvest averaged between 200 and 300 animals from 1970 to 1975. During 1976 no sport hunting was allowed.

Harvest of animals used for commercial purposes was legal from 1963 through 1975. The number taken depended upon the availability of caribou in the general vicinity of the large villages where there is a demand for caribou by people who are not able to hunt. The number of animals involved probably ranged from 200 to 800 annually.

Until 1976 harvest occured during all months of the year, but the bulk occurred during fall migration (normally September through November) and spring migration (March and April). If caribou happen to winter close to a community, then heavy harvest may occur during any of the winter months. Migration routes vary between years, so the magnitude and locality of the harvest varies accordingly. About 98 percent of the annual harvest is taken by residents of the communities of Barrow, Wainwright, Pt. Lay, Pt. Hope, Kivalina, Noatak, Kotzebue, Selawik, Noorvik, Kiana, Ambler, Shugnak, Kobuk, Anaktuvuk Pass, Bettles, Allakaket-Alatna, Hughes, Huslia and, in the past couple of years, Nuiqsut. Other villages have substantial harvest in some years if the movements of the caribou takes them beyond their "normal" range.

The herd has been the subject of many scientific and educational studies through the past two decades. Twenty-seven years of caribou studies by state and federal biologists have been conducted in Alaska. In most years, a portion of these activities were conducted on this herd. Early studies attempted to determine identity, distribution, age composition, population size and limiting factors, including disease studies. Other studies have included efforts by the Atomic Energy Commission as part of Project Chariot and assessing radio active fallout through the Arctic food chain of lichen-caribou-Eskimo. Recently, investigations have been made on several aspects of the Arctic ecosystem and impact of northern exploration and development upon caribou.

The number of people participating in nonconsumptive uses of the herd has been increasing in recent years. Most of these activities consist of outings where people plan float trips or mountain hikes to maximize the chance of encountering caribou. Others are making chartered aircraft flights to see the Arctic and alpine tundra and the caribou. A highlight for many persons making the pipeline tours of recent years is their observations of the caribou.

There are presently no designated public viewing areas for caribou in this area. Because caribou do not spend much time at any given location, the prospects for designated viewing areas in the traditional roadside situations are not likely. However, the post-calving aggregations and spring and fall migrations are spectacles that offer potential for viewing opportunity.

The "subsistence" utilization of caribou by residents of the area, primarily in the more remote villages, provides a setting of value to persons finding it gratifying to witness people still "living off the land". In the same line, the caribou are an integral part of the cultural heritage of many of the residents of the area. The presence of a huge population of caribou occupying a near pristine habitat provides a feeling of well being for a multitude of urban dwellers whose only interaction with the herd is a vicarious one.

The calving area and post-calving concentration areas mentioned previously will remain notable for the nonconsumptive use values in the future. Changes in land tenure will probably create areas where nonconsumptive use values will become notable.

To date, the carrying capacity of the Western Arctic herd's range has not been satisfactorily ascertained. There is some evidence that the total population of 200,000 to 300,000 may have been at or near the long-term carrying capacity of the range. The present population appears to be below the carrying capacity of the range.

All factors that may have contributed in decreasing the herd in recent years have not been identified. Presently, human utilization and wolf predation combined are exceeding the annual increment of the herd. If this mortality is reduced, it is probable that the caribou population would expand.

Because of the sporadic range use pattern that caribou have, there are many areas that appear in excellent range condition, suggesting that the total range may have a higher carrying capacity if proper distribution could be insured. These areas are scattered throughout the herds' range and have not been delineated other than by visual reconnaissance.

CARIBOU

(PORCUPINE HERD)

UNITS 24, 25, 26 and Adjacent Canada*

Critical habitats for caribou are the calving grounds, migration routes, winter range and insect relief areas such as the Arctic coast and high, windy ridges.

Current wintering area in Alaska is the drainages of the East Fork of the Chandalar River from its headwaters to Venetie and west to Chandalar Lake. In most years, the greatest portion of the Porcupine herd winters in Canada.

At the present time the calving ground for the Porcupine herd consists of the Arctic coastal plain and associated foothills lying between the Blow River in Canada and the Canning River in Alaska.

An important migration route for these caribou is from the calving grounds east into Canada, from the border east to Arctic Village and from the Junjik to the Wind River.

The Porcupine caribou herd remains in the calving grounds from late May to late June. In late summer most of this herd can be found along the coastal range from the Arctic Wildlife Range east to the Blow River. In October the Porcupine herd moves to the winter range and then in March or April the trek to their calving grounds begins.

The Porcupine caribou herd is stable or may be increasing. The estimated population is 110,000.

* (Harry Reynolds, A.D.F.& G., Barrow, Alaska, pers. comm.)

Impacts on future population fluctuations could be the construction of oil or gas pipelines which might affect migratory patterns. The construction of roads and their access might result in disturbance to the herd during calving and/or migration.

A major natural mortality factor is predation.

Human harvest from the Porcupine caribou herd varies from 2,500 to 4,500 animals annually, depending upon their movements. Usually no more than 1,500 to 2,000 are harvested in Alaska.

Sport use accounts for a maximum of five to ten percent of the total harvest. Domestic use is estimated to be 90 to 95 percent of the total harvest. The village of Kaktovik harvests a maximum of 500 caribou in the summer, Arctic Village takes 100 to 200 animals in August and up to 1,300 in the winter. The remainder of the domestic use harvest during the winter is taken by local residents of other villages.

Table 5. VILLAGE HARVEST OF CARIBOU - ARCTIC HERD

	HARVEST BY YEAR									
Village	1953-54[1]	1955-56[1]	1956-57[1]	1959-60	1960-61	1961-62[2]	1965-66[3]	1966-67[3]	1968[3]	1972[4]	1969-73[4,5]
Kobuk	25	350	30	-	-	-	-	-	-	180	-
Shungnak	250	2,700	106	-	-	150	-	-	-	525	-
Kiana	800	2,000	250	-	-	600	-	-	-	863	-
Noorvik	200	1,125	25	-	-	840	-	-	-	1,381	-
Selawik	150	-	30	-	-	450	2,540	1,156	-	1,887	-
Noatak	750	1,650	362	-	1,541[6]	1,310	811	131	-	1,214	-
Kotzebue	1,000	2,050	50	-	-	510	-	-	-	5,000	-
Kivalina	500	550	35	407[7]	619[7]	215	-	420	-	513	-
Pt. Hope	-	75	0	489[6]	742[6]	210	-	709	-	-	750
Pt. Lay	500	143	76	-	-	54	-	-	-	-	-
Wainwright	1,000	550	672	-	-	1,050	-	264	290	-	1,500
Barrow	2,000	700	500	-	-	-	-	-	-	-	3,500
Anaktuvuk	2,000	-	2,000	-	-	-	-	-	-	-	1,000
Ambler	-	-	-	-	-	271	773	-	-	2,500	-
Kaktovik	-	-	-	-	-	-	-	-	-	-	100
Total	9,175	11,893	4,136	-	-	5,660	4,124	2,680	-	14,063	6,850

1 Tremblay and Fredericksen, unpublished USFWS Arctic Village Survey, 1957
2 Lent. 1962. Final Report, Project Chariot, USAEC (unpubl.)
3 Unpublished data, ADF&G files
4 Joint Fed-State Land Use Planning Committee. 1974. Subsistence harvests in five native regions.
5 Average, based on years 1969-73, collected by Arctic Slope Regional Corporation.
6 Foote and Williamson. 1966. A human geographic study. In The Environment of the Cape Thompson Region, Alaska. USAEC.
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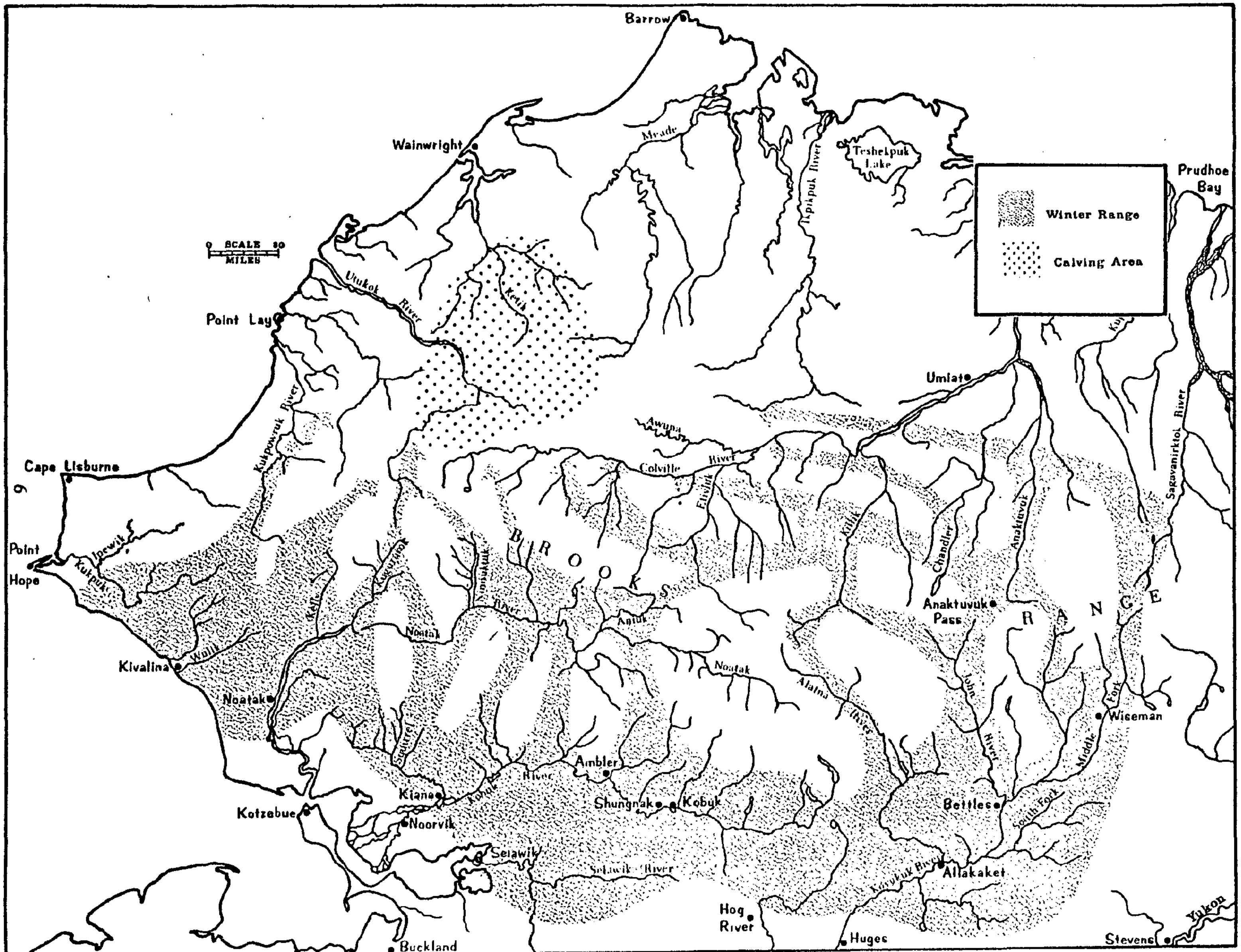


Figure 2. *Winter range of the Arctic herd and migration routes to the calving grounds.*

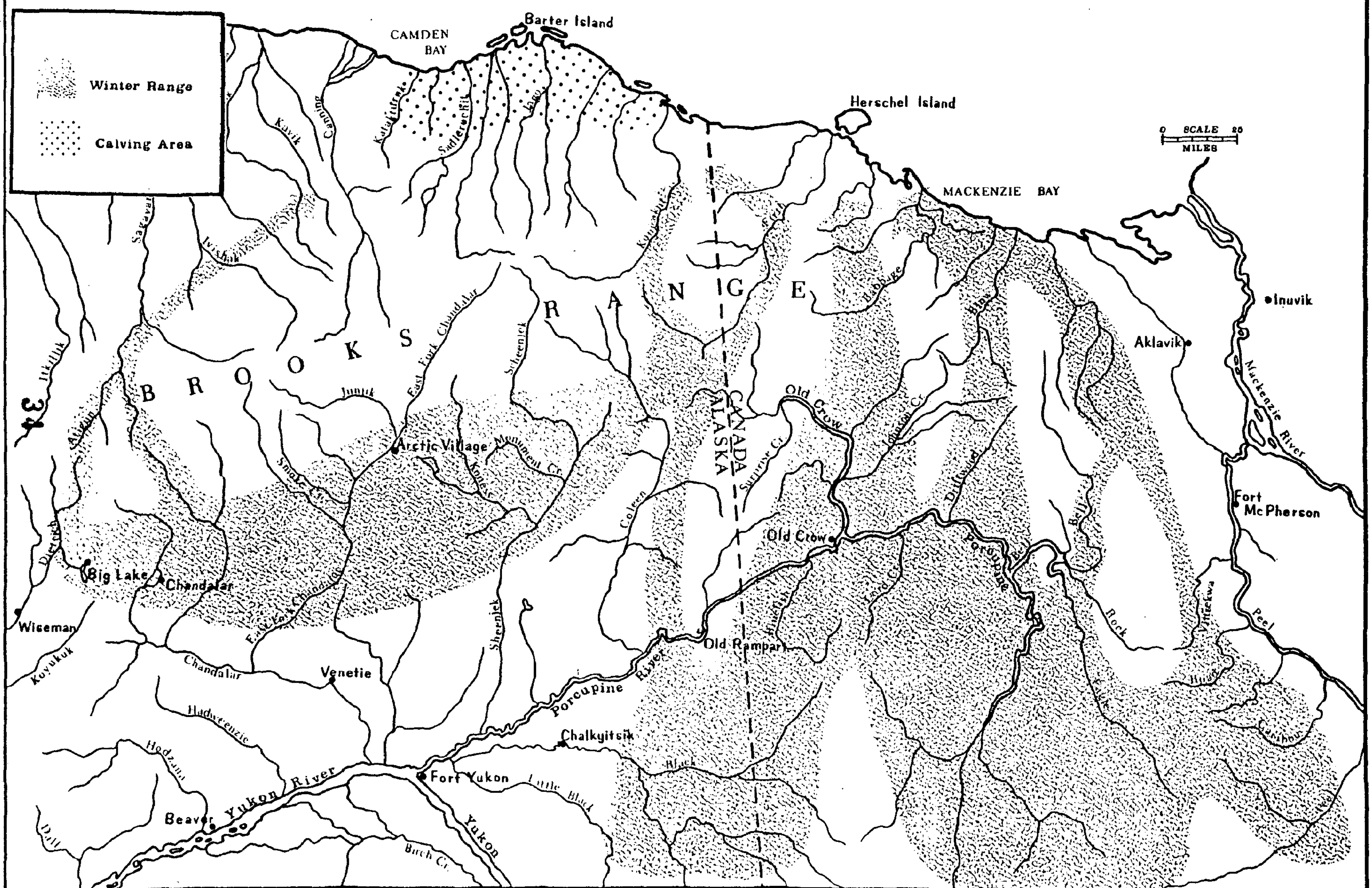
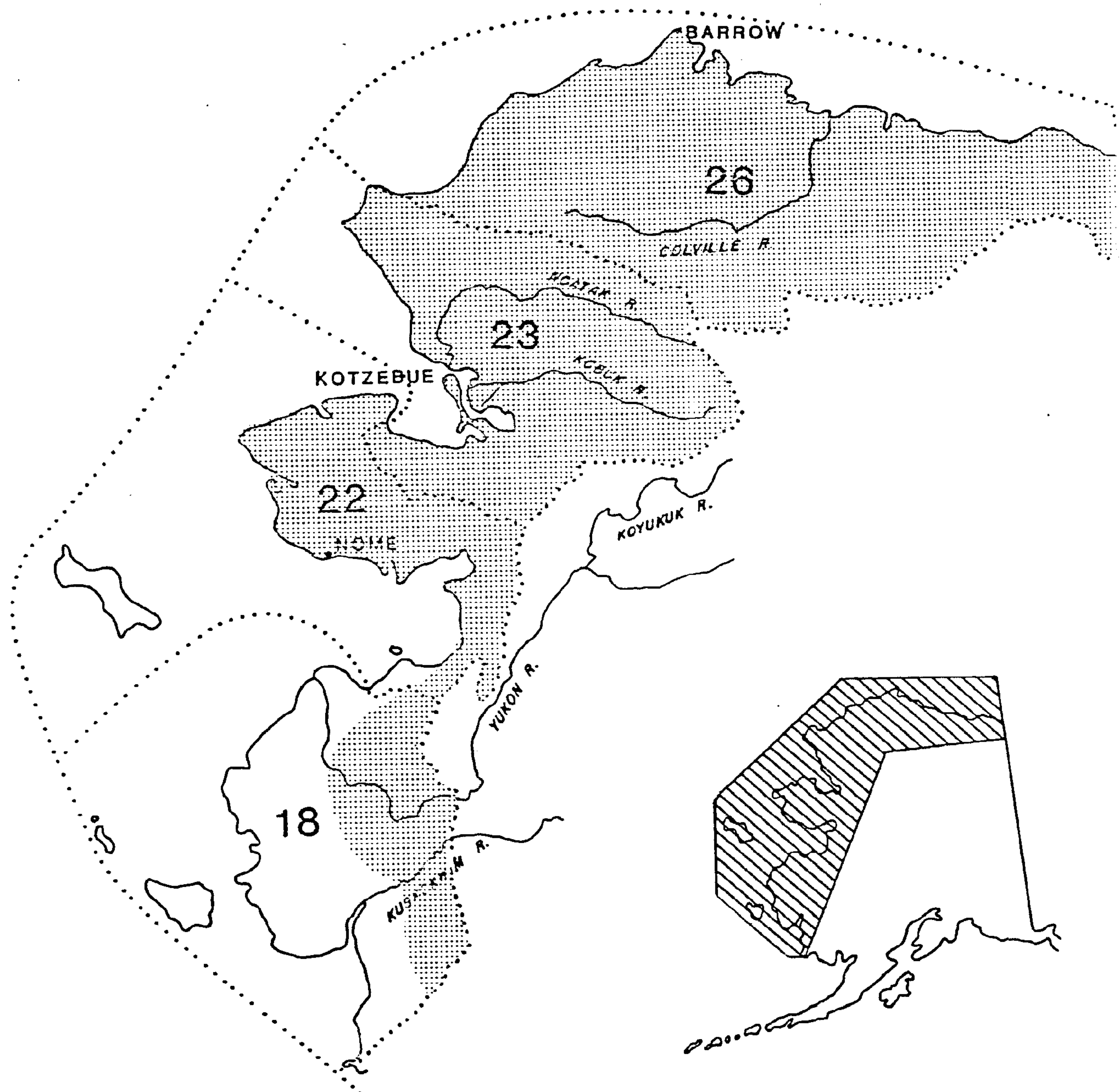


Figure 3. *Winter range of the Porcupine herd and migration routes to the calving grounds.*

Figure 4.
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. The most important factor regulating sheep numbers is probably adverse winter conditions when deep snows and icing conditions limit the availability of forage on the normally windswept ridge tops.

Units 18 and 22

Dall sheep do not occur in these units.

Unit 23

Dall sheep inhabit the Delong Mountains from Howard Pass to the western Wulik Peaks. Distribution is not continuous and sheep populations may be separated by several drainages. The influences of coastal weather may make habitat in northwestern Alaska marginal for Dall sheep. The total population in the region is estimated to be about 1,500 animals.

Historical information supported by data is not available, but longtime local residents feel that sheep numbers and distribution in Unit 23 have diminished over the last 30 years. This reduction may have been due to overhunting in places containing low sheep densities, and/or range deterioration may have occurred after a population high. Current sheep numbers appear to be stable, with the exception of some declines in local subpopulations in the western end of the Delong Mountains. Apparently increased hunting pressure on trophy rams has altered herd composition in favor of ewes.

Population fluctuations occurring in the immediate future will be influenced predominantly by weather, range conditions and predation. In future years, the mining of copper and gold deposits and the development of oil reserves may produce largescale adverse impacts.

Almost all the occupied sheep range in Unit 23 can be considered critical habitat, but the most important areas are north of the Noatak River above the confluence of the Igning River. This region contains a series of salt licks and steep escape terrain which are utilized mainly during the winter. The upper drainages of the Kelly and Kougarok Rivers are also important summer and winter range.

Lambing occurs throughout their range, but the above-mentioned areas probably support over 70 percent of all the sheep in Unit 23 and have the highest intensity of use. Migration also occurs throughout their distribution, but the principal routes follow the upper drainages of the Noatak River. Sheep also move freely between the drainages of the Kelly River on the west and the Nimiuktuk River on the east. A third route goes through the Eli River Valley.

Based on harvest reports, the Unit 23 harvest from 1962 to 1976 has averaged 16 sheep annually. All sheep reported on harvest reports were taken by sport hunters. Hunting pressure has been relatively uniform between the upper and lower Noatak River. Local hunters residing in the rural villages of the western Brooks Range also take some sheep not reported on the harvest reports. A regional corporation subsistence survey in 1972 indicated a subsistence harvest of 42 sheep, some of which were probably taken by sport hunters. The unreported kill, however, undoubtedly equals or exceeds the legal harvest. The total annual harvest is estimated to be between 50 and 100 sheep.

About 60 percent of the reported kill is taken by local residents. Loosely defined, this portion of the harvest could be considered domestic use. If the unreported illegal kill were included, an estimated 80 percent of the total annual harvest is taken for domestic use. It is difficult to assess the future trends of hunter pressure and harvest in northwestern Alaska, but hunter effort will probably increase.

Unit 26

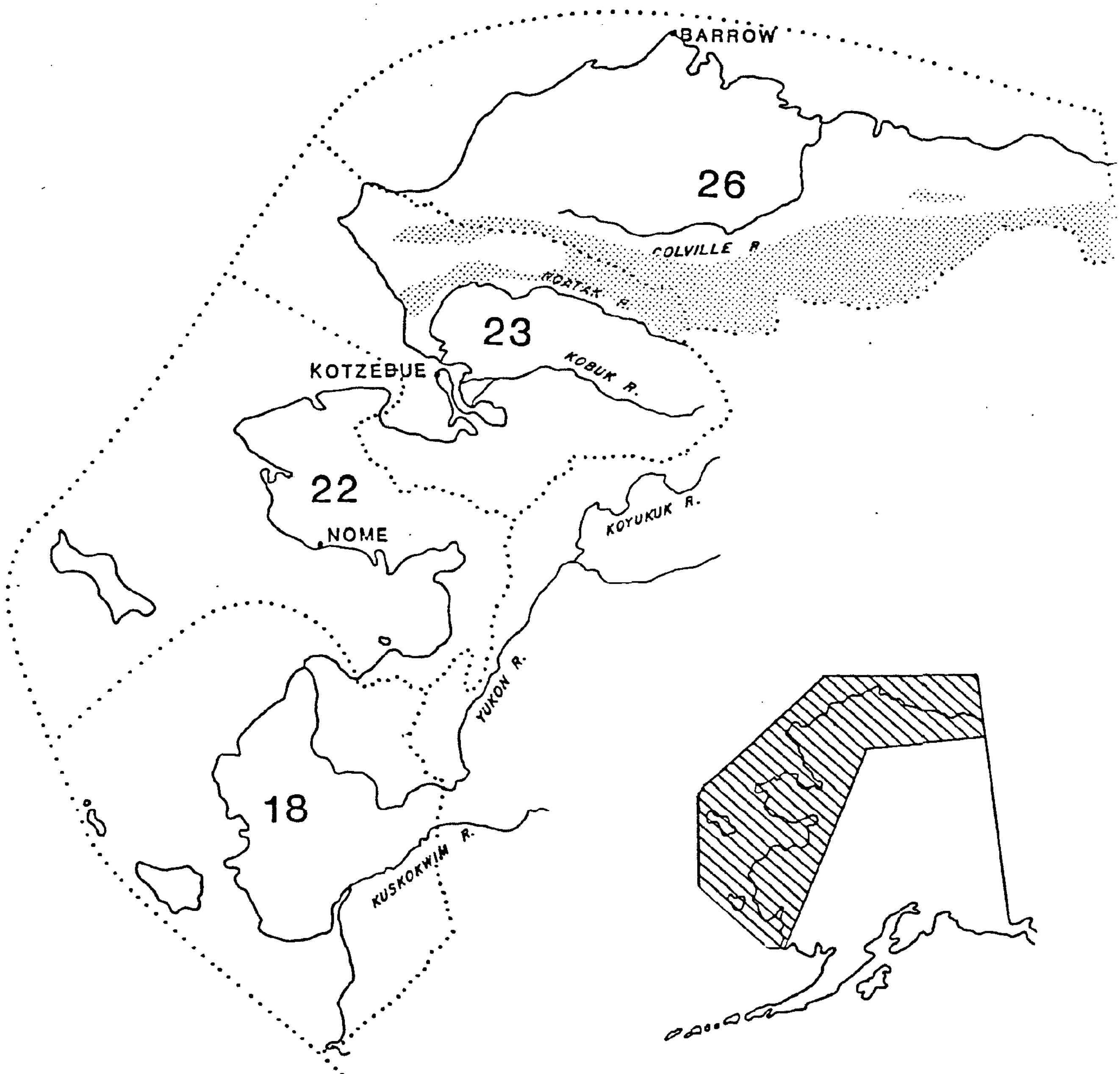
In Arctic Alaska Dall sheep are continuously distributed along the north and south slopes of the Brooks Range from the Canadian border as far west as Wulik Peaks. Estimates of sheep numbers in the region place the current population at about 20,000 sheep.

No well documented population fluctuations have been observed in the sheep populations throughout Arctic Alaska. No populations are currently known to be expanding, and it is thought that sheep numbers in the region, while subject to fluctuation, are stable at about current numbers.

Development of parks, refuges, mining and petroleum may result in changes of status and numbers.

Dall sheep in Arctic Alaska are used for nonconsumptive wilderness values and for consumptive recreational and domestic utilization. Traditionally only rams with horns of 3/4 curl or greater have been legal game during an August-September season. For the last several years sheep hunters have spent an average of about 700 man days per year hunting for sheep in the region. The number of hunters has averaged about 150 and the number of rams harvested annually has averaged about 110 over this same period. Resident hunters comprise about 65 percent of the hunter effort and have a success ratio of about 60 percent. Nonresident hunters have a success rate of about 85 percent, perhaps reflecting the benefit of the mandatory presence of a guide. Domestic utilization of Dall sheep has played a minor but continuing role in the Arctic region. Kaktovik and Anaktuvuk Pass Eskimos take sheep, but these people have never been entirely dependent on sheep for food. It is difficult to assess the future trends of hunter pressure and harvest in the Arctic region, but hunter effort will probably be greater than it has been in the past.

Figure 5.
SHEEP



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MUSKOXEN

Muskoxen (Ovibos moschatus) were once distributed from Greenland west through the Canadian Arctic Archipelago and along the Arctic Slope of Alaska. They became extinct in Alaska between 1850 and 1860. Their demise is generally blamed on increased hunting by natives and the introduction of firearms associated with the advent of Arctic whaling.

At the request of Alaska's Territorial Legislature, Congress (1930) appropriated $40,000 to obtain muskoxen from Greenland to restock Alaskan muskox range. Nunivak Island was designated a National Wildlife Refuge and the interim home of Alaska's new herd. In 1930, 34 animals were captured and moved to the University of Alaska where they were held for later release on Nunivak Island.

Unit 18

Populations of muskoxen in western Alaska are presently found only on Nunivak Island and Nelson Island. The species, extirpated from its original range on Alaska's Arctic Slope in the mid-1800's, was again introduced into Alaska with a transplant of 18 males and 13 females to Nunivak Island in 1936 and 1936. The purpose of the transplant was to provide a nucleus herd from which muskoxen could be taken to reestablish populations over their historic ranges in Alaska, as well as to provide recreational, scientific and agricultural utilization of the animals.

Following slow initial increases, the population began increasing rapidly after 1950, growing to about 500 in 1965. Despite the removal of 33 calves in 1964 and 1965 for domestication experiments and a transplant of 23 animals to Nelson Island in 1967 and 1968, the population reached a level of about 750 animals in 1968. A managment plan, which included both transplanting and sport hunting, was designed to balance the herd with its winter habitat. The plan was approved by the Alaska Board of Fish and Game in 1968. Although sport hunting of excess bull muskoxen was delayed until 1975, the State of Alaska, in cooperation with the U.S. Fish and Wildlife Service, was successful in transplanting a total of 137 muskoxen to several northwestern and Arctic Alaska sites in 1969 and 1970. In 1975, 40 animals were transplanted to Siberia in a cooperative program between the U.S. government and the Soviet government. On Nelson Island the population has experienced very rapid growth, with a total population of 66 animals by the fall of 1975. The Nunivak Island population presently numbers approximately 550 muskoxen.

Winter habitat is considered to be critical. Both Nunivak Island and Nelson Island are far south of the normal range of muskoxen, whose historic range in Alaska probably included the Arctic Slope westward to the Colville River. The primary winter habitat requirements for muskoxen seem to be windblown tundra areas with very light snowfall which permits them to feed on the grasses and sedges throughout the winter. Both Nelson Island and Nunivak Island have areas meeting these requirements for acceptable muskox habitat. Frequent high winds expose the vegetation on coastal sand dunes and hills, providing easy access to forage during the winter.

Unlike mainland habitats, Nunivak and Nelson Islands lack large predators. On Nunivak Island, the chief causes of mortality to muskoxen are insufficient food, accidents and old age. Animals also wander off the island in winter and are unable to return when the ice shifts or melts. Muskoxen are currently confined to islands where natural predators are absent and winter habitat is limited to coastal dune and bluff areas where winds keep the vegetation relatively snow-free. Under these conditions, the populations must be intensively managed to keep the herds in balance with the available habitat. Since the number of animals that can be transplanted to other areas is limited by the amount of good muskox habitat elsewhere and by the extremely high cost of transplanting, other forms of removal must be considered, including hunting for both sexes, capture for scientific and educational purposes and, if necessary, controlled slaughter.

Management efforts are currently directed toward reducing the Nunivak Island population to its range carrying capacity through transplanting and controlled hunting. The Nelson Island population is increasing.

Hunting is an effective tool for the management of muskox populations, providing for substantial beneficial public use and economic benefits to local communities. However, hunting of muskoxen is opposed by various anti-hunting groups on the basis of the relative scarcity of the species in Alaska and on the alleged lack of sporting quality to the hunt. It is important that the values of hunting be demonstrated and that a recurrence of unnecessary losses and wastage of muskoxen resulting from political opposition to hunting of Nunivak muskoxen during 1968-1974 be avoided.

In 1975, the hunting public was able to begin to obtain beneficial use of the muskox through carefully regulated sport hunting of mature bulls. These animals provide a unique and valuable trophy, and it was the first opportunity for hunters to be able to take this species in the United States. The hunt took place on Nunivak Island where 10 animals were harvested.

Unit 22

In 1970 the Department transplanted 36 muskox from the Nunivak Island herd to the vicinity of the Penny River in Unit 22. The transplant was only marginally successful due to several factors. Most were yearling or immature animals, too young for reproduction and lacking the dominant leadership necessary to maintain constant herd integrity. It was common for lone individuals to wander from the main group and never be seen again. On occasion, singles were seen in locations more than 100 miles from the transplant site. About 18 animals formed two groups and moved north across Imuruk Basin and eventually, after more than a year, established a semi-permanent residency in the York Mountains to the north and west of Brevig Mission. There was no reproduction until the summer of 1973 when at least one calf was produced. Production since then has been approximately six calves annually. The herd has not expanded significantly due to mortality from natural causes, but the expected trend is that it will increase. In the summer of 1975, the Unit 22 muskox herd was estimated to contain 24 animals.

Future population fluctuations will probably be determined by the rate of natural mortality. If the reindeer industry increases or large numbers of reindeer are wintered in the York Mountains, muskox herds could suffer as a result. A large, open pit mining operation is planned for Lost River, but most of the activity will be immediately along the coastal fringe and detrimental consequences to the muskox will likely be minimal. Serious conflicts could arise, though, if mineral development moves into the central York Mountains.

Over the past three years, the critical muskox habitat has consisted of their wintering and calving range in the York Mountains, north and west of Brevig Mission. Seasonal movements can occur throughout any of the drainages in the western portion of the York Mountains. The extent of their prime habitat include most of the western portion of the Seward Peninsula and the western end of the Delong Mountains south of Cape Lisburne.

No harvest is allowed at present, and none is planned until the herd reaches at least 150 animals. If conditions warrant, some old bulls may be removed when this population level is attained.

Unit 23

Basically, the same conditions that existed in the Unit 22 transplant also apply to the transplant in Unit 23. In 1970, 36 animals were released at Cape Thompson. The same initial problems were encountered when singles scattered in every direction, taking considerable time to establish a herd with coherent identity. Reproduction has averaged six calves per year since 1973, and unverified reports of eight calves were received in the spring of 1975. An additional 30 muskox were released near Cape Thompson in the spring of 1977. Current estimations place the herd size at about 75 muskox, which are contained in three to five different groups.

The western end of the Delong Mountains, essentially all of the drainages of the Kukpuk River, is important as winter range, summer range, calving areas and migration routes. All of the western Delong Mountains are potential prime muskox habitat.

Unit 26

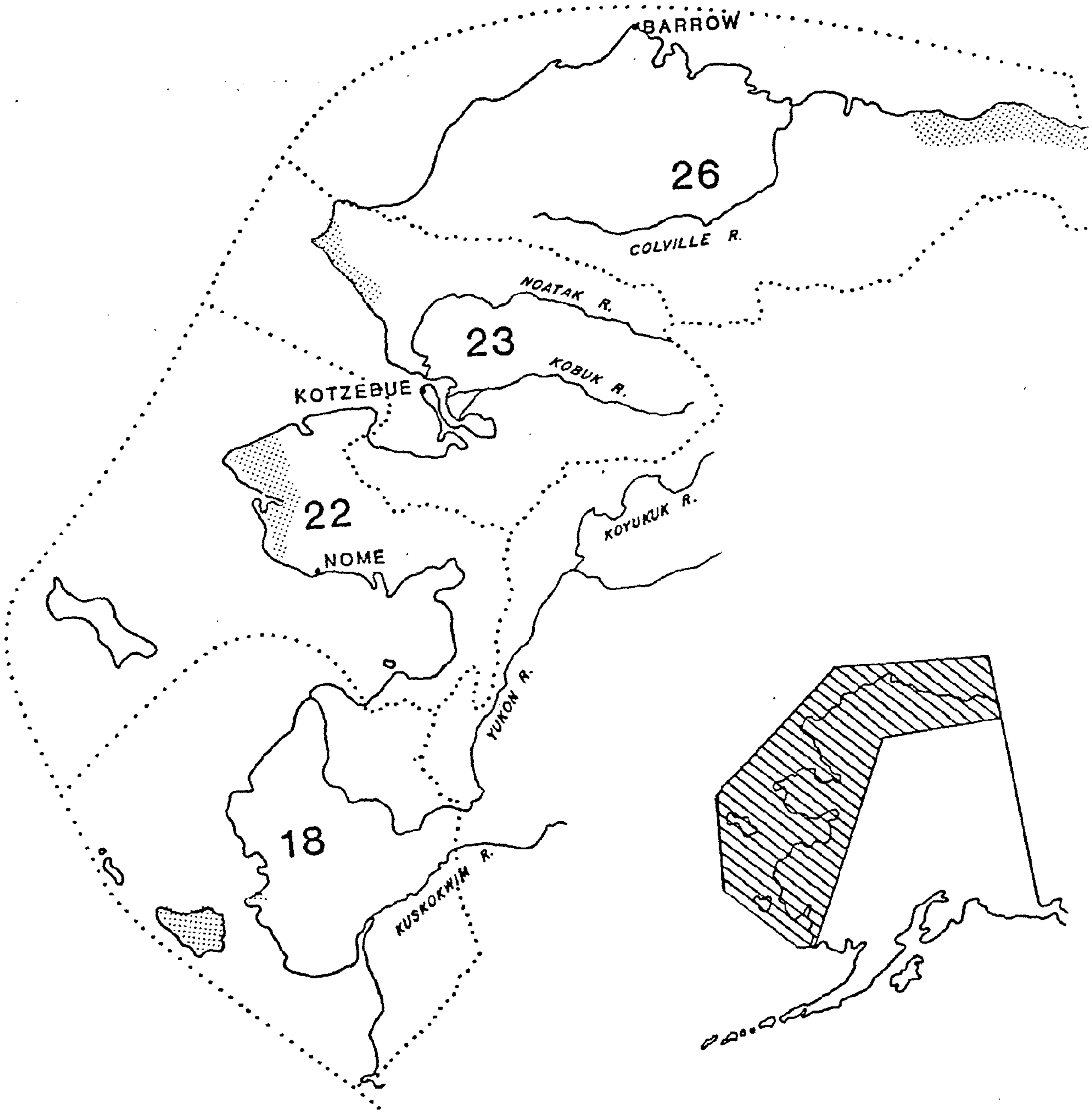
After their reintroduction in 1970, muskoxen survival rate was about 50 percent in the first three years. Now their numbers have increased to about 50 animals.

A proposed buried pipeline through the Arctic National Wildlife Range may have a negative impact on the survival of these muskoxen. Other possible impacts are the road to Kaktovik and oil exploration in this region. Disturbance from aircraft harassment may be having a detrimental effect on the current muskox population.

There is no critical habitat for muskox in Unit 26, only occupied habitat. Important winter range for muskoxen is the coastal plain of the Arctic Wildlife Range which includes the Carter-Marsh Creek foothills, Okerokovik-Jago River foothills and the Kongakut Delta and beach area.

Muskoxen may calve anywhere in the foothills of their range.

Figure 6.
MUSKOX



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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 encroachment than are brown-grizzly bears. The black bear, however, has a more limited distribution in Alaska than does the brown-grizzly bear. Primarily forest animals, black bears range throughout most of the state except north of the Brooks Range, the western Seward Peninsula, the Kuskokwim Delta, the 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 Aleutian Islands and the islands to the north. In terms of island distribution, they are generally absent from those occupied by brown-grizzly bears. Black bears are generally associated with open forests which include fruit producing shrubs interspersed with meadows and streams. In southeastern Alaska they are associated with coastal beaches.

Sexual maturity in black bears is generally attained at about three and one-half to four and one-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 spring and early summer they feed primarily on grasses and herbaceous vegetation. During late summer and fall they consume quantities of berries and spawning salmon. Invertebrates and carrion are also taken when available.

Winter denning for 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.

Unit 18

Because Unit 18 is largely composed of tundra habitat, black bears are not abundant and bear populations are largely confined to the transitional area between the boreal forest and the tundra. It is estimated that fewer than 250 black bears reside in Unit 18.

Black bear populations currently appear to be decreasing. A peak of abundance was reached about four years ago. During this period, bears were commonly seen in the spring and fall months. Complaints regarding black bear depredations also became numerous during the summer months of 1973. Past population fluctuations of black bears have generally followed the trend observed in other interior game management units.

Mortality factors affecting black bears are not well known in Alaska, although there is some evidence that cold and snowless winters may contribute to mortality of denning bears. Another factor which may well have some bearing on the successful overwintering of black bears is the abundance of berries. Poor feeding conditions in the fall when bears are accumulating fat reserves in preparation for the winter hibernation period may well account for higher mortality.

Black bear habitat is somewhat limited in Game Management Unit 18. Fires are of importance in maintaining successional stages conducive to herbaceous plant growth, many species of which provide an important food source for bears. Perhaps some of the most critical bear habitat is that which is found along the lowland river bottoms. Early plant growth in these areas is used extensively by bears in May, June and into July. Many other sources of food can be found in this habitat and all serve to sustain black bears until the fall berries and fish runs are available.

Black bears in Unit 18 are taken primarily by local residents for skins and meat. Some recreational hunting occurs, usually incidental to hunts for other big game species. Despite traditional liberal hunting seasons and bag limits, the harvest of black bears remains relatively small.

Unit 22

Black bears are absent throughout most of Unit 22 but can be found in low densities on the Koyuk River and in most of the turbid river drainages to the southeast such as the Shaktoolik, Unalakleet and Ungalik Rivers. Sightings have been reported on the Niukluk River, and if confirmed, this would be the westernmost distribution of their range. Total population is unknown, but is estimated at less than 200 animals.

Harvest data is not available, but a realistic estimate would be approximately five bears or less taken per year. Residents from Nome and Unalakleet could be considered sport hunters, but they account for only about two percent of the total hunting effort. Ninety-eight percent of the hunting is by local residents, and the vast majority of this hunting, probably in excess of ninety percent, is for domestic use.

Unit 23

Population data in Unit 23 is sparse or entirely lacking. The relative abundance of black bears occupying the major drainages is as follows: (1) upper Noatak, sparse; (2) lower Noatak, sparse to common; (3) upper Kobuk, abundant; (4) middle and lower Kobuk, common; (5) Selawik area, common in lowlands and sparse in the upper drainages.

A rough estimate of population is approximately 2,000 to 4,000 animals.

The prime habitat type for black bears in this unit is the alluvial bottom lands of the major river drainages. These lower river valleys, such as the Kobuk and lower Noatak in Unit 23, are extremely important to the welfare of the species and critical in the sense that without this habitat, the population would be severely reduced. Alpine areas are occasionally utilized, but usually only in the fall when the berries are ripe.

Future population fluctuations will be determined by the amount of development and habitat destruction that takes place. Mining in the upper Kobuk is now well established and oil development is not far behind. As these activities expand, impacts detrimental to black bears will inevitably result.

Very little historical information and trend data are available, but the population is probably increasing and expanding into new areas. Reduced hunting pressure from a relative high about twenty years ago may be a factor for this suspected expansion in numbers and distribution. Regulated hunting is not expected to influence future population numbers.

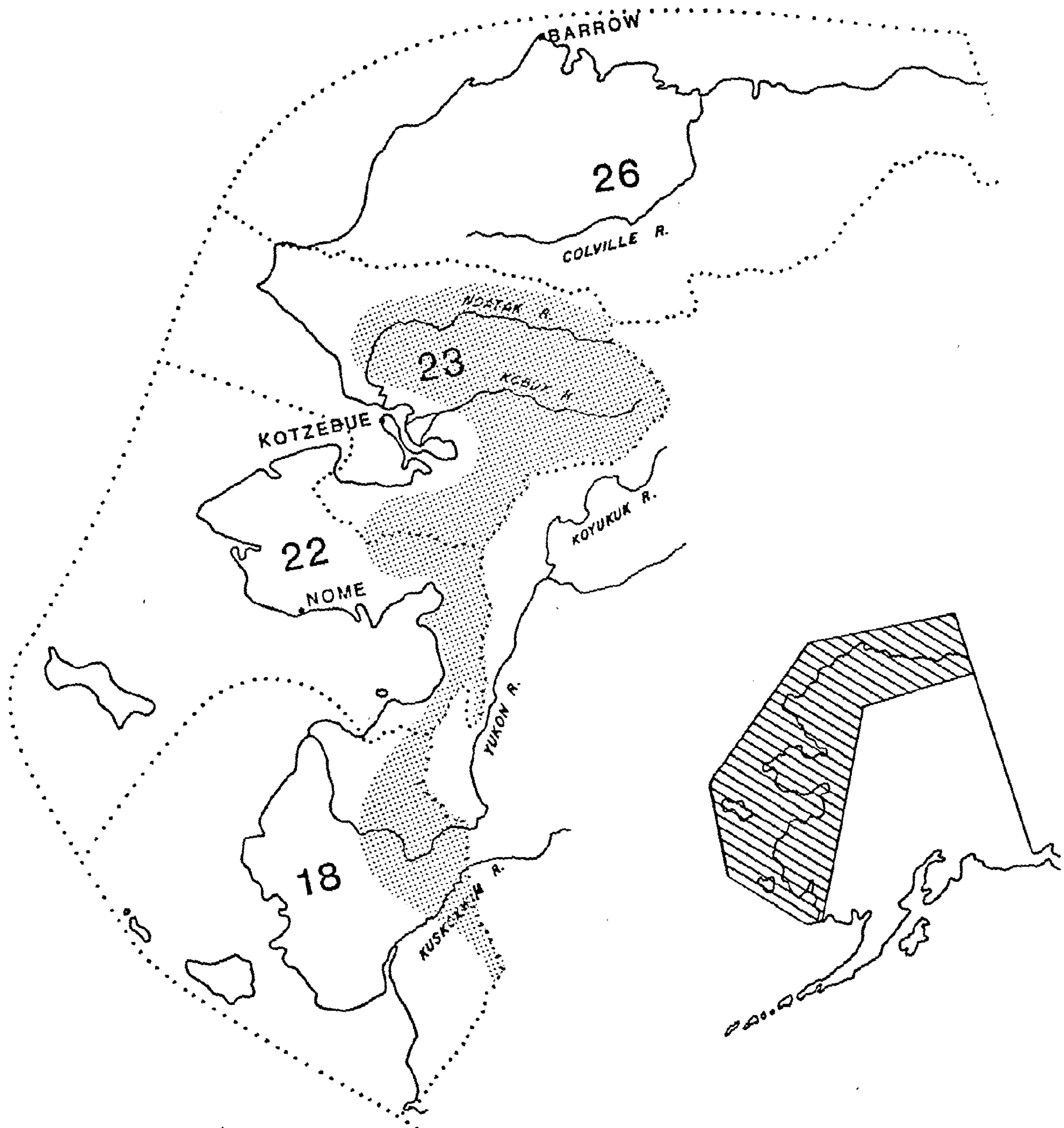
A realistic estimate of annual yearly harvest would be 125 bears. The kill is probably less than 6 percent of the total population, far below a safe, allowable maximum harvest. Sport hunters take about 20 percent of the total harvest, and hunters pursuing bears for domestic use account for the remaining 80 percent.

A regional corporation subsistence survey in 1972 listed the take at approximately 106 bears for 1973. Most of these came from the Kobuk valley, but the Sekawik area accounts for about 15 percent of the total. The majority of black bears killed primarily for their meat are taken during August and September. A large percentage of the hides are left in the field or are never used.

Unit 26

Black bears do not occur in this unit.

Figure 7.
BLACK BEAR



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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 in southwestern Alaska. Generally, brown bears are popularly considered coastal populations, whereas grizzlies are considered interior populations of the same species. This species is distributed throughout Alaska except for the Aleutian Islands beyond Unimak Island, the islands of the Bering Sea and the islands south of Frederick Sound.

Brown-grizzly bears generally appear to prefer open grassland or tundra habitats. Their greatest population densities occur in the lush grassland communities on the Alaska Peninsula and Kodiak Island, and also in the coastal forests on Admiralty Island in southeastern Alaska. Brown-grizzly bears utilize a wide range of forage material. During spring, numerous species of sedges, 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 are also utilized when available. Spawning salmon are a major food item in late summer and fall and the cause of bear concentrations near streams.

In Alaska the brown-grizzly bear breeds from May through mid-July. Both sexes generally attain sexual maturity at about five and one-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 late October or November 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 18

The current grizzly population in Unit 18 is about 100 bears. In the past, bear populations were high but they declined because there was considerable mining activity in the area and miners customarily killed bears on sight. More recently, with improved regulation of hunting and fewer people in the bush areas, the bear population has increased.

Future population fluctuations will probably result from mineral exploitation within brown-grizzly bear habitats. Road systems would expose them to greater hunting pressure, and the incidence of human-bear conflict would probably rise.

Salmon spawning rivers and streams are critical habitats as they provide bears with their most important food source. The most critical of these areas in Unit 18 are the Kisaralik, Qwithluk and Kuskokwim Rivers and tributaries. Brown-grizzly bears do not occur on the Yukon-Kuskokwim Delta.

The brown-grizzly bear harvest in recent years has averaged one or two bears annually in Unit 18 (Table 6).

The brown bear is rarely eaten and most of the harvest is by sport hunters. Some animals are killed as nuisances or in defense of life and property.

Table 6.

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GAME MANAGEMENT UNIT 18
YEARLY BEAR SPORT HARVEST 1961 - 1976
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY

CALENDAR YEAR	TOTAL KILL	# OF MALES	# OF FEMALES	% OF MALES	% OF FEMALES	# OF UNKNOWN	# BY NONRES	% BY NONRES	SEASON DATES
1961	0000	000	000	000	000	000	000	0	154 DAYS
1962	0000	000	000	000	000	000	000	0	154 DAYS
1963	0000	000	000	000	000	000	000	0	154 DAYS
1964	0000	000	000	000	000	000	000	0	154 DAYS
1965	0000	000	000	000	000	000	000	0	154 DAYS
1966	0000	000	000	000	000	000	000	0	154 DAYS
1967	0000	000	000	000	000	000	000	0	154 DAYS
1968	0000	000	000	000	000	000	000	0	154 DAYS
1969	0000	000	000	000	000	000	000	0	123 DAYS
1970	0001	001	000	100	000	000	000	0	108 DAYS
1971	0006	005	001	083	017	000	004	67	91 DAYS
1972	0000	000	000	000	000	000	000	0	108 DAYS
1973	0000	000	000	000	000	000	000	0	108 DAYS
1974	0001	001	000	100	000	000	000	0	48 DAYS
1975	0000	000	000	000	000	000	000	0	47 DAYS
1976	0000	000	000	000	000	000	000	0	47 DAYS
TOTALS	0008	0007	0001	0088	0013	0000	0004	50	

Unit 22

Although the Seward Peninsula contains a diversified number of habitats, grizzly food is limited throughout this range and the population density is relatively sparse. The minimum estimate of population for Unit 22 is 400 bears.

Historical records indicate that grizzly bears have been occupying the Seward Peninsula for at least several hundred years. Prior to the arrival of Caucasians, bear numbers were probably near carrying capacity as natural predators were few. During the era of the 1900's when fortune hunters swept across the Peninsula hills in search of gold, encounters with grizzly bears created problems. The few old timers remaining today say the grizzly bear population was severely reduced because the bears represented a security threat to the miners. Bears were often utilized as a source of food. As the gold fields became depleted, the miners dispersed, leaving the land to the few Eskimos who traversed it during the winter. Grizzly bear numbers began to slowly increase. Current indications are that they have once again approached the carrying capacity, and it is thought that numbers are nearly as great as in former years. As long as hunting pressure remains low, the population may continue to increase.

As a general rule, grizzly bears migrate to the coastal beaches or to lower river valleys during May and early June to feed on the available carrion. Numerous marine mammal carcasses are washed up on the beaches between Unalakleet and St. Michael and along the western Seward Peninsula after spring breakup, and these become important feeding areas for bears following their emergence from winter dens. After the vegetation begins to "emerge", they move upstream or into the hills. In July they begin coming back to the major salmon rivers such as the Fish, Kwiniuk, Koyuk, Ungalik, Unalakleet and Kuzitrin drainages where they remain through the first part of August until the berries begin to ripen. Then there is a gradual shift to higher elevations to take advantage of this rich food source prior to freezeup.

Bears are particularly susceptible to hunting pressure in the spring because of the lack of suitable cover and the ease of being found while scavenging the coastal beaches for carrion. Although the current harvest is undoubtedly below the annual productivity, as the kill increases it may be necessary to eliminate the spring hunting season.

The bear harvest reported under the sealing program has averaged only 2 annually during the past 10 years and was the highest in 1974 and 1976 when 10 were taken (Table 7). Due to noncompliance with the reporting system, it is estimated that the actual harvest probably ranges between 20 and 25 bears per year.

Trends indicate that it is reasonable to expect a greater interest in bear hunting on the Seward Peninsula during the next few years. If this is true, the size of the population will be limited more by the effects of hunting than any other single factor. Future mineral developments, especially oil and gas, could have severe impacts, mostly due to an influx of permanent residents, which in turn will increase hunting pressure. Activities reducing the fish runs could cause corresponding reductions in bear numbers.

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03/31/77

Table 7.

GAME MANAGEMENT UNIT 22
YEARLY BEAR SPORT HARVEST 1961 - 1976
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY

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	154 DAYS
1962	0001	001	000	100	000	000	000	0	154 DAYS
1963	0000	000	000	000	000	000	000	0	154 DAYS
1964	0000	000	000	000	000	000	000	0	154 DAYS
1965	0002	002	000	100	000	000	001	50	154 DAYS
1966	0002	001	001	050	050	000	001	50	154 DAYS
1967	0003	002	001	067	033	000	000	0	154 DAYS
1968	0006	003	003	050	050	000	000	0	154 DAYS
1969	0002	001	001	050	050	000	000	0	123 DAYS
1970	0002	002	000	100	000	000	000	0	108 DAYS
1971	0002	001	001	050	050	000	000	0	91 DAYS
1972	0002	001	001	050	050	000	000	0	61 DAYS
1973	0001	001	000	100	000	000	000	0	68 DAYS
1974	0010	008	002	080	020	000	002	20	68 DAYS
1975	0006	004	001	080	020	001	002	33	76 DAYS
1976	0010	007	003	070	030	000	002	20	76 DAYS
TOTALS	0050	0035	0014	0071	0029	0001	0008	16	

Unit 23

Estimating the absolute number of bears in Unit 23 is extremely difficult due to the large area, the diversified habitat and the lack of consistent scientific effort in recent years. Combining the methods used for estimating bear numbers in Unit 22 and relying heavily on the expertise of local residents who have spent a lot of time in the field, it is possible there are approximately 700 bears in Unit 23. The minimum population is 500 bears, although the number may exceed 1,000.

The history of the Unit 23 bear population prior to the 1950's is unclear, but it is thought that bears were relatively common there in the early part of the 20th century. They were intensively hunted, especially during the fall when the meat and fat were actively sought for domestic use. The hide was also prized for its durability as a door covering. In the spring, when villages were short of fresh meat, bears were frequently tracked down shortly after they emerged from hibernation. With the demand for the products that grizzly bears could provide, hunting pressure probably suppressed the population considerably below range carrying capacity.

Later, during the 1930's, wood houses, lard, canvas and other items of "modern" Caucasian culture became available. Natives became less dependent upon the products of the grizzly, and bear numbers increased substantially. It appears that bear numbers approached carrying capacity during the 1950's, and growth began to level off. In the 1960's polar bear hunting by aircraft became fashionable and guides began booking large numbers of clients. Taking advantage of the spring grizzly bear season, several enterprising guides offered concurrent hunts for both species of bear. This resulted in a dramatic increase in hunting pressure, and the grizzly bear population was probably reduced to its lowest level for that period within the last 30 years. Aerial polar bear hunting ceased in 1972, and with the lucrative bear market reduced by half, many guides ceased booking spring grizzly bear hunts. Bear numbers have again increased because the hunting pressure has been lower. At the present time, though, it is estimated the population is below carrying capacity.

Salmon streams constitute critical, or at least important, habitat in Unit 23. The Squirrel, Salmon and Nimiuktuk Rivers have substantial runs of late spawning salmon and attract a relatively large number of bears in September and October. It is thought that about 80 bears or more use these streams during the fall. The Nimiuktuk and Squirrel Rivers are also important denning areas and there are certainly others. These large river valleys and their tributaries are also used as major migration routes, although lateral movements between drainages are common. Bears in Unit 23 do not use the beach areas as extensively as in Unit 22. In the early spring the river bottoms are more important areas of concentration.

The reported harvest from 1961 through 1976 has averaged 15 bears annually, with a high of 29 (Table 8.).

Unit 26

The 1973 grizzly bear density (from aerial surveys) on the Canning River drainage is one bear per 30 to 65 square miles, or an average of one bear per 50 square miles, which is a reasonable density for the

Table 8.

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GAME MANAGEMENT UNIT 23
YEARLY BEAR SPORT HARVEST 1961 - 1976
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY

CALENDAR YEAR	TOTAL KILL	# OF MALES	# OF FEMALES	% OF MALES	% OF FEMALES	# OF UNKNOWN	# BY NONRES	% BY NONRES	SEASON DATES
1961	0006	004	002	067	033	000	002	33	154 DAYS
1962	0004	003	001	075	025	000	003	75	154 DAYS
1963	0010	008	002	080	020	000	007	70	166 DAYS
1964	0015	013	002	087	013	000	005	33	154 DAYS
1965	0027	024	003	089	011	000	018	67	154 DAYS
1966	0013	012	001	092	008	000	008	62	154 DAYS
1967	0013	011	002	085	015	000	007	54	154 DAYS
1968	0029	024	005	083	017	000	017	59	154 DAYS
1969	0015	013	002	087	013	000	009	60	123 DAYS
1970	0026	019	007	073	027	000	015	58	108 DAYS
1971	0013	007	006	054	046	000	007	54	91 DAYS
1972	0027	019	006	076	024	002	022	81	61 DAYS
1973	0028	018	010	064	036	000	018	64	78 DAYS
1974	0012	010	002	083	017	000	011	92	31 DAYS
1975	0013	009	004	069	031	000	006	46	46 DAYS
1976	0017	012	004	075	025	001	006	35	47 DAYS
TOTALS	0268	0206	0059	0078	0022	0003	0161	60	

North Slope population within the mountains and the foothills. Based on the above figures, a rough estimate of the grizzly bear population in Unit 26 would be 500 to 700 bears.

In the spring there is a concentration of grizzly bears in the major river valleys where they search for carrion or prey on ungulates. In the summer the bears are dispersed from the valley bottoms to high in the alpine areas. Grizzly bears may be concentrated again in the fall (mid-August to mid-September) in the willow stands if there is a good crop of soapberry.

Critical habitat for grizzly bears in Unit 26 consists of large areas which are underdeveloped and sparsely inhabited. Important habitats are the valley bottom riparian willow stands, poorly drained areas where *Equisetum* grows abundantly and the river beds.

Up to 35 bears are harvested annually in Unit 26, including estimates of unreported or illegal kills. The sport harvest has averaged 12 bears annually since 1961 (Table 9). The resident sport use accounts for 20 percent of the annual harvest, non-resident guided hunters 75 percent, and domestic or local use 5 percent or less.

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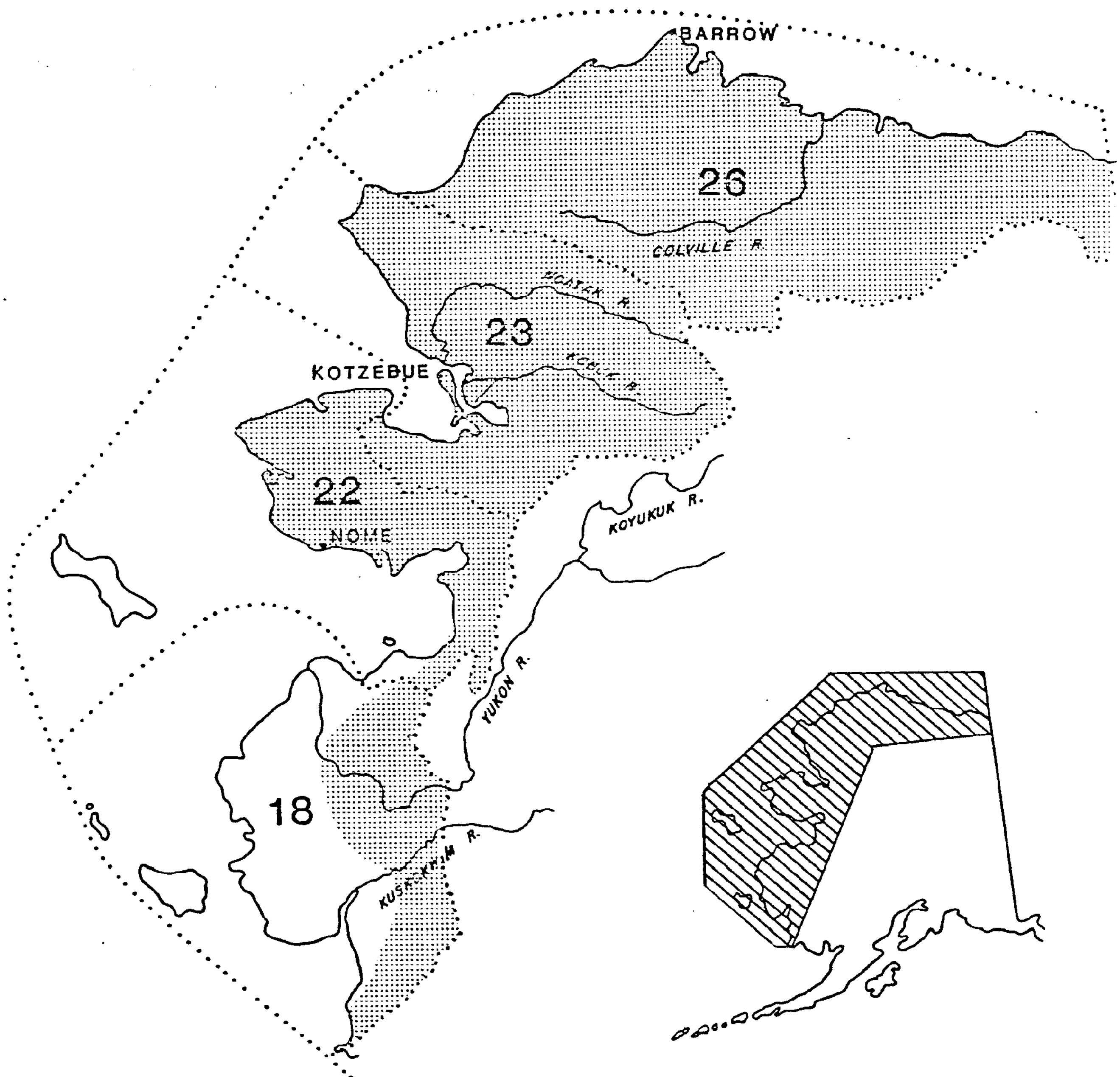
04/01/77

Table 9.

GAME MANAGEMENT UNIT 26
YEARLY BEAR SPORT HARVEST 1961 - 1976
HARVEST SUMMARY BY YEAR, SEX OF BEAR, AND RESIDENCY OF HUNTER
BROWN GRIZZLY

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	154 DAYS
1962	0002	001	001	050	050	000	001	50	154 DAYS
1963	0014	006	005	055	045	003	005	36	180 DAYS
1964	0014	011	003	079	021	000	005	36	168 DAYS
1965	0006	005	001	083	017	000	001	17	168 DAYS
1966	0009	005	003	063	038	001	004	44	154 DAYS
1967	0003	002	001	067	033	000	002	67	154 DAYS
1968	0014	013	001	093	007	000	008	57	154 DAYS
1969	0016	011	003	079	021	002	005	31	123 DAYS
1970	0015	011	003	079	021	001	011	73	91 DAYS
1971	0023	014	008	064	036	001	020	87	91 DAYS
1972	0000	000	000	000	000	000	000	0	0 DAYS
1973	0012	009	003	075	025	000	008	67	17 DAYS
1974	0015	009	006	060	040	000	013	87	31 DAYS
1975	0019	016	003	084	016	000	014	74	46 DAYS
1976	0026	021	005	081	019	000	009	35	47 DAYS
TOTALS	0189	0135	0046	0075	0025	0008	0106	56	

Figure 8.
BROWN/GRIZZLY BEAR



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POLAR BEAR

UNITS 18, 22, 23 and 26*

There are two distinct populations of polar bears inhabiting arctic Alaska. The north population, numbering about 2,500 animals, ranges along the coast and on sea ice north of Game Management Unit 26 from the Canadian border to a line extending northwest from Point Lay. The west, or Chukchi Sea, population numbers about 5,000 and extends west and south of this line to the southern limits of the polar bears' range. This would normally be only as far as the Bering Strait in the winter, but occasionally bears range as far south as St. Lawrence Island. About one-third of the Chukchi Sea population, or 1,700 bears, is found on the Alaska side of the dateline, adjacent to Game Management Units 22 and 23.

One of the habitats most crucial to the welfare of polar bears includes those areas used for denning. The Chukchi Sea population is probably associated with the denning area on Wrangell Island off the coast of Siberia. Present information indicates that some of the most intensive denning on the Alaskan coast takes place from the Colville River east to the Canadian border. This zone is approximately 50 miles wide and includes a corridor of land extending about 25 miles from the coast and the strip of adjoining shorefast ice. This ice extends from the shore outward to the moving ice and includes offshore islands.

Some denning also takes place on the drifting sea ice which is in constant movement. The land and shorefast ice provide stable conditions

* (Jack Lentfer, U.S. Fish and Wildlife Service, Anchorage, pers. comm.)

for denning, and bears tend to select gullies and cut banks where drifting snow accumulates to provide desirable sites. In late October or November pregnant females come to shore to go into winter dens where the cubs are born. During the denning period, males will also come ashore in search of beach carrion or other food but do not den. Denning lasts until late March or early April when the bears move back out onto the sea to begin feeding on seals.

Polar bears concentrate in areas of available food supplies, often where currents keep ice in motion, causing open leads or newly frozen leads. Seals, the main prey of polar bears, congregate in these leads due to the ease of maintaining breathing holes and there become vulnerable to bear predation. Such conditions are more common within 100 to 200 miles of the coast than they are further to the north in the heavy ice pack.

Polar bears begin to move south as the Chukchi Sea freezes in the fall and as heavy ice is carried south by prevailing northerly winds. The southern limit of common occurrence of the Chukchi Sea population is the Bering Strait, with bears occasionally reaching St. Lawrence Island in some winters. Members of this population start migrating north in the middle of March. Their range in the summer is the southern edge of the ice pack.

North of Point Barrow bears begin moving toward the east in the latter part of April, seemingly being drawn to the area of Barter Island where the ice is more stable and breaks up later. The southern edge of the ice pack varies in the summer depending on the winds. It can be lodged against the shoreline from Point Barrow eastward, or it can be

100 miles offshore. Polar bears generally stay with the moving ice during the summer and concentrate on its southern edge where seals are abundant.

There has been some slight change in distribution over the last two years. More bears are coming in closer to shore and a larger number are moving into their more southern range. This condition, in part, is related to cessation of aerial hunting in 1972, but it is unknown whether there is a true increase in the numbers of bear or if there is a tendency for them to move closer to the coastal villages because there is less aircraft activity emanating from these villages.

Historical records indicate fur traders purchased about 120 polar bear skins annually, most of which were taken along the coast by Eskimos hunting with dog teams. Skins of cubs, which were usually used for garments, are not included in these totals. It appeared a harvest of this magnitude could be sustained indefinitely without any adverse effects.

The annual harvest from 1961 to 1972 averaged about 260 bears by both sport and native hunters (Table 10). Analysis of the data from this period shows some fluctuations in the average size and age of bears harvested, but there were no clearcut trends.

Future population fluctuations will probably be determined by climatic changes and man's activities. Long-term warming trends could diminish suitable hunting and denning habitat. It could also decrease seal populations, which in turn would reduce bear numbers due to the diminished food supply.

Table 10 . Alaska polar bear harvest and sex ratios, 1961-1972.

Year	Non-Resident No.	Non-Resident % Male	Resident White No.	Resident White % Male	All Sport Hunters No.	All Sport Hunters % Male	Resident Native No.	Resident Native % Male	All Hunters No.	All Hunters % Male
1961	70	93	59	57	129	77	23	52	152	73
1962	78	85	103	60	181	70	16	50	201	69
1963	106	88	57	68	163	81	22	68	189	79
1964	142	89	86	60	228	78	23	69	253	77
1965	159	89	116	64	275	79	21	50	296	76
1966	195	89	152	66	347	79	52	46	399	74
1967	124	97	42	69	166	90	25	50	191	80
1968	184	84	56	66	240	80	111	61	351	74
1969	227	76	44	63	290	69	27	56	298	72
1970	217	79	83	65	300	76	15	53	316	72
1971	78	87	98	64	176	74	27	54	203	70
1972	67	90	157	81	224	84	41	59	265	80

Oil and gas development on the Arctic coast and offshore regions could have a severe impact on bears. There are known gas and oil reserves on the major polar bear denning areas. Bears have exhibited an intolerance to any disturbance during the denning period, and if encroachment occurred, denning may be displaced to the sea ice where it could be less successful. If major development along the coast occurs, it would undoubtedly prove harmful to the polar bear population.

At the present time, development at Prudhoe Bay is extensive and expansion can be expected to occur with the state's proposal to lease more land. The Arctic National Wildlife Range has huge oil and gas reserves, and there is considerable pressure to open this to development. The Navy is proceeding with exploratory work on "Pet 4", and west of "Pet 4" the land is eligible for native selection. If reserves are located, they too will probably be exploited. In addition, a gas pipeline has been proposed from Prudhoe Bay east to the MacKenzie Delta. The Trans-Alaskan Pipeline and this gas pipeline, together with their support activities such as harbors, barges, compressing stations and gravel excavation, could all have a disturbing effect on denning bears. There is evidence of at least one bear being forced out of a den by a seismic crew, probably resulting in the death of the cub.

Very little information on natural mortality factors is available. Polar bears have no serious natural predators. About 60 percent of Alaska's bears harbor Trichinella larval, but there is no evidence that bears are adversely affected. A high percentage of bears have low levels of DDT, PCB and mercury. There are probably few bears in the wild that live beyond 25 years of age.

The level of harvest from 1961 to 1972, prior to the Marine Mammal Protection Act (MMPA), has been 260 bears taken annually by hunters. Since 1972, 50 to 60 bears have been harvested annually by natives and, in most cases, the meat was consumed. Until 1974, the MMPA did not permit polar bear skins to be tanned commercially, and with natives having no ready market för sale of raw products, some waste occurred. Presently the Act does not put any restrictions on numbers, age or sex of polar bears taken by the natives for subsistence purposes. The only limitation is that taking shall not be done in a wasteful manner.

Except for ongoing scientific studies, there is relatively little non-consumptive use at the present. There is some photography by various individuals and occasional viewing by local residents when the bears come near enough to the villages.

The polar bear has a high aesthetic value. People throughout the world are interested in it because it is a large carnivore in a hostile environment. Even though most people will never get the opportunity to see a live, wild polar bear, they are concerned for them and there is value in knowing that polar bear populations and their habitat are secure.

There is no information available on polar bear carrying capacity and, consequently, no way of telling if numbers are below the potential. Studies are now beginning for determining relationships between seals, polar bears and ice types, and there should be more defininitive information on carrying capacity within two or three years.

Before the MMPA, guiding for polar bears was an important economic activity. Figures for 1966 showed that gross expenditures for Alaskan polar bear hunting was about \$450,000. This includes transportation, guide fees, taxidermy fees, money spent for fleshing skins and cleaning skulls and living costs while in Alaska.

Economic values at the present are negligible in comparison as the only use allowed is by natives. About 50 bears are eaten annually, and about 300 pounds of meat could conceivably be consumed from each animal. Skins are used for garments, mainly as mukluks and mittens and to a lesser extent as parka ruffs. The Marine Mammal Act does permit the sale of clothing and handicrafted items, and a market is starting to develop for these.

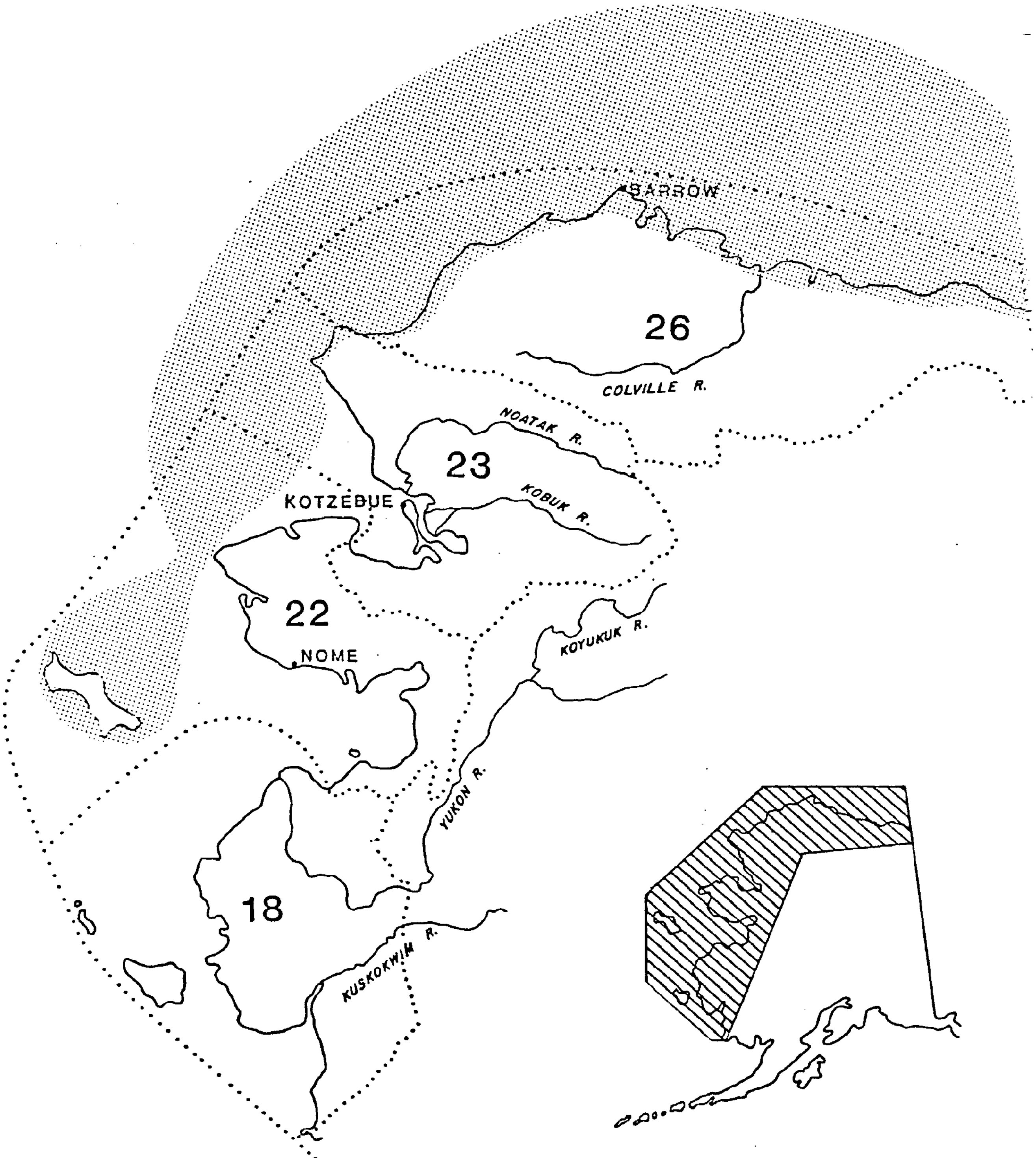
There is the possibility that management of certain marine mammals including polar bears will go back to the state, and, if so, the state would probably allow recreational hunting from the ground. Females with young would be protected. Recreational hunters may need to enlist the services of Eskimo guides, and guide fees would range between \$1,500 and \$2,500 per hunt. It is possible that up to 150 bears per year would be allowed to be taken. More realistically, 50 to 60 bears per year would be taken by guided hunting from the ground, in contrast to the methods used previous to the MMPA where as many as 250 bears per year were taken with the use of aircraft.

The MMPA does not provide for management of polar bears using existing scientific knowledge and applying present resource management concepts and principles. In order to allow for management regulations, the moratorium on the taking of bears must first be waived. The state has had an application pending since January, 1973, to return management responsibilities to the Alaska Department of Fish and Game. No action had been taken on this proposal as of mid-1977.

One problem of establishing a management program is that some people are opposed to any recreational hunting. If management were returned to the state, it proposes to allow hunting bears from the ground only. The taking of cubs or females accompanied by cubs by either recreational or subsistence hunters would be prohibited. The proposed season would extend from January 1 to May 31, protecting bears during the time they are moving inland to den. Recreational hunters could take one bear per four regulatory years by permit only. Residents utilizing bears for food would be able to take one bear each regulatory year without a permit.

Another problem is that some people who are considered to be subsistence hunters are opposed to a limit of one bear annually, feeling such a restriction is unwarranted and claiming that it would impose hardships on their ability to obtain food for their family. Many of these individuals would not qualify as a subsistence hunter except under a very liberal interpretation of the word, and the validity of their arguments may be debatable. In addition, polar bears do not form a staple food item as do seals and caribou, for example, and therefore should not be considered a basic subsistence item.

Figure 9.
POLAR BEAR



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FURBEARERS, SMALL GAME AND UPLAND GAME BIRDS

In Game Management Units 18, 22 and 23, mink, land otters, muskrats, red foxes and arctic foxes reach high levels of abundance. Wolverines, lynx, beavers, marten and other species common to upland and alpine habitats are less abundant than in other northern Alaska areas. Coyotes are uncommon in much of the region and do not inhabit the western portion of the Seward Peninsula or the lower portions of the Noatak, Kobuk and Selawik River systems. Beaver and lynx populations are expanding their historical ranges in the region, with beavers moving into the northern portions of the area and lynx becoming established on the Seward Peninsula. The Noatak, Kobuk, Selawik, and Yukon and Kuskokwim Deltas are noted for their high quality mink. Furbearers on the St. Lawrence Island are limited to arctic foxes and ground squirrels.

In Arctic Alaska (Unit 26) the variety of harvestable species is lower than in regions to the south. Marten, beavers, muskrats and red squirrels reach the northern limits of their distribution at the southern boundary of the Arctic region. Lynx, mink, land otters and coyotes are present in low densities. Economically important furbearers include arctic foxes, red foxes, wolverines, weasels and arctic ground squirrels.

Most human use of furbearers in these areas is consumptive. The degree of use varies with abundance, market value and traditional utilization of various furbearer species. Long established traditions, market conditions and trapping regulations have limited the use of furbearers to the season from October to May when pelts are prime, although some species are taken at other times.

Rock and willow ptarmigan occur throughout the western and arctic areas where suitable habitat exists. Spruce grouse are absent from the western two-thirds of the Seward Peninsula and Yukon-Kuskokwim Deltas, the tundra in the vacinity of Pt. Hope and the treeless arctic.

The upland game bird resource in these areas has received only light to moderate harvest by sport and subsistence hunters. Harvests have fluctuated with ptarmigan abundance and have had little influence on population trends. Although some individuals may hunt specifically for ptarmigan, a significant amount of the harvest occurs incidental to big game hunting. Like hunting, nonconsumptive uses such as observation and photography have been light in the past. For the most part, consumptive and nonconsumptive uses are compatible.

Both the snowshoe hare and tundra hare occur in western Alaska. The tundra hare is found in coastal tundra areas and is periodically abundant on the Seward Peninsula and along the Kuskokwim River. Both of these hares occur in Arctic Alaska but neither is common.

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 the offshore islands of the Bering Sea, the Aleutian Islands south of Unimak Island, the Kodiak Island group, the islands of Prince William Sound and the islands south of Frederick Sound in southeastern Alaska. In Alaska wolves are classified as both a big game species and a furbearer. Current market value averages $127 per pelt (Seattle Fur Exchange, February, 1977).

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) were the primary factors which brought about their demise, through predator control programs, throughout most of the lower 48. Other prey species utilized by wolves (although of secondary importance) consist of snowshoe hares, beavers, salmon, sheep and goats. Their food consumption is in the range of four to eight pounds of meat per wolf per day.

In general, 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. In southeastern Alaska, however, this range area is probably smaller, and pack size averages 5 to 7 animals. The social structure of these packs is highly developed and complex, and is an important factor in their success as predators.

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, survival is related to available food resources. In periods of low prey densities, pup mortality may be high.

Historically, the wolf has been a controversial figure. Today, emotions run high on both sides of the issue of wolf management. The logical approach to the problem 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 wilderness.

Unit 18

Unit 18 has a low wolf population due to the predominance of wet tundra areas and low ungulate populations. Wolves are absent from much of the unit and are generally found only in the more inland river valleys. Harvests from this unit have averaged less than four per year. There is little other information available on wolves in this unit.

Units 22 and 23

Although wolves have been reported throughout the entire Seward Peninsula, the greatest number are in the eastern portion. In Unit 22 the Koyuk, Shaktoolik, Ungalik and Unalakleet River systems contain nearly 75 percent of the wolves in this area. Within the remainder of the unit wolves are sparce, but are rather evenly dispersed throughout the area. There are an estimated 100 to 150 wolves in Unit 22.

Wolves have been reported in all of Unit 23. There are continuous population shifts, depending on available food, hunting pressure and weather conditions, which result in high numbers in an area one year and perhaps a total absence the next. Wolf populations are currently estimated at 400 to 800 or more in this unit.

Wolf populations in northwestern Alaska have increased dramatically in the last few years. The cessation of aerial wolf hunts in 1972 has had the most pronounced effect. The banning of polar bear hunts by non-natives also reduced the hunting of wolves, as persons who booked hunts for polar bears often combined the hunt with the opportunity to take a wolf. The elimination of the bounty in 1969 also decreased the hunting of wolves. Although the increase in the value of wolf hides would have seemed to compensate, the result was less effort by local residents to take wolves. Today, with the price of wolf hides being double their 1972 value, trapping and hunting efforts are marginal compared to earlier years.

The most notable change in numbers of wolves seems to have taken place in Unit 23 where, according to local residents, wolf numbers have more than doubled from 1972 levels.

Prime wolf habitat in this area includes the lower half of the Noatak and Sekawik Rivers in the vicinity of Purcell Mountain and portions of the upper Kobuk River.

Sealing records indicate an average harvest of about 10 wolves per year in Unit 22, but sealing data only accounts for one-third to one-half the actual harvest in this unit. The average take is probably 20 to 30 wolves per year in Unit 22.

Unit 23 has averaged 84 wolves sealed per year over the past 10 years. Taking unsealed hides into account, the actual harvest averages about 150 to 200 wolves per year in Unit 23.

Many wolf hides are used domestically for parka ruffs, parkas and mittens.

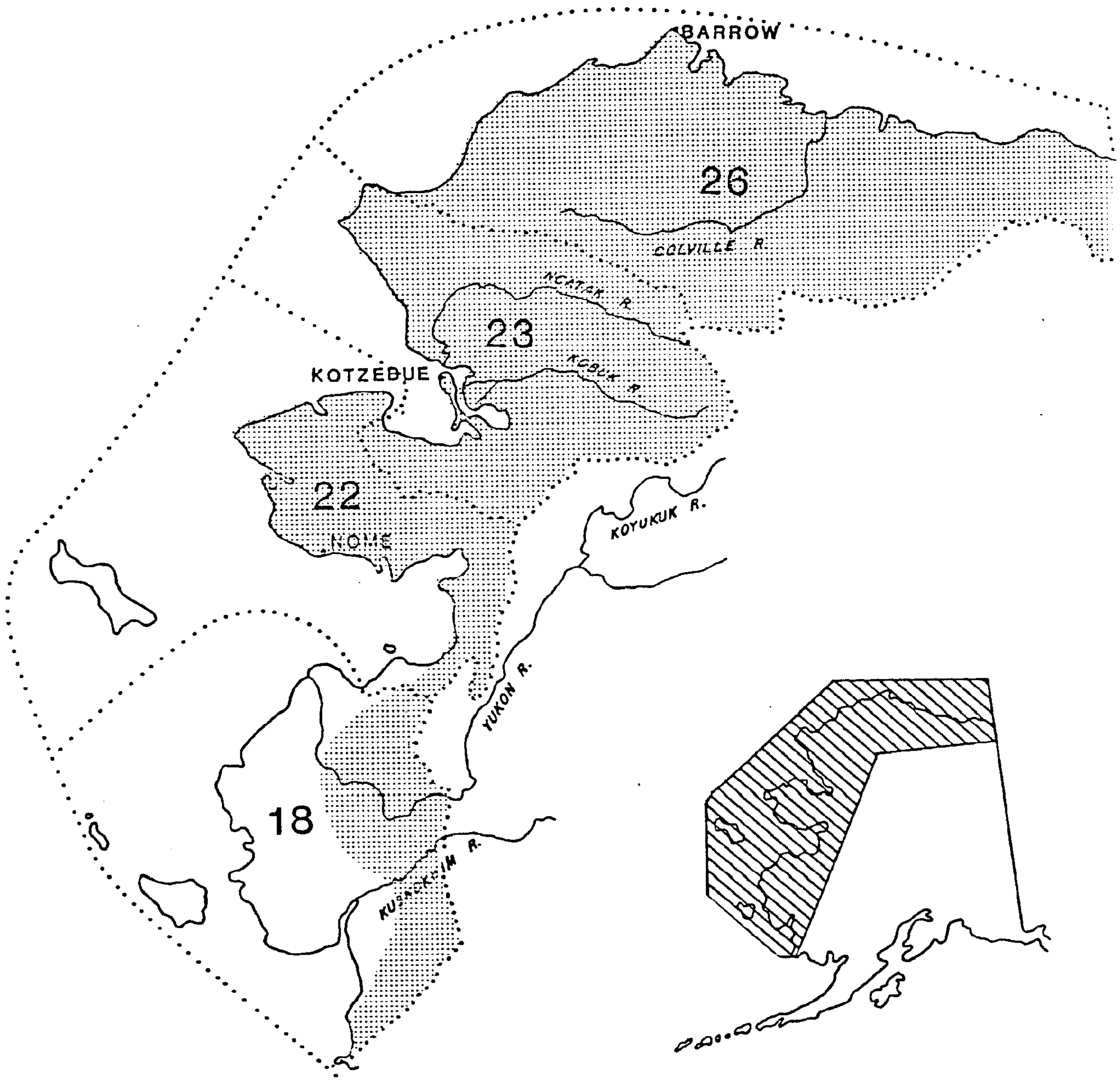
Unit 26

Wolves are distributed throughout Unit 26, with the highest densities occurring in the mountains and foothills where there are concentrations of big game animals. The best habitat is found in the Brooks Range along the major river valleys that have good populations of moose, caribou and sheep. Valley bottom riparian habitat is used extensively by wolves as a hunting area and as a travel route to hunting areas.

Aerial hunting in Unit 26 reduced the wolf populations to the extent that the season was closed in 1971 and 1972. Since then, wolf numbers have increased in this unit to about 1 per 150 square miles.

Wolves in the Brooks Range are taken both by trapping and by ground shooting, usually during the winter months. Probably more are used domestically for parka ruffs, parkas and mittens than are sold commercially.

Figure 10.
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 northern 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 coyotes 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 18

Coyotes rarely occur in this unit.

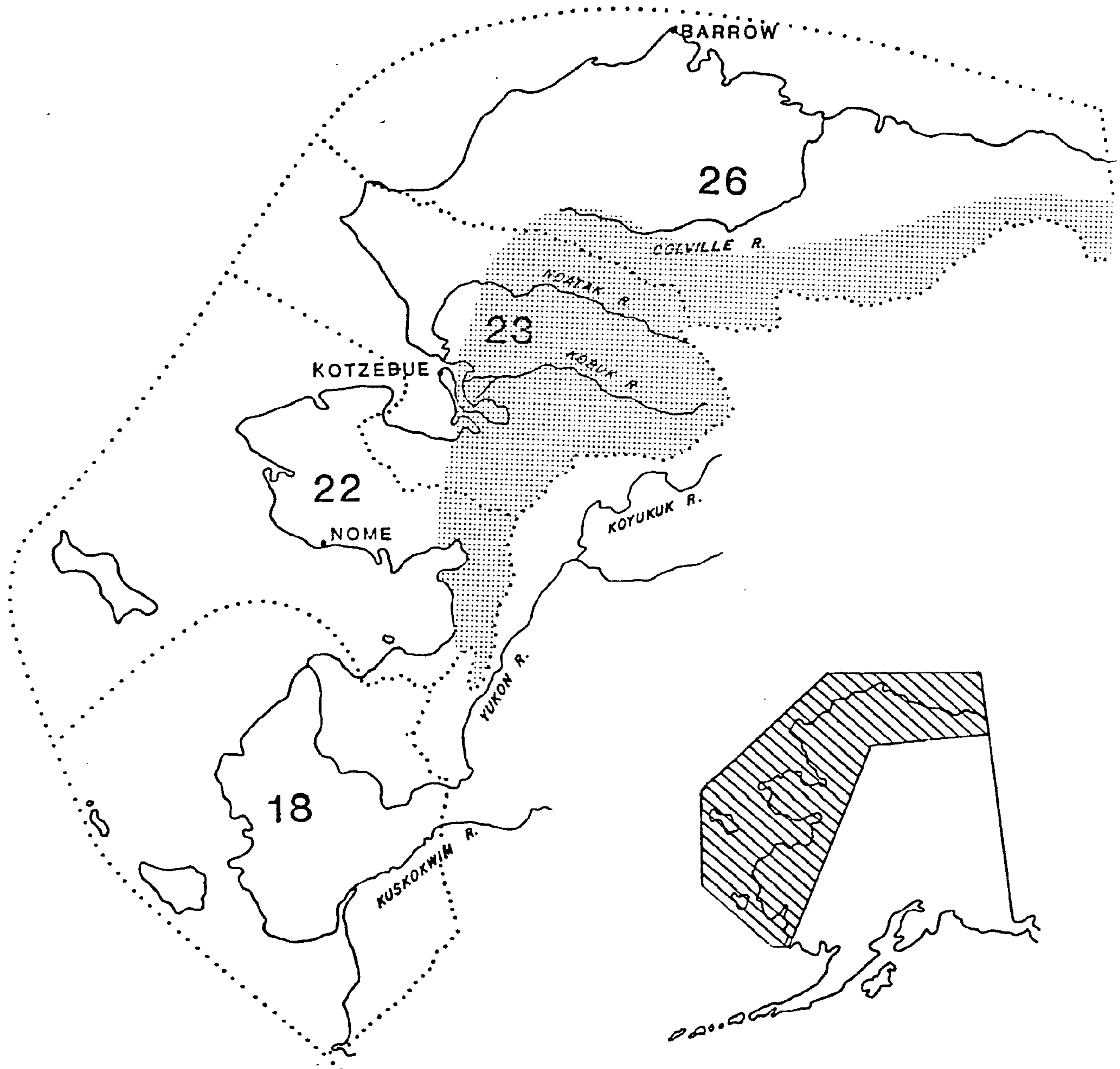
Units 22 and 23

Coyotes probably do not occur in most of Unit 22. In Unit 23 they can be found in the upper portion of the Kobuk and Noatak drainages. There is no other information available.

Unit 26

Coyotes occur occasionally on the North Slope, but they are rare. They are probably found more often in the foothills of the Brooks Range than on the coastal plains.

Figure 11.
COYOTE



RED FOX

The red fox (Vulpes fulva) occurs throughout Alaska except for some islands in the Bering Sea, the Aleutian Chain and the islands in southeastern Alaska and Prince William Sound. Red foxes inhabit a variety of habitats, but they seem to prefer broken country or 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 the early 1900's.

Red foxes are omnivorous and forage on a wide variety of items, including small mammals, birds, eggs, invertebrates, plant material and carrion. Their diet 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. During winter, they are restricted almost exclusively to fresh meat and carrion.

Red foxes breed during February and March. Following breeding, a pair of foxes locates an appropriate denning site. Their dens are excavations, usually 15 to 20 feet long, located on the side of a well-drained hill. A 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 unit persists until fall when the individuals disperse.

Red foxes are considered one of Alaska's most important furbearers, and recently their value has increased. The current market value for a single pelt averages $90 (Seattle Fur Exchange, February, 1977).

Unit 18

Red foxes are present in low to moderate numbers in Unit 18. They are in competition with the white fox near the coast, but predominate inland in very low-lying areas. Red fox populations fluctuate cyclicly to some degree.

The red fox population has been decreasing in this unit for the past few years. Their numbers are affected mainly by food availability and by occasional outbreaks of disease such as rabies. They are not being overtrapped at present.

The lowland areas of Unit 18 can be considered prime habitat for red foxes, even though they are adaptable to a wide range of habitats. There are no estimates of population levels in this area, and there are no accurate figures on harvest. Estimates derived from information given by fur dealers and local trappers indicate that at least 300 red foxes were taken in Unit 18 in 1975. Most of the harvest is considered commercial, although a few pelts are used domestically for mittens and parka ruffs.

Units 22 and 23

Red foxes are found throughout these units. In winter they often congregate along the coast where they feed on marine mammal carcasses and in river valleys where carrion, such as winter-killed moose, is common. Although subject to population fluctuations, red fox numbers in these units do not change dramatically. Changes in availability of food is probably the principal cause of fluctuations. These changes are reflected in oscillations of microtines, seabirds and gallinaceous birds.

Conservatively, the red fox population in Units 22 and 23 is estimated at 15,000 animals.

Without a comprehensive village survey it is difficult to assess the number of foxes actually taken in northwestern Alaska, although a regional corporation subsistence survey indicates that about 500 foxes are harvested each year from Unit 22 and about 400 from Unit 23.

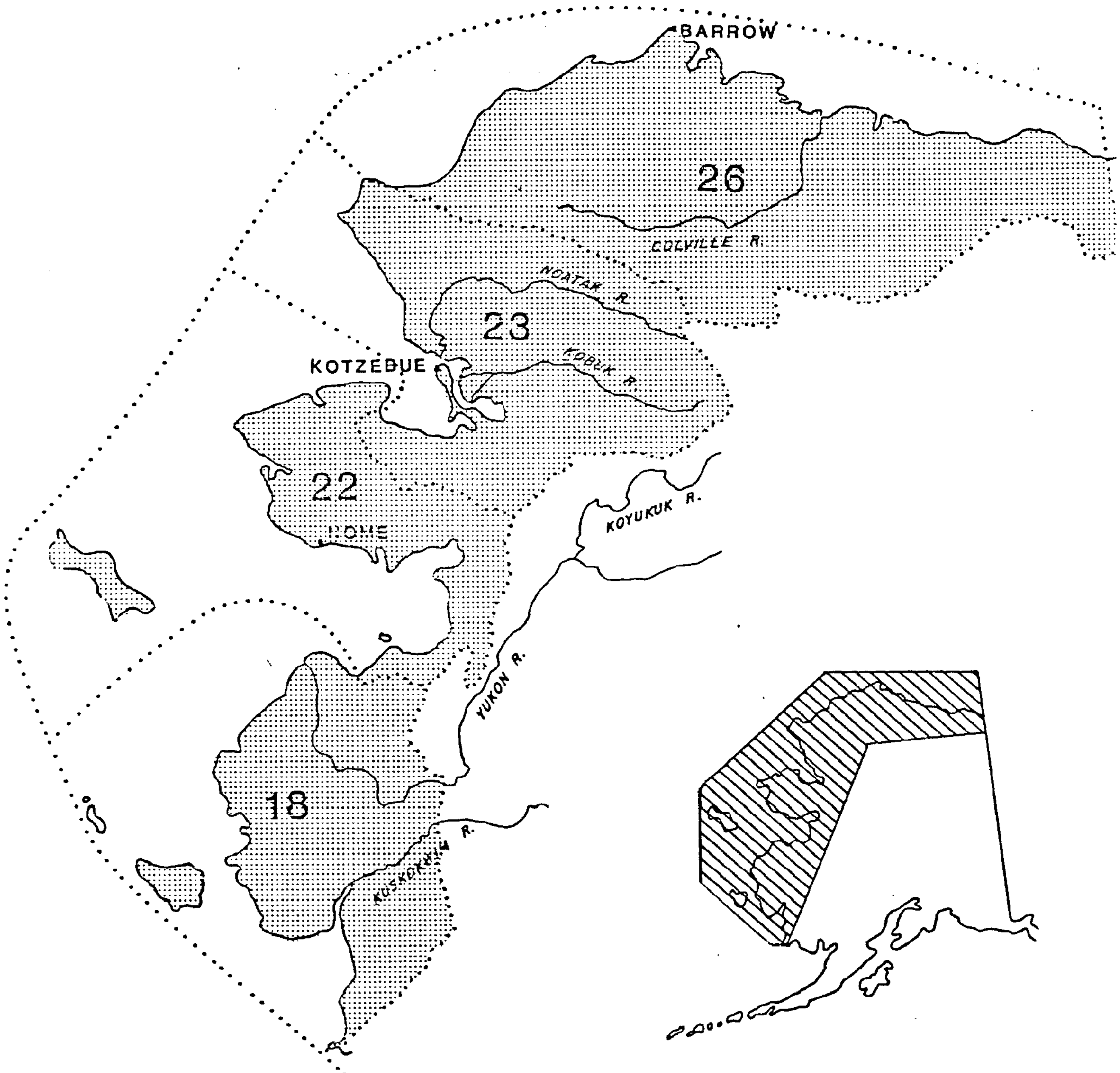
Unit 26

Red foxes are found throughout Unit 26, but populations are highest in the mountains and foothills and lowest on the coastal plains and along the coast. The best habitat is the riparian communities along drainages in the foothills and mountains. These foxes also utilize sedge communities extensively to hunt microtines.

There are no population estimates available for red foxes in this area, but it is suspected that their numbers fluctuate due to changes in microtine populations, although not with the same magnitude as the arctic fox.

Red foxes are trapped by local residents of coastal villages, and their hides are exchanged for cash and credit through villages stores. There is no accurate estimate of numbers of red fox harvested annually from this unit, but the number is low. Only 15 red foxes were reported exported from this unit in 1973-74. Some red fox fur may be used locally for hats, trim, etc.

Figure 12.
RED FOX



ARCTIC FOX

The arctic fox (Alopex lagopus) is an animal of the northern tundra. In Alaska they occur in a narrow band along the marine coasts, on open tundra, rocky beaches and on sea ice many miles from shore. The southern limit of their 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 Pribilof and Aleutian Islands.

Arctic foxes feeds on hares, microtine rodents (especially lemmings), birds, eggs and a variety of carrion. Arctic foxes display extreme fluctuations in population densities, with periodic peaks occurring approximately every four years. These fluctuations correspond to forage availability, especially with respect to densities of lemming populations. Foxes patrol the tideline on beaches in search of many forms of carrion. They also search out polar bear kills located far out on the pack ice. These foxes are also highly efficient predators on the eggs and young of waterfowl and seabirds.

Arctic foxes breed at one year of age, usually in March or April. They produce 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 arctic foxes.

The harvest of arctic fox in Alaska is highly variable. The average annual harvest between 1912 and 1963 was 4,072, while between 1968 and 1974 it averaged 2,369. The average statewide value of an arctic fox pelt is $38 (Seattle Fur Exchange, February, 1977).

Unit 18

In Unit 18 arctic foxes occur on the islands along the mainland coast and on the open tundra. Critical denning habitat includes the rocky beach and sand dune areas along the coast. Prime denning areas are on Nelson Island and along the southeast shore of Nunivak Island.

There are no estimates available of populations of arctic foxes in Unit 18, but the 1973-74 fur harvest data indicates that 455 pelts were taken from this unit. Probably 50 percent of the state's total harvest comes from western Alaska and the nearby islands.

Most arctic foxes are taken for commercial use in late winter and early spring. There is very little subsistence use.

Units 22 and 23

Prime habitats of arctic foxes are coastal beaches where currents carry marine mammals ashore and the delta areas of some of the major river valleys. All of the Bering Sea islands support high breeding populations. Of these, the most important in terms of numbers is St. Lawrence Island, followed by King, Diomede and Sledge Islands.

The arctic fox population in these units exceeds 10,000.

A regional corporation subsistence survey in 1972 indicated an annual harvest of 1,144 arctic foxes in Unit 22. The average harvest for Unit 23 is between 200 and 400 annually.

Unit 26

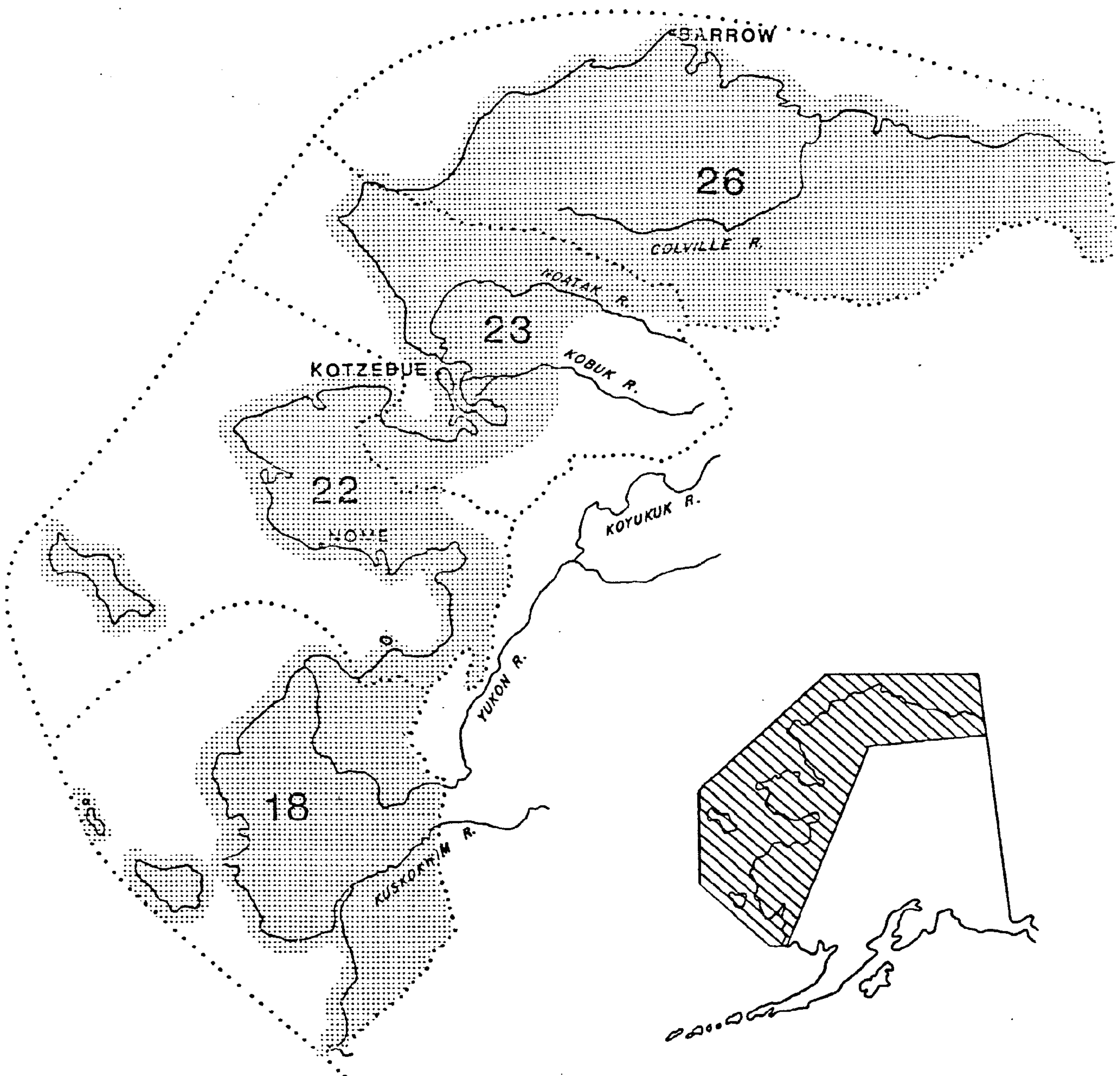
The arctic fox is the most important furbearer in Unit 26. Only five of the eleven economically important land furbearers found in Alaska regularly occur on the Arctic Slope. These are red foxes, arctic foxes, wolves, weasels and wolverines. Although these furbearers occur throughout the Arctic Slope, all except the arctic fox are either very sparse in the area or are concentrated in the foothills and mountains of the Brooks Range. Few trappers penetrate the latter area as adverse winter conditions and the distance from villages (most located along the coast) restrict intensive trapping in the interior portions of the Arctic Slope. Arctic fox densities vary considerably in the physiographic province of Unit 26. The highest density occurs on the arctic coastal plains, moderate numbers occur in the foothills, and very low numbers occur in the Brooks Range proper.

Thus, on the coastal plain of northern Alaska, only the arctic fox occurs in large enough numbers to be subject to an intensive trapping effort. Consequently, because of a relatively high pelt value, periodic high populations and availability to local trappers, the arctic fox is the only furbearer of significance to trappers on the Arctic Slope of Alaska.

Due to topography and permafrost, conditions on the Arctic coastal plain limit available denning habitat for arctic foxes which utilize pingos, riverbanks, sand dunes and old lake shores for den sites. The available denning habitat is also one of the main sources of granular fill material for human use development, and its removal could have significant impact on arctic fox populations. The marine environment is also important habitat for arctic foxes. During the ice-free period it provides a source of food such as carrion. In the winter months, arctic foxes follow polar bears and feed on the remains of seal kills. This may be particularly important during years of low lemming abundance. During these periods fox densities have been reported to increase along the coast. Any impact which affects the marine environment or populations of polar bear or seal could be important to arctic foxes.

The majority of arctic foxes are harvested from Units 18, 22 and 26, of which Unit 26 contributes approximately 40 percent of the total. Most arctic foxes are trapped by local residents from the villages of Wainwright and Barrow or from Barter Island and are either sold to local stores, fur buyers or tourists or are utilized for subsistence purposes.

Figure 13.
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, the coastal islands and much of southeastern Alaska. 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 period, usually one to four kittens are born in a den formed by a natural cavity. Productivity is closely related to prey density and is therefore 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 valuable furbearer and is harvested throughout its range, primarily by trapping. Currently, prime pelts may average over $300 each (Seattle Fur Exchange, February, 1977).

Unit 18

There are very few lynx in Unit 18. They are confined to the forested areas along the Kuskokwim River.

Units 22 and 23

In Units 22 and 23 lynx do not follow the typical pattern of residing only in areas containing spruce trees and viable populations of snowshoe hares. They have been seen on several occasions along the river systems of the Seward Peninsula, miles away from the nearest spruce trees.

Lynx appear to be slowly expanding their range on the Seward Peninsula to the west and to the north into the Noatak Valley in Unit 23. Presently, lynx numbers are moderately low in both Unit 22 and Unit 23 in response to decreased snowshoe hare populations.

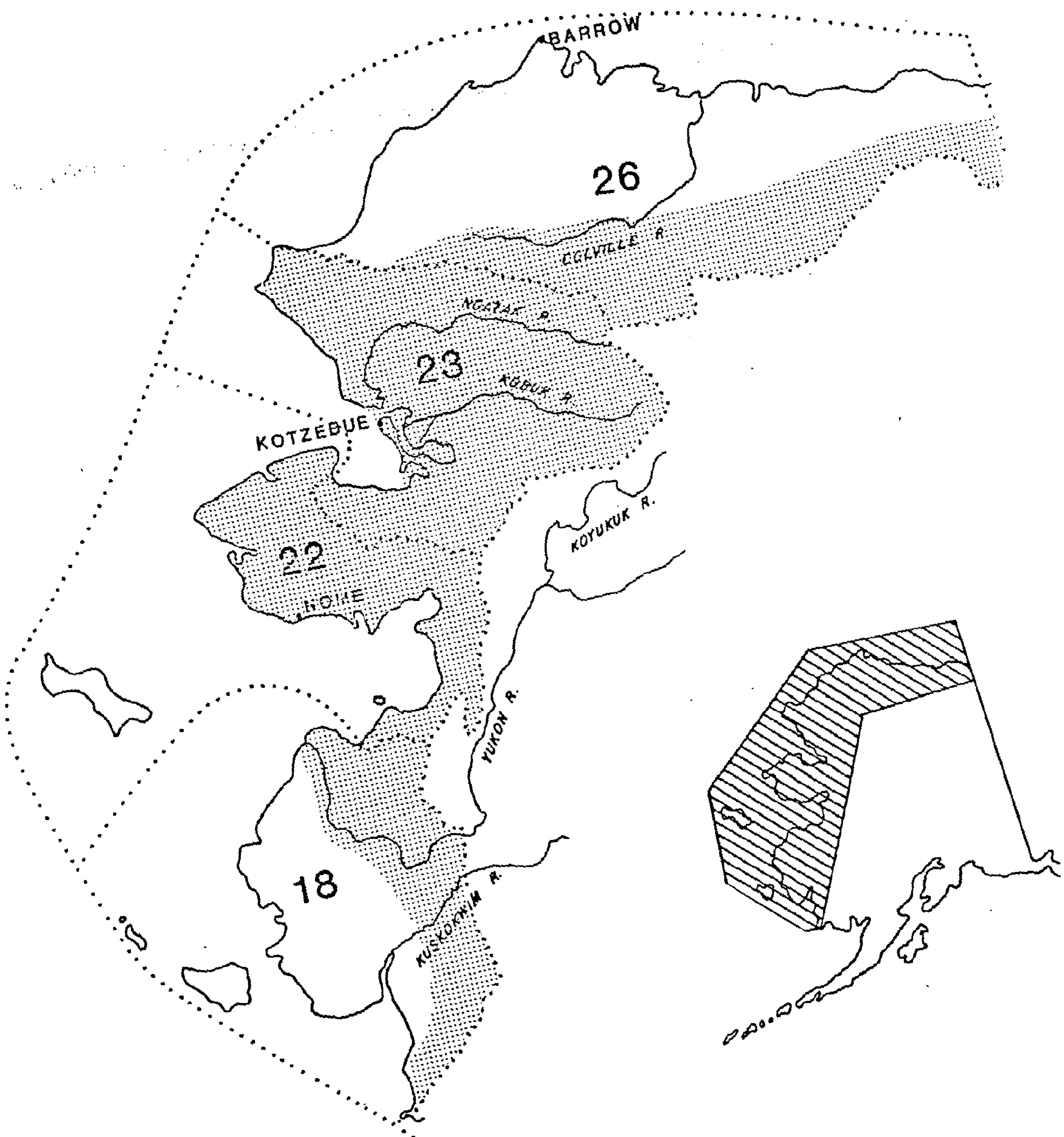
Prime habitat for lynx includes the lower Koyuk, Niukluk and Unalakleet River systems in Unit 22 and the lower Noatak, Selawik and Kobuk River systems in Unit 23. Lynx populations in these areas follow the same basic patterns exhibited in the interior but the cycles are not as extreme as ptarmigan and small mammals are available as substitute food sources when hares are scarce.

Trapping pressure has been low but is increasing due to high fur prices. The harvest averages about 100 to 150 lynx per year in Unit 22 and about 200 per year in Unit 23. Most pelts are sold commercially due to the high prices. Domestic use is minimal.

Unit 26

There are few lynx present in Unit 26. Densities are extremely low, especially when compared to adjacent game management units. They are not economically important as a furbearer in this unit, and no information is available on the harvest.

Figure 14.
LYNX



WOLVERINE

The wolverine (<u>Gulo luscus</u>) 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 the southeastern portion. Wolverines inhabit forests and tundra areas from sea level into the mountains. Although they have a wide distribution throughout Alaska, they are not found in high densities.

Wolverines are omnivorous and consume a wide variety of materials 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 are born in a den and usually number two to three.

The specific habitat requirements for wolverines are unknown. They occur over large areas of diverse habitat where food is abundant. There is no evidence, however, that wolverine predation adversely affects game populations or causes excessive economic losses. Wolverines are considered valuable furbearers; the current value of a single hide averages $120 (Seattle Fur Exchange, February, 1977).

Unit 18

Wolverines occur in very low numbers in most of Unit 18. They are most numerous in portions of the Kilbuk Mountains, but even there populations are lower than throughout the rest of their range in Alaska. Apparently they have never been numerous in this area as the suitable habitat is marginal.

Wolverine populations in Unit 18 are experiencing an upward trend but will probably never be high. The number of wolverines sealed from Unit 18 has averaged seven per year over the last four years. Most hides are probably used domestically for parka ruffs, gloves, etc.

Units 22 and 23

Wolverines are fairly evenly distributed throughout all of northwestern Alaska. Populations are sparse around settlements because of heavy hunting pressure.

The river drainages throughout northwestern Alaska contain most of the suitable wolverine habitat. In Unit 22 the broad valleys and lower two-thirds of the Nukluk, Koyuk, Kuzitrin and Unalakleet River drainages are important wolverine habitat. In Unit 23 the best habitat is located along the lower Noatak, Kobuk and Selawik Rivers. The Salmon, Squirrel, Ambler and Pak tributaries on the Kobuk River are also important areas.

Wolverine populations are estimated at a minimum of 300 in Unit 22 and 600 in Unit 23. Although quite a few wolverines are taken in traps, at least half or more are taken by tracking the animals down and shooting them from snowmachines. In open country a wolverine has little chance of escaping when a hunter gets on his trail in good tracking conditions.

Sealing records indicate an average annual harvest of 20 wolverines in Unit 22 and 55 in Unit 23, but the actual harvest is much higher as most wolverines taken in this area are never sealed. The harvest is probably 70 to 75 wolverines annually in Unit 22 and about 150 annually in Unit 23. About 95 percent are taken by local recreational hunters in the upper income brackets living in larger communities such as Nome or

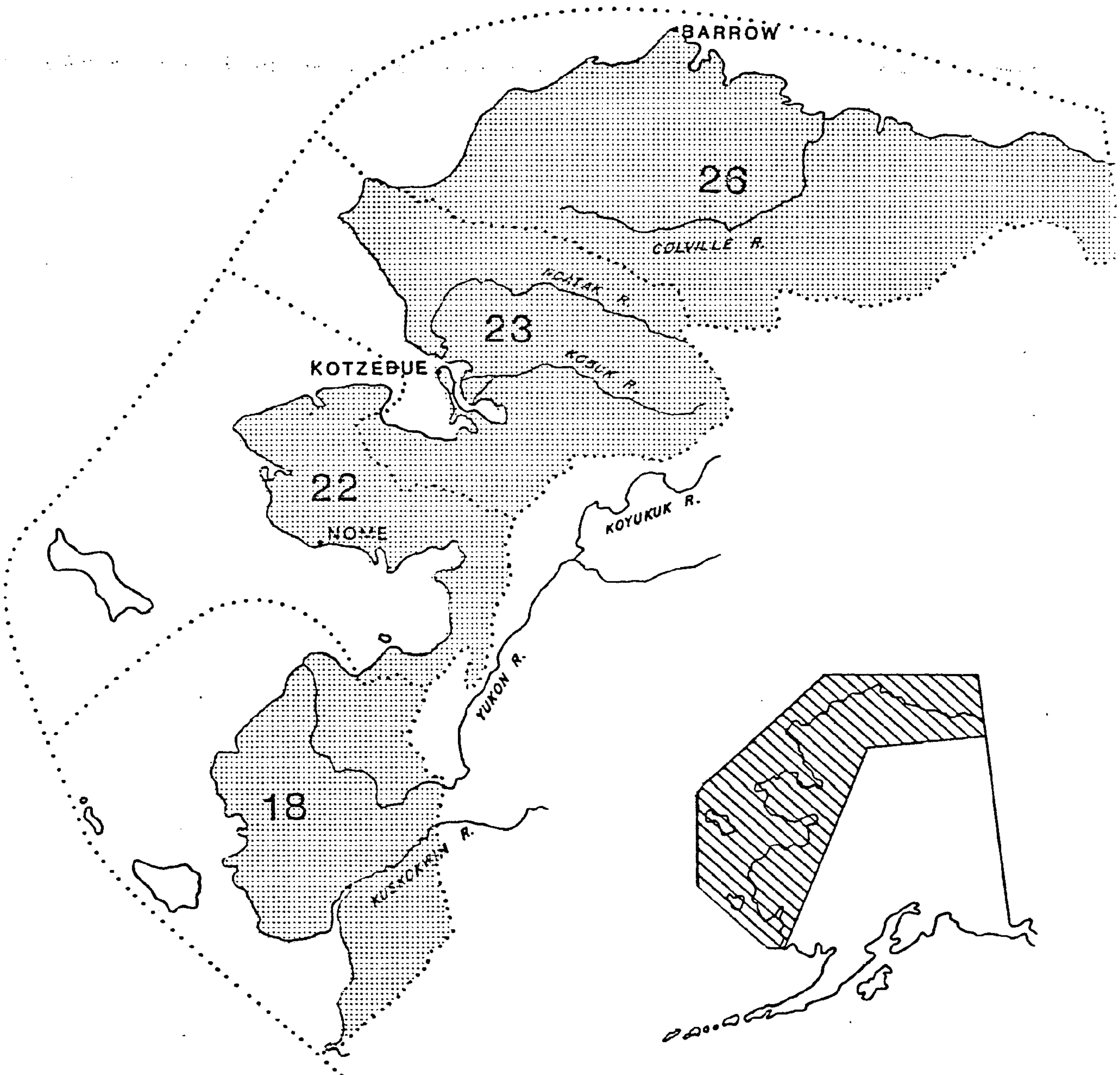
Kotzebue. Most of the skins are cut up and either used by the trapper or sold locally.

Unit 26

Wolverines are present throughout Unit 26. They are most numerous in the Brooks Range and in the foothills and scarce along the coast or on the coastal plain. Wolverines traverse all habitat types, but frequently travel valley bottoms in search of carrion from wolf or bear kills. They travel extensively and apparently have a very large home range. Populations are lower in Unit 26 than in the interior units.

Wolverines are avidly sought by local users and demand high prices in the villages in Unit 26. The harvest from this unit is relatively low. Less than six have been sealed annually over the past four years.

Figure 15
WOLVERINE



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 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 more 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. Statewide, the current average value of a prime pelt is $45 (Seattle Fur Exchange, February, 1977). Although trapping pressure often influences local marten densities, loss of habitat has a greater influence on overall numbers.

Unit 18

Few marten are found in Unit 18 due to the predominance of tundra in this unit. They are restricted to the dense spruce forests

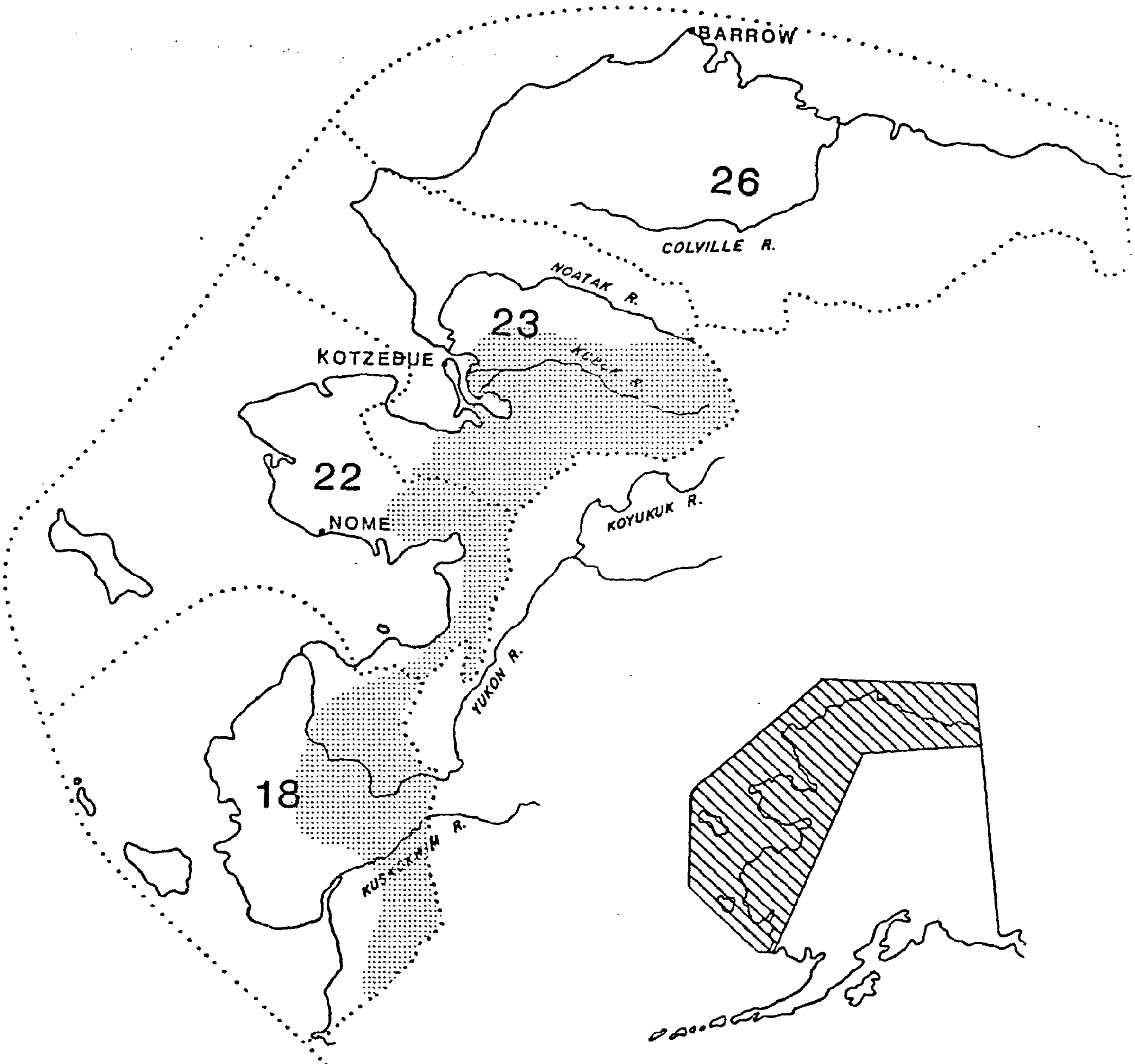
Units 22 and 23

No information is available on marten in these units.

Unit 26

Marten do not occur in this unit.

Figure 16.
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 Aleutian Islands west of Unimak Island and the Kodiak Island 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, mink 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 harvested by trapping and provide a source of income and recreation for many Alaskans. The average statewide value of a mink pelt is currently $33 (Seattle Fur Exchange, February, 1977). The highest quality mink found in the State occur in the Yukon-Kuskokwim Delta.

Unit 18

Mink in the Yukon-Kuskokwim Delta are among the most valuable produced in North America. Delta mink are much larger than mink from other sections of Alaska. In winter, when they are prime, these mink are dark chocolate brown in color with coarse guard hairs 2 1/2 to 3 cm long. Underfur is usually thick and wavy and is about 1 1/2 cm long and dark gray or light brown in color. There is a great deal of uniformity in color among individuals, and the fact that large numbers of uniformly colored animals are available is another point contributing to their value. In comparison, mink taken from different drainages in localized areas in Interior Alaska often exhibit differences in color which make them hard to match. Mink occur throughout the Yukon-Kuskokwim River drainages as far west as the mouths of these rivers, but the Kuskokwim mink, locally known as tundra mink, are found, as their name implies, on the tundra.

Abundance of delta mink within the confines of the tundra type community varies considerably with the differences in habitat. Two major areas have high mink densities. The first and largest is in the low, swampy terrain in the southwest section of the delta around Baird Inlet and Dall Lake. Individual catches of mink in the Dall Lake-Baird Inlet area have been as high as 300 per year. A second, much smaller area is located east of Scammon Bay in the drainage of the Kashunuk

River. Extensive interconnected water systems with large concentrations of blackfish and whitefish characterize both areas. Areas of low mink abundance include most of those portions of the delta where the relative relief exceeds 100 feet.

Mink trappers in the Yukon-Kuskokwim Delta make use mainly of a cage type trap called a taluyak. These mink traps evolved from a type of fish trap which was used extensively to catch blackfish. The most widely used type of taluyak is made entirely of one-inch mesh chicken wire and is constructed without a frame. Mink caught in these traps are drowned in a matter of minutes and are not subjected to starvation or exposure as are animals caught in steel traps. The efficiency of these traps lies in the fact that they will continue to catch mink after others have already been caught. Mink caught in these traps are also protected from damage caused by foxes and other animals. Taluyaks account for 75 to 85 percent of the total catch of mink from the Yukon-Kuskokwim Delta.

Mink pelts are traded for manufactured goods or are sold for cash. This source of income is important because it comes at a time of year when many families have no other means of obtaining cash. To the merchants of the area, mink are a double source of income as pelts are sold for a profit and money paid trappers is often used to purchase goods in their stores.

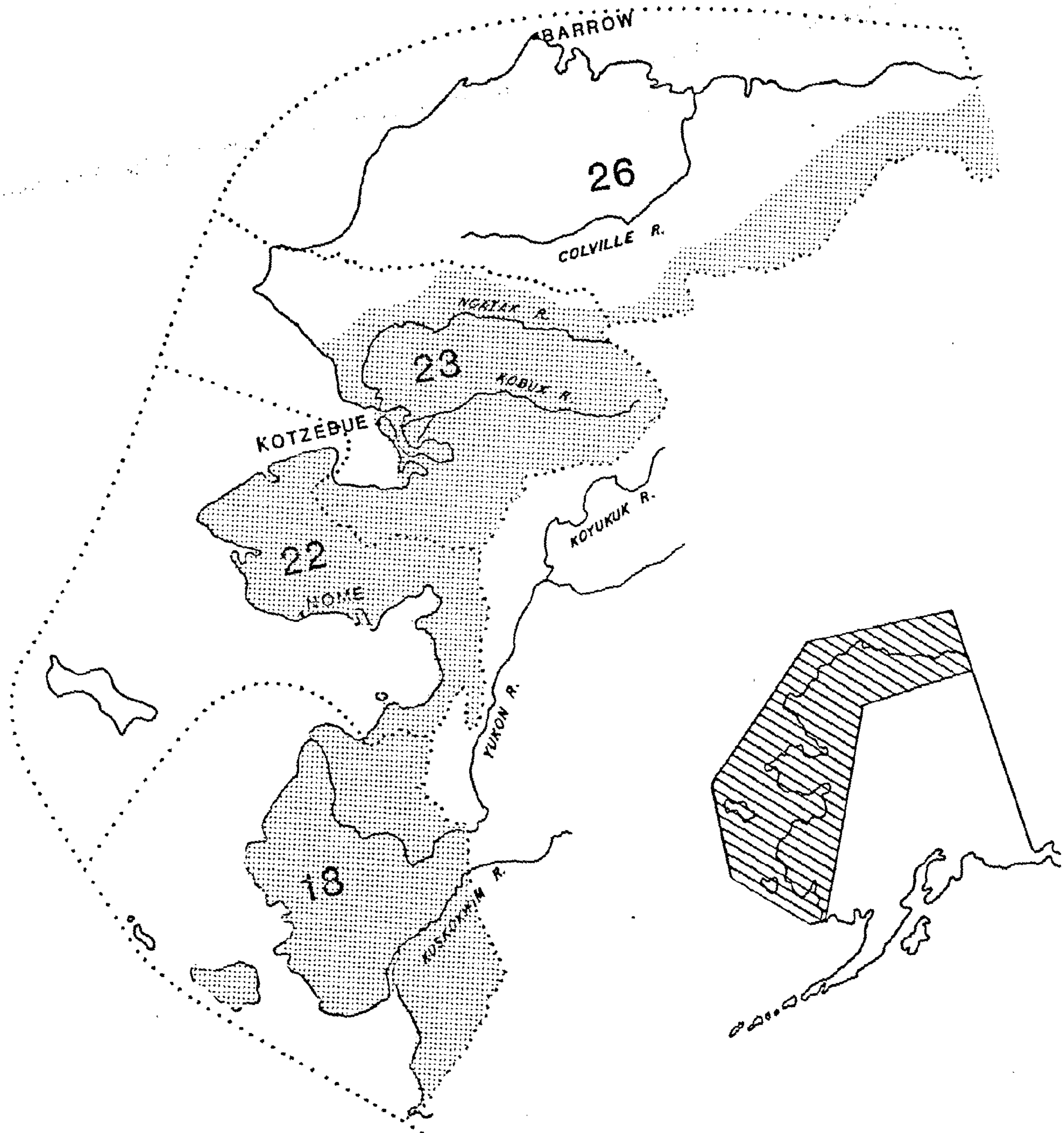
<u>Units 22 and 23</u>

The drainages of the Selawik and Kobuk Rivers have produced large numbers of top quality mink. Catches of over 100 mink per trapper have been common the past few years. The quality of mink from these units compares with that of the Yukon-Kuskokwim Delta mink.

Unit 26

Mink are present in Unit 26 only occasionally and are not considered an important furbearer in this area. They are generally absent from the North Slope.

Figure 17.
MINK



SHORT-TAILED WEASEL

Short-tailed weasels or ermine (Mustela erminea) occur 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.

Primary prey items of short-tailed weasels include microtine rodents, shrews and mice. Others included in their diet are birds, eggs, young hares, pikas, insects and fish. Predators of short-tailed weasels 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 period. Litter size usually ranges between four and eight young.

As a furbearer, short-tailed weasels are not of major importance. They are usually taken incidental to the trapping of other furbearers. The value of the average pelt is generally worth about $1.

LEAST WEASEL

Least weasels (Mustela rixosa) occur throughout most of Alaska except the offshore islands of the Bering Sea, the Aleutians west of Unimak Island, the Kodiak Island area and most islands in southeastern Alaska. 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 forest 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.

Unit 18

Unit 18 contains extensive prime habitat for weasels. Both the short-tailed weasel and least weasel are present. Least weasels, called bob-tailed weasels by the natives in the area, are most abundant in the marsh areas. Short-tailed weasels can be found in the more upland areas. There are no population estimates for either weasel, but they are not as abundant as they have been in the past. Weasels are subject to drastic fluctuations in population numbers. Food supply is the biggest factor in population fluctuations. They are dependent on microtine rodents, which fluctuate naturally in abundance. There is no overtrapping of weasels at present as most are taken incidental to trapping of other furbearers. Some are taken by hawks, owls or larger mustelids. A few weasel skins are used for trim on parkas and moccasins.

Units 22 and 23

No information is available on weasels in these units.

Unit 26

Both species of weasels are distributed throughout Unit 26. Short-tailed weasels are most abundant in the foothills and mountains, while least weasels are most abundant in the foothills and coastal plains, especially during or soon after microtine population highs. Prime habitat for short-tailed weasels seems to be riparian communities along water courses with rock slides. There is no information on the preferred habitat of least weasels. Populations of both species of weasels fluctuate widely due to microtine population fluctuations. Most weasels are trapped incidental to the trapping of other furbearers. Most hides are sold, although some may be used for garment trim.

Figure 18.
SHORT-TAILED WEASEL

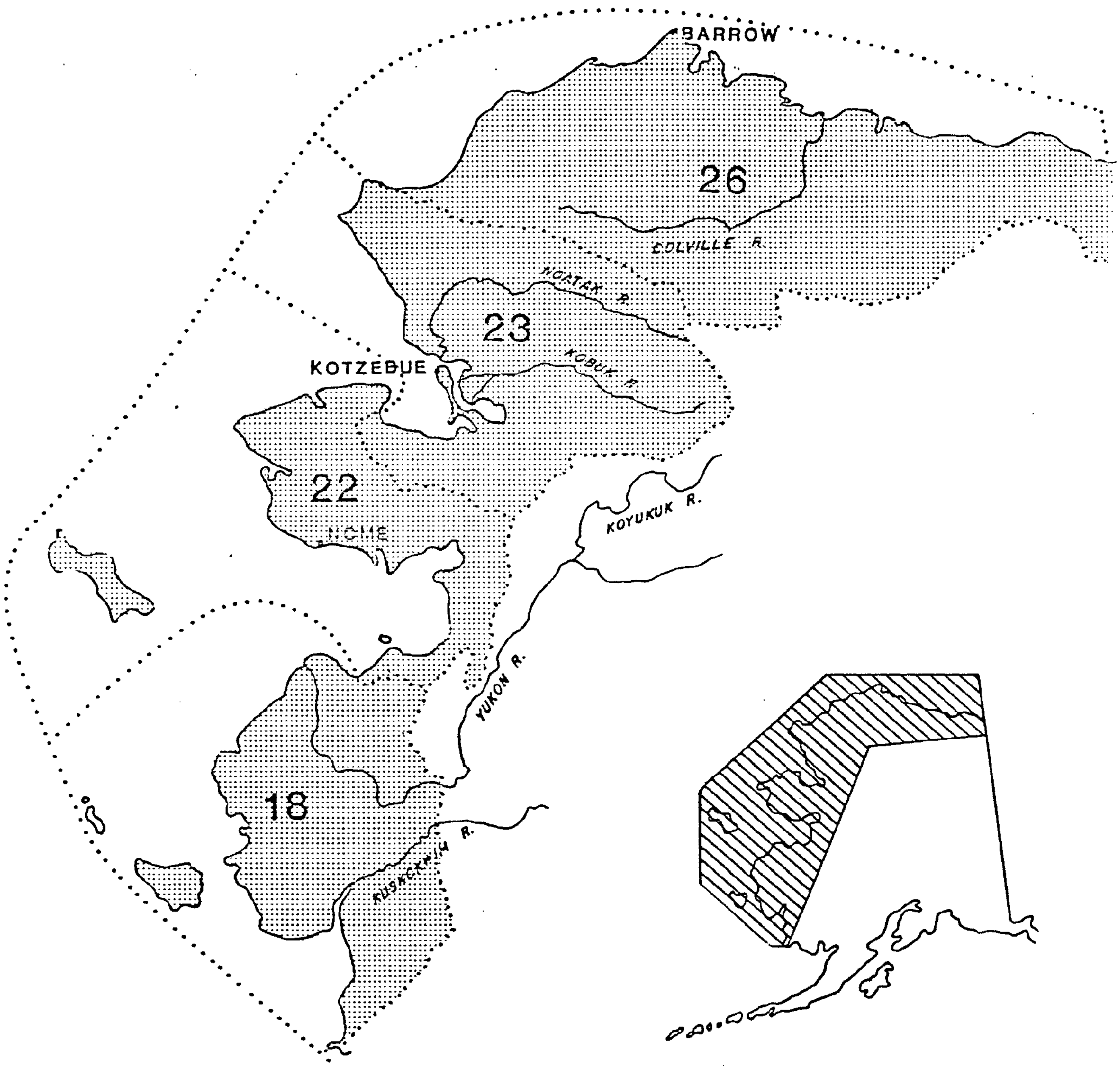
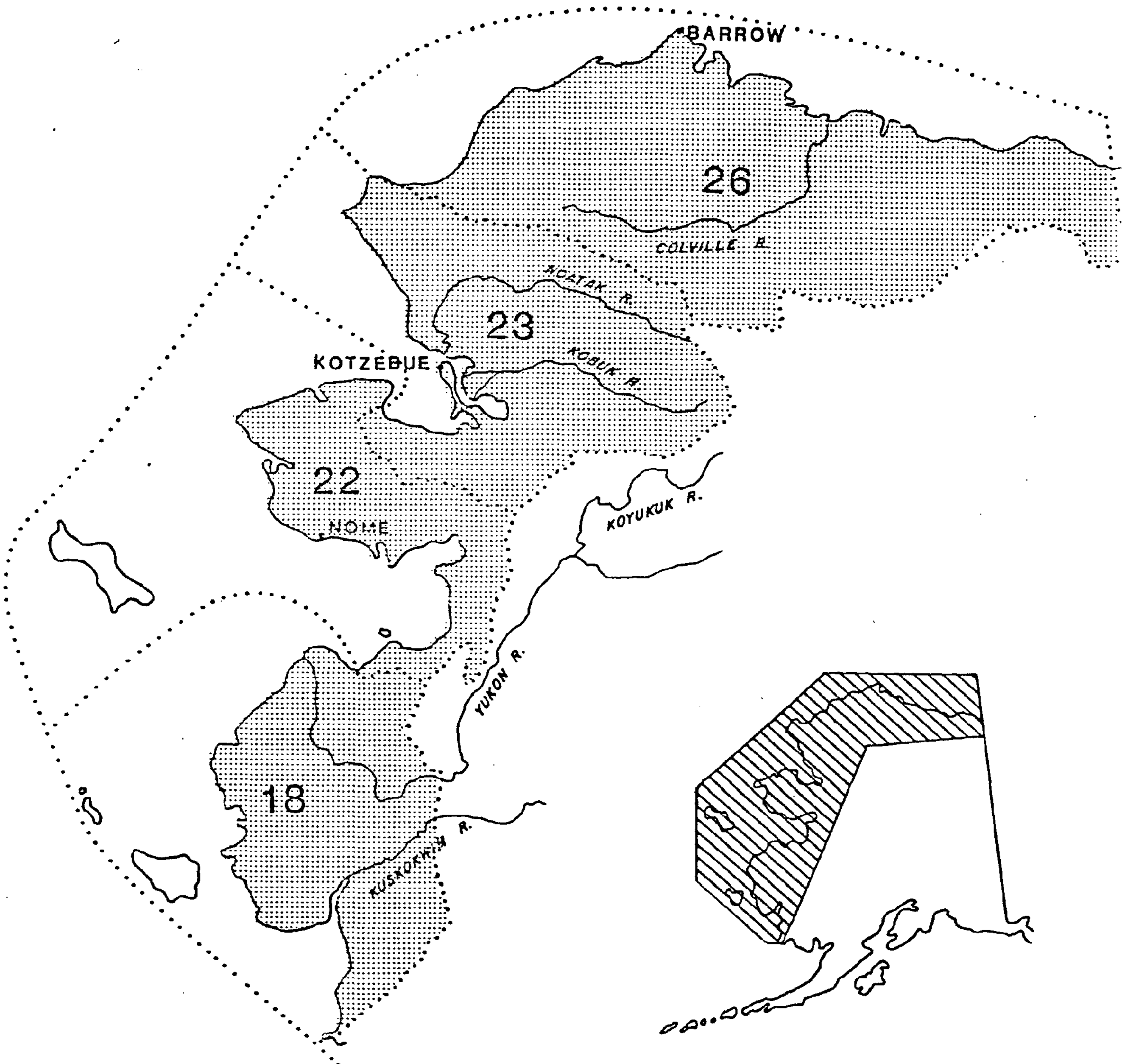


Figure 19.
LEAST WEASEL



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, otters 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 commercially in many parts of the State. A prime pelt currently averages $76 on the fur market (Seattle Fur Exchange, February, 1977). 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.

Unit 18

Land otters are abundant in Unit 18. Otter populations fluctuate somewhat, but not as much as most species because their diet is not as specific as some animals and they do not have many natural predators.

The harvest of land otters in Unit 18 has been as high as 500 to 1,000 pelts in a good year. Most are sold for commercial use; very few are used domestically.

Units 22 and 24

Land otters are present in Units 22 and 23, primarily in the upper drainages of the Kuzitrin, Buckland and Koyuk Rivers in Unit 22 and in the lower and middle Noatak River, the Salmon River, the upper Selawik River and the upper Kobuk River in Unit 23. Although they are commonly found in every major drainage in these units, their density varies considerably.

Populations of otter in these units are unknown, but there are probably at least 500 in Unit 22 and at least 800 in Unit 23. Otter populations seem to have increased in the past few years, perhaps because of decreased trapping effort. Population fluctuations seem to be rather gradual, probably because their diet is not as specific as some other furbearers.

Trappers take a few otters every year but probably do not seriously depress the populations except in local areas near villages or main routes of travel.

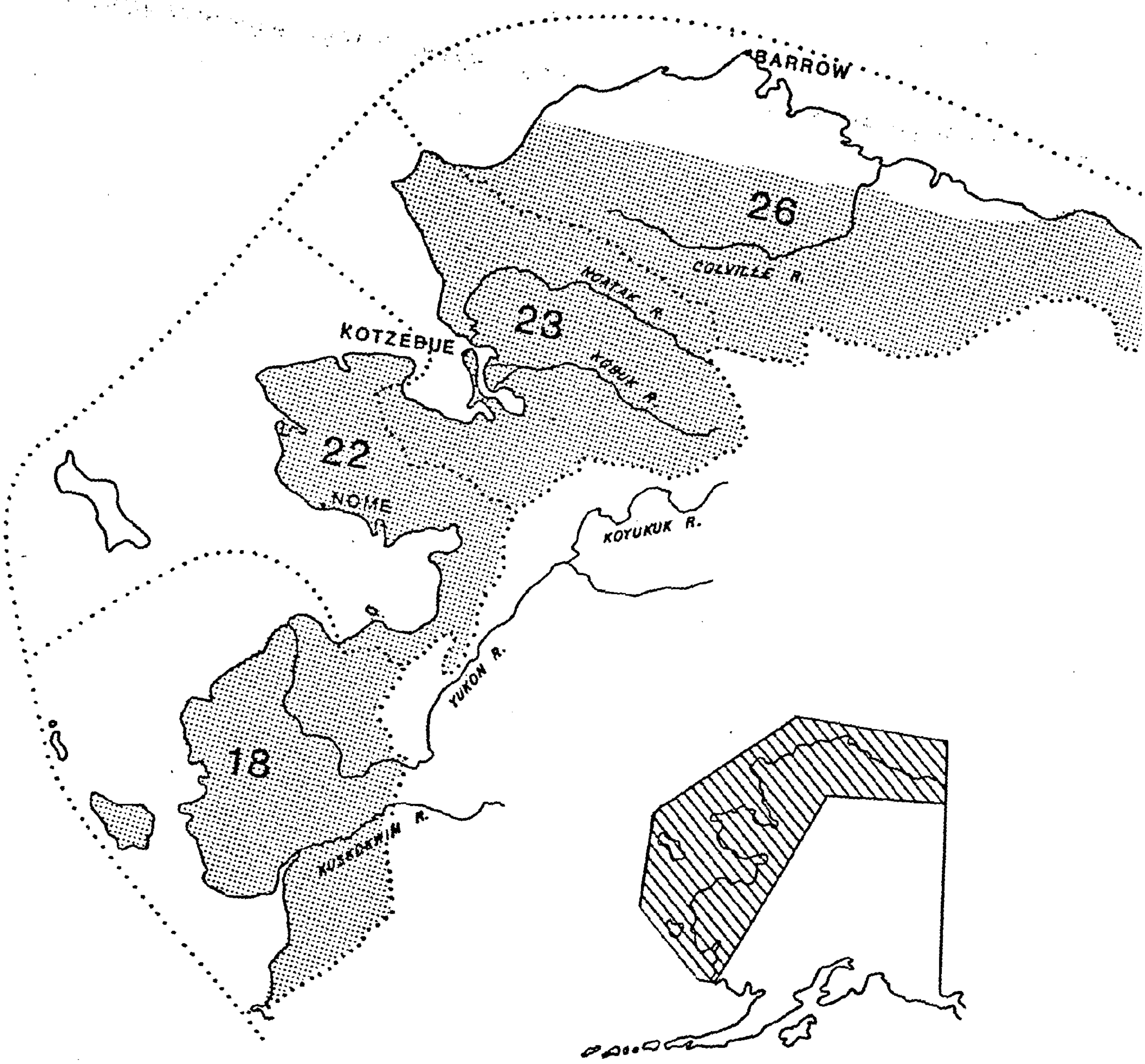
The actual harvest of otters in unknown. At least 20 are taken annually in Unit 22 and at least 50 annually in Unit 23. A regional corporation subsistence survey in 1972 indicated the region accounted for at least 215 otter harvested per year, but the actual number may be smaller.

Most otters are taken by native hunters in the rural villages, and many pelts are used domestically for trim on garments. Occasionally animals are shot by "recreation" hunters from Nome or Kotzebue.

Unit 26

Otters are present in Unit 26 only in scattered populations. They are found only occasionally in the western part of the unit and rarely in the rest of the area.

Figure 20.
LAND OTTER



BEAVER

The beaver (Castor canadensis), a large, aquatic rodent, is widely distributed over most of the North American Continent. Beavers occur throughout most of the State of Alaska south of the Brooks Range. They do not occur in the Aleutians or in the far western portion of either the Seward or Alaska Peninsulas, and they only occasionally occur on the Kuskokwim Delta. Beavers 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.

Beavers 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 beavers are limited primarily to the bark of shrubs and trees. Beavers 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 beavers' 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 beavers breed from January through March. Their gestation period is believed to be around 100 days. Parturition occurs from late April to late June, with the average litter generally consisting 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, beavers 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, beavers were harvested to the point that their populations declined to low levels, and the taking of beavers was eventually prohibited in 1910. The beaver season was opened in 1921, and more than 16,000 beavers 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, beavers are still considered one of the State's most important furbearers. The average pelt is currently valued at $30 (Seattle Fur Exchange, February, 1977).

Unit 18

The beaver population in Unit 18 has been roughly estimated at 3,000 and is decreasing because of overtrapping. This area is one of the best in the State for beaver harvest. The average catch over the last three years in Unit 18 was 1,000 per year. The pelts are sold and the meat is used domestically for human and dog food. Interest in beaver trapping has declined in the past few years due to increased employment and comparative low prices for beaver pelts.

Units 22 and 23

Prior to 1930 there were few beavers in Units 22 and 23. In the late 1940's and early 1950's a few beavers began moving into the Upper Selawik drainages and then, as populations established themselves, they began moving downstream, colonizing new areas as they went. By the late 1960's, beavers were common throughout most of the Selawik Valley. Residents in this area were concerned that beaver dams would restrict natural migration routes of fish or produce severe winter kills by trapping fish in shallow lakes. Residents hunt beavers in the spring primarily as a predator control measure. Only a few trap beavers on a regular basis.

Beavers have now moved into portions of the Kobuk Valley, particularly in the lower portion of the drainage. They have also extended their range into the southeast part of Unit 22. A small population resides in the Stebbins-Unalakleet area. This group is increasing and expanding into areas to the north.

Prime beaver habitat in these units may be found in the lower Selawik Valley and the Pikmiktalik River south of Stebbins.

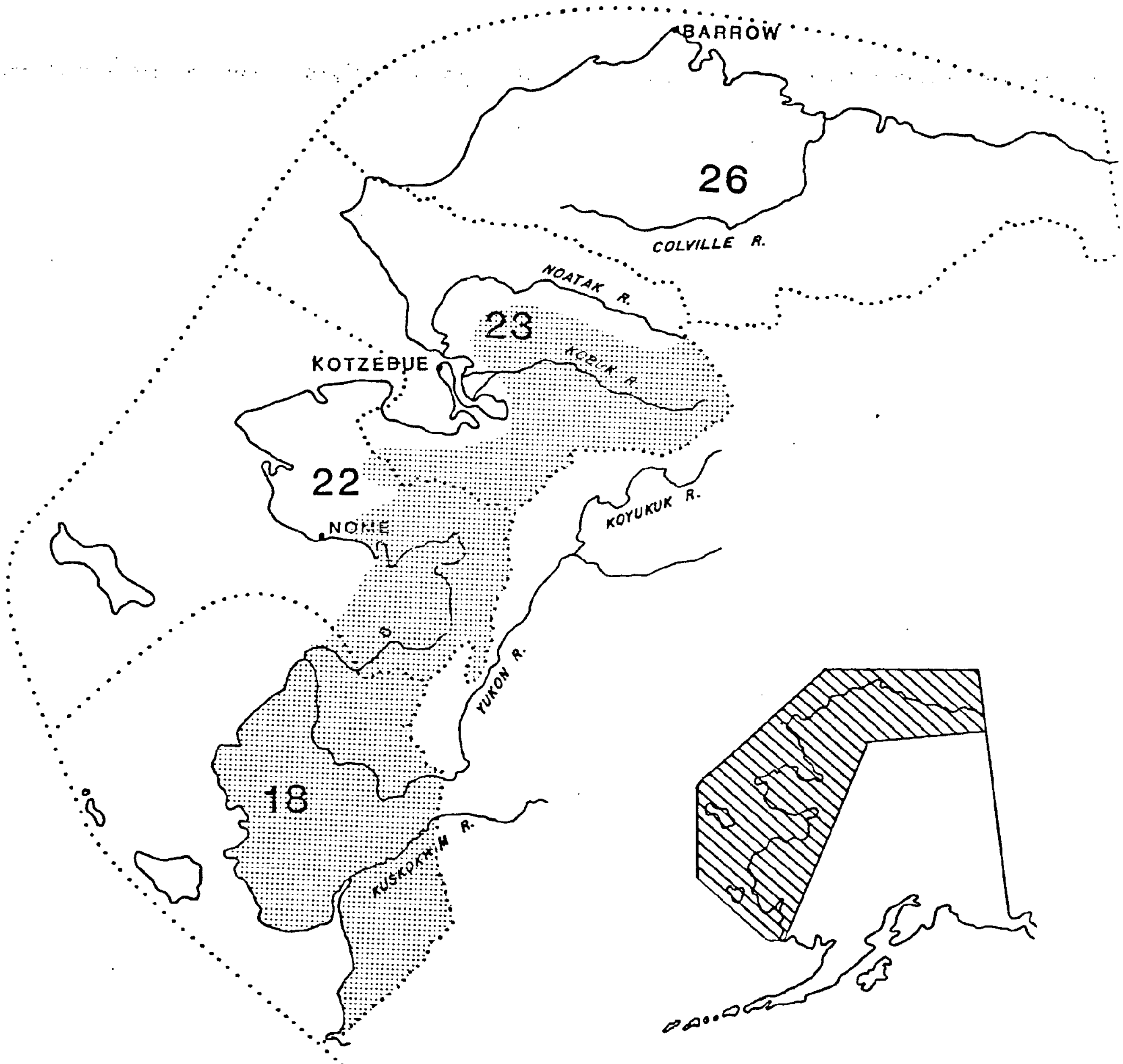
A minimum estimate of the beaver population in Units 22 and 23 is 5,000. Carrying capacity is unknown, but considering that beavers are now expanding into new areas, the population is probably below its potential. The areas that presently contain the greatest number of beavers are probably the areas with the highest carrying capacity.

Trapping pressure is relatively light. The annual harvest in Unit 22 is between 100 and 250 beavers per year. In Unit 23, 100 or less are taken annually. About 50 percent of all beavers are taken for domestic use.

Unit 26

Beavers do not occur in this unit.

Figure 21.
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, although 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 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. During winters when ice thickness of five feet or more is prevalent, muskrat populations are substantially reduced.

The muskrat is an important furbearer in Alaska in terms of total numbers taken. Approximately 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 18

Muskrats are present in low to moderate abundance in Unit 18. At one time the unit was a very good muskrat producing area, but adverse weather conditions and higher predation may have contributed to the current low population level. There are large areas of prime habitat for muskrats in Unit 18. Populations fluctuate. When there is little snow muskrats freeze out, and when there is too much snow they flood out in the spring which exposes them to more predation and disease. Muskrats have never been overtrapped in this unit. People are not presently trapping muskrats to the extent they were 20 years ago, probably due to low prices for pelts and the availability of welfare. Many muskrats are used domestically in this area for food and for parkas. The commercial harvest in Unit 18 has been about 3,000 animals per year for the last few years.

Units 22 and 23

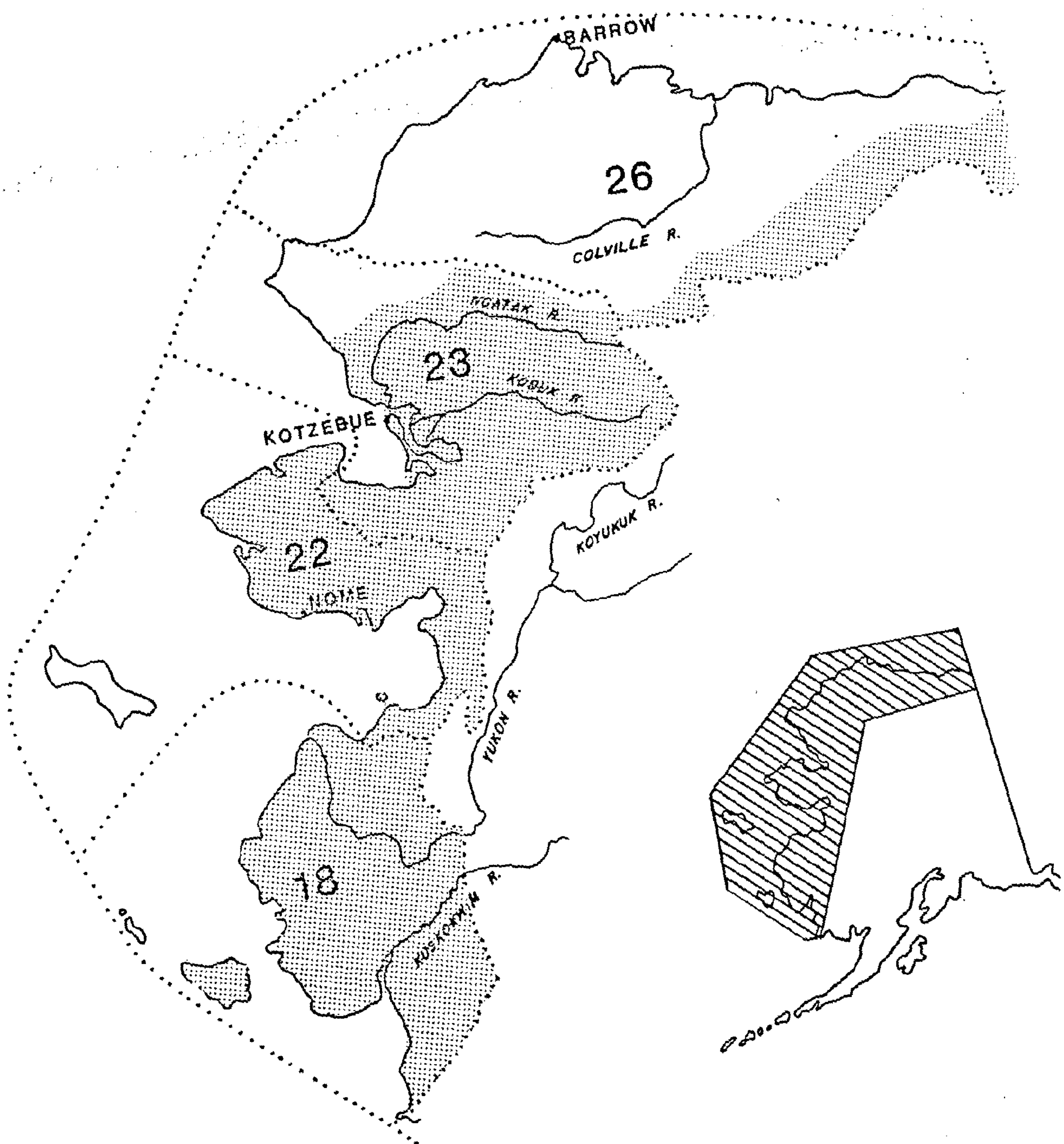
Few muskrats are found in Unit 22. Some of the best habitat, however, occurs in Unit 23, which produces some of the best pelts. The lower Kobuk and Noatak Rivers and the Selawik Flats support excellent muskrat populations.

Muskrats are harvested for both commercial and domestic use. Locally, the fur is used for parkas and the meat for human food.

Unit 26

Muskrats probably reach their most northern distribution at the southern boundary of this unit. They are not an economically important furbearer in Unit 26. If they are present at all, their numbers would be very scattered in the southern part of this unit.

Figure 22.
MUSKRAT



MARMOT

The hoary marmot (Marmota caligata) inhabits the mountainous regions of mainland Alaska. They prefer 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, marmots accumulate fat which enables them to go into 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 their fur. Where these animals are abundant, they provide viewing and photographic opportunities for the wildlife observer.

Unit 18

There are few marmots, if any, in Unit 18 due to lack of appropriate habitat.

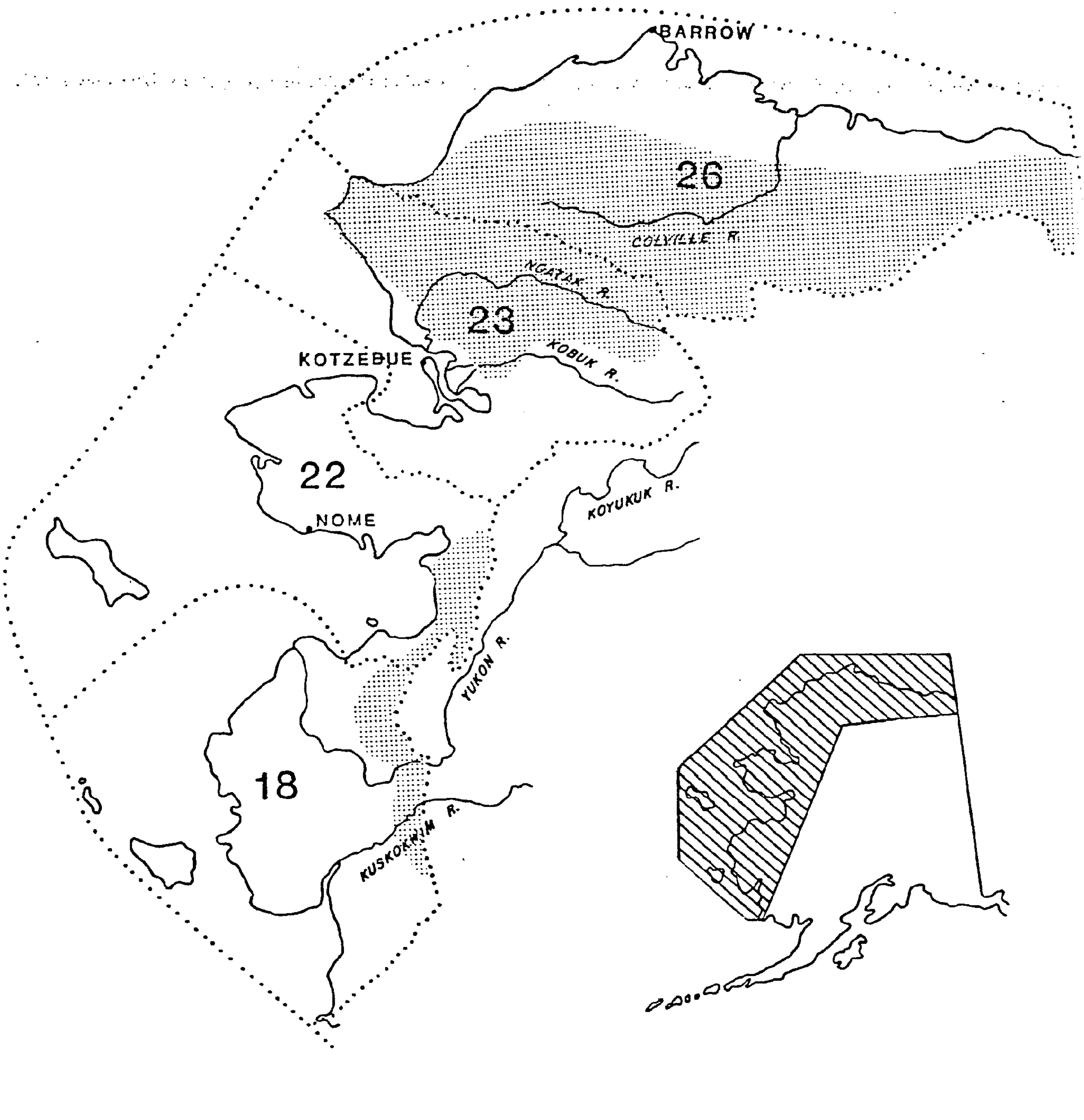
Units 22 and 23

Marmots occur only in the southeastern portion of Unit 22. Some may be found in the mountainous areas in the northern part of Unit 23, but there is no other information available.

Unit 26

Marmots occur in the Brooks Range portion of Unit 26. There is no other information available.

Figure 23.
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 weasels, grizzly bears, wolves, foxes, wolverines and raptors. Ground squirrels are sometimes used locally for meat and fur.

Unit 18

Arctic ground squirrels are abundant in Unit 18. These squirrels are taken for domestic use for food and clothing. The fat is eaten and the fur is used for parkas. They are hunted in the spring immediately after they emerge from hibernation until they lose most of their body fat. The hides are currently valued at $1.50 to $2.00 each and are often used for bartering.

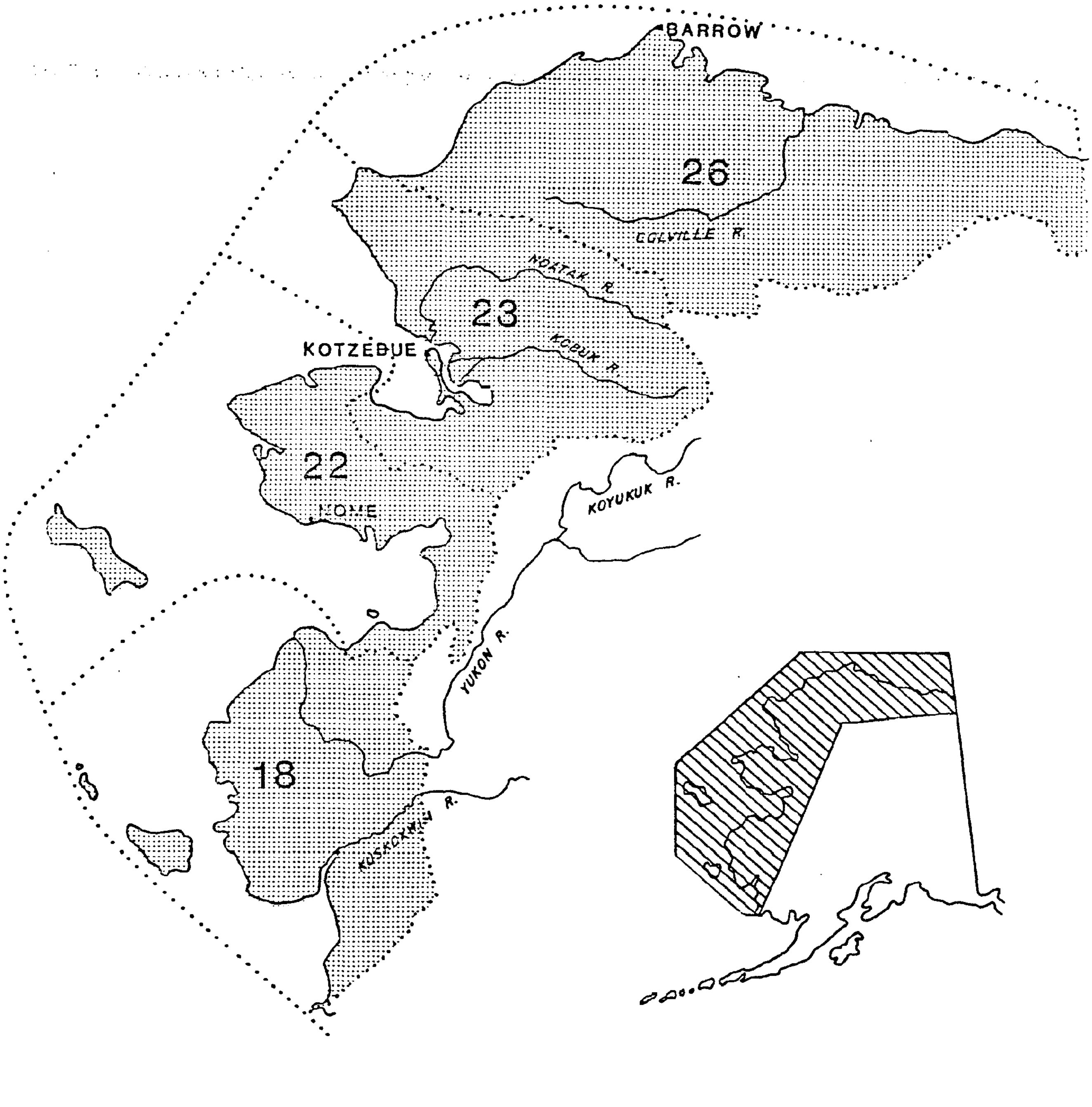
Units 22 and 23

Arctic ground squirrels are common in suitable habitat. No other information is available.

Unit 26

The arctic ground squirrel is found throughout Unit 26 where the permafrost is several feet below ground level. They are found from sea level to high in the mountains and are the most common small mammal in the area. The meat and fat are eaten and the skins are used for parkas by residents of the area.

Figure 24.
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 red squirrels is the seeds of the white spruce, whereas throughout the coastal forest it is presumably the seeds of Sitka 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 many provide viewing and photography opportunities for the noncomsumptive user.

Unit 18

Red squirrels are not abundant in Unit 18, largely because the area is mostly tundra. There is very little utilization of red squirrels for fur or food. They are occasionally hunted for sport and are often shot as nuisances.

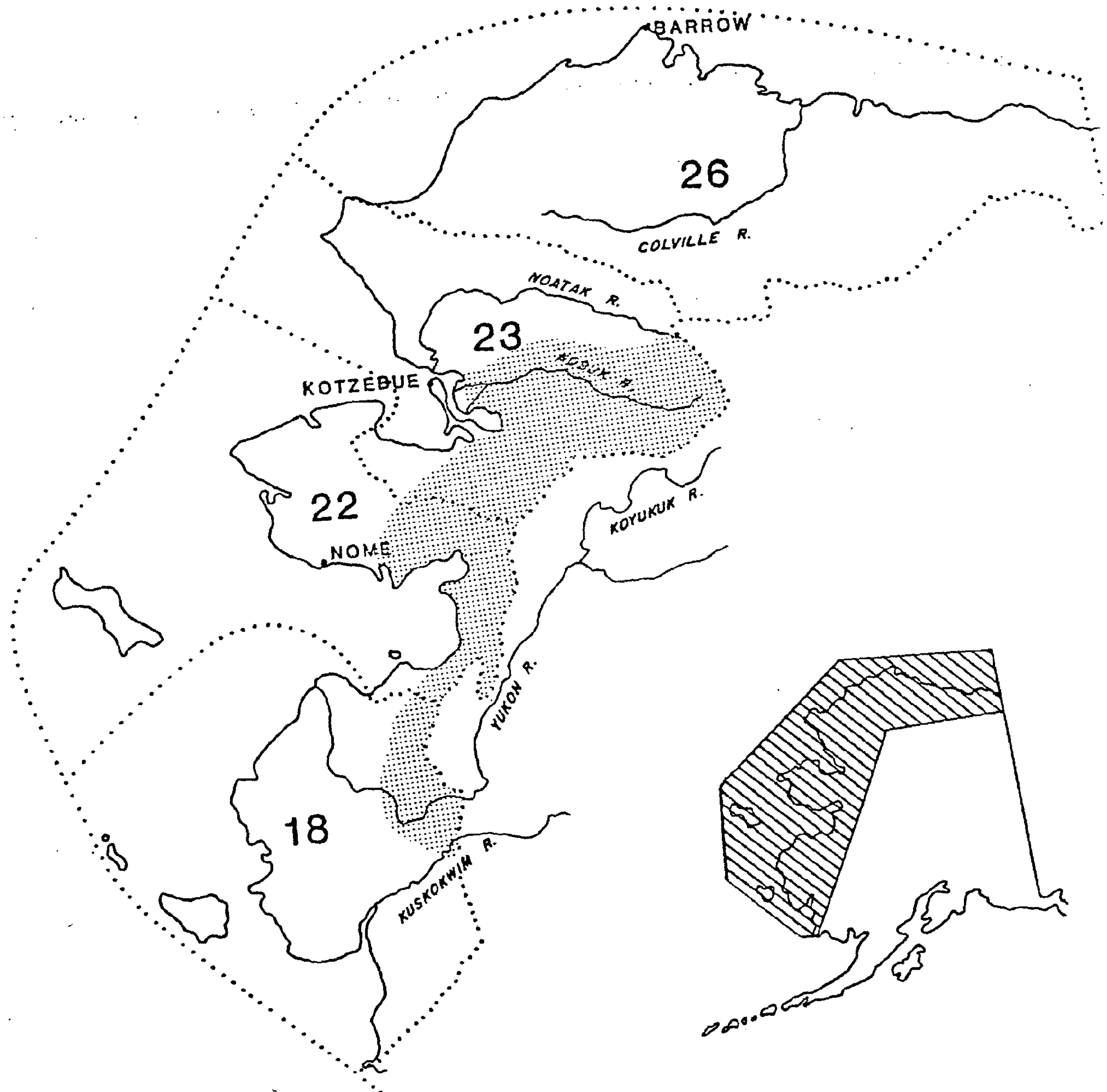
Units 22 and 23

No information is available.

Unit 26

Red squirrels reach perhaps their northernmost distribution at the southern boundary of Unit 26.

Figure 25.
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 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. They also sometimes feed on carrion.

Flying squirrels produce one litter per year, which averages three young usually born in May. These squirrels are generally quite sociable and are 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.

Unit 18

An occasional flying squirrel may occur in the timbered areas in the eastern part of Unit 18, but there are no formal records for this area.

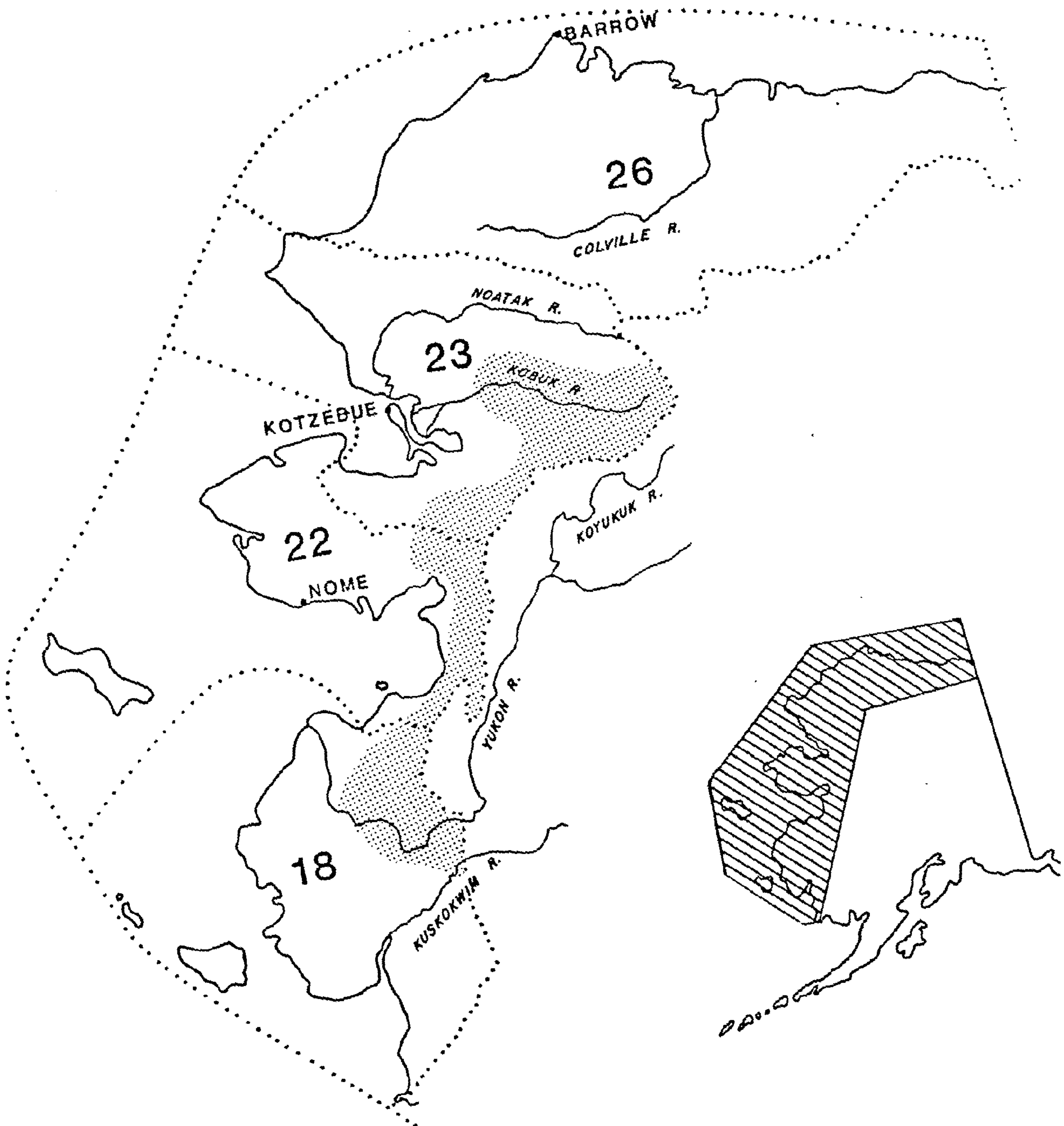
Units 22 and 23

Flying squirrels probably do not occur in these units.

Unit 26

Flying squirrels do not occur in this unit.

Figure 26.
FLYING SQUIRREL



PORCUPINE

Porcupines (Erethizon dorsatum) occur throughout most of Alaska. They are absent or rare on the northern slope of the Brooks Range, the Seward Peninsula, the delta regions of the Kuskokwim and Yukon 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. Occasionally, however, it does 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 16-week gestation period, they produce a single young. Natural predators of the porcupine include wolves, coyotes, fox, lynx and wolverines.

Unit 18

Porcupines occur in this unit in very low numbers. Populations of porcupines have decreased since the 1950's, but the reason for the decline is unknown.

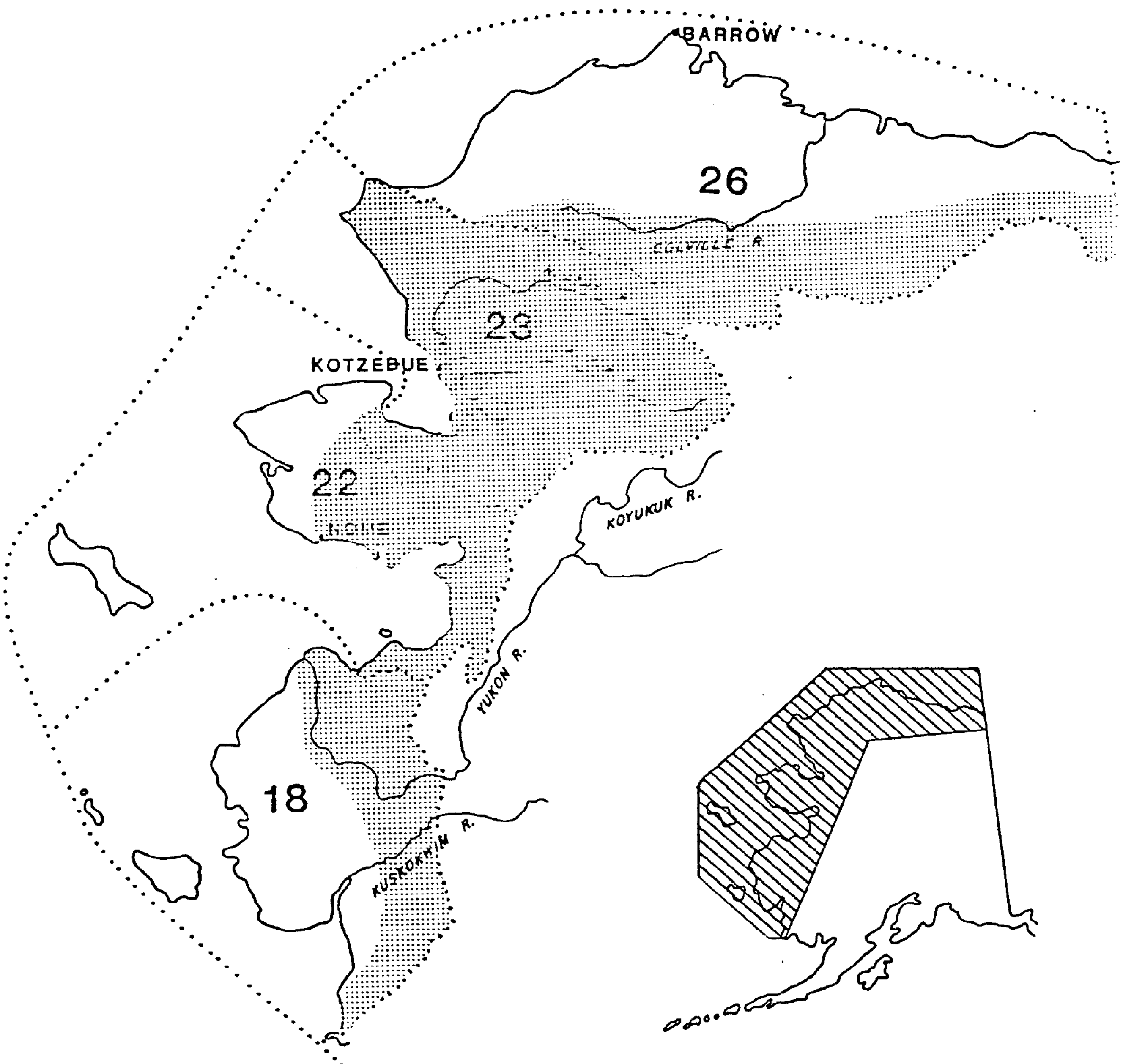
Units 22 and 23

Porcupines occur in the treeless areas of the Seward Peninsula, as well as the timbered areas in Unit 23.

Unit 26

Porcupines are present in the foothills and mountains along water courses where there are stands of willow or balsam poplar. They are not abundant in Unit 26.

Figure 27.
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. They occur 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 sub-alpine areas, brush lands, white spruce-birch communities, black spruce communities and riparian areas. Habitat types most preferred include aspen and birch communities with brushy understories of willow, alder, highbush cranberry and wild rose, and riparian areas with an abundance of willow. 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.

Snowshoe hares generally have two or sometimes three litters per year. They breed for the first time at about one year of age and have 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 occurring 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 18

Snowshoe hares have been relatively abundant along the Kuskokwim River in Unit 18. However, they are currently in a low stage of their cycle.

Many snowshoe hares are harvested when their populations are high. The meat is eaten and sold and the fur is used to make sleeping robes. Hares are also used for dog food and trap bait. Sometimes the pelts are sold commercially to make felt.

Units 22 and 23

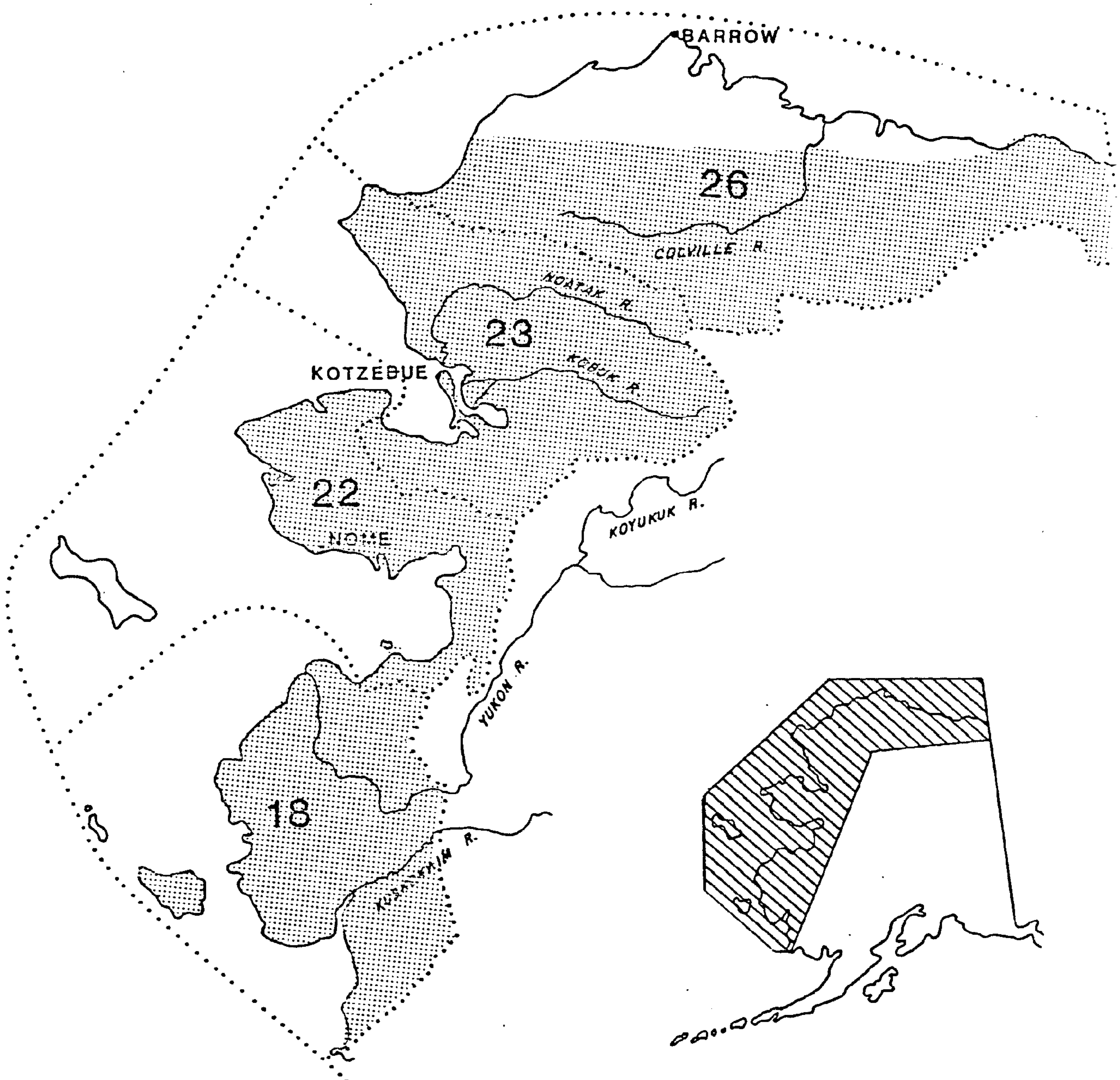
Snowshoe hares occur in these units, particularly in the riparian willow stands along the rivers on the Seward Peninsula in the upper Kobuk Valley. No additional information is available.

Unit 26

Snowshoe hares occur only occasionally in the lower portion of Unit 26. They were observed along the Canning River in 1973 after high population levels occurred in Game Management Unit 25 in 1971 and 1972. It is possible that the high hare populations in adjacent units caused their migration into the North Slope area. They are generally found in willows along major water courses when they do occur in this unit.

Snowshoe hare populations are so scattered and low in Unit 26 that they are not considered important to the hunter and probably have little effect on furbearer populations in the area.

Figure 28.
SNOWSHOE HARE



TUNDRA HARE

The tundra hare (*Lepus othus*) is the less common of the two hare species which occur in Alaska. They are distributed over most of the western coast of Alaska including the Alaska and Seward Peninsulas. They 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 fluctuations in their population numbers occur similar to the snowshoe hare.

Tundra hares have been relatively unstudied. Thus, little information is available on their status in Alaska. Tundra hares appear to feed primarily on low growing tundra shrubs, the most important being willow. 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.

Tundra hares are harvested locally by residents primarily 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 these hares is by herding and killing with clubs or by gun or snare. The statewide harvest is unknown.

Unit 18

Tundra hares are found in Unit 18 in the coastal tundra areas in low to moderate numbers. They are hunted by the natives of this unit who often herd and kill them with clubs. Most are taken for food in the fall, winter and spring. There is no estimate of harvest, but the meat and occasionally the fur are used domestically.

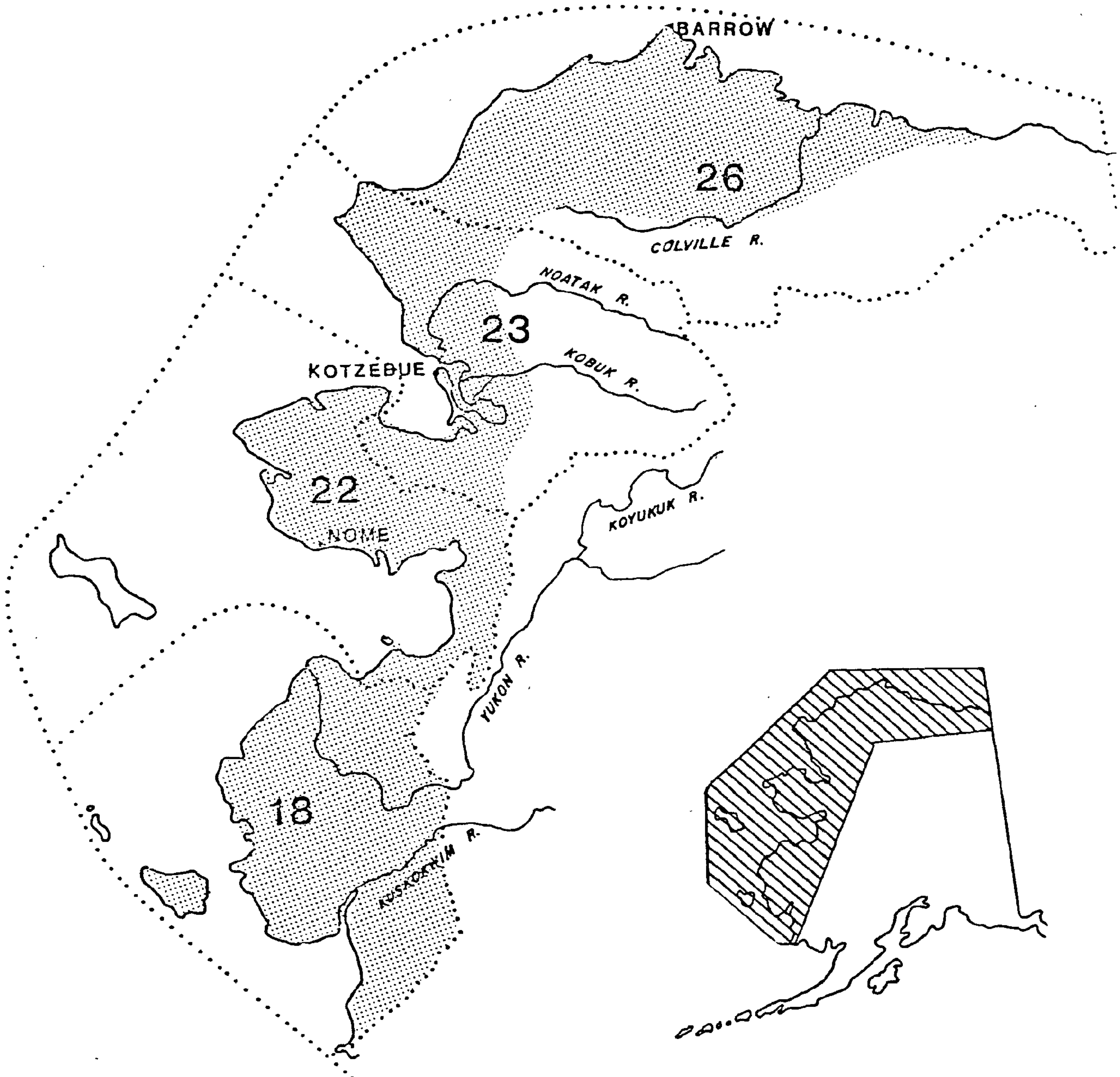
Units 22 and 23

There is little information on tundra hares in these units, but they are apparently relatively abundant at times in some parts of the Seward Peninsula. Most hunting is by local residents for meat, with some small use of the fur. Occasionally sport hunters from the Nome area will hunt these large hares. A regional corporation subsistence survey indicated an annual harvest of over 10,000.

Unit 26

Tundra hares have a very scattered distribution in Unit 26, and probably most occur in the western corner southwest of Point Lay. Little information is available on tundra hares in this unit, but apparently they are scarce or absent on the North Slope of the Brooks Range.

Figure 29.
TUNDRA HARE



WILLOW PTARMIGAN

Willow ptarmigan (Lagopus lagopus) are the most widely distributed species of ptarmigan in Alaska and occur in suitable habitat throughout most of the State. They are absent from several coastal islands and are uncommon in the broad, forested valleys of the interior and the dense forests of southeastern Alaska. Willow ptarmigan breed close to timberline (usually between 2,000 and 2,800 feet elevation), often partially within the fringe of the coniferous forest woodland, along stream courses and in riparian shrub communities. 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.

Willows are the primary source of food of the willow ptarmigan. 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 is mainly confined to the areas around major cities and road systems. The total harvest is greatly influenced by the local density of birds and the abundance of alternative game.

Unit 18

Willow ptarmigan occur throughout this unit. The bulk of the harvest and hunting pressure results from subsistence activities by local residents. A small portion of the harvest is conducted by nonlocal residents incidental to other recreational activities.

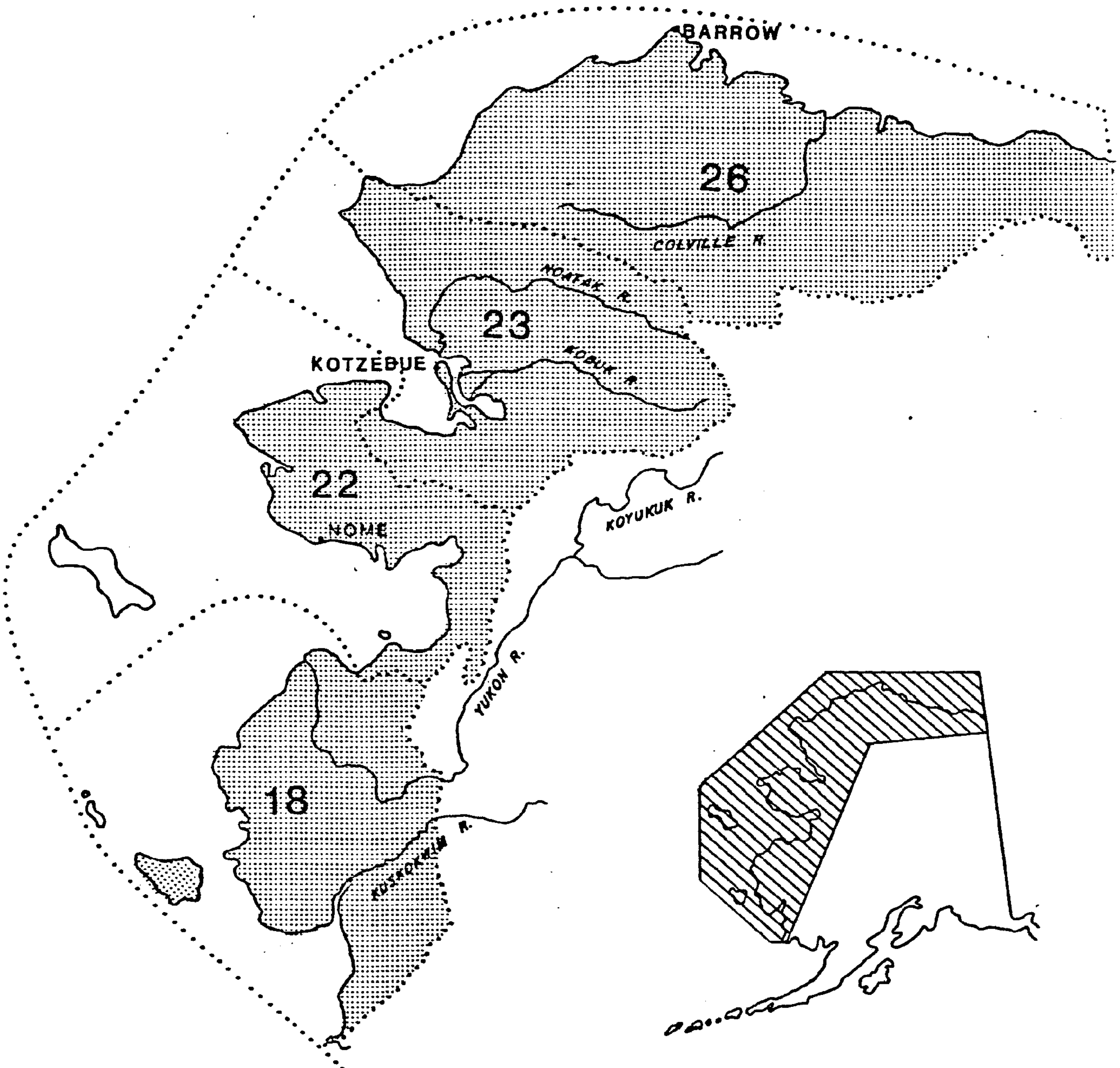
Units 22 and 23

Willow ptarmigan occur in Units 22 and 23 but are absent from St. Lawrence and Little Diomede Islands. In these units, willow ptarmigan are used for recreational and subsistence activities. A small portion of the harvest results incidentally from other recreational activities. A subsistence survey conducted in 1975 indicated a harvest of 18,000 and 12,000 willow ptarmigan in Units 22 and 23, respectively.

Unit 26

Good populations of willow ptarmigan occur throughout this unit when cycles are high. The bulk of the hunting pressure and harvest results from subsistence activities of local residents. A small portion of the harvest occurs incidental to other recreational activities of nonlocal residents. When willow ptarmigan populations are at high levels, they are used extensively for food by natives living in village areas.

Figure 30.
WILLOW PTARMIGAN



ROCK PTARMIGAN

Rock ptarmigan (Lagopus mutus), although not as widely distributed as willow ptarmigan, occur throughout much of Alaska. 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. Preferred breeding habitat of rock ptarmigan includes scattered shrubs and herbaceous vegetation in the mountainous tundra area from timberline to approximately 3,500 feet elevation. Although the range of this species sometimes adjoins that of the willow ptarmigan, rock ptarmigan generally occur in higher elevations which are usually drier and rockier.

During the fall, winter and spring, rock ptarmigan feed almost exclusively on the buds and catkins of dwarf birch. A variety of green herbaceous vegetation, insects, berries and seeds make up most of their diet throughout the summer. 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. Most males move toward the higher ridge tops once incubation is in progress. By late August, females and chicks also move to higher elevations where they join the males in large flocks. Females move down to lower elevations near the forest edge during late September, 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.

Unit 18

Rock ptarmigan occur in Unit 18 but are absent from Nunivak Island and the lowland areas along the lower Yukon and Kuskokwim Rivers. When these birds are abundant and available, they are used extensively by local residents for subsistence purposes. A small portion of the harvest results incidentally from other recreational activities.

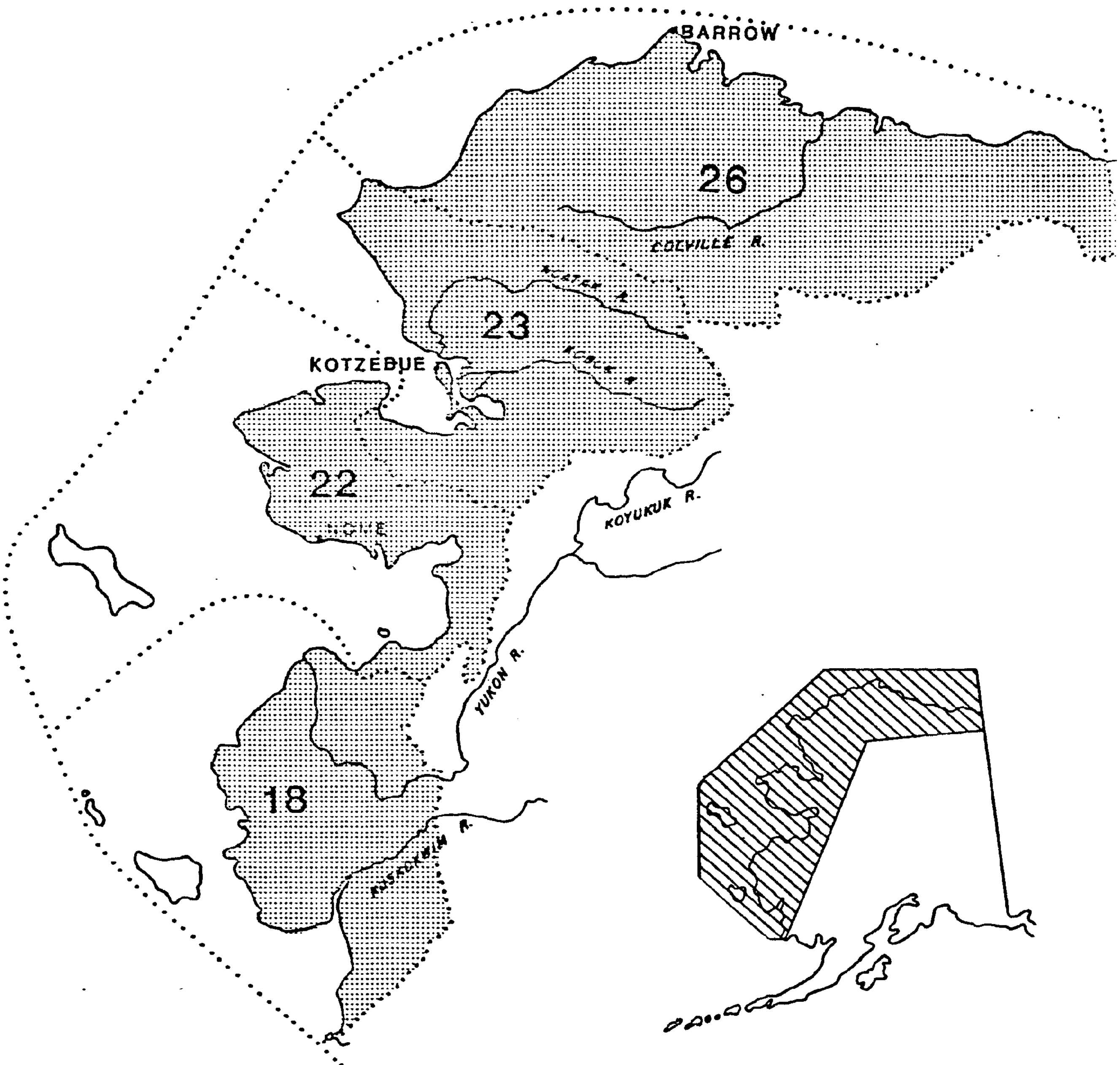
Units 22 and 23

Rock ptarmigan occur in Units 22 and 23 but are absent from St. Lawrence Island. When these birds are abundant and available, they are used extensively by local residents for subsistence purposes. A small number of birds are harvested by nonlocal residents incidental to other recreational activities.

Unit 26

Rock ptarmitan occur throughout Unit 26 except in the lowlands of the Arctic coastal plain. When abundant and available, rock ptarmigan are used extensively by local residents for subsistence purposes. A small portion of birds are harvested by nonlocal residents incidental to other recreational activities.

Figure 31.
ROCK PTARMIGAN



SPRUCE GROUSE

Spruce grouse (Canachites canadensis) occur throughout most of the forested portions of Alaska. 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 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 18

Most spruce grouse harvested in this unit are taken along the Yukon and Kuskokwim River systems and are primarily used for subsistence purposes by local residents. A small harvest results incidentally from recreational activities of nonlocal residents. The spruce grouse population in this unit is recovering from a cyclic low experienced in the early to mid-1970's. Feathers from harvested birds are used for decorative purposes by natives, as well as for bait for trapping mink and marten.

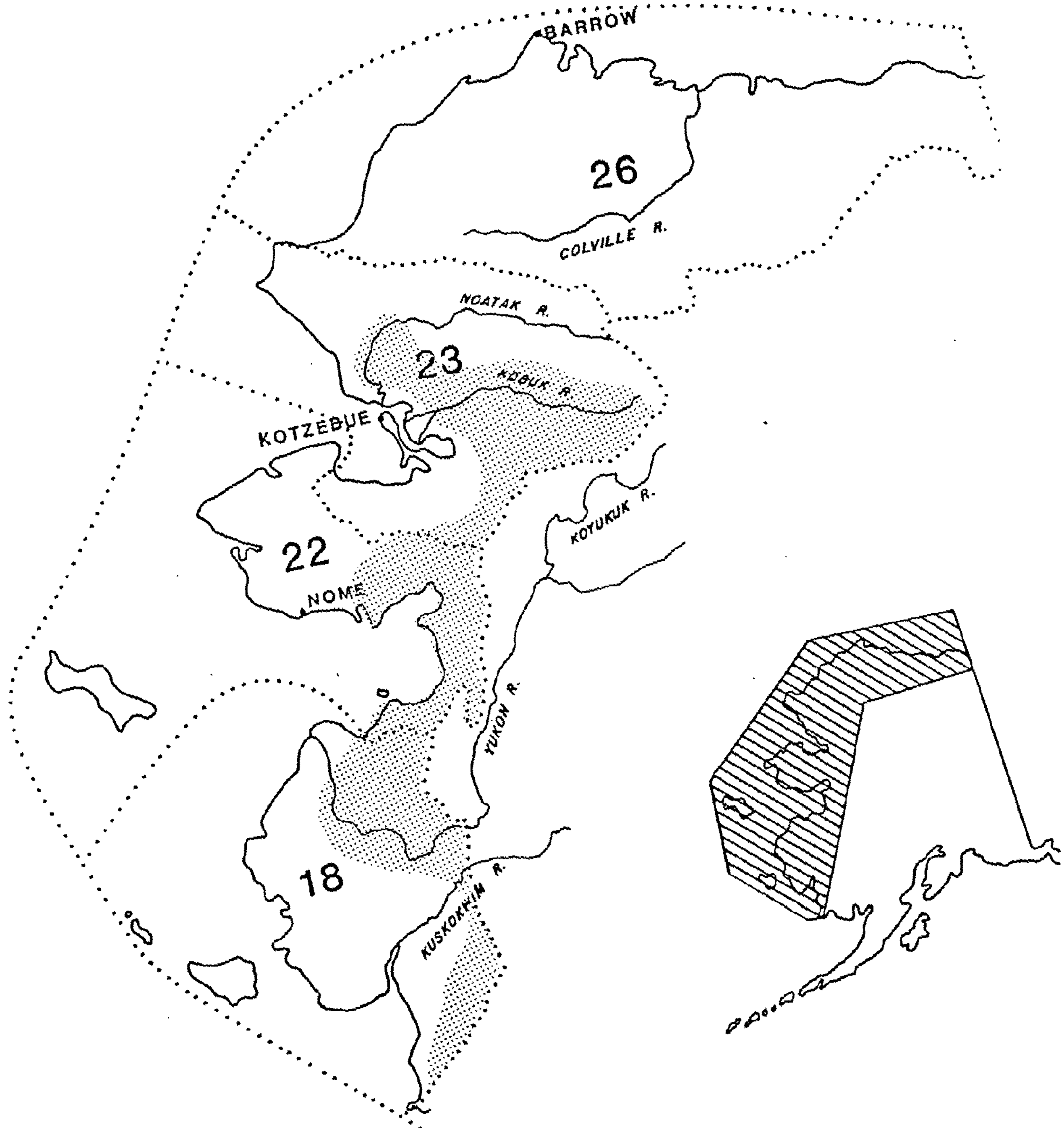
Units 22 and 23

Spruce grouse are taken from along the southeastern side of the Seward Peninsula and along drainages of the Noatak and Kobuk River systems. Spruce grouse harvested in these units are primarily used for subsistence purposes by local residents. A small harvest also results incidentally from recreational activities of nonlocal residents.

Unit 26

Spruce grouse do not occur in this unit.

Figure 32.
SPRUCE GROUSE



FURBEARERS - SMALL GAME - UPLAND GAME

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MARINE MAMMALS

The Bering and Chukchi Seas comprise one of the richest areas in the Northern Hemisphere in terms of biological productivity, even surpassing many places in the tropics. Nutrient-rich water from the Yukon River is distributed throughout the Bering and Chukchi Seas by prevailing northerly currents, providing the nutrient basis for supporting a myriad of marine organisms in a complex food web. These nutrient-rich waters usually do not extend east of Barrow, although the Colville and Makenzie Rivers contribute significant material. The productivity of the Beaufort Sea is comparatively low. At the upper trophic levels are a variety of marine mammal species whose total number is conservatively estimated to exceed two million animals. Principal species found in the area during some time in their annual cycle are sea lion, walrus, polar bear, fur seal, four species of ice-associated phocid seals (ringed, bearded, spotted and ribbon), bowhead, grey, minke and belukha whales, as well as other less numerous species of whales and porpoises.

To some extent all species are seasonally migratory, usually moving north in the spring to occupy previously "virgin" feeding areas and then retracing their path in the fall to suitable winter habitat in warmer southern waters. Distribution and numbers of marine animals are continually shifting. The Bering Sea supports more animals in the winter and the Chukchi Sea receives the most intensive use during the summer.

The diversity and large numbers of marine mammals were a contributing stimulus to the exploration and settlement of western and Arctic Alaska beginning in the early 1700's. The history of early utilization is one of unchecked exploitation rather than conservation. Many species were reduced to low numbers, particularly whales and walruses, and some species were extirpated in local areas. Within the last 50 years, most have become abundant following reduced harvests and better protection. The number of ringed, harbor and bearded seals, whose populations were never heavily exploited, has remained relatively stable through the years.

Residents living along the northwestern Alaska coast traditionally have depended on marine mammals for their essential domestic needs. Although Eskimo cultures have changed markedly in the last few decades, marine mammals still play an important role in the local economy. They are used for food and provide a variety of raw products for the arts and crafts industry.

Passage of the Marine Mammal Protection Act in 1972 limited all marine mammal hunting to Alaska Natives and imposed a moratorium on non-native users. The Act remains in effect today, but restrictions on use are being reviewed on a species by species basis as each marine mammal population is fully enumerated and proposed use is justified biologically. In April, 1976, walrus became the first species for which management authority was returned to the State of Alaska and for which use by non-natives was again allowed. In the future, other marine mammals of the area may be used in more diversified ways.

The problem of environmental contaminants and their impact on the marine ecosystem is a major concern for all species of marine mammals and will certainly become more critical as resource development progresses in the north. The threat posed by petrochemical pollution resulting from the exploration, extraction and transportation of oil and natural gas is of primary concern. Marine mammal populations may be seriously impacted by reduction of primary production and its effects on marine food webs, by direct losses of invertebrate and vertebrate food species, by direct ingestion of toxic substances and by loss of insulative quality of fur. Other contaminants have entered the northern marine ecosystem, primarily from sources outside of Alaska. Significant accumulations of several pesticide residues and of mercury have been detected in several species of marine mammals. The effects of these contaminants on marine mammals are unknown. Based on the observed effects on humans, the impact could be very serious. All resource development and utilization with the potential for contamination of the marine ecosystem must be carefully regulated to minimize introduction of pollutants and consequent effects on marine food systems. Use of pesticides and industrial waste processing in Alaska must also be closely controlled.

Several species of marine mammals compete with man for fisheries resources. To date, such competition has taken the form of depredations on netted fish and also has resulted in the destruction of some fishing gear. Conflicts between fishermen and marine mammals are likely to increase as human utilization of fisheries intensifies. Reduction of fish stocks is certain to impact populations of marine mammals which are approaching or have achieved carrying capacity levels. Development of new or expanded fisheries will affect some species not now impacted. The reverse is also true; levels of human utilization of fisheries may be limited by intensive use of fish stocks by marine mammals. Since affected species of marine mammals are limited to shallow waters in their foraging activities, much potential conflict may be eliminated by zoning certain commercial fishing activities to deeper waters. In some situations, conflicts may require reduction of some marine mammal populations in specified areas.

Human activity, including movement of people, operation of equipment or harassment by low-flying aircraft, can result in desertion of traditional haul out areas. Of particular importance is disturbance during critical pupping periods which can result in abandonment of pups. Areas of importance to marine mammals for hauling out or pupping need to be protected by regulations which will minimize disturbance.

Coastal residents do not depend on marine mammals to the extent they once did. Nevertheless, it is necessary to recognize that a partial subsistence economy still exists, of which marine mammals are an integral part. Management programs must be designed to insure that marine mammals are allocated in sufficient numbers to satisfactorily meet subsistence requirements.

Marine mammals occurring in the Bering-Chukchi Sea are harvested by several foreign countries whose management policies may differ from those of the United States. If marine mammal species are to be managed on a truly comprehensive, coordinated basis, international cooperative agreements will have to be formulated between all parties concerned.

WALRUS

Historically, the Bering, Chukchi, Beaufort and east Siberian Seas supported about 200,000 walruses (Odobenus rosmarus). They were first hunted heavily on a commercial basis by whalers, starting around 1868. At one point in the early 20th century there may have been less than 50,000 walruses remaining in the population. Following cessation of commercial hunting at the turn of the century and increased protection in the 1960's, the walrus population increased significantly. Today it is estimated at 200,000 animals. Despite an apparent decline in productivity and an annual Soviet-American kill in excess of 5,000, the population seems to be increasing slowly.

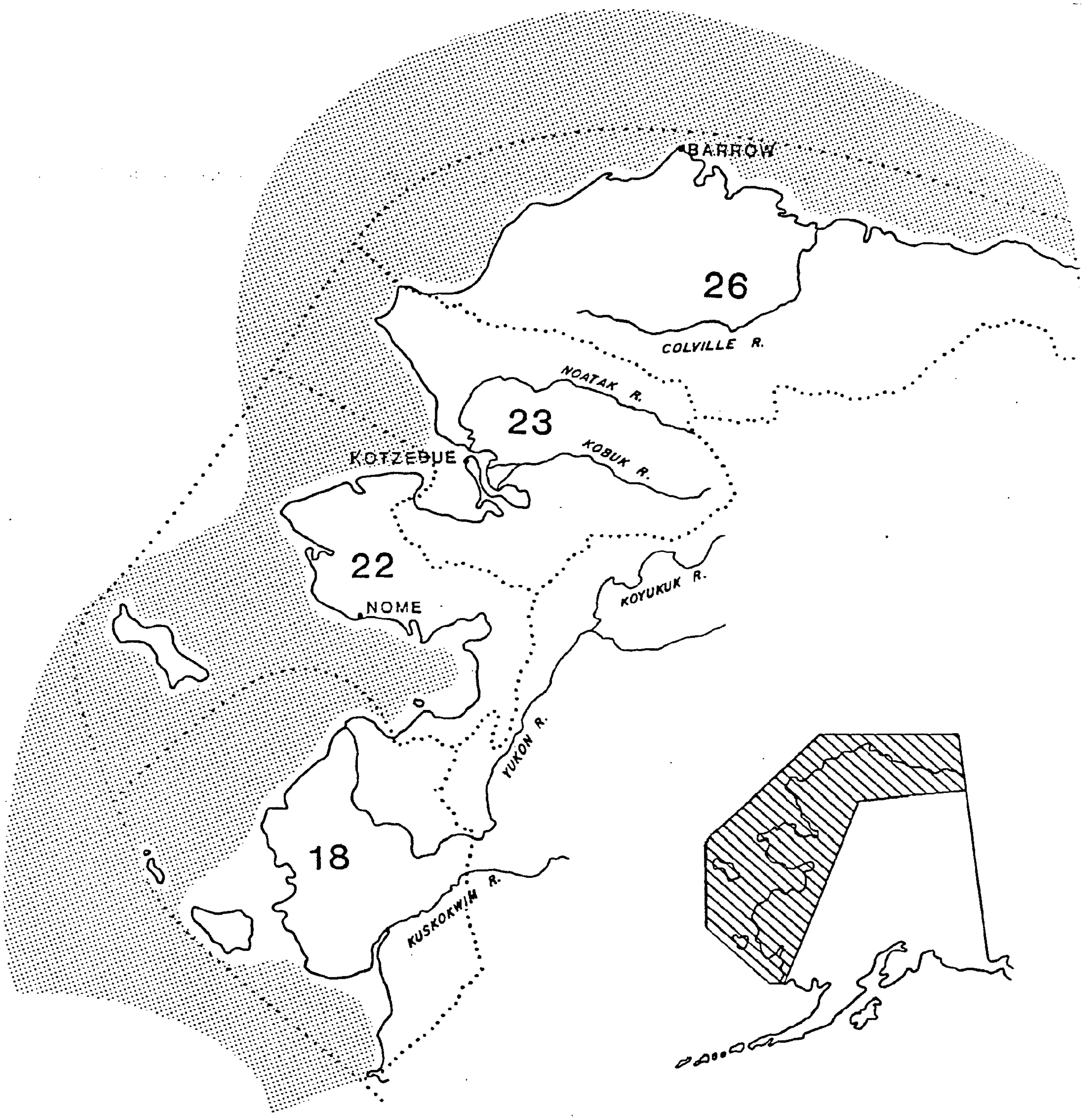
Wintering largely in the central and northwestern Bering Sea, generally many miles from the Alaskan mainland, the majority of the population begins a northward migration in late March and April. Females with young are usually in the vanguard, followed later by bulls and barren cows. The height of the nursery herd migration enters the Bering Strait in late May and early June and reaches the northern Chukchi Sea by mid-July. Most of the bulls pass into the Chukchi Sea by the last of June. Most of the population goes west along the Soviet coast, and the remainder moves northward toward Point Hope. Eventually the walruses disperse along the southern polar ice in the east and frequently congregate in large herds on land in the west. Some travel into the Beaufort Sea as far east as the Canadian border. In September or early October the most northern migrants begin moving south. Walruses arrive near St. Lawrence Island in November. Some walruses remain in the Bering Sea, particularly in Bristol Bay and the Gulf of Anadyr, throughout the summer months.

The annual retrieved harvest of walruses by Alaskans has averaged about 1,600, but has shown a marked increase since passage of the Marine Mammal Protection Act which eliminated protective measures on females. Because most of the walrus population funnels through the Bering Strait, villages in that vicinity often take more than one-half of the annual harvest. The villages that are consistently successful (Gambell, Little Diomede, Savoogna and Wales) usually take 100 or more animals each. The residents of Arctic Alaska kill only about 100 walruses a year because most communities satisfy their sustenance needs from whaling. Also, walruses disperse rather widely in the northern Chukchi and Beaufort Seas and are not always accessible.

Walruses are used for human consumption, dog food, boat coverings and rawhide. Today the most important use of walruses in many communities is as a source of raw ivory for carvers. Often the sale of carvings may contribute more than 50 percent of the cash in the local economy.

Prior to 1972, guiding of sport hunters was a means of providing extra cash in some villages. In the future, sport hunting may become more important. In April, 1976, the U.S. Fish and Wildlife Service waived the moratorium on walruses established by the Marine Mammal Protection Act and returned management to the State of Alaska. Under State regulations, non-natives are eligible to take walruses on a permit basis.

Figure 33.
WALRUS



BEARDED SEAL

Exact determination of the size of the bearded seal (*Erignathus barbatus*) population is difficult because like other ice-associated phocid seals they are widely distributed and difficult to enumerate.

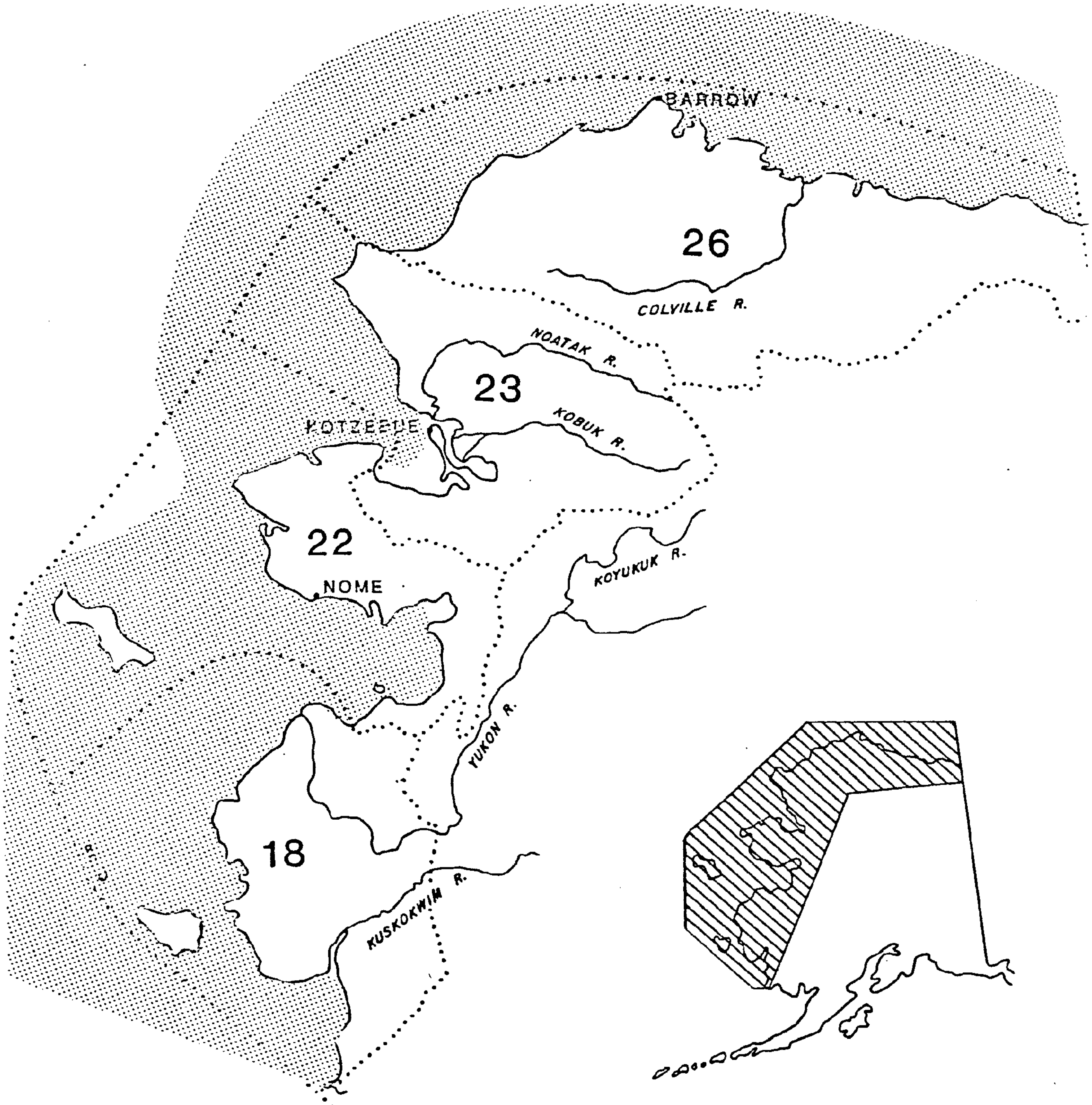
The population currently appears to be stable and near carrying capacity. The total Bering Sea-Arctic Ocean population is estimated to be 300,000. Soviet estimates place the population at over 450,000 bearded seals, including the entire Pacific population.

Adult bearded seals rarely venture far from ice, but juveniles often remain in ice-free areas during the summer. In late winter and early spring, bearded seals occur from the southern edge of the ice pack in the Bering Sea north to the solid cover of the polar pack ice. Most, however, are south of the Bering Strait. Seldom do they use shore-fast ice. They prefer the moving pack ice and undertake a general movement away from land with the onset of winter. Bearded seals commonly haul out on ice, but do not normally come ashore. As the ice disintegrates and moves northward, bearded seals follow its retreat and by late summer are distributed along the edge of the polar pack ice. Most of the population summers along the southern edge of the polar ice pack. They move south in the fall and usually enter the Bering Sea, starting in November. Because they prefer bottom dwelling organisms such as crabs, shrimps, clams and amphipods, bearded seals do not compete with man for commercially valuable fishes, crustaceans or mollusks.

The crude birth rate for bearded seals is 22 percent. Annual recruitment to age one is at least half this figure. Conservatively, the population probably can withstand a harvest of six to seven percent per year, or about 18,000 seals. Present take by Soviet and Alaskan hunters is about 4,000 bearded seals, but hunting loss is high and the true kill is probably more than double the number actually retrieved. The population appears to be stable, indicating that the total annual mortality, including harvesting, is about equal to recruitment.

Because of their large size, high quality meat and blubber and strong, durable skin, bearded seals have always been important in the economy of coastal residents. In the last few years many changes have occurred in the Eskimos' way of life as they move closer to a cash oriented economy. The necessity for taking marine mammals has decreased, but hunting bearded seals is a tradition still pursued with enthusiasm in many communities. After spring whaling, hunters in northwestern Alaska look forward to the "oogruk" season, hoping to acquire enough meat to last them through the entire year. The annual harvest from this area is 1,500 seals or less. Shishmaref, Gambell, Savoogna, Stebbins, Kotzebue, Wainwright and Pt. Lay are villages which generally take the most bearded seals and are most dependent on their meat. Shore-based hunting is not likely to seriously affect population status. The greatest threat to the security of bearded seals stems from environmental pollutants which result from offshore mineral and energy resource development.

Figure 34.
BEARDED SEAL



HARBOR SEAL

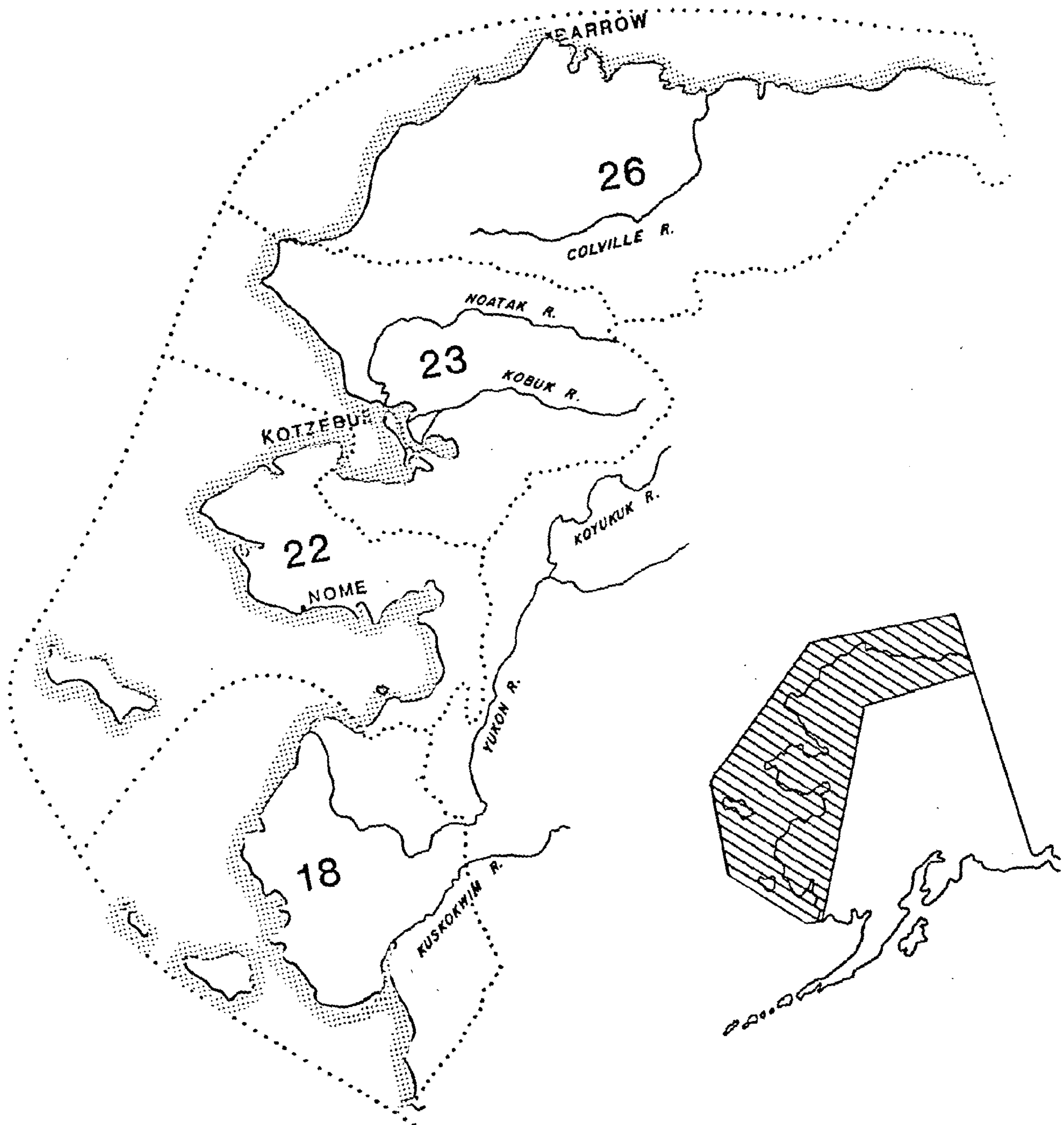
Harbor seals (Phoca vitulina largha) are found seasonally from the Aleutian Islands north to the Beaufort Sea. Their population is estimated at 200,000 to 250,000 individuals, but the census technique is based largely on indirect methods. Soviet biologists feel the actual number is closer to 450,000, including the population of the Okhotsk Sea.

Harbor seals are seasonally dependent upon sea ice for the birth and nurturing of their pups. Prior to parturition in late winter, the entire population inhabits the southern edge of the pack ice, usually in the central Bering Sea. As spring breakup progresses, most seals follow the northward retreat of the pack ice and gradually move toward land (including islands) where intermittent rest and feeding may occur. During the ice-free summer and early fall, they are found along the entire coast of northern Alaska. A substantial portion of the population spends all or part of the summer in northern waters. With the approach of winter they begin moving south, usually preceding the formation of heavy pack ice. Most of the population winters outside northwestern Alaska waters in the southern Bering Sea.

Diet of the harbor seal varies, depending on season and location. Primary food species are pelagic, demersal and anadromous fishes. Because harbor seals often feed on fish sought for commercial purposes, notably salmon, problems have occurred with fishermen who compete for the same resource. Due to their migratory nature, the impact of harbor seal predation is minimized somewhat when the seals move north in the late spring. Natural mortality among adults is probably low. They are infected by a variety of internal and external parasites, but the effects of this form of pathology are unknown. Some harbor seals are undoubtedly taken by killer whales and polar bear, but hunting by humans is probably the greatest single mortality factor.

The annual harvest of harbor seals by both American and Soviet hunters is 7,000 or less, more than one-half of which are taken by the Soviets. Annual gross recruitment to the population is about 25 percent. Seven to eight percent would constitute a safe level for a sustained yield harvest of up to 17,500 harbor seals annually. Since a large portion of the population winters south of Norton Sound, residents of northwestern and Arctic Alaska seldom have the opportunity to take harbor seals until the spring migration. About half the harvest occurs during June and July when the seals are moving north, and the remainder are killed in the fall migration, usually during September and October. Harbor seals are considered less palatable than ringed or bearded seals and are usually used for dog food. The skins are often made into pokes (floats) and are also prized for making garments. Harbor seals were eagerly sought in the 1960's when fur prices were high and the State offered a bounty. The harvest then was two to three times its present level. A reduction in the price of seal skins and passage of the Marine Mammal Protection Act greatly reduced the harvest.

Figure 35.
HARBOR SEAL



RIBBON SEAL

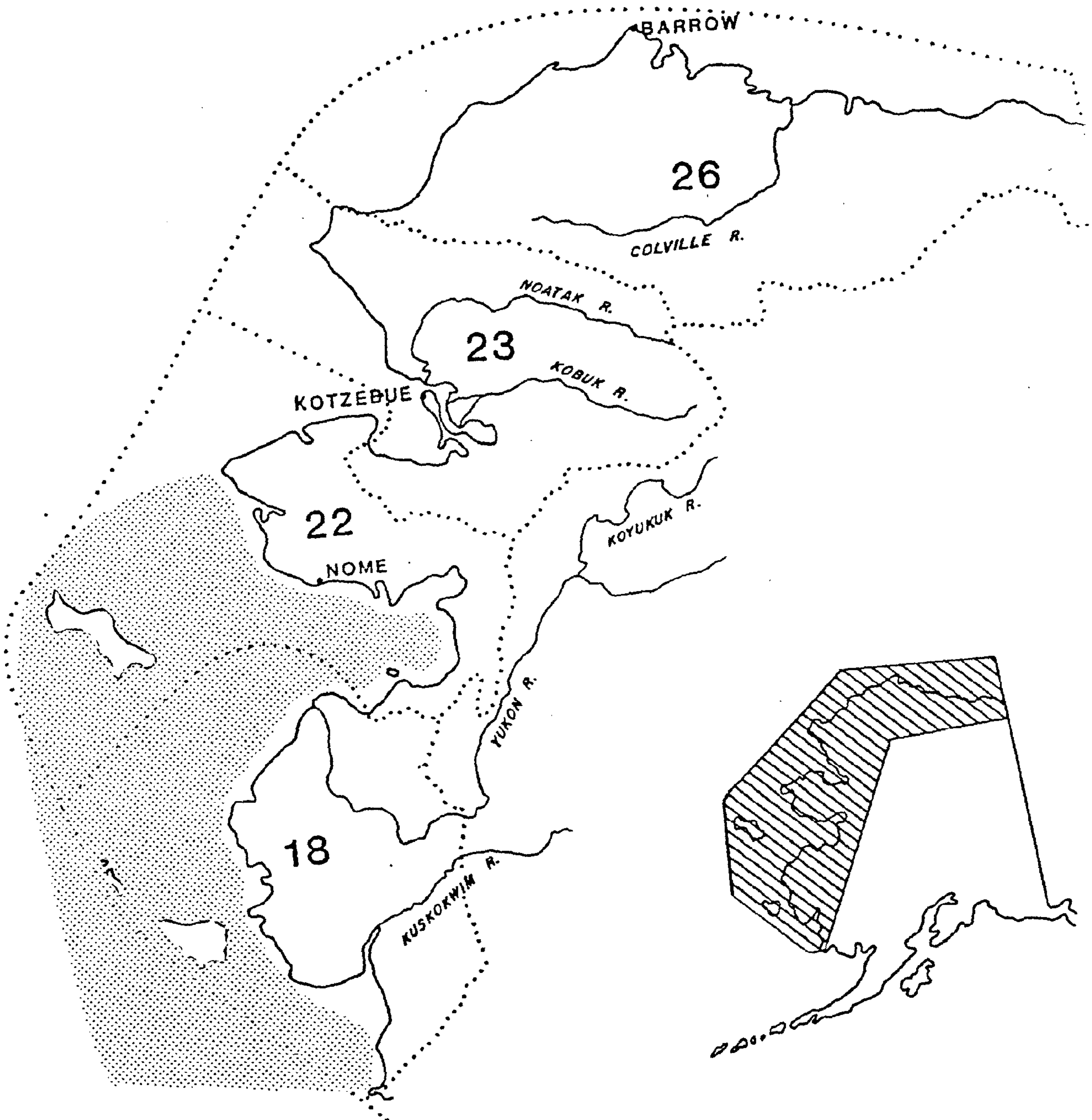
Ribbon seals (Histriophoca fasciata) are distributed in two groups, one in the Bering-Chukchi Sea and the other to the west near Russia in the Sea of Okhotsk. Due to the lack of physical barriers, there is probably some degree of interchange between the two populations, but to what extent has not yet been determined. No satisfactory method of accurately censusing ribbon seals has been developed to date. Based on relative indices of abundance, the Bering-Chukchi Sea population of ribbon seals is currently less than maximum; this results from a brief period of intensive commercial exploitation by Soviets during the 1960's. Recovery has taken place due to the implementation of restrictive quotas, and recent estimates indicate the population is now between 80,000 and 100,000 seals.

Ribbon seals are seasonally pelagic but depend on the sea ice for the birth and nurturing of their pups. In the late winter and early spring, the entire population is concentrated along the southern edge of the pack ice in the Bering Sea. Following spring breakup of ice there is a moderate movement north associated with dispersal of the pack ice. Few seals pass north of the Bering Strait, however, as most remain in the Bering Sea during the summer. The principal foods are pelagic and demersal fishes but also include small marine organisms such as shrimp.

Although ribbon seals were hunted extensively by the Soviets for their skins, they have played a minor role in the Alaskan economy. Due to their pelagic nature and limited distribution, the annual harvest of ribbon seals seldom exceeds 100 animals in northwestern and Arctic

Alaska. Because of their distinctive markings, most ribbon seals are used for clothing, the meat usually being of secondary importance. Since the population is relatively low and their distribution does not favor an extensive shore-based harvest, it is unlikely these seals will be taken in large numbers by Alaskan hunters in the near future. However, increased commercial sealing by foreign governments could again depress the population. The main threat in the immediate future seems to be environmental pollution from the development of offshore mineral and energy resources.

Figure 36.
RIBBON SEAL



RINGED SEAL

Ringed seals (Pusa hispida) are the most widely distributed ice-inhabiting seal of Arctic and sub-Arctic Alaska. Although population status is difficult to determine exactly, their habit of utilizing land-fast ice and their behavior of hauling out on ice during the long spring days helps determine relative abundance. The population appears to be high and stable and is estimated to contain a minimum of 250,000 animals in areas of land-fast ice alone. The total ringed seal population of the Chukchi and Beaufort Seas exceeds one million.

In northwestern Alaska most of the ringed seals are found in areas covered by extensive land-fast ice in winter, although it is not uncommon to find juveniles anywhere in ice covered areas. Ringed seals migrate in the spring following the retreat of the pack ice. Except for some juveniles, most seals spend the summer in the northern Chukchi Sea and may travel over 600 miles to reach it.

The diet of ringed seals is variable, depending on season, location and depth of water, but the predominant items consumed are zooplankton in the form of mysids, amphipods, euphausids and shrimps. They seldom compete with man for food, but commonly take small fish such as saffron cod, polar cod and sculpin.

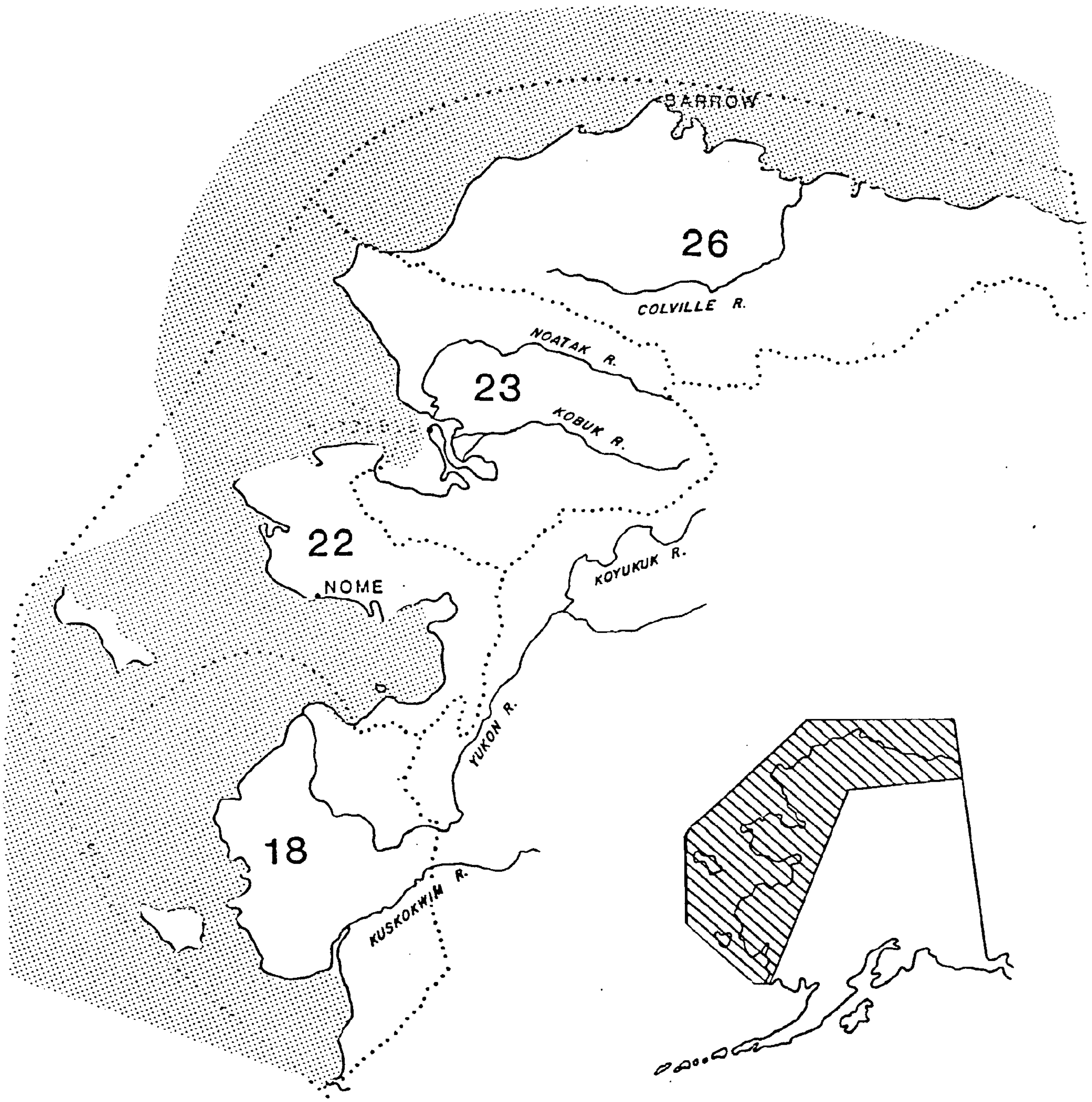
Recent harvests by Alaskan hunters have been around 5,000 seals annually, and the total harvest, including the Soviet kill, is estimated to be between 8,000 and 10,000. Annual gross recruitment to the population is about 25 percent. Seven to eight percent would constitute a safe level for a sustained yield harvest.

Because ringed seals are seasonally the most numerous species of seal, they are the mainstay in the diet of coastal Eskimos. While archaeological evidence points to the reliance of many Eskimo settlements on a diversity of marine mammals, ringed seals were probably the key element in supporting people during winter. Ringed seals provided not only meat, but also oil for heat and light and skins for warmth. Since coastal residents have adopted a cash oriented economy and are now able to obtain non-native food through the winter, the importance of ringed seals has decreased. The harvest is only one-half to one-third of what it was in the early 1950's.

Today seals are used mainly as a food and clothing supplement. Only in a few communities such as Gambell, Savoonga and Point Hope is there a concerted effort to hunt them in winter, and most seals are taken in spring when weather conditions are better. Of the four species of seals taken in northwestern and Arctic Alaska, ringed seals account for more than half the annual harvest.

To date, man has not altered ringed seal habitat greatly. While some contamination of food webs by pesticides and heavy metals has been documented, the effects have apparently been minimal and probably have not altered carrying capacity of habitat in recent years. However, offshore development of mineral and energy resources is imminent. Unless the proper environmental restraints are exercised, serious problems could develop which would have a marked impact upon the ringed seal population.

Figure 37.
RINGED SEAL



WHALES

The coastal waters of Alaska are frequented by a number of whales, porpoises and dolphins. Several of the large whales enter into the sustenance of certain arctic communities, but information on the degree of utilization is not available. Miscellaneous observations on cetaceans are included here only to indicate their presence and possible relative abundance.

Belukha (*Delphinapterus leucas*)

The belukha whale, or white whale, has traditionally 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 the animals periodically ascend. The demise of the sled dog as a result of the introduction of the snowmachine and the availability of alternate commercial food sources through the development of a cash economy and welfare measures such as food stamps have greatly reduced the demand for belukha products. This is particularly true in the southern portions of the belukhas' range. From Norton Sound north, belukhas are still taken regularly in some communities.

Brooks (1954a) estimated that Alaskan Eskimos utilize at least 200,000 pounds of belukha flesh annually. Lensink (1961) estimated an annual harvest of 400 to 500 animals. Today, the estimated annual harvest for the Bering Sea-Arctic Ocean coasts is 150 to 300; very few belukhas are still taken in Cook Inlet (Alaska Department of Fish and Game, 1973).

Belukhas have been studied more intensively in Bristol Bay than in any other area of Alaska. These belukhas appear to be resident and the population of 1,000 to 1,500 individuals is considered stable. The degree of interchange between this population and that of the northern Bering Sea, if any, is not known.

Belukhas north of Bristol Bay appear to spend the summer in ice-free portions of the northern Bering Sea and Arctic Ocean, concentrating in shallow areas and estuaries and then, as the more northern bays freeze, migrating to portions of the Bering Sea that are either ice-free or contain abundant leads. The actual distribution may vary from year to year or week to week as ice conditions change. Belukhas wintering in the Bering Sea may include animals that spend the summer in the western Canadian Arctic and eastern Siberian Arctic. The size of this northern population is unknown, but it is certainly much greater than that residing in Bristol Bay.

The ecology of the belukha 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 belukhas significantly influence some fish populations. The relationship between belukhas and red salmon has been studied in some detail in Bristol Bay where commercial fishermen feel that belukha predation is a significant factor influencing red salmon runs. Studies indicate that large numbers of salmon smolt are eaten by belukhas as the salmon migrate to the sea in concentrated schools and that a lesser number of adult salmon are eaten as they ascend the rivers to spawn. The importance of this predation depends on the size of the salmon run and how predation by belukhas is viewed in relation to other mortality factors. A conflict does exist, however, between belukhas and the commercial fishing industry in Bristol Bay and perhaps in several other areas.

Bowhead Whale (Balaena mysticetus)

All bowhead whale populations were decimated by the end of the 19th century because of the great value of this species for oil and baleen. No commercial whaling for bowheads has taken place since about 1915. Bowhead whales have been completely protected from commercial whaling by the International Convention for the Regulation of Whaling since 1947 and, subsequently, by the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. These Acts allow for a subsistence harvest of these whales by the Indians, Aleuts and Eskimos. In the last two decades, the take of bowhead whales by Eskimos in Alaska has varied between 1 (1959) and 48 (1976) (Marquette, 1977). Much of this variation in take is because of variation in hunting conditions, although in recent years an increase in hunting intensity may have taken place. Pt. Hope, Gambell and Savoonga are the most successful whaling communities.

Human activities such as those related to the North Slope oil project might alter the inshore southward migration should fall boat and barge traffic increase to force the whales farther offshore. Some conflict of interest may exist between people who would like complete protection for bowhead whales and Eskimos who hunt these whales.

Humpback Whale (*Megaptera novaeangliae*)

The humpback whale was important, especially to shore stations, during the first half of the 20th century. Now, however, this mammal is so scarce that it will require a half century of complete protection for it to increase to a significant level.

The original population size in the North Pacific Ocean is unknown but is now severely depleted to about 1,200 individuals (Wada, 1972). The population has apparently not increased since complete protection was given the species in 1966.

Table 11.
Harvests of marine mammals in Alaska, 1968-1972. These harvests include only species on which there was a commercial or sport hunt, but the data include subsistence take whenever that occurred 1/.

	1968	1969	1970	1971	1972	5-year Average
Sport Hunted Species:						
Polar Bear 2/	351	298	316	203	265	287
Walrus 2/	1,436	882	1,442	1,915	1,325	1,396
Commercially Hunted Species:						
Sea Lion 3/4/	4,118	5,208	6,075	3,314	6,924	5,128
Harbor Seal 2/5/	8,000	10,000	10,000	10,000	12,000	10,000
Experimentally Harvested Species:						
Sea Otter 6/	1,016	251	1,088	183	57	519

1) Data supplied by A.D.F.&G.
2) Includes some subsistence take.
3) Almost totally pups.
4) Estimated harvest.
5) Includes both pups and adults.
6) Includes sea otters transplanted, harvested by A.D.F.&G. and accidental mortalities. The 1971 figure does not include an estimated 1,000 to 1,350 otters at Amchitka Island by nuclear test "Cannikin."

Table 12.
Estimates of current takings of marine mammals in waters off Alaska allowed under provisions of the Marine Mammal Protection Act of 1972*.

Species of Marine Mammals

Purpose of Taking	Polar Bear	Sea Otter	Walrus	Sea Lion	Harbor Seal	Largha Seal	Ribbon Seal	Ringed Seal	Bearded Seal	Beluga Whale
Scientific Research 1/	--	20	10	60	170	30	20	50	20	45
Public Display 2/	--	--	10	--	8	--	2	2	4	--
Native Subsistence 3/	50	--	1,650 4/	--	500	2,750 5/	250 5/	10,500 5/	1,500 5/	180
Fishing Operations 6/	--	5	--	2,350	2,800	75	75	75	75	20
Totals	50	25	1,670	2,140	3,478	2,855	347	10,627	1,599	245

* From E.I.S. - consideration of a waiver of the moratorium and return of management of certain marine mammals to the State of Alaska, U.S. Dept. of Commerce and U.S. Dept. of Interior, 1975.

1) Actual requests with some interpolation (control files of NMFS and FWS).
2) Estimated from averaging 1973-1974 requests with some interpolation (control files of NMFS and FWS).
3) Includes 30 bowhead and 2 gray whale.
4) Does not include an estimated 50% to 60% of the kill which is not retrieved.
5) The higher estimate of 15,000 ice seals is used even though the actual harvest in 1973-1974 may be closer to 6,000.
6) The estimates provided by United Fishermen of Alaska for takings incidental to domestic fishing operations.

Table 13.

The 1971 and 1972 harvest of hair seals in northern Alaska.

Village	Reported Seal Harvest 1965 1/	Village Population 1970 2/	Reported Harvest 1971	Estimated Seal Harvest 1971 3/	Estimated Seal Harvest 1972 3/
Platinum	0	55	0	20	0
Goodnews Bay	0	218	0	200	100
Quimhagak	0	340	0	150	100
Eek	0	186	0	150	150
Tuntutuliak	0	158	0	100	75
Kwigillingok	0	148	0	100	75
Kipnuk	0	325	0	185	100
Chefornak	0	146	0	125	100
Nightmute	0	127	0	80	50
Mekoryuk	1,332	249	10	1,000	800
Toksook Bay	0	257		100	100
Tununak	0	274	0	400	300
Hooper Bay	1,046	490	269	1,400	1,200
Chevak	629	387	87	300	150
Scammon Bay	319	166	0	200	150
Alukanuk	0	265	0	70	50
Kwiguk (Emonak)	0	439	0	15	15
Stebbins	401	231	0	250	150
St. Michael	0	207	0	100	75
Unalakleet	173	434	20	300	300
Shaktoolik	321	151	0	300	200
Koyuk	172	122	9	150	150
Elim	0	174	0	150	150
Golovin	230	117	38	50	50
White Mountain	0	87	42	50	30
Solomon	0	7 4/	0	25	15
Nome	815	2,488	67	250	250
Gambell	893	372	888	1,200	800
Savoonga	621	364	708	1,500	1,000
Northeast Cape	0	12 4/	0	20	0
Teller	320	220	204	350	200
Brevig Mission	729	123	182	350	200

continued

1) No seals were bountied from several villages in the Yukon-Kuskokwim Delta due to absence of a bounty agent, or lack of information about the bounty.
2) Village census figures (with exceptions of Solomon and Northeast Cape) from Federal Field Committee for Development Planning in Alaska, Anchorage, 1971.
3) Estimates based on known seasonal harvests at some villages, reports of interested residents, and estimates by investigators residing in or visiting various villages.
4) Estimated human population in 1970.

Table 13
(continued) The 1971 and 1972 harvest of hair seals in northern Alaska.

Village	Reported Seal Harvest 1965[1/]	Village Population 1970[2/]	Reported Harvest 1971	Estimated Seal Harvest 1971[3/]	Estimated Seal Harvest 1972[3/]
Wales	761	131	183	300	150
Little Diomede	210	84	279	300	250
Shishmaref	6,064	267	1,244	2,000	1,500
Deering	185	85	0	50	50
Buckland	0	104	0	50	40
Kotzebue	1,131	1,696	12	300	150
Noatak	0	293	0	40	30
Kivalina	827	188	108	350	250
Point Hope	2,016	386	341	2,000	1,800
Wainwright	345	315	0	250	250
Barrow	114	2,104	0	1,800	1,600
Kaktovik	0	123	0	70	70
Miscellaneous	826	--	--	400	300
Total	21,015	15,115	4,691	17,540	13,525

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WATERFOWL AND OTHER BIRDS - COASTAL ALASKA

IN THE BERING, CHUKCHI AND BEAUFORT SEAS

With the exception of a recent Outer Continental Shelf study, Alaska Department of Fish and Game personnel have made few intensive or extensive bird studies in this region. The information gathered during the OCS bird and habitat study conducted by the State of Alaska in 1976 in the Beaufort and Chukchi Seas has not yet been published.

A considerable amount has been written by others on the coastal bird resources in this region. Much of this information is in a concise format by geographic area. For that reason, it would be redundant for A.D.F.& G. to reword what has already been written. Therefore, we have provided pertinent materials from other sources. These sources appear at the end of this section. A.D.F.& G. has, however, provided the map on critical and other major bird use areas, the data on black brant and the tables on subsistence and sport harvest of waterfowl.

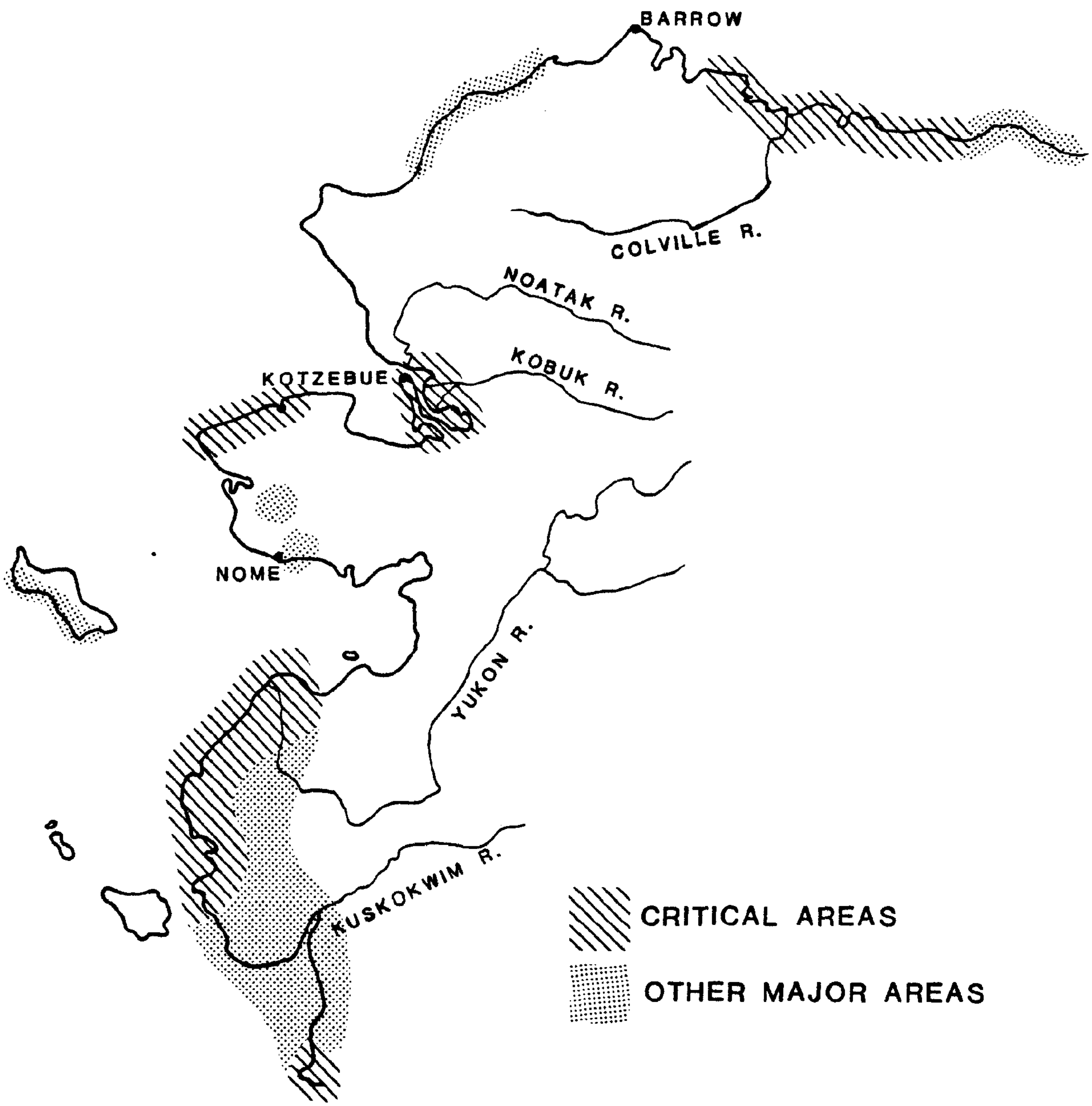


FIGURE 1. PRIMARY WATERFOWL AREAS

Table 1 . Estimated subsistence harvest by native Alaskans.*

Native Corporation	Canada	Whitefront	Brant	Emperor	Snow	Total	Total Ducks	Swan	Crane
Arctic Slope 1/	50	50	860	--	--	960	16,600	--	--
Nana 1/	1,500	1,500	500	--	150	3,650	17,716	--	37
Doyon 1/	4,000	4,000	--	--	436	8,436	23,983	1	52
Bering Straits 1/	1,000	3,000	7,000	220	1,000	12,220	32,500	--	155
Calista 2/	38,200	22,600	8,000	8,200	5,800	82,800	35,300	5,585	1,033
Cook Inlet 3/	--	--	--	--	--	--	--	--	--
Ahtna 1/	145	140	--	--	--	285	455	--	--
Bristol Bay 3/	500	500	500	500	100	2,100	3,000	300	100
Chugach 3/	--	--	--	--	--	--	--	--	--
Koniag 3/	--	--	200	100	--	300	500	--	--
Aleut 3/	--	--	--	3,000	--	3,000	5,000	--	--
Sea Alaska 3/	--	--	--	--	--	--	--	--	--
Totals	45,395	31,790	17,060	12,020	7,486	113,751	135,009	5,886	1,377

1/ From the 1974 Land Use Planning Commission Study With A.D.F.& G. species estimates.
2/ Klein, 1966 - Y-K Delta estimates only
3/ A.D.F.& G. estimates.
* Includes upland bird eggs and/or alcid eggs.

Table 2 . Estimated total subsistence harvest in Alaska.

	Harvest	Est. Crip. Loss	Total Kill
Canada geese	45,395	.15	52,205
Whitefronts	31,790	.15	36,560**
Snow	7,486	.15	8,610
Emperor	12,020	.15	13,825
Black Brant	17,060	.20	20,470
Total geese	113,751	--	131,670
Ducks	135,009	.20	162,000
Swans	5,886	.15	6,700
Cranes	1,377	.15	1,585
Eggs	131,670*	--	--

* Includes upland birds and/or alcids.

** Pacific Flyway - 26,565; Mid-continent - 9,995.

Table 3 . Estimated sport harvest of waterfowl, coastal areas only, 1972-1975 four-year average (from Timm, 1973-1976).

Area	Hunter Days	Duck Harvest	Goose Harvest Canada	Emperor	Brant	Snow	Whitefront	Total	Crane Harvest	Snipe Harvest
Yukon* Delta	600	900	250	125	150	265	50	840	25	25
Seward Peninsula	1,200	1,600	200	70	215	15	25	525	175	150
North Slope	100	150	25	-0-	10	-0-	30	65	-0-	-0-
All Areas	1,900	2,650	475	195	375	280	105	1,430	200	175

* Estimates are believed to be at least 50 percent conservative.

UNIT 18

YUKON-KUSKOKWIM DELTA (Yukon Delta Proposal)

Within the 170 species of birds which have been observed on the Yukon Delta are 136 species which probably nest there. Others are common migrants or infrequent visitors from Asia. Only 13 species are year-round residents. During migration, some birds from the Yukon Delta probably reach most Provinces of Canada, every State in the United States, every State of Mexico, all countries in Central and South America, Antarctica, virtually all Pacific islands, all Asian countries bordering the Pacific, Australia and New Zealand (Appendix A).

Birds on the Delta are divided into 31 families, of which 20 are land birds and 11 are water birds. However, 100 species and the great majority of individuals are associated with the aquatic habitats which distinguish the Delta.

Nearly three million waterfowl departing the Delta each fall constitute a recreational and economic resource of major international importance. Primary benefits accrue in regions far from the Delta--the other 49 States, Canada, Mexico and the Soviet Union (Tables 4 to 6).

The waterfowl breeding population is estimated at 1,890,000. More than 3,000,000 birds, adults and young, return to the four flyways each fall. Of these, 280,000 are harvested in the other 49 States, 130,000 in Canada and 5,000 in Mexico. Recreation by persons other than hunters cannot be estimated, but the value of nonconsumptive use associated with waterfowl and other birds from the Delta exceeds the value of hunting.

The proposed Yukon Delta National Wildlife Refuge, which includes the existing Clarence Rhode NWR and Hazen Bay NWR, will contain habitat

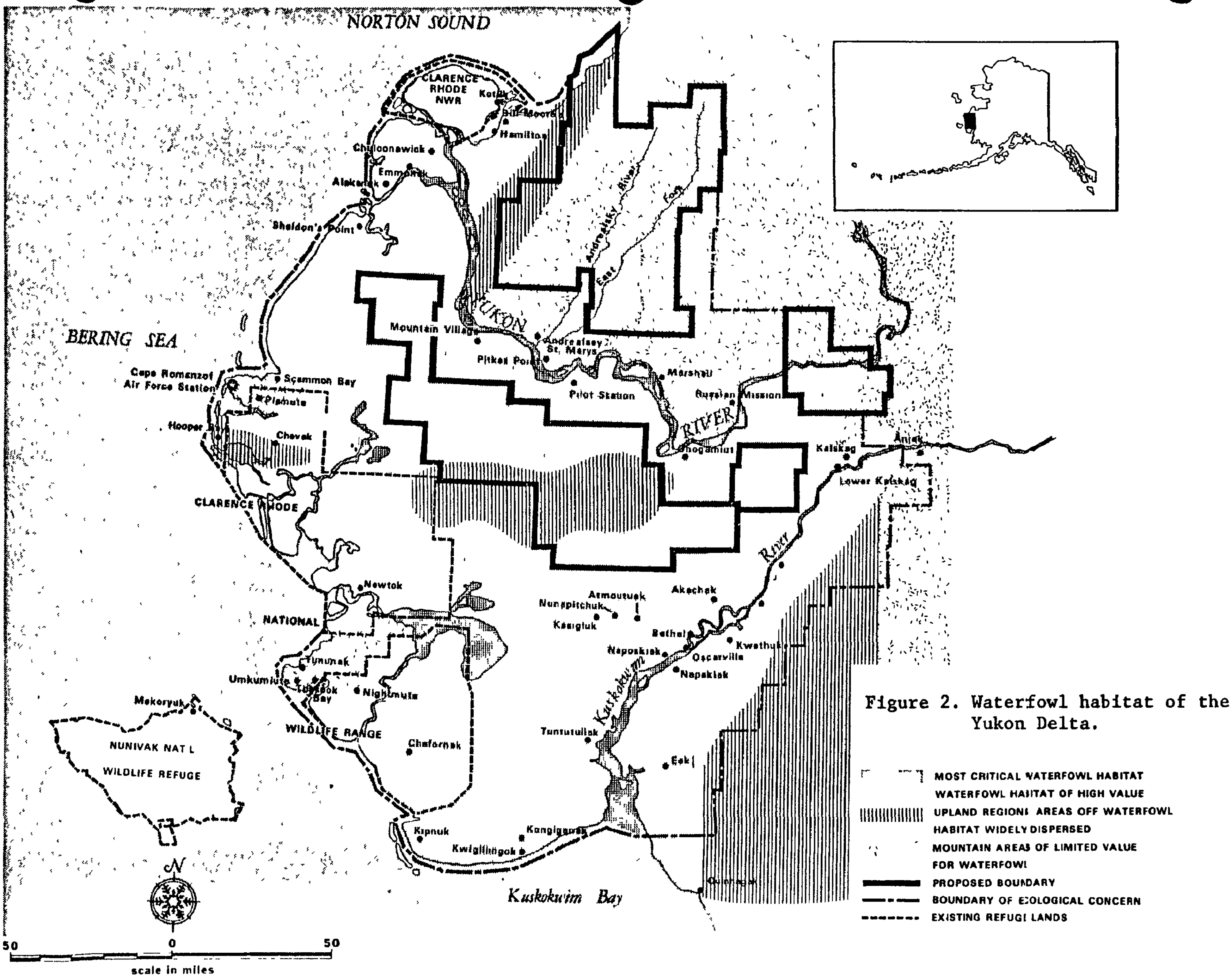


Figure 2. Waterfowl habitat of the Yukon Delta.

TABLE 4.

WATERFOWL POPULATIONS OF THE YUKON DELTA

Species	Estimated Population a/	Percent Composition	Percent of Continental Population c/
Swans			
Whistling	40,000	100	45
Trumpeter	t d/	t	t
	40,000	100	
Geese			
Cackling goose	100,000	17.4	80
Taverner's Canada goose	50,000	8.7	30
Black brant	100,000	17.4	60
Emperor goose	125,000	21.7	80
White-fronted goose	200,000	34.8	65
Snow Goose	t	t	--
	575,000	99.9	
Ducks			
Mallard	33,500	2.6	0.3
Pintail	287,000	22.6	4.9
Green-winged teal	44,000	3.5	1.5
Wigeon	43,300	3.4	1.2
Shoveler	5,000	0.4	0.3
Redhead	100	t	t
Canvasback	1,200	0.1	0.2
Scaup (2 spp)	335,000	26.3	5.0
Goldeneye (2 spp)	20,500	1.6	2.8
Bufflehead	2,500	0.2	0.3
Oldsquaw	292,000	23.0	18.8
Eider (4 spp)	51,000	4.0	--
Scoter (3 spp)	157,000	12.3	14.3
Merganser (2 spp)	200	t	t
	1,272,300	100.0	
Total Breeding Population	1,887,300		
Projected Fall Flight, Adults and Young b/			
Swans	50,000		
Geese	720,000		
Ducks	2,292,000		
	3,062,000		

a/ Breeding populations for swans and geese are estimated from winter inventories as well as from general information and surveys on the Delta. Estimates for ducks are based on averages for aerial censuses conducted each spring for the 14-year period 1957 to 1970. Eiders are not sampled adequately and the Delta population probably exceeds 100,000.

b/ Fall flights are estimated by adding the average number of young produced to the breeding population. The figures do not include migrants which occur briefly on the Delta in spring and fall.

c/ Estimates for percentage of continental population are based on aerial censuses conducted throughout North America for the same period as on the Delta. Continental data for oldsquaw probably reflect underestimated populations; hence, the proportion indicated for Yukon Delta may be high. No estimates for continental populations of eiders are available.

d/ Trace or less than .05 percent.

TABLE 5.

WATERFOWL BANDED ON THE YUKON-KUSKOKWIM DELTA

Species	Banded: Number	Banded: Percent of Average Population	Recovered: Number	Recovered: Percent of Number Banded
Whistling swan	447	1.1	41	9.2
Geese				
Canada goose	240	0.5	41	17.1
Cackling goose	5,060	5.1	666	13.2
Black brant	24,213	24.2	2,490	10.3
Emperor goose	779	0.8	16	2.1
White-fronted goose	4,945	4.9	584	11.8
Snow goose	16		3	18.8
	35,253		3,800	10.8
Ducks				
Mallard	1	0	0	0
Pintail	154	t*	13	
Green-winged teal	2	0	0	0
Wigeon	0	0		
Shoveler	0	0		
Canvasback	50	4.0	7	14
Greater scaup	2,295	0.7	169	7.4
Lesser scaup	31	0.1	2	6.5
Common goldeneye	108	0.5	3	2.8
Barrow's goldeneye	6	t	1	16.7
Bufflehead	204	8.0	6	2.9
Oldsquaw	1,791	0.6	31	1.7
Steller's eider	22		2	0.9
Common eider	4	t	0	0
Spectacled eider	124	0.4	1	0.8
Common scoter	1	t	0	0
	4,713		235	5
Total all species	40,493		4,076	10.1

*t - traces

TABLE 6.

DISTRIBUTION OF RECOVERIES FROM PRINCIPAL SPECIES OF WATERFOWL BANDED ON THE YUKON DELTA

Area of Recovery	Canada Goose	Cackling Goose	Black Brant	Whistling Swan	White-Fronted Goose	Pintail	Greater Scaup	Oldsquaw
Alaska								
Banding location	6	70	218		33		28	17
Other location		1	257	1	10	1	1	
	6	71	475	1	43	1	29	17
Pacific Flyway								
Washington	5	25	194	3	3		21	
Oregon	8	139	27		15	1	3	
Idaho		1		1				
California	21	423	1,025	16	471	8	35	
Nevada				2	1			
Utah				11				
	34	589	1,246	33	490	9	59	0
Central Flyway								
Montana							1	
South Dakota			2					
Nebraska		1			1			
Colorado			1					
Texas				1			1	
	0	1	3	1	1	0	1	0
Mississippi Flyway								
Wisconsin							4	
Michigan							11	
Iowa				1				
Illinois							1	
Louisiana							1	
	0	0	0	1	0	0	17	0

TABLE 6. (continued)

Area of Recovery	Canada Goose	Cackling Goose	Black Brant	Whistling Swan	White-Fronted Goose	Pintail	Greater Scaup	Oldsquaw
Atlantic Flyway								
Connecticut							4	
Rhode Island							1	
New York							19	
New Jersey							8	
Maryland							7	
Virginia							2	
Georgia				1				
	0	0	0	1	0	0	41	0
Total United States	40	661	1,734	37	534	10	148	17
Canada								
Yukon						1		1
Northwest Territories			31					
British Columbia		5	296	4		1	8	
Alberta				1				
Saskatchewan					2		1	
Manitoba							1	
Ontario							8	
Quebec							3	
	0	5	327	5	2	2	21	1
Mexico	1		394		2	1		
Central America			1					
USSR			43					13
TOTAL ALL AREAS	41	666	2,489	41	538	13	169	31

supporting approximately 30 percent of the ducks, 51 percent of the geese and 36 percent of the swans nesting on the Yukon Delta. The remainder of the nesting population is found within Native village or village deficiency withdrawals and on a small area of public interest (d-1) lands.

Subsistence hunting of ducks, geese and swans is traditional with Natives of the Delta and is inseparable from the significant element of recreation attached to it. Studies made of harvest and harvest patterns of residents of the area during 1964 and 1965 indicated a harvest of approximately 82,800 geese, 35,300 ducks and 5,585 swans (Table 7). In addition, an estimated 39,795 eggs of all species, mostly of geese, were removed from nests.

Field studies of waterfowl began in 1878 with the work of E. W. Nelson. Nelson's work is still of historical interest, and many of his observations have not been duplicated. Bureau of Biological Survey personnel first visited that area in 1924 when a number of waterfowl were banded.

A reconnaissance survey in 1941 filled in further details, but extensive studies did not begin until 1949. Aerial surveys and/or ground studies conducted annually since then resulted in the establishment of the Clarence Rhode National Wildlife Range in 1960.

The Clarence Rhode NWR encompasses habitat that includes the primary nesting area for black brant and cackling and emperor geese. Up to 759,000 acres of critical habitat for these species will be deleted from the wildlife range by Native selections under provisions of ANCSA.

TABLE 7.

HARVEST OF WATERFOWL ON THE YUKON DELTA a/

Species	Number Harvested Spring	Fall	Total
Swans			5,585
Cranes			1,033
Geese			
Cackling and Canada	20,000	18,200	38,200
Black Brant	2,500	5,500	8,000
Emperor	6,500	1,700	8,200
White-fronted	13,500	9,100	22,600
Snow	5,400	400	5,800
	47,900	34,900	82,800
Ducks			
Mallard	4,700	4,800	9,500
Pintail	12,000	10,500	22,500
Eider	3,300	0	3,300
	20,000	15,300	35,300

a/ Data are from Klein's "Waterfowl in the Economy of Eskimos." In addition to the above species, others (mostly scaup and oldsquaw) are shot or taken in drives during summer while molting or still not fledged. Total take in this manner may be as high as 1,000 to 2,000 geese and 3,000 to 5,000 ducks. The number of shotgun shells sold in villages at the present time suggests these estimates may be low.

With establishment of the wildlife range, work on waterfowl was expanded, censuses and production surveys were extended, definitive studies on the ecology of several species were initiated and banding programs were refined. More than 40,000 banded waterfowl have produced 4,076 recoveries to date.

The Delta produces about 80 percent of the swans of the Pacific Flyway and part of those migrating to the Atlantic Flyway. It produces all of the white-fronted geese of the Pacific Flyway, perhaps half the continental population of black brant, over 80 percent of the emperor geese and all of the cackling geese. There is probably no area of similar size as critical to so many species.

Ducks are three times as numerous as geese, but because their continental populations and breeding ranges are much larger, Delta habitats are relatively less important to them. Greater scaup, oldsquaw and pintail are the most numerous species, comprising more than 70 percent of the population (Table 4). Other species forming an important segment of the population are the common scoter, green-winged teal, mallard and widgeon. Common and spectacled eiders probably are much more numerous than censuses indicate because their nesting area is confined to a narrow, coastal zone not sampled adequately. Eiders are among the most beautiful ducks, and although they do not contribute recreation to other States, they are used extensively by subsistence hunters. They are among the most interesting species of the Delta and add significant esthetic value to the area.

The Yukon Delta is large, and not all habitats are equally important. Some species such as whistling swans, lesser Canada and white-fronted geese, pintail, scaup, oldsquaw and green-winged teal are well dispersed throughout the area, however. Other ducks or geese with more specific habitat requirements are confined to a relatively small part of the Delta. Estuarine and coastal lowland habitats are clearly the most important areas for many species. Nesting of all black brant, cackling geese, emperor geese and common, spectacled and Steller's eiders is confined to this narrow zone. More than 100 broods may be produced for each square mile of habitat in much of the coastal area. In some parts of the extreme coastal fringe between Cape Romanzof and Nelson Island production may reach a brood for each acre of habitat. Vegetation surrounding lakes and ponds is grazed short by the large number of geese.

Not only is the coastal habitat most critical to waterfowl, it is also the habitat which would be most adversely affected by development, pollution or other influences that could alter its present characteristics. A pollutant such as oil, originating either on land or in the adjacent Bering Sea, could be trapped in the tidal estuaries, endangering large segments of continental populations of waterfowl for several species. Shorebirds, numbering in the millions, would be equally affected. Inland, the relatively low gradient of land and rivers and the lesser concentrations of birds would serve to confine effects to relatively limited areas and a much smaller number of wildlife.

Away from the coast, quality of habitat is related largely to the number of lakes and ponds. Highest production occurs in areas of many small lakes, but larger lakes are essential in that they are used extensively by large numbers of molting birds in summer and often are important staging areas for migrants. Other important staging areas are located on coastal tideflats and on sandbars and islands of the Yukon River.

Waterfowl arrive on their nesting grounds in late April or early May. Frequently, first arrivals may find the tundra still covered with snow and rivers and ponds locked in ice. By breakup in late May or early June, nesting has already begun. First broods appear in mid-June, although in coastal areas the peak of hatching may be delayed in some years until early July. Growth of young is rapid, and most broods of ducks and geese are fledged by mid-August. Some swans, however, may not gain flight until early September. Brant are among the first waterfowl to depart the Delta. Adults without broods leave first, around mid-August, but families move soon thereafter. By early September, few remain.

First steps of migration for brant are short hops to Nunivak Island, Cape Newenham and to Izembek Bay, a major staging area on the Alaska Peninsula. Brant will remain at Izembek until early November. Then, choosing weather providing favorable winds, most depart within a period of a few hours and cross the Gulf of Alaska non-stop, making their first landfall off Vancouver Island. From there they migrate along the Pacific coast to their final destinations in the waters of Washington, California, Baja California or the Mexican mainland. Other brant nesting in northern Canada or Siberia fly the Arctic and Bering Sea coasts of Alaska to the Delta; then, from the Delta onward. The entire world population is mingled on Izembek Lagoon.

Other species may not depart until September although their distribution on the Delta may be quite different in late summer than during the breeding season. The gradually diminishing numbers of late September or the first days in October do not match the drama of the spring migration.

Information on migration routes is incomplete for many species and details can only be surmised from the location of their wintering areas, but for other species recoveries of banded birds provides considerable insight on distribution patterns (Figures 3 to 7).

Most Delta waterfowl are oriented to States of the Pacific Flyway. Routes of travel for a given species may be inland through Interior Alaska and British Columbia or via a coastal route. Segments of a population may differ. Widgeon migrate mostly inland, pintails both inland and along the coast and greater scaup of the Pacific Flyway only along the coast. However, about half the greater scaup from the Delta migrate southeasterly across Canada to the Great Lakes and eventually to the Atlantic Coast, perhaps via the Hudson River Valley. Canvasbacks, although few in numbers, probably duplicate the two routes followed by scaup.

Other species have equally distinctive migration patterns. White-fronted geese, for instance, appear to move non-stop for at least 2,500 miles from the Delta to interior valleys of California. From there a few drift southward into Mexico. Most oldsquaw ducks move only as far as the Bering Sea, mingling there with ducks from the Soviet Union. Band recoveries indicate courtship and pairing will take place at sea in winter or early spring. Females seem certain to return to their place

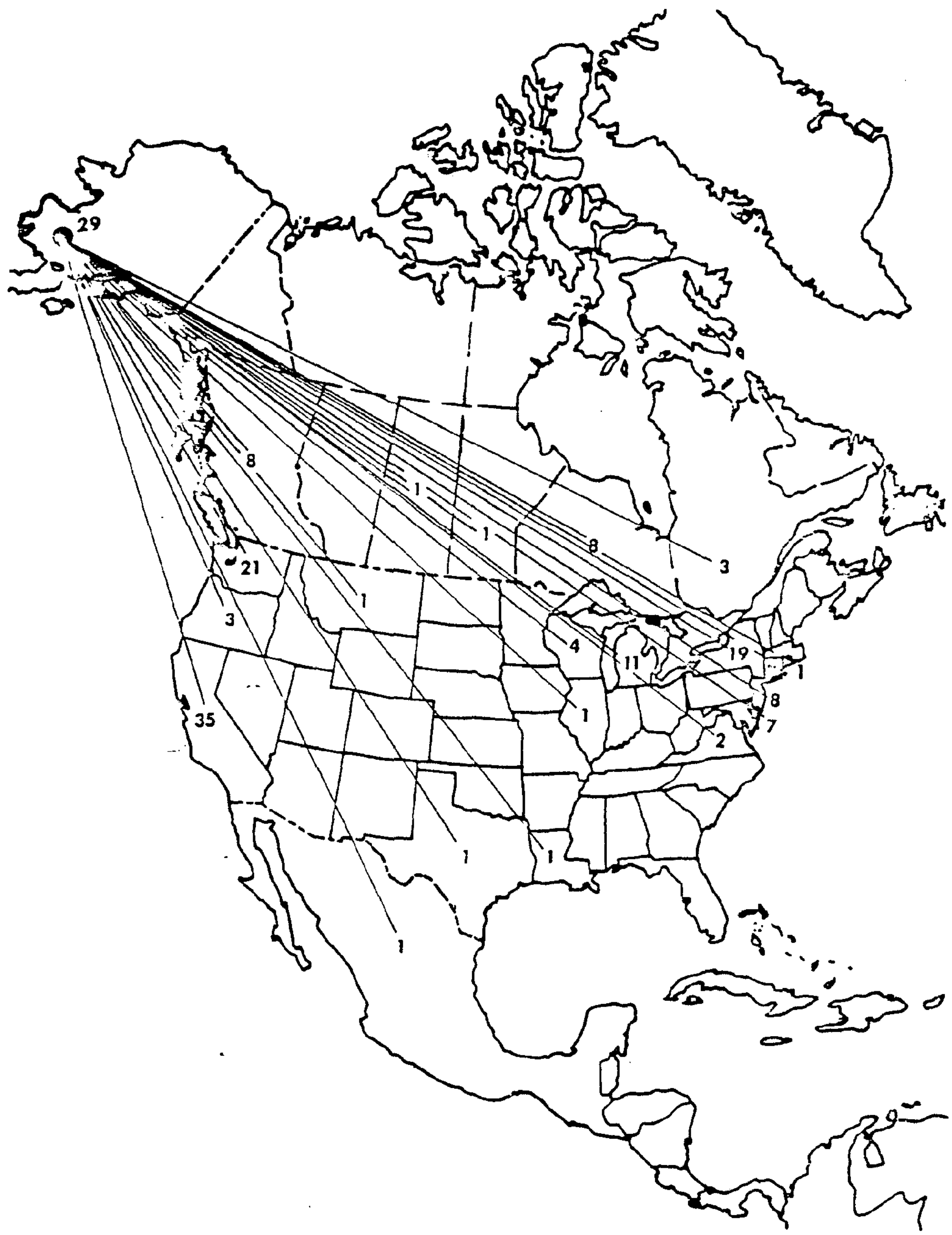
Figure 3. RECOVERIES OF BANDED WHISTLING SWANS

Figure 4. RECOVERIES OF BANDED BLACK BRANT

Figure 5. RECOVERIES OF BANDED WHITE-FRONTED GEESE

Figure 6. RECOVERIES OF BANDED CACKLING GEESE

Figure 7. RECOVERIES OF BANDED GREATER SCAUP



of origin, but males from Alaska may follow mates from the Soviet Union to nesting grounds on the Anadyr River or the Lena Delta in Siberia.

Shore and waterbirds include seabirds, gulls, jaegers, cranes, loons, grebes, plovers and the vast family of sandpipers, snipe, godwits and curlews. The populations of many species in these groups using Delta habitats as a nesting area or as an area for resting and foraging during migration dwarf the number of waterfowl. There is no means to calculate total numbers accurately, but the populations of shorebirds is at least 100 million and could greatly exceed this number.

Murres, auklets, puffins and kittiwakes nest in small rookeries on cliffs of Cape Romanzof and Nelson Island. They occur on lowlands only when blown inland by storms, hence do not occur commonly on the proposed refuge.

Arctic, red-throated and common loons are all present throughout the Delta, but the arctic loon is by far the most common, averaging more than five pairs per square mile. In spring, their vociferous presence is seldom in doubt. Red-necked and horned grebes are relatively uncommon on coastal parts of the Delta but become more numerous inland.

Lesser sandhill cranes are abundant. The Delta may be among the most important nesting areas for this species. An estimated 1,000 cranes or more are taken by Delta residents for subsistence and recreational purposes.

Sandpipers, plovers and phalaropes are among the most abundant species on the Delta. If none other were present, this group alone would qualify the Delta as a highly productive habitat for birds. Northern phalaropes, western sandpipers, dunlins and black turnstones are most numerous in the order named. Bar-tailed godwits are more conspicuous, however, because they are large and call vociferously whenever danger threatens their nesting territory. Whimbrels and bristle-thighed curlews occur on the Delta during migration and from early summer when non-breeders return to forage on coastal lowlands. The bristle-thighed curlew nests in the mountains north of the Yukon River in the area proposed for the wildlife refuge. Most of the world population of this species may be present within the region of the Yukon Delta during the summer. Hopefully its survival is more secure than that of the Eskimo curlew which was once reported to be the most abundant of migrant curlews on the Delta but which now may be extinct.

Plovers, sandpipers and phalaropes are among the greatest travelers of the avian world. Golden plovers, bar-tailed godwits, bristle-thighed curlews and ruddy turnstones migrate to islands throughout the South Pacific and may reach New Zealand or Australia. Red and northern phalaropes winter at sea in the same region and off the coast of South America, while other birds--whimbrels, Hudsonian godwits, black-bellied plovers, sanderlings, dowitchers and spotted, solitary, least, pectoral, western and semi-palmated sandpipers--migrate along the Pacific coast or inland through North America to wintering areas extending through Mexico, Central America and countries of South America to Cape Horn or Tierra del Fuego.

As might be expected with the extensive estuarine and lake habitat, gulls and terns are abundant and widespread over the area. The large glaucous gull nests in small colonies or singly in coastal lowlands. The slightly smaller and less abundant glaucous-winged gull nests primarily on low lying reefs, bars or coastal islands where they are protected from mammalian predators. Both prey extensively on nests and young of waterfowl, although the fish and invertebrates they catch or scavenge in estuarine and coastal waters are their primary food. Mew gulls are similar in appearance but smaller and more widely distributed, nesting in all habitats. Oldsquaw ducks frequently nest near colonies of Sabine's gulls, suggesting such sites may be selected for safety because the small gulls vigorously attack any predator approaching the nesting territory. Arctic terns are distributed throughout all habitats. Their migrations take them to Cape Horn and the Antarctic continent. The very similar Aleutian tern nests only in Alaska and remains in the northwestern Pacific area during winter.

Three species of jaegers or skuas occur on the Delta. The pomarine jaeger is only a migrant on its way to nesting areas in arctic Alaska or Canada. Parasitic and long-tailed jaegers found throughout the area are among the most efficient predators in arctic regions, readily pursuing and capturing many small birds and robbing nests. Their primary food, however, is lemmings and other small rodents. They winter at sea from California to Chile and across the Pacific to New Zealand.

Terrestrial birds of the Delta include most species common to forested habitats of interior Alaska, as well as those confined to the tundra. In tundra habitats which most characterize the Delta, the Lapland longspur is most abundant. Savannah sparrows are most common in marshes or areas of tall grass, as they are throughout Alaska. Yellow wagtails, much less common than other species, prefer small patches of shrub or occasionally tall grass for nesting. Redpolls and tree sparrows also are associated with brush patches, but otherwise small land birds are few on the open tundra. Other species (Appendix I) are found primarily in woodland habitat.

Raptors are sparse in tundra habitats but are more common in mountainous areas where rough-legged hawks, falcons and eagles find eyries for nesting. Short-eared owls are the most abundant raptors. Like the larger snowy owl, their numbers fluctuate widely from year to year, depending on the cyclic abundance of lemmings or other rodents.

APPENDIX I

Checklist of Birds from the Yukon Delta

Birds of the Yukon Delta are listed with keys to their abundance or status and primary areas in which they winter. Abbreviations used to indicate abundance or probable status are:

Abundance

a	abundant
c	common
o	occasional
u	uncommon or rare

Status

n	nesting
m	migrant
r	resident throughout the year
v	vagrant or stray

Abundance is considered relative to both numbers elsewhere and to its occurrence in preferred habitat on the Yukon Delta. For example, black brant are listed as abundant because they are numerous on the Delta and occur in greater numbers there than in any other part of their range. Although bristle-thighed curlews are present in relatively low numbers, they are listed as common because most, perhaps all, individuals of this species are present on the Delta in summer and fall. When information on wintering areas is not based on recoveries of birds banded on the Delta, the most likely area within the known distribution of the species is given. Usually a western distribution is assumed when species range over the continent, but this may be incorrect. An asterisk (*) is used to indicate species of which more than half the world population utilizes the Delta for nesting or foraging during migration.

Species	Status		Wintering Areas
Common loon	o	n	S.E. Alaska south to Baja California
Yellow-billed loon	u	m	S.E. Alaska south to British Columbia
Red-throated loon	c	n	Aleutian Islands south to Baja California and Sonora
Arctic loon	a	n	S.E. Alaska south to Baja California and Sonora
Red-necked grebe	c	n	S.E. Alaska south to central California
Horned grebe	o	n	S.E. Alaska south to southern California
Double-crested cormorant	u	n	Bering Sea
Pelagic cormorant	c	n	Bering Sea
Red-faced cormorant	c	n	Bering Sea
Whistling swan*	a	n	British Columbia south to California, Nevada and Utah, occasionally to Atlantic Coast
Trumpeter swan	u	n	S.E. Alaska and British Columbia
Taverner's Canada goose	c	n	Washington, Oregon, and California
Cackling Canada goose*	a	n	Washington, Oregon, and California
Black brant*	a	n	British Columbia south to Baja California and Mexico
Emperor goose*	a	n	Aleutian Islands, Alaska Peninsula, Kodiak
Pacific white-fronted goose*	a	n	California and Mexico
Lesser snow goose	a	m	California (summers in USSR)
Mallard	c	n	British Columbia, Washington, and Oregon
Gadwall	u	v	California
Pintail	a	n	Washington to California and Mexico
Aleutian teal	u	v	Aleutian Islands

Species	Status		Wintering Areas
Green-winged teal	a	n	Washington, Oregon, and California
American wigeon	c	n	British Columbia south to California
Shoveler	c	n	Washington,Oregon, and California
Redhead	u	v	California
Canvasback	o	n	California, Texas, Maryland
Ring-necked duck	u	m	California, Gulf Coast, south through Mexico
Greater scaup	a	n	British Columbia south to California, Great Lakes, Louisiana, Connecticut south to Virginia
Lesser scaup	o	n	British Columbia south to Mexico, Texas, Great Lakes, Connecticut south to Florida
American goldeneye	c	n	Alaska south to California
Barrow's goldeneye	o	n	Alaska south to California
Bufflehead	o	n	British Columbia south to California (USSR)
Oldsquaw	a	n	Bering Sea (USSR, northern Canada)
Harlequin	u	m	Aleutian Islands
Steller's Eider	o	n	Bering Sea
Pacific common eider	a	n	Bering Sea
King eider	c	m	Bering Sea
Spectacled eider	a	n	Unknown, probably Bering Sea
White-winged scoter	u	n	Kodiak, S.E. Alaska
Surf scoter	u	n	S.E. Alaska
Common scoter	c	n	Aleutian Islands, Kodiak, S.E. Alaska
American merganser	u	v	S.E. Alaska
Red-breasted merganser	c	n	Aleutian Islands, to S.E. Alaska
Goshawk	o	n	Alaska, possibly south to British Columbia and California

Species	Status		Wintering Areas
Sharpshinned hawk	o	n	British Columbia and possible south to Central America
Rough-legged hawk	o	n	British Columbia possible south to California
Golden eagle	u	n	Alaska, possibly south to Montana and other mountain states
Bald eagle	u	n	S.E. Alaska
Marsh hawk	c	n	British Columbia, Alberta, possibly south to Central America
Osprey	o	n	California, possibly south to South America
Gyrfalcon	o	n	Alaska
Peregrine falcon	o	m	British Columbia, possible south to California and Central America
Pigeon hawk	o	n	California, probably south to Baja California
Sparrow hawk	o	v	California, probably south to Mexico
Spruce grouse	c	r	Alaska
Ruffed grouse	c	r	Alaska
Willow ptarmigan	a	r	Alaska
Rock ptarmigan	o	r	Alaska
Sharp-tailed grouse	u	r	Alaska
Lesser sandhill crane	a	n	Southern California, Texas, south to Baja California and Sonora
Semipalmated plover	o	n	California south to Sonora
Mongolian plover	u	v	Southern Asia and south to Pacific Islands
Killdeer	u	v	British Columbia south to Mexico
Golden plover	u-c	n-m	South Pacific Islands to New Zealand
Black-bellied plover	a	n	British Columbia, California, south to Peru

Species	Status	Wintering Area
Surfbird	u m	S.E. Alaska south to Cape Horn
Ruddy turnstone	c n	California south to Chile, South Pacific Islands to New Zealand
Black turnstone	a n	S.E. Alaska south to Baja California and Sonora
Wilson's snipe	a n	British Columbia south to Mexico Central America, Venezuela
Whimbrel	u-c n-m	California, south to southern Chile
Bristle-thighed curlew*	a n	Hawaiian Islands south to Fiji, Samoa, other South Pacific Islands
Eskimo curlew	Probably extinct, once most abundant migrant of large curlews	
Spotted sandpiper	o n	British Columbia south to Peru
Solitary sandpiper	o n	Baja California south to Equador, Boliva, and Argentina
Wandering tattler	u v	Baja California to Equador, South Pacific Islands
Greater yellowlegs	o n	California south to Central America
Lesser yellowlegs	o n	Texas south to Central and South America
Eurasian knot	c m	Washington to California
Rock sandpiper	c n	Aleutian Islands to S.E. Alaska
Sharp-tailed sandpiper	a m	Alaska south to California
Pectoral sandpiper	o n	Bolivia, Argentina
Baird's sandpiper	u n	Andes Mountains, Ecuador, Bolivia and Chile
Least sandpiper	o n	Oregon, California south to Central America and northern Peru
Dunlin	a n	S.E. Alaska south to California, Baja California and Sonora
Long-billed dowitcher	c n	California south to Central America and Ecuador

Species	Status		Wintering Areas
Semipalmated sandpiper	o	n	Gulf Coast to Central America and West Indies and widespread in South America
Western sandpiper	a	n	California through Mexico, Central America to Ecuador
Bar-tailed godwit	a	n	Philippines, Malaya, south to Australia, Tasmania and New Zealand
Hudsonian godwit	o	m	Southern Chile, Tierra del Fuego and Falkland Islands
Sanderling	o	m	British Columbia south through Mexico, Central America to Chile
Red phalarope	a	n	At sea, South Pacific to Falkland Islands and New Zealand
Northern phalarope	a	n	At sea off South America, Malaya and Philippines
Pomarine jaeger	c	m	At sea, California to Peru
Parasitic jaeger	a	n	At sea, California to southern Chili, Australia, New Zealand
Long-tailed jaeger	a	n	At sea off South America
Glaucous gull	a	n	Bering Sea, Aleutians, to Kodiak
Glaucous-winged gull	c	n	Aleutians and S.E. Alaska south to Baja California and Sonora
Slaty-backed gull	u	v	Bering Sea
Herring gull	o	n	Alaska south to Central America
Mew gull	a	n	S.E. Alaska south to California
Bonaparte's gull	c	n	Washington south to Baja California and Jalisco
Black-legged kittiwake	c	n	S.E. Alaska to Baja California
Sabine's gull	a	n	At sea south to Peru
Arctic tern	a	n	Cental Chile south to Antarctica
Aleutian tern	c	n	Northwestern Pacific, Sakhalin to Honshu

Species	Status	Wintering Areas
Common murre	c n	Bering Sea
Black guillemot	o m	Bering Sea
Pigeon guillemot	o m	Bering Sea
Parakeet auklet	o m	Bering Sea to coasts off Washington and Oregon
Crested auklet	o m	Seas adjacent to Aleutian Islands
Horned puffin	c n	Bering Sea
Tufted puffin	c n	Bering Sea
Great horned owl	c n	Alaska
Snowy owl	o n	Alaska
Hawk owl	o n	Alaska south to northern United States
Short-eared owl	c n	Alaska south to British Columbia, Washington and Montana
Boreal owl	o n	Alaska
Kingfisher	o n	S.E. Alaska south to Baja California, northwestern Mexico
Boreal yellow-shafted flicker	o n	California
Downy woodpecker	o n	Alaska
Northern three-toed woodpecker	o n	Alaska
Northern Say's phoebe	o n	California
Alder flycatcher	o n	Honduras south to Peru and northern Argentina
Horned lark	o m	British Columbia, Washington and Oregon
Violet-green swallow	o n	California south to Cental America
Tree swallow	c n	California south to Baja California and northern Mexico
Bank swallow	c n	Central South America
Barn swallow	u n	Central South America to northern Chili and Argentina

Species	Status		Wintering Areas
Cliff swallow	o	n	Brazil south to Chile Argentina
Alaska gray jay	c	n	Alaska
American black-billed magpie	u	m	Alaska south to Puget Sound
Northern raven	a	r	Alaska
Black-capped chickadee	c	r	Alaska
Gray-headed chickadee	o	r	Alaska
Boreal chickadee	c	r	Alaska
Robin	c	n	Gulf Coast, Florida south to Veracruz
Varied thrush	c	n	Idaho, California and south to Baja California
Hermit thrush	c	n	British Columbia south to Baja California
Gray-cheeked thrush	c	n	Central America south to Peru and northeastern Brazil
European wheatear	o	m	S.E. Asia
Arctic warbler	o	n	Philippines, East Indies, and Indochina
Ruby-crowned kinglet	o	n	South China, Boreno, Philippines
White wagtail	u	v	British Columbia south to California
Yellow wagtail	c	n	Oregon and Nevada to Baja California and western Mexico
Water pipit	u	n	Eastern China and Japan
Red-throated pipit	u	v	Southern China, Borneo
Bohemian waxwing	o	n	S.E. Alaska south to California
Northern shrike	c	n	Alaska south to Oregon, eastern California, Nevada and Utah
Orange-crowned warbler	o	n	California to Baja California
Yellow warbler	c	n	Southern Baja California and Campeche to Panama

Species	Status	Wintering Areas
Myrtle warbler	c n	Oregon and California south through Mexico to Panama
Blackpoll warbler	c n	Guiana and Venezuela to Brazil and Ecuador
Northern waterthrush	c n	Baja California and Mexico to northern South America
Wilson's warbler	c n	Mexico to Panama
Rusty Blackbird	c n	Gulf of Mexico
Pine Grosbeak	o n	Alaska south to Oregon and Montana
Gray-crowned rosy finch	o n	Alaska
Hoary redpoll	o r	Alaska
Common redpoll	c r	Alaska
White-winged crossbill	o r	Alaska
Savannah sparrow	a n	Western Oregon and Utah to Sonora and Baja California
Slate-colored junco	o n	Minnesota, Michigan, and New England States to Gulf Coast
Tree sparrow	c n	Nevada, Arizona, New Mexico, and Texas
White-crowned sparrow	c n	British Columbia, Wyoming, Utah to Baja California and southern Mexico
Golden-crowned sparrow	o n	British Columbia to California
Fox Sparrow	c n	Texas, Louisiana, Alabama, and northern Florida
Lincoln's sparrow	o n	Baja California, Mexico, and Central America
Lapland longspur	a n	Northeastern California and Colorado to Texas
Snow bunting	c r	Alaska
McKay's snow bunting	c m	Alaska

UNIT 22

SEWARD PENINSULA (Chukchi-Imuruk National Reserve Proposal)

Of the 352 species of birds recorded as occurring in Alaska, nearly half have been recorded from within the Seward Peninsula region. Perhaps most of the Asiatic vagrant species that have been reported in northern and western Alaska came via the Bering Strait, across the Seward Peninsula only to be "discovered" elsewhere. Of the 137 species recorded within the region, 91 are nesting migrants, 5 are nesting residents and 41 probably occur only as nonbreeding migrants and vagrants (Appendix II).

Situated at the crossroads of the Asiatic-North American Flyway, the area includes habitats used by nesting, summering, molting and migrating birds. Birds that are raised within this area currently provide considerable recreational and subsistence uses to people throughout the United States. Birds that are produced there also migrate to wintering areas throughout the Americas, and most lands within and bordering the Pacific Ocean, to the Antarctic.

A good proportion of the wetland habitat within the region which is important to many species of nesting and migrating waterfowl, shorebirds and other water-related groups of birds is being proposed for inclusion in the reserve or adjacent refuge. However, an equally large proportion of wetland habitat--some of the very best--is within Native village withdrawals and village deficiency areas. As can be readily understood, Native settlements were located in areas where fish and game could be found in both abundant and dependable quantities. The wetlands within the village withdrawals for Wales, Shishmaref, Mary's Igloo, Candle and

Buckland are the primary examples. Figure 8 delineates the various types of wetland habitat within the proposal and adjacent areas.

The estuarine habitat is the most important type in the region because it is limited in amount, with a tidal amplitude ranging from only two to four feet, and many species of water birds are adaptively restricted to it (i.e., they could live in no other type of habitat). The best examples of this habitat are found along the shores of the coastal lagoons and the deltas, especially those of the Serpentine, Nugnugaluktuk, Goodhope and Arctic Rivers.

The high value freshwater wetlands found inland may be every bit as productive in numbers and biomass of birds as the estuarine habitat. Wetlands can be found bordering most rivers and streams, and they all are of value to birds even though they may not occur in large blocks. The upland habitats, both forest and tundra-covered, provide habitat for the resident species of birds and a majority of the passerines.

Information on waterfowl populations and distribution is generally better than for any other group of birds, primarily because of that which was acquired in order to better regulate hunting harvest. Fourteen years of aerial surveys to assess breeding duck populations within this region provide good information on yearly fluctuations among the more numerous and conspicuous (as viewed from the airplane at 100 mph) ducks. Information on bird densities and, therefore, total populations is not as good. Table 8 presents the information derived from these surveys. There are no more precise estimates for the numbers of swans or geese within the region available, including those lands being considered for refuge and park purposes.

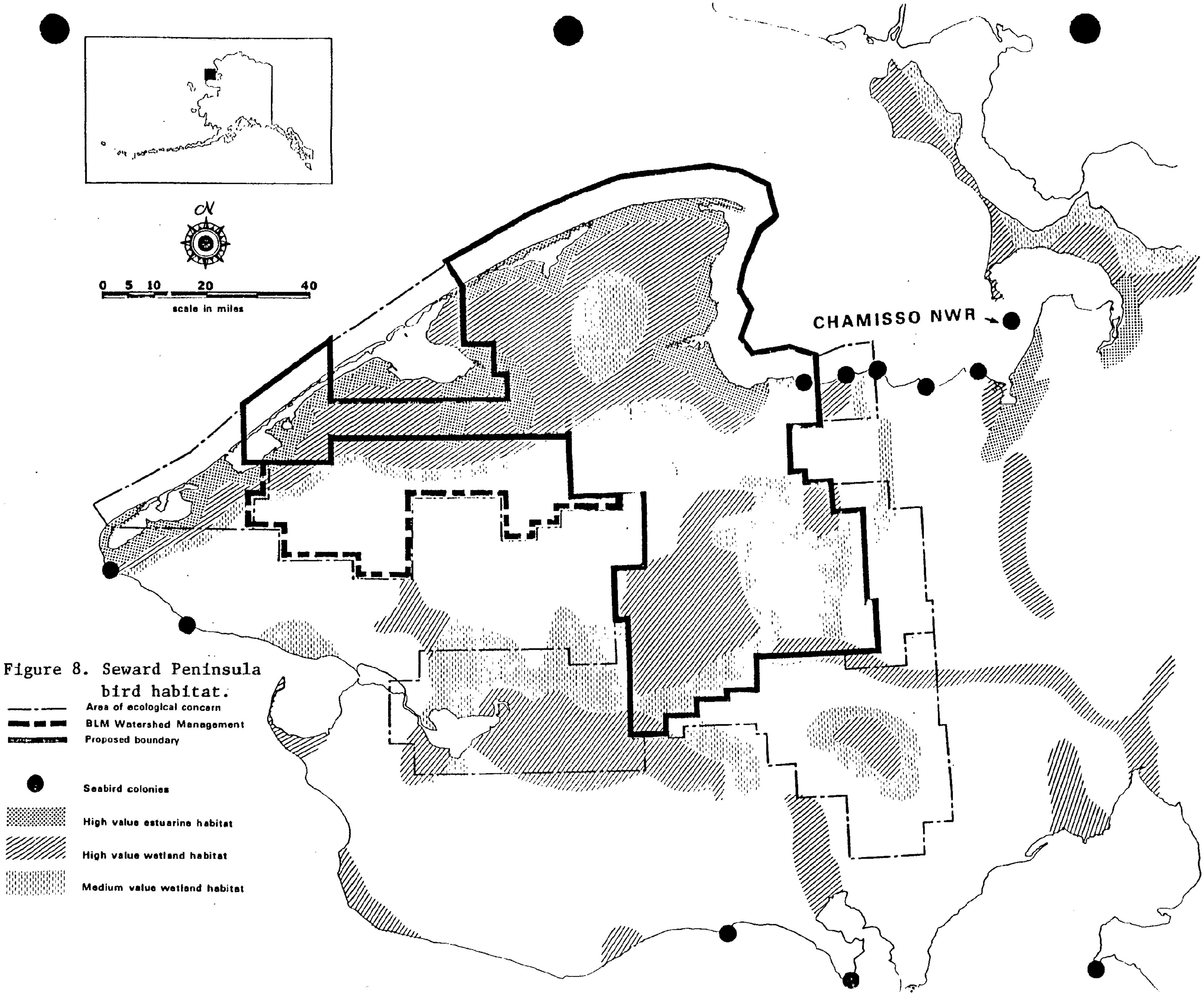


Figure 8. Seward Peninsula bird habitat.

Table 8
Average populations of breeding ducks, peak populations of breeding ducks, and estimated fall populations within the Seward Peninsula as calculated from 14 years (1957-1970) of aerial survey data (King and Lensink, 1972).

	Average Population (1957-1970)	Peak Population
Mallard	2,600	-
American Widgeon	6,900	-
Greenwinged Teal	4,300	-
Shoveler	700	-
Pintail	87,000	-
B.W. Teal	900	-
Subtotal - Dabblers	102,400	-
Canvasback	500	-
Scaup	50,000	-
Goldeneye	2,500	-
Bufflehead	300	-
Subtotal - Divers	53,300	-
Oldsquaw	49,200	-
Eider	4,900	-
Scoter	20,700	-
Merganser	200	-
Subtotal - Misc.	75,000	-
TOTAL ALL DUCKS	230,700	400,800
TOTAL DUCKS PER SQ. M *	59,9	59.9
Projected Fall Flight**	461,400	801,600

* Waterfowl habitat is estimated to include 3,850 square miles on the Seward Peninsula.

** Ducks in this region are assumed to annually produce 1.0 young per adult in the breeding population.

The Seward Peninsula contains several productive units of waterfowl habitat which contain a breeding population of about 231,000 ducks (King and Lensink, 1972). Population densities for ducks, about 60 per square mile, are higher than for the average of any habitat in western Alaska.

The large, white whistling swans can be found throughout the region from spring through fall occupying a variety of wetland types. Adult birds nest near lakes in interior basins, along rivers and adjacent to coastal lagoons. Perhaps from three to five percent of the Pacific Flyway's estimated 42,000 (10-year average) wintering population of swans comes from this area. The only recorded nest of the Asiatic whooper swan in North America was found in this area.

The cackling Canada goose is found throughout the Seward Peninsula area during summer and fall, along with the somewhat larger and more numerous Taverner's Canada goose. The breeding population and distribution of this diminutive goose within the proposal area have not been determined, but most birds are believed to be sub-adult nonbreeders from the Yukon-Kuskokwim Delta. Both of these species of small geese are prized game birds along their entire migration route which terminates in Washington, Oregon and California. Total goose populations are, however, comparable with those in the better habitats throughout the State.

Black brant are birds of the estuarine and marine habitat. Within the lands under consideration, they can be found nesting in low densities almost exclusively within the estuarine habitat. Brant can be found from spring through fall within salt water, including the many lagoons along the coastline of the Seward Peninsula.

White-fronted geese are numerous (probably numbering in the tens of thousands) and widely spread within the proposal area. These whitefronts migrate through the northcentral prairies of Canada and the United States to wintering grounds in Texas and Mexico.

The northern coast of the Seward Peninsula is the northernmost major breeding area of the emperor goose, though nonbreeding adults have occasionally wandered as far north as Point Barrow. While this species is known to be adaptively restricted to an estuarine habitat, the factors limiting its northward and southward breeding distribution are not known. The wintering area of this population is presumed to be that of those from the Yukon Delta, i.e., from Kodiak Island westward through the Aleutian Islands. However, future banding efforts may show that this population has greater affinities to the Siberian population which is believed to winter on the Kamchatka Peninsula coast and in the Kommander Islands of the U.S.S.R.

From 50,000 to 100,000 snow geese biannually fly between nesting grounds on the U.S.S.R.'s Wrangell Island north of the Siberian coast to wintering grounds in California. A portion of these geese will stop on the peninsula to feed and rest before resuming migration.

Historical information, including reports by some local residents (others disagree) and an evaluation of the available habitat, suggests that goose populations of the Seward Peninsula, especially the estuarine and delta areas, have been seriously depleted by subsistence hunting of Eskimo residents (King and Lensink, 1972).

Pintails are the most abundant dabbling duck species, comprising more than three-fourths of the dabblers and a third of all ducks observed during aerial surveys. American widgeon, green-winged teal, mallards and shovelers comprise the majority of the other dabblers, and they, along with the pintails, migrate principally down the Pacific Flyway. The Bering Strait Regional Corporation considers the green-winged teal estimate in Table 8 to be quite low due to the difficulty of spotting the small bird.

Scaups are the most numerous diving ducks nesting in the area. Greater scaup which migrate to the Atlantic Flyway probably constitute most of the scaups in the area and are widely distributed. Buffleheads and goldeneyes are not abundant; they nest in cavities in trees and are, therefore, restricted in nesting to the timbered portions which are extremely limited in area. Most of the birds seen in coastal areas are probably nonbreeders.

Oldsquaws, three species of scoters and four species of eiders are the most common seaducks nesting in the area. Red-breasted mergansers constitute a much greater proportion of the waterfowl population than the survey data would indicate. The disparities between the numbers of mergansers can be attributed in part to the secretive behavior of the species and in part to the fact that little of their preferred nesting habitat is surveyed.

Seabird colonies are found at several locations along the Seward Peninsula coastline. The only lands presently within the National Parks, Forests, Wildlife Refuges or Wild and Scenic Rivers Systems within this region are in the Chamisso National Wildlife Refuge which is situated about two miles south of the Choris Peninsula in Kotzebue Sound. The 641-acre refuge consists of Chamisso and Puffin Islands and a few associated islets. It was established in 1912 to protect nesting sites of horned puffins, thick-billed murres and black-legged kittiwakes that possibly number several thousands. Within the Deering Native village withdrawal block of townships, which is included within the area of ecological concern, are colonies of murres, kittiwakes, puffins and gulls along approximately one mile of coast about one mile east of Toawlevic Point, at Cape Deceit, and two miles southeast of Ninemile Point. A few puffins are nesting in the overhang above the cliffs on the Choris Peninsula, the southernmost promontory of the Baldwin Peninsula.

Because of the quantity of wetlands, both freshwater and estuarine, waterbirds are a conspicuous part of the avifauna. The densities of yellow-billed loons are nowhere greater in Alaska than those within the proposal area. The Arctic and red-throated loons are abundant here as in most coastal lowlands of western and northern Alaska. Shorebirds exceed in numbers, if not in biomass, any other group of birds in the wetlands.

The Eskimo curlew, which is possibly extinct, was formerly found in its greatest abundance in northwest Alaska. If the species persists, it may well be found within the proposal area.

Sandhill cranes which migrate through the Central and Pacific Flyways to wintering grounds in the southwest United States and Mexico are found nesting in large numbers throughout the wetlands. Even larger numbers cross the Bering Strait to and from breeding grounds in Siberia.

Gulls, terns, jaegers are seasonally abundant--most from spring through summer--but the ivory gull is found at the edge of the sea ice in winter and on occasion may come over land.

The passerines (perching songbirds) both in individuals and species far outnumber any other group of birds in the area. They range in size from the tiny warblers and redpolls to the raven.

The migrations of some of these birds are spectacularly long. The wheatear, for example, leaves its nesting grounds within the reserve, traverses the Bering Strait and then travels southeast across Asia to winter in central Africa. The Arctic warbler, bluethroat, yellow wagtail and the white wagtail which nest within the reserve will winter from Borneo west through India and Africa. Most of the three species of swallows will migrate to central South America where an abundance of insects can be found in winter.

APPENDIX II

Checklist of Birds from the Seward Peninsula

Information on the relative abundance, status and primary wintering areas of those species occurring within the units are listed. Abbreviations used to indicate relative abundance and status are:

Relative Abundance

a	abundant
c	common
o	occasional
u	uncommon or rare

Status

n	nesting
m	migrant
r	resident throughout the year
v	vagrant or stray

Relative abundance is considered relative to abundance of the species elsewhere. Thus, greater scaup and sandhill cranes, for example, are listed as "abundant" in some units inasmuch as they are as numerous per unit of area there as in any other portion of their range. The mallard, on the other hand, is listed as "common" because it is present in relatively low numbers compared to densities in its major breeding range. Kittiwakes and alcids are listed as "occasional" because they occur at only one or two small colonies. Wintering area generally follows the description of Gabrielson and Lincoln (1959). An asterisk (*) indicates species that are endangered.

Because of the Seward Peninsula's proximity to Asia and the migratory pathway between the continents across the Bering Strait, this region will undoubtedly have a host of yet unrecorded bird species that will summer and even nest. Perhaps most of the Asiatic vagrants will already have been reported in northern and western Alaska came via this route but were "discovered" elsewhere.

The checklist was compiled from information in Gabrielson and Lincoln (1959), Bailey (1949), Grinnell (1909), Hudson (1957), Kessel (1968), Divoky (1972) and unpublished observations by Bureau of Sport Fisheries and Wildlife personnel.

Many species of seabirds, including shearwaters, black guillemot, the dovekie, murrelets and auklets, do not nest within the study areas but are listed as migrants because they are found in summer in the Chukchi Sea along the north coast of the Seward Peninsula and in Kotzebue Sound. Some of the species nest nearby at colonies being proposed for inclusion within the National Wildlife Refuge System.

Abundance & Status by Unit

Species	Shish-maref	Imuruk & Kuzitrin	Primary wintering area
Common loon	u n	u n	S. Alaska & British Columbia
Yellow-billed loon	c n	c n	SE Alaska & British Columbia
Arctic loon	c n	c n	SE Alaska & British Columbia
Red-throated loon	c n	c n	SC & SW Alaska
Red-necked grebe	c n	c n	Aleutians to British Columbia
Horned grebe	o n	c n	Coastal Alaska to California
*Fulmer	o m		Aleutians South to California and Japan
*Slender billed Shearwater	o m		Tasmania, Australia and New Zealand
Pelagic cormorant	o m		Aleutians to California
Whooper swan	u m		Aleutians to N. Japan
Whistling swan	c n	c n	Utah, Nevada & California
Cackling Canada goose	c n	c n	Washington, Oregon, California
Taverner's Canada goose	c n	c n	Washington, Oregon, California
Black brant	c n		Coast from Washington to Mexico
Emperor goose	c n		Kodiak Is. & Aleutian Is.
White-fronted goose	c n	c n	Texas & northern-central Mexico
Snow goose	a m	c m	Central California
Mallard	c n	c n	Pacific Coast from Alaska to Oregon
Pintail	a n	a n	Pacific Flyway from Canada to Mexico

Abundance & Status by Unit

Species	Shish-maref	Imuruk & Kuzitrin	Primary wintering area
American Widgeon	a n	a n	Pacific Flyway from Canada to Mexico
Green-winged teal	a n	a n	Pacific Flyway from Canada to Mexico
Shoveler	c n	c n	Pacific Coast states
Canvasback	o n	o n	California
Greater Scaup	a n	a n	Pacific Coast south to California, Gulf Coast, Atlantic Coast to Virginia
Lesser Scaup		u n	Gulf Coast states & as far north as Iowa
Common Goldeneye	a n	o n	Alaska south to California
Bufflehead	o n	o n	British Columbia south to California
Oldsquaw	a n	a n	Bering Sea, Siberia, northern Japan
Harlequin duck	o m		Aleutian Islands
Steller's eider	c m		Bering Sea
Common eider	c n		Bering Sea
King eider	c m		Bering Sea
Spectacled eider	o m		Unknown, probably Bering Sea
White-winged scoter	o n		Kodiak, southeastern Alaska
Surf scoter	c n	o n	Southeastern Alaska
Common scoter	c n	c n	Aleutian Is. to southeast Alaska
Red-breasted Merganser	c n	c n	Aleutian Is. to southeast Alaska

Abundance & Status by Unit

Species	Shish-maref	Imuruk & Kuzitrin	Primary wintering area
Goshawk	u v	o v	Central Alaska to British Columbia
Sharp-shinned-hawk	o n	o n	Montana through Mid-west states
Rough-legged hawk	o n	o n	Japan & China southwest to Black Sea
Golden eagle	u n	o n	Pacific Coast states to British Columbia
Bald eagle	o n	c n	Southern British Columbia through Mexico
Osprey	o m	o m	California to central South America
Gyrfalcon	o n	c n	Siberia, Kurile Is., & Japan
*Peregrine falcon	u m		Across Asia to Thailand, SE Alaska to Mexico
Spruce grouse		o r	Resident
Willow ptarmigan	a r	a r	Resident
Rock ptarmigan	c r	c r	Resident
Sandhill crane	a n	c n	West Texas, New Mexico, northern Mexico
Semipalmated plover	c n	c n	Pacific Coast from California to Chile
Mongolian plover	o v		China to Australia
Dotterel	u v	u v	Southern Europe & northern Africa
American golden plover	c n	c n	From eastern India, to Malaysia New Zealand
Black-bellied plover	c n	c n	British Columbia to Brazil
Ruddy turnstone	c n	c n	California south to Chile, South Pacific Islands to New Zealand
Black turnstone	c n		SE Alaska to Mexico
Common snipe	c n	c n	Western U.S. to Central Americ-

	Abundance & Status by Unit		
Species	Shish-maref	Imuruk & Kuzitrin	Primary wintering area
Whimbrel	o n	o n	Pacific Coast from California to Chili
Bristle-thighed curlew	c n	c n	Hawaiian Is. south to Micronesia
*Eskimo curlew	Probably extinct or extripated from this region; formerly it was the most abundant curlew along the coasts of Bering Sea and Kotzebue Sound		
Spotted sandpiper	c n	c n	Washington to Peru
Wandering tattler		o n	Baja California to Ecuador, New Zealand, Micronesia, Philippines
Eurasian knot	o m		S. California to South America
Great knot	u v		SE Asia, Micronesia, Australia
Rock sandpiper	o n	c n	Aleutian Is. to SE Alaska
Sharp-tailed sandpiper	u v		SE Asia, Micronesia, Australia
Pectoral sandpiper	a n	a n	South America
Baird's sandpiper	c n	c n	Mountainous South America
Least sandpiper	o n	o n	Oregon, California south to northern South America
Rufous-necked sand piper	u n		SE Asia, Australia, New Zealand
Dunlin	o n	o n	Pacific Coast from B.C. to Mexico
Long-billed dowitcher	o n		S. California, Texas, Mexico
Stilt sandpiper	u v		Uruguay to Argentina
Semipalmated sandpiper	a n	a n	Gulf Coast of U.S. through Central America
Western sandpiper	c n	c n	California through Mexico & Central America

Abundance & Status by Unit

Species	Shish-maref	Imuruk & Kuzitrin	Primary wintering area
Bar-tailed godwit	c n	c n	SE China, Malaysia, Australia and New Zealand
Red phalarope	c n	o n	At sea, SE Pacific, South America to New Zealand
Northern phalarope	a n	o n	At sea, S. Pacific; Malaysia to South America
Pomarine jaeger	c m	c m	At sea, California to Peru
Parasitic jaegar	c n	c n	At sea, California to Chile, New Zealand
Long-tailed jaeger	a n	a n	At sea, off South America
Glaucous gull	c n	o n	Aleutians, S. Alaska, British Columbia
Glaucous-winged gull	o v	u v	Along northern rim of Pacific Ocean, Japan to California
Slanty-back gull	u v	u v	Siberia south to northern Japan and China
Herring gull		u v	Bering Sea
Mew gull		o n	SE Alaska to California
Bonaparte's gull	o m		Washington to Baja California
Ivory gull	o m		The frozen Arctic Ocean
Black-legged Kittiwake	o n		SE Alaska to Baja California
Sabine's gull	a n	o m	At sea south to Peru
Arctic tern	a n	a n	Central Chile south to Antarctica
Common murre	o n		Bering Sea
Thick-billed murre	o n		Bering Sea
Dovekie	u m		Bering Sea
Black guillemot	c m		Bering Sea

Species	Abundance & Status by Unit: Shish-maref	Abundance & Status by Unit: Imuruk & Kuzitrin	Primary wintering area
Pigeon guillemot	o n		Bering Sea
Kittlitz's murrelet	c m		Bering Sea
Parakeet anklet	o m		Bering Sea
Crested anklet	o m		Bering Sea
Oriental cuckoo	u v		South China
Snowy owl	o n	o n	Alaska
Short-eared owl	c n	c n	Western U.S.
Wryneck	u v		Indo-China
Yellow-shafted flicker	o v	o v	SE states
Downy woodpecker		u v	Alaska
Horned lark	o n		NW U.S. & W. Canada
Tree swallow	o n	o n	SW U.S., Mexico & Caribbean
Bank swallow		c n	Central South America
Barn swallow		c n	Central South America
Purple martin	u v		Central South America
Common raven	c r	c r	Resident
Dipper		o r	Resident
Robin	c n	c n	Southern states to Vera Cruz
Gray-cheeked thrush	c m	c m	Central America to northern half of S. America
Wheatear	o n	o n	China, India & Africa
Bluethroat	o n	o n	SE Asia to Africa

Species	Shish-maref	Imuruk & Kuzitrin	Primary wintering area
Arctic warbler	o m	o m	Philippines, Indo-China, East Indies
Ruby-crowned kinglet	u v		British Columbia to California
White wagtail	o n	o n	Eastern China and S. Japan
Yellow wagtail	c n	o n	SE Asia, India & Africa
Water pipit	o n	o n	Oregon to W. Mexico
Red-throated pipit	u n		S. China, India, central Africa
Yellow warbler		u n	Baja California to Panama
Wilson's warbler	c n	c n	Mexico to Panama
Red-winged blackbird	u v		Colorado to Texas and Louisiana
Pine grosbeck	u v		Alaska south to upper Mid-West
Hoary redpoll	c n	c n	Alaska & resident
Common redpoll	c n	c n	Alaska & resident
Savannah sparrow	a n	a n	Oregon to Texas and Mexico
Slate-colored Junco	c m	c m	Upper Mid-West, New England to Gulf Coast
Tree sparrow	o n	c n	SW states
White-crowned sparrow	o n	o n	British Columbia, western U.S. & Mexico
Golden-crowned sparrow	o n	o n	British Columbia to California
Fox sparrow	o n	o n	Gulf Coast states to Florida
Lapland longspur	a n	a n	Northern U.S.
Snow bunting	a n	c n	Alaska to northern U.S., Resident

UNIT 23

KOTZEBUE SOUND-SELAWIK AREA (Selawik National Wildlife Refuge Proposal)

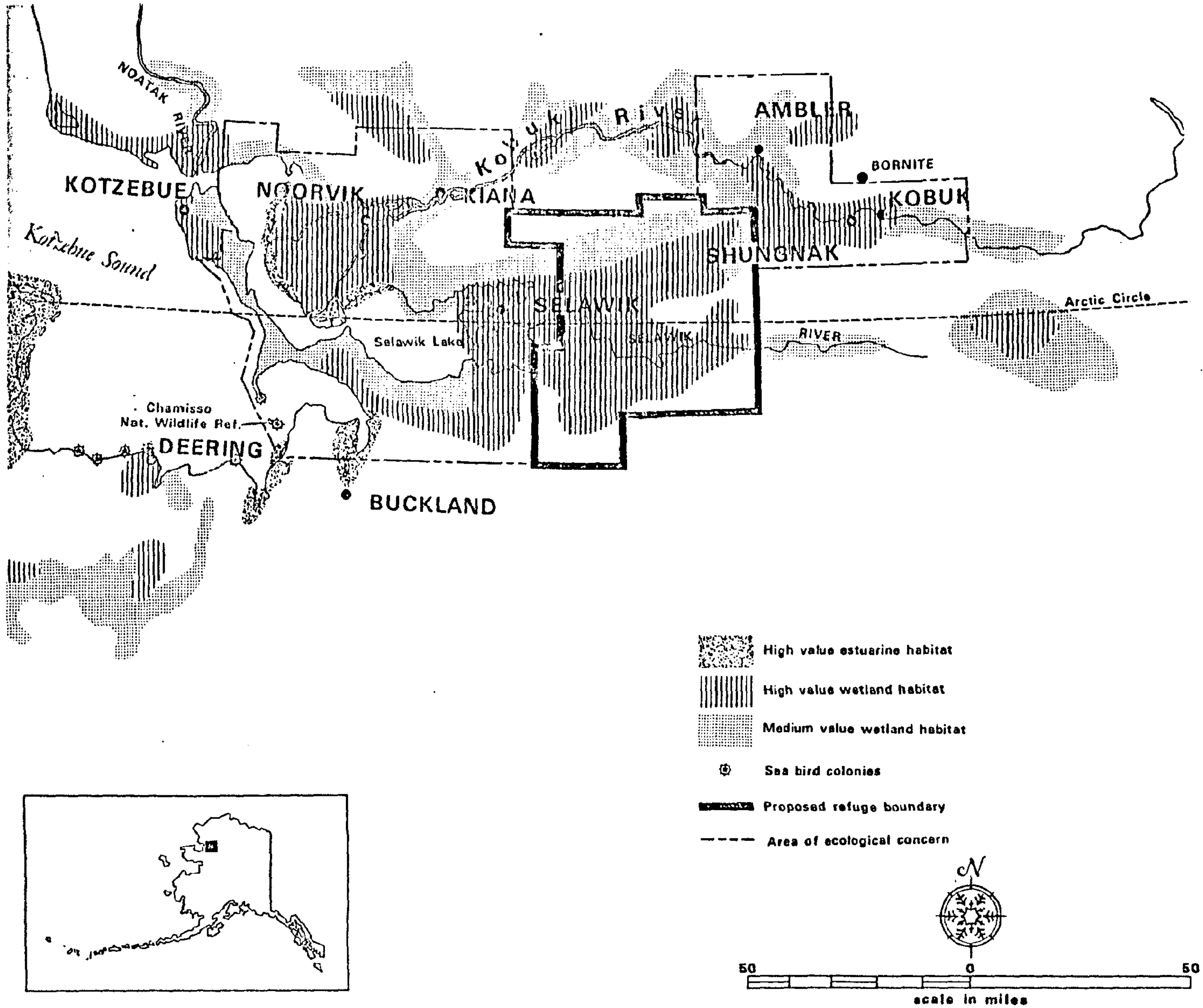
Of 352 species of birds recorded in Alaska, almost half are from within the Kotzebue Sound-Selawik region. Of the 142 species recorded within the region, 109 are nesting migrants, 15 are nesting residents and 18 probably occur only as nonbreeding migrants and vagrants (Appendix III).

Situated near the crossroads of the Asiatic-North American Flyway, the region includes habitats used by nesting, summering, molting and migrating birds. Birds that are raised within this area currently provide considerable recreational and subsistence uses to people throughout the Americas and most lands within and bordering the Pacific Ocean, to the Antarctic and through western Asia as far west as Africa.

A good proportion of the wetland habitat within the region is important to many species of nesting and migrating waterfowl, shorebirds and other water-related groups of birds. Some of this habitat is within the Selawik Refuge. However, an equally large proportion of wetland habitat is within Native village withdrawals, village deficiency areas and d-1 and d-2 lands within the areas of ecological concern--some of which is the best in the region. Native settlements were located in areas where fish and game could be found in both abundant and dependable quantities. The wetlands within the village withdrawals for Candle, Buckland, Noorvik, Selawik, Kiana, Ambler, Shungnak and Kobuk are the primary examples.

Figure 9 delineates the various types of wetland habitat according to their use by waterfowl within the refuge, the areas of ecological

Figure 9. WETLAND HABITATS, WITH RANKING ACCORDING TO THEIR VALUE TO WATERFOWL, SHOREBIRDS, OTHER WATERBIRDS, AND SEABIRD COLONIES



concern and adjacent areas. These same wetlands have other values to other species of fish and wildlife.

The estuarine habitat is one of the most important types in the region because it is limited in amount, has a tidal amplitude ranging from only two to four feet, and many species of waterbirds are adapted to it to the extent that they could live in no other type of habitat. There is no estuarine habitat in the refuge, but much of it is within the area of ecological concern. The best examples of this habitat are found along the shores of the coastal lagoons and the deltas, especially those of the Kobuk, Kauk, Kiwalik and Buckland Rivers.

Geese, brant and swans congregate in Eschscholtz Bay, Hotham Inlet and Selawik Lake within the western area of ecological concern in fall prior to migration.

The high value freshwater wetlands found inland may be every bit as productive in numbers and biomass of birds as the estuarine habitat, but their loss would not be as serious because the habitat and the birds dependent upon it are generally common and widespread throughout Alaska.

Wetlands can be found bordering most rivers and streams. These all are of value to birds even though they may not occur in large blocks.

The upland habitats, both forest and tundra-covered, constitute about half the region and provide habitat for the 15 resident species of birds and a majority of the passerines.

Information on waterfowl populations and distribution is generally better than for any other group of birds, primarily because regulations for hunting necessitated it. Fourteen years of aerial surveys within this region have provided data on yearly fluctuations among numbers of the more numerous and conspicuous species of ducks. These same data have been extrapolated to provide estimates of duck densities and populations. Table 9 presents the information derived from these surveys. There are no reliable estimates of numbers of geese within the region.

The breeding population of about 234,000 ducks within the Selawik-Kobuk-Baldwin Peninsula region averages about 44 ducks per square mile, or only slightly lower than densities of over half a million ducks (Table 9).

Goose populations are believed to be comparable with those in the better habitats throughout the State. The cackling Canada goose is found throughout the Kotzebue Sound area during summer and fall along with the somewhat larger and more numerous Taverner's Canada goose. The breeding population and distribution of the diminutive "cackler" within the proposed refuge has not been determined. Both of these species of small geese are prized game birds along their entire migration route which terminates in Washington, Oregon and California.

White-fronted geese are numerous (probably numbering in the tens of thousands) and widely spread within the proposal. These whitefronts migrate through the northern prairies of Canada and the United States to wintering grounds in Texas and vicinity.

Black brant and emperor geese breed in the estuarine habitat within the western area of ecological concern.

Between 200,000 and 300,000 snow geese, or about half of the Pacific Flyway's population, biannually fly between wintering grounds in California and nesting grounds on the U.S.S.R.'s Wrangell Island north of the Siberian coast, with a portion of this flight stopping in the Kotzebue region for feeding and resting.

Table 9 . Average populations of breeding ducks, peak populations of breeding ducks and estimated fall populations within the Selawik-Kobuk-Baldwin Peninsula region as calculated from 14 years (1957-1970) of aerial survey data.

	Average Population	Peak Population
Mallard	4,700	---
Pintail	67,800	---
Green-winged teal	7,900	---
American widgeon	23,000	---
Shoveler	1,100	---
Subtotal - Dabblers	104,500	
Canvasback	600	---
Scaup (2 species)	83,800	---
Scoter (3 species)	300	---
Bufflehead	300	---
Subtotal - Divers	85,000	
Oldsquaw	25,600	---
Eider (4 species)	0	---
Scoter (3 species)	18,600	---
Red-breasted merganser	Trace	---
Subtotal - Miscellaneous	44,200	
Total all ducks	233,700	315,600
Total ducks per sq. mi.*	43.7	59
Projected fall flight**	421,000	568,200

* Waterfowl habitat is estimated to include 5,350 square miles in the Kotzebue Sound-Selawik region.

** Ducks in this region are assumed to annually produce 0.8 young per adult in the breeding population.

Whistling swans can be found throughout the region from spring through fall occupying a variety of wetland types. Adult birds nest near lakes in interior basins, along rivers and adjacent to coastal lagoons. Perhaps from two to five percent of the Pacific Flyway's estimated 42,000 (10-year average) wintering population of swans come from this area.

The only record of the Asiatic whooper swan breeding in North America is that of at least one pair reported by Peter E. K. Shepherd to have nested in the proposed Selawik Refuge.

Pintails are the most abundant dabbling duck species, comprising two-thirds of the dabblers and one-third of all ducks observed during aerial surveys (Table 9). American widgeon, green-winged teal, mallards and shovelers comprise the majority of the other dabblers. They, along with the pintails, migrate principally down the Pacific Flyway.

Scaups are the most numerous diving ducks nesting in the area. The greater scaup which migrates to the Atlantic Flyway probably constitutes about 90 percent of the scaups in the area and is widely distributed. The lesser scaup constitutes the remaining 10 percent and tends to be found in the more inland forested habitat. Buffleheads and goldeneyes are not abundant; they nest in cavities in trees and, therefore, are restricted in nesting to the few timbered portions of the area.

Oldsquaws, three species of scoters and four species of eiders are the most common seaducks nesting in the area. Although not enumerated in the aerial surveys, the colorful harlequin duck nests throughout the region, especially on swift, clearwater streams such as the Kobuk drainage. Also, red-breasted mergansers probably constitute a much greater proportion of the waterfowl population than the survey data would indicate. The disparities between the numbers of harlequins and mergansers can be attributed in part to the secretive behavior of the species and in part to the fact that little of their preferred nesting habitat is surveyed.

About one-third of the previously mentioned waterfowl are found within the proposed Selawik Refuge. About half of the total, including all the waterfowl of the estuarine habitat, come from the areas of ecological concern. The remainder come from the middle drainage of the Kobuk River and the Squirrel River drainage, within the Kobuk Valley National Monument and the Noatak National Ecological Range, respectively, and the Pah River Flats.

Seabird colonies are found in the western area of ecological concern at Chamisso and Puffin Islands that are part of the existing Chamisso National Wildlife Refuge. The refuge colony, however, is not the largest colony in the area. Horned puffins, murres, kittiwakes and gulls nest on Puffin Island and its associated islets. A few puffins and murres nest in the overhang above the cliffs on the Choris Peninsula, the southernmost promontory of the Baldwin Peninsula. Few seabirds nest on Chamisso Island itself.

Because of the quantity of wetlands, both freshwater and estuarine, waterbirds are a conspicuous part of the avifauna.

Densities of yellow-billed loons within this region are perhaps only surpassed by those found on the Seward Peninsula. The arctic and red-throated loons are abundant here as in most coastal lowlands of western and arctic Alaska. The common loon, whose haunting cry has become synonymous with wilderness, reaches its northwestern limits in the region--its habitat being the forested lakes and ponds. Shorebirds exceed in numbers, if not in biomass, any other group of birds in the wetlands. At least 29 species have been reported from the area.

The Eskimo curlew, an endangered species which is possibly extinct, was formerly found in its greatest abundance within the Kotzebue Sound area. If the species persists, it may well be found within the proposed refuge.

Sandhill cranes which migrate through the Central and Pacific Flyways to wintering grounds in the southwest United States and Mexico are found nesting in large numbers throughout the wetlands. Even larger numbers cross the Bering Strait to and from breeding grounds in Siberia.

Gulls, terns and jaegers are seasonally abundant--primarily from spring through summer.

Gyrfalcons are likely to be found nesting in the hills to the south of Selawik Lake, in the Waring Mountains and in the hills facing Hotham Inlet between the Kobuk and Noatak Rivers. Although ptarmigan are a principal prey of this falcon, ducks, gulls and shorebirds are utilized in summer.

The endangered peregrine falcon has been reported in this region, but apparently does not nest to any great extent along the Noatak, Kobuk, Koyukuk and other rivers flowing south of the Brooks Range.

Rough-legged hawks, golden eagles and short-eared owls can be found throughout the area. Boreal owls, hawk owls and goshawks are restricted to the forested areas. Snowy owls appear irregularly at any season of the year in search of lemmings.

The passerines, both in individuals and in species, far outnumber any other group of birds in the area. They range in size from the tiny warblers and redpolls to the raven.

The migrations of some of these birds are spectacularly long. The wheatear, for example, leaves its nesting grounds within the Selawik Refuge, traverses the Bering Strait and then travels southwest across Asia to winter in central Africa. The arctic warbler, bluethroat, yellow wagtail and white wagtail which nest within the refuge winter from Borneo west through India and Africa. Most of the three species of swallows migrate to central South America where an abundance of insects can be found in what is winter in Alaska but summer south of the equator.

The production of migratory birds within the Selawik proposal area is an important economic use of the land for the local area as well as for the State, the Nation and other countries through which these birds fly. Subsistence and sport uses of this renewable resource are widespread. The economic value of local subsistence harvests is discussed in a later section. Subsistence harvests of these birds in other regions during the nonbreeding season is equally important, but not as readily quantifiable. The recreation values of sport hunting are better known and are believed to be one of the primary values of the area.

The optimum allowable hunting harvest of waterfowl differs with each species because of differences in reproductive capacities and rates of nonhunting mortality. Harvest also will vary from year to year because of climatic factors affecting production. Harvest rates of from 20 to 30 percent are generally acceptable for most ducks. Acceptable harvest rates for geese, cranes, swans and other long-lived and slow-maturing species are generally lower.

Applying 20 and 30 percent harvest rates to the 14-year average fall population of 421,000 ducks (Table 9) in the Kotzebue Sound-Selawik region gives a potential annual harvest of from 84,200 to 126,300 ducks. This harvestable population of ducks is of considerable value to the Nation in terms of recreational opportunities and dollars expended towards that sport. The average U.S. waterfowl hunter during the period 1968 to 1971 hunted 6.12 days per season and bagged 7.1 ducks per season, with hunting expenditures averaging $9.73 per day. Using these statistics and the potential allowable harvest for ducks based upon the 20 to 30 percent harvest rates of the average population, this region could provide a minimum of from 11,900 to 17,800 hunters with from 84,000 to 110,000 days of recreation. Related expenditures could range from $817,000 to $1,070,000 annually.

Sport harvest of geese, swans, cranes and snipe produced in this region would be in addition to those values calculated for ducks. The value of the meat also would be additional.

The contribution that birds produced in this region make to the enjoyment of the Nation's estimated 6.8 million birdwatchers and 4.5 million wildlife photographers cannot be similarly assessed in terms of dollars or days.

APPENDIX III

Checklist of Birds from the Kotzebue Sound-Selawik Region

Birds of the Kotzebue Sound-Selawik region are listed according to their occurrence within the two areas within the proposed refuge which show obvious differences in avifauna related to the differences in habitat.

Information on the relative abundance, status, and primary wintering areas of those species occurring within the units are listed. Abbreviations used to indicate relative abundance and status are:

Relative Abundance

a	abundant
c	common
o	occasional
u	uncommon or rare

Status

n	nesting
m	migrant
r	resident throughout the year
v	vagrant or stray

Relative abundance is considered relative to abundance of the species elsewhere. Thus, greater scaup and willow ptarmigan, for example, are listed as "abundant" inasmuch as they are as numerous per unit of area there as in any other portion of their range. The mallard, on the other hand, is listed as "common" because it is present in relatively low numbers compared to densities in its major breeding range. Kittiwakes are listed as "occasional" because they occur at only one or two small colonies. Wintering area generally follows the description of Gabrielson and Lincoln (1959). An asterisk (*) indicates species that are endangered.

Because of the area's proximity to Asia and the migratory pathway between the continents across the Bering Strait, there are undoubtedly a number of yet unrecorded species that will summer and even nest.

The checklist was compiled from information in Gabrielson and Lincoln (1959), Bailey (1949), Grinnell (1909), Hudson (1957), Kessel (1968), Divoky (1972) and unpublished observations by U.S. Fish and Wildlife Service personnel.

Some species of seabirds do not nest within the study areas but are listed as migrants because they are found in summer in Kotzebue Sound and to a lesser extent in Hotham Inlet. Some of these species nest nearby at colonies being proposed for inclusion within the National Wildlife Refuge System.

Species	Abundance & Status: Kobuk Dlt & Selawik		Upper Kobuk		Primary Wintering Area
Common loon	o	n	o	n	S. Alaska & British Columbia
Yellow-billed loon	c	n	c	n	SE Alaska & British Columbia
Arctic loon	c	n	c	n	SE Alaska & British Columbia
Red-throated loon	c	n	c	n	SC & SW Alaska
Red-necked grebe	c	n	c	n	Aleutians to British Columbia
Horned grebe	c	n	c	n	Coastal Alaska to California
Whooper swan	u	n			Aleutians to N. Japan
Whistling swan	c	n	c	n	Utah, Nevada & California
Cackling Canada goose	c	n			Washington, Oregon, California
Taverner's Can. goose	c	n	c	n	Washington, Oregon, California

Species	Abundance & Status: Kobuk Dlt. & Selawik		Abundance & Status: Upper Kobuk		Primary Wintering Area
Black brant	o	m			Coast from Washington to Mexico
Emperor goose	o	m			Kodiak Is. & Aleutian Is.
White-fronted goose	c	n	c	n	Texas & north-central Mexico
Snow goose	c	m	o	m	Central California
Mallard	c	n	c	n	Pacific coast from Alaska to Oregon
Pintail	a	n	a	n	Pacific Flyway from Canada to Mexico
European wigeon	u	v			Japan, China
American wigeon	a	n	a	n	Pacific Flyway from Canada to Mexico
Green-winged teal	a	n	a	n	Pacific Flyway from Canada to Mexico
Blue-winged teal	u	v			Gulf Coast states
Shoveler	c	n	c	n	Pacific Coast states
Canvasback	o	n	o	n	California
Greater scaup	a	n	a	n	Pacific Coast south to California, Gulf Coast, Atlantic Coast to Virginia
Lesser scaup	o	n	o	n	Gulf Coast states & as far north as Iowa
Common Goldeneye	o	n	c	n	Alaska south to California
Bufflehead	a	n	c	n	British Columbia south to California
Oldsquaw	a	n	a	n	Bering Sea, Siberia, northern Japan
Harlequin duck	o	m	c	n	Aleutian Islands
Common eider	c	n			Bering Sea
White-winged scoter	o	n	o	n	Kodiak, southeastern Alaska

Species	Abundance & Status				Primary Wintering Area
	Kobuk Dlt & Selawik		Upper Kobuk		
Surf scoter	c	n	u	n	Southeastern Alaska
Common scoter	c	n	u	n	Aleutian Is. to southeast Alaska
Red-breasted merganser	c	n	c	n	Aleutian Is. to southeast Alaska
Goshawk	o	n	c	n	Central Alaska to British Columbia
Sharp-shinned hawk	o	n	o	n	Montana through Mid-west states
Rough-legged hawk	o	n	o	n	Japan & China southwest to Black Sea
Golden eagle	o	n	o	n	Pacific coast states to British Columbia
Bald eagle	c	n	c	n	Coastal Alaska & British Columbia
Marsh hawk	c	n	c	n	Southern British Columbia through Mexico
Osprey	c	n	c	n	California to central South America
Gyrfalcon	c	n	c	n	Siberia, Kurile Is., & Japan
*Peregrine falcon	u	n	u	n	Across Asia to Siam, SE Alaska to Mexico
Pigeon hawk	u	v	o	v	From California to Texas & Mexico
Spruce grouse	c	r	c	r	Resident
Willow ptarmigan	a	r	a	r	Resident
Rock ptarmigan	c	r	c	r	Resident
Sandhill crane	c	n	c	n	West Texas, New Mexico, northern Mexico
Semipalmated plover	c	n	c	n	Pacific coast from California to Chile
Mongolian plover	o	v			China to Australia
American golden plover	c	n	c	n	From eastern India, to Malaya, New Zealand
Black-bellied plover	c	n	c	n	British Columbia to Brazil

Species	Abundance & Status: Kobuk Dlt. & Selawik		Upper Kobuk		Primary Wintering Area
Surfbird	o	m	o	m	SE Alaska to tip of South America
Ruddy turnstone	c	n	u	n	California south to Chile, south Pacific Islands to New Zealand
Black turnstone	c	n			SE Alaska to Mexico
Common Snipe	c	n	c	n	Western U.S. to Central America
Whimbrel	c	n	c	n	Pacific coast from California to Chile
Bristle-thighed curlew	o	n			Hawaiian Is. south to Micronesia
*Eskimo curlew	Probably extinct or extirpated from this region; formerly it was the most abundant curlew along the coasts of Bering Sea and Kotzebue Sound				
Upland plover	u	n	u	n	Pampas of South America
Spotted sandpiper	c	n	c	n	Washington to Peru
Solitary sandpiper			o	n	South America
Wandering tattler	o	n			Baja California to Ecuador, New Zealand, Micronesia, Philippines
Lesser yellowlegs	c	n	c	n	Texas south to Central & South America
Eurasian knot	o	m			S. California to South America
Sharp-tailed sandpiper	u	v			SE Asia, Micronesia, Australia
Pectoral sandpiper	a	n	o	n	South America
Baird's sandpiper	c	n	c	n	Mountainous South America
Least sandpiper	o	n			Oregon, California, south to northern South America
Dunlin	o	n			Pacific coast from British Columbia to Mexico
Semipalmated sandpiper	a	n			Gulf Coast of U.S. through Central America

Species	Abundance & Status Kobuk Dlt & Selawik		Upper Kobuk		Primary Wintering Area
Western sandpiper	c	n			California through Mexico & Central America
Bar-tailed godwit	c	n			SE China, Malaysia, Australia, & New Zealand
Hudsonian godwit			u	v	Southern South America
Sanderling	u	v			Micronesia to Indian Ocean
Red phalarope	c	n			At sea, SE Pacific, South America to New Zealand
Northern phalarope	a	n			At sea, S Pacific; Malaysia to South America
Pomarine jaeger	c	m			At sea,California to Peru
Parasitic jaeger	c	n			At sea, California to Chile, New Zealand
Long-tailed jaeger	a	n			At sea, off South America
Glaucous gull	c	n			Aleutians, S. Alaska, British Columbia
Glaucous-winged gull	o	v			Along northern rim of Pacific Ocean, Japan to California
Slaty-back gull	u	v			Siberia south to northern Japan and China
Mew gull	c	n	c	n	SE Alaska to California
Bonaparte's gull	c	n	o	n	Washington to Baja California
Ivory gull	u	m			The frozen Arctic Ocean
Black-legged kittiwake	o	n			SE Alaska to Baja California
Sabine's gull	c	n			At sea south to Peru
Arctic tern	a	n	c	n	Central Chile south to Antarctica
Horned puffin	o	n			Bering Sea
Tufted puffin	o	n			Bering Sea

Species	Abundance & Status Kobuk Dlt & Selawik		Upper Kobuk		Primary Wintering Area
Horned owl	o	n	c	n	Alaska
Snowy owl	o	n	o	m	Alaska
Hawk owl	o	n	o	n	Alaska
Short-eared owl	c	n	c	n	Western U.S.
Boreal owl	u	v	u	r	Alaska
Belted kingfisher	o	r	c	r	Resident
Yellow-shafted flicker	o	m	o	n	SE States
Downy woodpecker			o	v	Alaska
Northern three-toed woodpecker	o	v	o	r	Resident
Say's phoebe	u	n			California to Texas
Traill's slycatcher	u	n			Central & South America
Tree swallow	o	n	o	n	SW U.S., Mexico & Caribbean
Bank swallow	a	n	a	n	Central South America
Barn swallow	c	n	c	n	Central South America
Gray jay	o	r	c	r	Resident
Common raven	c	r	c	r	Resident
Black-capped chickadee	c	r	c	r	Resident
Gray-headed chickadee	o	r	c	r	Resident
Boreal Chickadee	c	r	a	r	Resident
Dipper			o	r	Resident
Robin	c	n	c	n	Southern states to Vera Cruz
Varied thrush	a	n	a	n	Western states
Gray-cheeked thrush	a	n	a	n	Central America to northern half of South America
Wheatear	o	n			China, India & Africa

Species	Abundance & Status Kobuk Dlt & Selawik		Upper Kobuk		Primary Wintering Area
Bluethroat	o	n			SE Asia to Africa
Arctic warbler	o	m	o	n	Philippines, Indo-China, East Indies
Ruby-crowned kinglet	o	n	o	n	British Columbia to California
White wagtail	o	n			Eastern China and S. Japan
Yellow wagtail	o	n			SE Asia, India & Africa
Water pipit	o	n	o	n	Oregon to W. Mexico
Bohemian waxwing			o	v	Alaska, western Canada
Northern shrike	c	n	c	n	Alaska south to western U.S.
Orange-crowned warbler	o	n	o	n	California to Guatamala
Yellow warbler	c	n	c	n	Baja California to Panama
Myrtle warbler	c	n	c	n	Oregon south to Panama & east to Mississippi
Blackpoll warbler	c	n	c	n	Northern South America
Northern waterthrush	c	n	c	n	Baja California, Mexico to northern South America
Wilson's warbler	c	n	c	n	Mexico to Panama
Rusty blackbird	c	n	c	n	South of Ohio to Gulf Coast States
Pine grosbeak	c	n	c	n	Alaska south to upper Midwest
Hoary redpoll	c	r	c	r	Alaska & resident
Common redpoll	c	r	c	r	Alaska & resident
White-winged crossbill	o	r	c	r	Alaska & resident
Savannah sparrow	a	n			Oregon to Texas and Mexico
Slate-colored junco	c	n	c	n	Upper Midwest, New England to Gulf Coast

Species	Abundance & Status Kobuk Dlt & Selawik		Upper Kobuk		Primary Wintering Area
Tree sparrow	c	n	c	n	SW states
White-crowned sparrow	c	n	c	n	British Columbia, western U.S. & Mexico
Golden-crowned sparrow	o	n	o	n	British Columbia to California
Fox sparrow	c	n	c	n	Gulf Coast states to Florida
Lincoln's sparrow			u	n	SW states and Mexico
Lapland longspur	a	n	a	m	Northern U.S.
Snow bunting	c	n	c	m	Alaska to northern U.S., resident

NOATAK AREA (Noatak National Arctic Range Proposal)

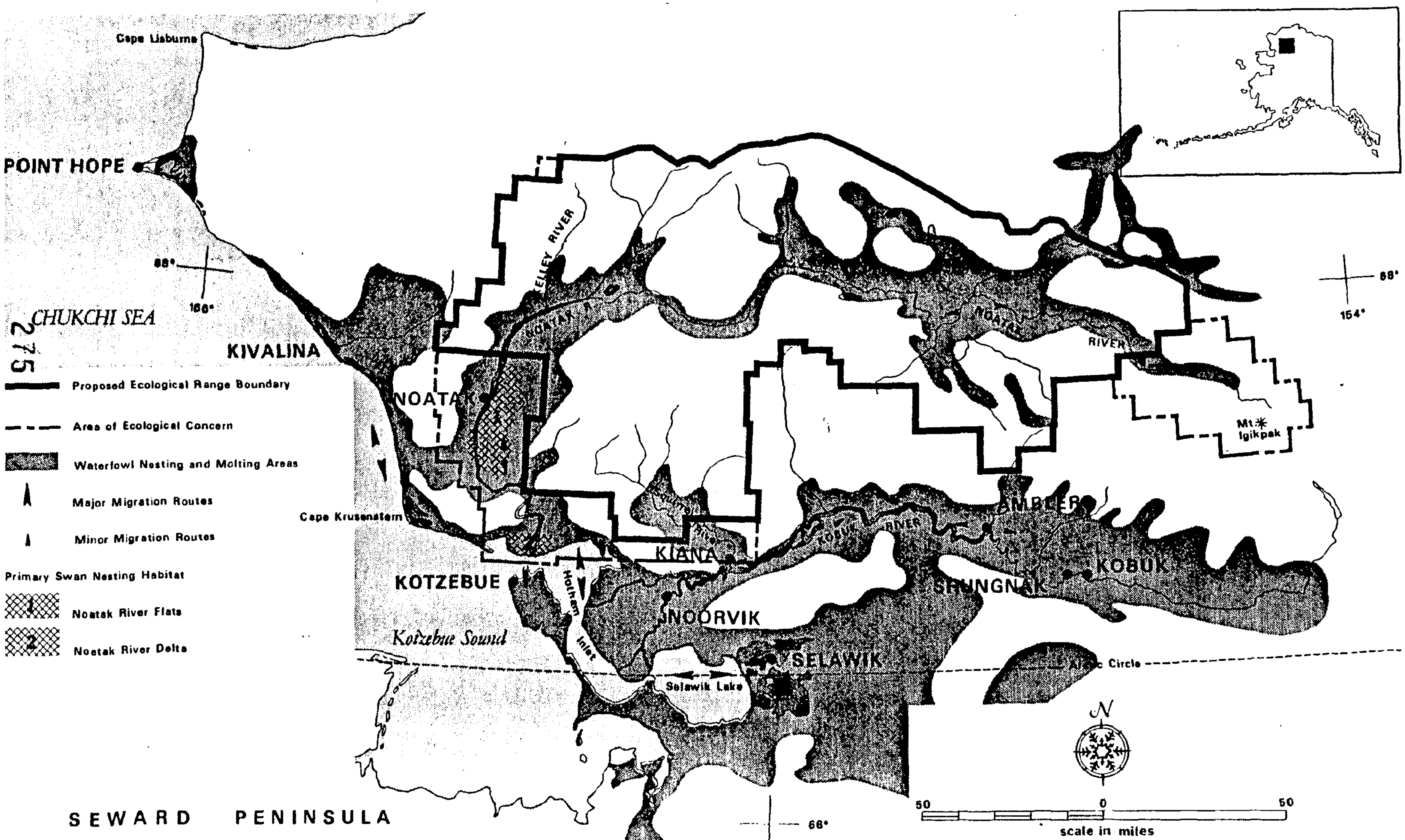
The diverse habitats of the Noatak area account for a rich avifauna. Bird life is especially varied in summer and most species are migratory. Approximately 122 species of 31 families have been identified, and 31 additional species are expected to occur (Appendix IV). Most are protected under the Migratory Bird Treaty Act. The list is undoubtedly incomplete because of the limited amount of work done in the area by ornithologists.

The abundant and varied water areas of the Noatak Basin are attractive to many water and shorebirds. Four species of loons occur. The common and yellow-billed loons are apparently uncommon, but the red-throated and arctic are widespread and abundant. These fish-eating birds nest at the edge of the tundra lakes and ponds and are known to use the Noatak River for fishing.

As many as 25 species of waterfowl may inhabit the Noatak's varied wetland habitats (Figure 10). The largest and most spectacular of these is the whistling swan. Swans nest on the shores of tundra lakes in the Noatak River Delta and the Noatak River Flats south of the confluence of the Kelly River. Approximately 200 pairs of swans are known to inhabit this lake region. Some are known to be members of the western population of North American swans that migrate through the interior of Alaska to wintering grounds in Utah and California. It is probable, however, that others may migrate to the Atlantic coast as those in the adjacent Kobuk River Delta are known to do.

Surveys by Dr. William Sladen in August, 1973, indicate dense nesting and summering populations of whistling swans in the lower Noatak

Figure 10. WATERFOWL NESTING AND MOLTING AREAS, AND PRIMARY HABITATS FOR WHISTLING SWANS (FROM ALASKA DEPARTMENT OF FISH AND GAME, 1973, AND W. J. L. SLADEN, 1973)



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Valley. A total of 489 swans were observed in 475 miles of what is considered prime habitat, or a density of 1.03 swans per square mile. This density is nearly three times that of the two other known concentration areas for swans in northern Alaska. The best swan habitat comprises 141,000 acres on the Noatak River Flats and 34,000 acres on the Noatak River Delta. Both areas are contained within lands withdrawn for Native Village selection but are within the proposed range's largest area of ecological concern.

Several thousand lesser Canada and white-fronted geese also nest and molt in the lake region of the lower Noatak Valley. Nelson Walker, a pilot and guide from Kotzebue, reports that several thousand Canada geese molt in a series of lakes north of the mouth of the Cutler River. An aerial survey conducted by a U.S. Fish and Wildlife Service banding crew on July 2, 1973, estimated 7,000 flightless geese on plateau lakes between the Noatak River and Feniak Lake. About three-fourths were Canadas and the remainder whitefronts.

The lesser (Taverner) Canada geese of the Noatak are believed to winter in California, while the whitefronts migrate through the interior of Alberta and Saskatchewan to wintering grounds in Texas and Louisiana. Other geese species frequenting the Noatak are principally migrants and are most commonly seen on the Noatak River Delta.

Most abundant among the ducks are pintails, greater scaup and oldsquaws. Pairs of ducks can be seen on most tundra lakes and ponds in early summer, with broods of young appearing in July and August. Duck populations and production for the area are unknown but are considered only moderate by most authorities. The limited amount of waterfowl survey work that has been accomplished in the Noatak Basin has been through the use of fixed-wing aircraft. That waterfowl populations may be easily underestimated when such a technique is used (unless ground comparisons are made) has been revealed on the adjacent Arctic Slope where the U.S. Fish and Wildlife Service, through intensive ground and aerial helicopter surveys, has revealed a density of 30 to 80 ducks per square mile. Investigations are needed to determine waterfowl breeding populations and production in the Noatak area and to locate primary molting areas.

American widgeon also occur as common breeders, and the red-breasted merganser is the most frequently sighted duck along the Noatak and Squirrel Rivers. The colorful harlequin duck is known to nest along the upper reaches of the fast-flowing, boulder-strewn streams and rivers, including the Squirrel River. The seldom-seen wandering tattler, a species of shorebird, inhabits these lacustrine habitats in company with the harlequin.

Birds of prey (eagles, hawks and owls) are special features of the remote Noatak region. Sixteen species are known to occur, of which 10 were sighted during the National Park Service's 1972 summer expedition to the area. The rough-legged hawk appears to be the most common species. It and the golden eagle, peregrine falcon and gyrfalcon were found nesting on rocky cliffs or bluffs along the Noatak River from the headwaters region to just above the confluence of the Kelly River.

The arctic peregrine falcon is now an endangered species. Evidence was found of only three recently active nest sites along the entire length of the Noatak. Four peregrines were actually observed and a pair has been reported along the upper Kelly River by Jim Bartonek of the U.S. Fish and Wildlife Service. Breeding peregrines are much more abundant along the Colville River north of the DeLong Mountains.

Gyrfalcons, the largest of the true falcons, are rare to uncommon over their range in Alaska. They are predominantly a bird of foothill tundra and arctic alpine areas during the breeding season. In 1972 a possible nest site of the highly prized and quite rare white race of gyrfalcon was located where a single adult was observed.

Ospreys have been known to occur in the Lower Noatak Canyon, but none were observed in 1972.

A variety of shorebirds arrive from as far away as South and Central America, Asia and the Pacific islands to nest on the expanse of tundra in the Noatak Valley. Included among these are plovers, turnstones, sandpipers, dowitchers and curlews.

Of special interest among the many song birds of the area are four species of Asiatic birds that have extended their ranges into the Noatak region of northwestern Alaska. These include the wheater, bluethroat, arctic warbler and yellow wagtail. All but the bluethroat were sighted along the Noatak River in 1972. Manual (1973) found the yellow wagtail to be common in most tussock tundra areas of the Noatak Valley and found direct evidence of breeding of this species and the bluethroat. The distribution abundance and reproductive biology of the bluethroat is unknown for North America. Research is needed to determine the actual geographical distribution and ecological requirements of these Old World species.

Among the many valuable bird habitats in the region, the extensive freshwater and brackish marshes of the Noatak Delta are of special significance since they are probably the most productive communities in the entire area. Thousands of waterfowl and shorebirds congregate there during their annual spring and fall migrations, and these marshes are important nesting areas for some species.

APPENDIX IV

ABUNDANCE, STATUS AND OCCURRENCE OF BIRDS IN THE NOATAK AND SQUIRREL RIVER WATERSHEDS, ALASKA

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family Gaviidae (Loons)			
Common loon	u	b	S. Alaska & British Columbia
Yellow-billed loon	u	b	SE Alaska & British Columbia
Arctic loon	c	b	SE Alaska & British Columbia
Red-throated loon	c	b	SC & SW Alaska
Family Podicipedidae (Grebes)			
Red-necked grebe	c	b	Aleutians to British Columbia
Horned grebe	r	p	Coastal Alaska to California
Family Anatidae (Swans, Geese, and Ducks)			
Whistling swan	c	b	Utah, Nevada & California
Canada goose	c	b	Washington, Oregon, Calif.
Black brant	u	b	Coast from Wash. to Mexico
Emperor goose	h		Kodiak Is. & Aleutian Is.
White-fronted goose	c	b	Texas & northcentral Mex.
Snow goose	u	m	Central California
Mallard	u	b	Pacific coast from Alaska to Oregon
Pintail	c	b	Pacific Flyway from Canada to Mexico
Green-winged teal	u	b	Pacific Flyway from Canada to Mexico
European wigeon	r	v	Japan, China
American wigeon	c	b	Pacific Flyway from Canada to Mexico

[1]Abundance: a=abundant; c=common; u=uncommon; r=rare; h=hypothetical

[2]Status: b=breeding; p=possibly breeding; m=migrant; u=status unknown

Family and Species	Abundance[1]	Status2	Primary Wintering Area
Family Anatidae con't			
Shoveler	u	b	Pacific Coast states
Canvasback	h		California
Greater scaup	c	b	Pacific Coast south to California, Gulf Coast, Atlantic Coast to Virginia
Lesser scaup	h		Gulf Coast states & as far north as Iowa
Common goldeneye	u	b	Alaska south to California
Bufflehead	h		British Columbia south to California
Oldsquaw	c	b	Bering Sea, Siberia, northern Japan
Harlequin duck	u	b	Aleutian Islands,
King eider	r	b	Bering Sea
White-winged scoter	u	b	Kodiak, southeastern Alaska
Surf scoter	u	v	Southeastern Alaska
Black scoter	u	b	Aleutian Is., Kodiak,SE Ak.
American merganser	r	v	S. E. Alaska
Red-breasted merganser	c	b	Aleutian Is. to southeast Alaska
Family Accipitridae (Hawks, Old World Vultures, and Harriers)			
Goshawk	r	p	Central Alaska to British Columbia
Sharp-shinned hawk	r	v	Montana through Mid-west states
Rough-legged hawk	u	b	Japan & China southwest to Black Sea

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family Accipitridae con't			
Golden eagle	u	b	Pacific coast states to British Columbia
Bald eagle	r	u	Coastal Alaska & British Columbia
Marsh hawk	c	b	Southern British Columbia through Mexico
Family Pandionidae (Ospreys)			
Osprey	r	v	California to central South America
Family Falconidae (Caracaras and Falcons)			
Gyrfalcon	u	b	Siberia, Kurile Is., & Japan
Peregrine falcon	u	b	Across Asia to Siam, SE Alaska to Mexico
Pigeon Hawk	u	b	From California to Texas & Mexico
American kestrel	r	v	Southern Canada to Mexico, Central
Family Tetraonidae (Grouse and Ptarmigan)			
Spruce grouse	u	b	Resident
Ruffed grouse	h		Resident
Willow ptarmigan	c	b	Resident
Rock ptarmigan	c	b	Resident
Family Gruidae (Cranes)			
Sandhill crane	u	b	West Texas, New Mexico Northern Mexico

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family Scolopacidae con't			
Lesser yellowlegs	c	b	Texas south to Central & South America
Knot	h		Washington to California
Pectoral sandpiper	c	b	South America
White-rumped sandpiper	h		
Baird's sandpiper	c	b	Mountainous South America
Least sandpiper	u	b	Oregon, California, south to northern South America
Dunlin	h		Pacific coast from British Columbia to Mexico
Long-billed dowitcher	c	b	Calif. south to Central Amer and Ecuador
Stilt sandpiper	h		
Semipalmated sandpiper	c	b	Gulf Coast of U.S. through Central America
Western sandpiper	u	m	California through Mexico & Central America
Buff-breasted sandpiper	h		
Bar-tailed godwit	u	u	SE China, Malaysia, Australia, & New Zealand
Hudsonian godwit	u	u	Southern South America
Sanderling	h		Micronesia to Indian Ocean
Family Phalaropodidae (Phalaropes)			
Red phalarope	h		At sea, SE Pacific, South America to New Zealand
Northern phalarope	a	b	At sea, S Pacific; Malaysia to South America

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family *Charadriidae* (Plovers, Turnstones, and Surfbirds)			
Semipalmated plover	u	p	Pacific coast from Calif. to Chile
Killdeer	h		British Columbia south to Mexico
American golden plover	c	b	From eastern India, to Malaya, New Zealand
Black-bellied plover	h		British Columbia to Brazil
Surfbird	u	b	SE Alaska to tip of South America
Ruddy turnstone	h		California south to Chile, south Pacific Islands to New Zealand
Black turnstone	u	m	SE Alaska to Mexico
Family *Scolopacidae* (Woodcock, Snipe, and Sandpipers)			
Common snipe	c	b	Western U. S. to Central America
Whimbrel	u	b	Pacific coast from California to Chile
Bristle-thighed curlew	h		Hawaiian Is. south to Micronesia
Upland sandpiper	u	b	Southern South America
Eskimo curlew	h		Probably extinct or extirpated from this region; formerly it was the most abundant curlew along the coasts of Bering Sea and Kotzebue Sound
Spotted sandpiper	c	b	Washington to Peru
Solitary sandpiper	u	b	South America
Wandering tattler	r	p	Baja California to Ecuador, New Zealand, Micronesia, Philippines

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family Stercorariidae (Jaegers and Skuas)			
Pomarine jaeger	r	u	At sea, California to Peru
Parasitic jaeger	c	b	At sea, California to Chile, New Zealand
Long-tailed jaeger	c	b	At sea, off South America
Family Laridae (Gulls and Terns)			
Glaucous gull	c	b	Aleutians, S. Alaska, British Columbia
Glaucous-winged gull	u	v	Along northern rim of Pacific Ocean, Japan to California
Herring gull	r	u	Alaska south to Central America
Mew gull	c	b	SE Alaska to California
Bonaparte's gull	u	b	Washington to Baja Calif.
Sabine's gull	h		At sea south to Peru
Arctic tern	c	b	Central Chile south to Antarctica
Family Strigidae (Typical Owls)			
Great Horned Owl	u	b	Alaska
Snowy owl	c	b	Alaska
Hawk-owl	h		Alaska
Great gray owl	h		Alaska to Northern U. S.
Short-eared owl	u	b	Western U.S.
Boreal owl	h		Alaska

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family *Corcidae* (Jays, Magpies, and Crows)			
Gray Jay	c	b	Resident
Black-billed magpie	h		Alaska south to Puget Sound
Northern common raven	c	b	Resident
Family *Paridae* (Titmice, Verdins, and Bushtits)			
Black-capped chickadee	h		Resident
Gray-headed chickadee	u	b	Resident
Boreal chickadee	c	b	Resident
Family *Cinclidae* (Dippers)			
Dipper	h		Resident
Family *Turdidae* (Thrushes, Solitaires, and Bluebirds)			
American robin	c	b	Southern states to Vera Cruz
Varied thrush	c	b	Western states
Hermit thrush	h		British Columbia south to Baja, California
Swainson's thrush	h		Southern Mexico
Gray-cheeked thrush	c	b	Central America to northern half of South America
Wheatear	c	b	China, India & Africa
Bluethroat	u	b	SE Asia to Africa
Family *Sylviidae* (Old World Warblers, Gnatcatchers, and Kinglets)			
Arctic warbler	u	b	Philippines, Indo-China, East Indies
Ruby-crowned kinglet	u	b	British Columbia to Columbia

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family Alcedinidae (Kingfishers)			
Belted kingfisher	u	b	Resident
Family Picidae (Woodpeckers and Wrynecks)			
Yellow-shafted flicker	r	u	SE States
Downy woodpecker	h		Alaska
Black-backed Three-toed Woodpecker	h		Alaska
Northern three-toed Woodpecker	u	b	Resident
Family Tyrannidae (Tyrant Flycatchers)			
Say's Phoebe	c	b	California to Texas
Alder Flycatcher	r	b	Central & South America
Western Wood Pewee	h		Ecuador, Peru & Bolivia
Olive-sided Flycatcher	u	b	Northern South America
Family Alaudidae (Larks)			
Horned Lark	c	b	British Columbia, Washington and Oregon
Family Hirundinidae (Swallows)			
Violet-green Swallow	h		California south to Central America
Tree Swallow	c	b	SW U.S., Mexico & Caribbean
Bank Swallow	c	b	Central South America
Barn Swallow	h		Central South America
Cliff Swallow	c	b	Central South America

Family and Species	Abundance[1]	Status[2]	Primary Wintering Area
Family Motacillidae (Wagtails and Pipits)			
Yellow wagtail	c	b	SE Asia, India & Africa
Water pipit	c	b	Oregon to W. Mexico
Family Bombycillidae (Waxwings)			
Bohemian waxwing	c	b	Alaska, western Canada
Family Laniidae (Shrikes)			
Northern shrike	c	b	Alaska south to western U.S.
Family Parulidae (Wood Warblers)			
Orange-crowned Warbler	u	b	California to Guatamala
Yellow warbler	c	b	Baja California to Panama
Yellow-rumped warbler	c	b	Oregon south to Panama & east to Mississippi
Blackpoll warbler	c	b	Northern South America
Northern waterthrush	u	b	Baja California, Mexico to northern South America
Wilson's warbler	c	b	Mexico to Panama
Family Icteridae (Meadowlarks, Blackbirds, and Troupials)			
Rusty blackbird	c	b	South of Ohio to Gulf Coast States

Family and Species	Abundance[1]	Status[2]	Primary wintering area
Family Fringillidae (Grosbeaks, Finches, Sparrows, and Buntings)			
Pine grosbeak	c	b	Alaska south to upper Midwest
Gray-crowned rosy finch	c	b	Alaska
Hoary redpoll	u	b	Alaska & Resident
Common redpoll	a	b	Alaska & Resident
Pine siskin	h		
White-winged crossbill	u	b	Alaska & resident
Savannah sparrow	a	b	Oregon to Texas and Mexico
Dark-eyed junco	c	b	Upper Midwest, New England to Gulf Coast
Tree sparrow	a	b	SW states
White-crowned sparrow	a	b	British Columbia, western U.S. & Mexico
Golden-crowned sparrow	u	b	British Columbia to California
Fox sparrow	c	b	Gulf Coast states to Fla.
Lincoln's sparrow	h		SW states and Mexico
Lapland longspur	a	b	Northern U.S.
Smith's longspur	u	b	
Snow bunting	c	b	Alaska to northern U.S., resident

The above names have been taken from the Check list of North American Birds American Ornithologists' Union (1957) and the Thirty-Second Supplement to the American Ornithologists' Union Check-list of American Birds (1973). Primary Wintering Areas are from Gabrielson and Lincoln (1959).

UNIT 26

ARCTIC AREA (Arctic National Wildlife Refuge Proposal)

The area within the proposal is characterized by diverse geologic, soil and vegetative features which provide habitats for at least 142 species of birds. Those that are migratory travel to all the continental flyways and, in many cases, international flyways. With the arrival of spring, arctic terns return from wintering grounds in the Antarctic, golden plovers from the Hawaiian Islands and South America, and wandering tattlers from Equador. The yellow wagtail, dotterel, wheatear and bluethroat migrate from Asia, and the buff-breasted sandpiper from India and Africa (Appendix V).

Thirty-one species of waterfowl frequent tundra wetlands and adjacent coastal waters (Figure 11). Pintails, green-winged teal and oldsquaws are the most common breeding ducks. An overall nesting population of 20 pairs of pintails per square mile has been recorded in the productive coastal plains. Pairs of ducks can be seen on most tundra lakes and ponds in early summer and broods of young appear in July and August. Duck production on the Arctic Range is estimated at 1,200 annually.

Canada geese, white-fronted geese and black brant nest on the tundra and produce an estimated 1,200 young annually. Whistling swans raise an average of 40 cygnets per year. A density of 21 arctic loons per square mile was observed during the 1970 nesting season in the coastal plain. During August and September, prior to their southern migration, many species of birds, including thousands of snow geese,

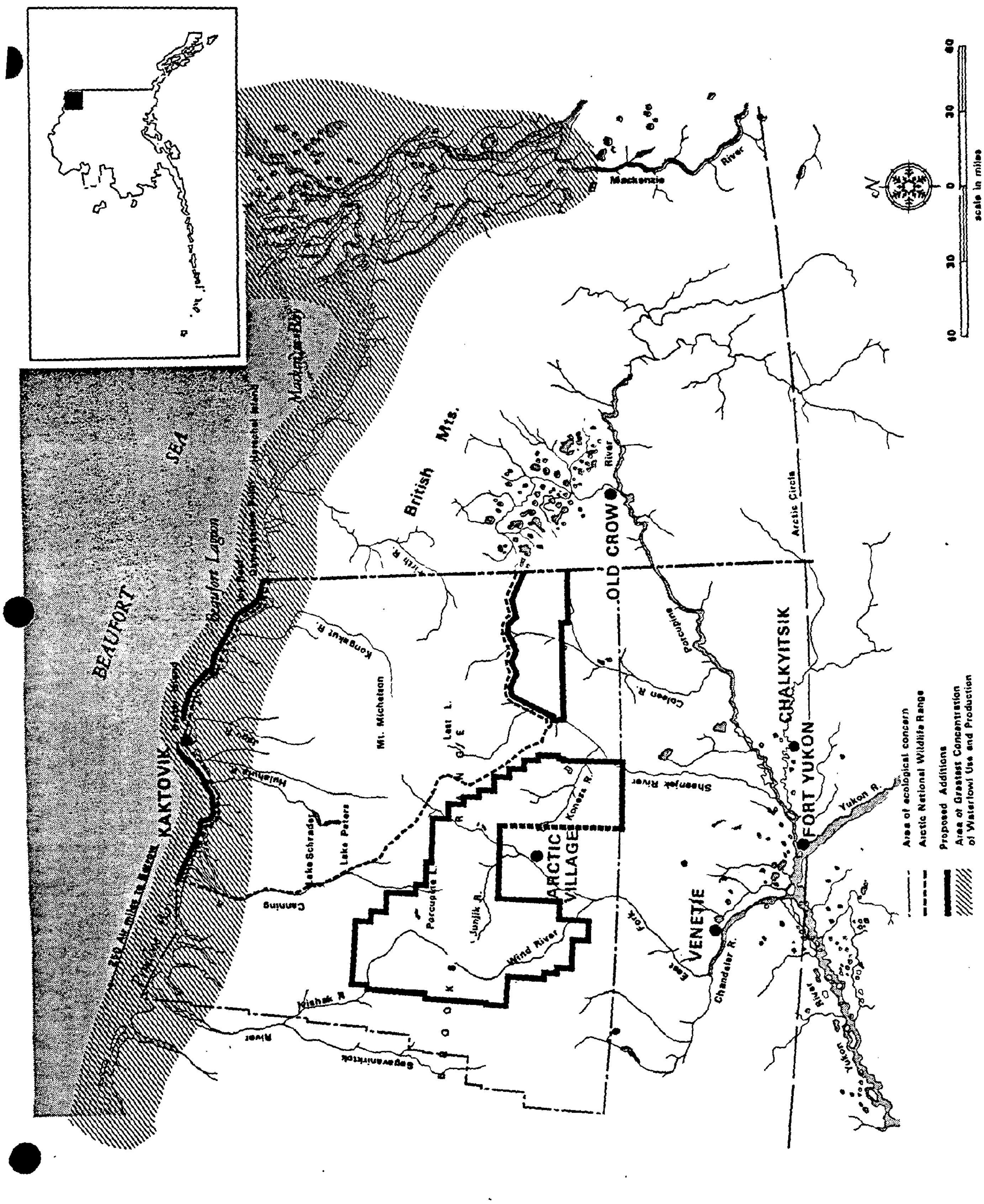

Figure 11 Waterfowl habitat

frequent the tundra to feed on ripe crowberries, blueberries and lowbush cranberries.

Other migratory birds nesting on the coastal plain include hawks, plovers, sandpipers, cranes, jaegers, gulls and owls.

The most concentrated waterfowl use occurs in the rich estuarine waters. Birds are attracted to the lagoons by brackish-water shrimp and other foods. The Arctic coast constitutes a major migratory route for a variety of shorebirds and waterfowl. Birds from all four continental flyways follow inland routes and the Arctic coastal route to estuarine waters of the wildlife range. The coastal route is used almost constantly throughout the summer. During the last half of May, eiders move east along the coast in numbers aggregating about one million. In June, oldsquaws numbering about 500,000 move westerly en route to their wintering grounds. In late June and early July male eiders start back to their wintering ground in flocks of 100 to 200, moving westerly over the lagoons and bays. During their annual molt, up to 60,000 oldsquaws may be seen feeding or resting on coastal lagoon waters and adjacent sand spits. Upon completion of the molt in late August and early September, female oldsquaws also migrate west, accompanied by their young of the year.

In late August white-fronted geese begin their autumn migration, moving easterly, usually with favoring winds. Thousands of snow geese forage inland on the tundra in late summer and early fall during their annual migration.

Waterfowl are not as numerous in the proposed additions as in the existing wildlife range because the areas contain no estuarine waters.

However, waterfowl are found on the numerous streams, ponds, marshes and lakes throughout the addition. Their aggregate numbers are an important contribution to the continental waterfowl population.

Shorebirds are numerous on the gravel bars, estuarine beaches, ponds and sedge-grass marshes throughout the wildlife range. The semi-palmated sandpiper and northern phalarope are among the most abundant.

Inland cliffs, such as those bordering the Kongakut and Canning Rivers, Porcupine Lake plateau, the Marsh Fork of the Canning River and pinnacles as found along Mancha Creek in the upper Firth drainage, are rugged in appearance and offer spectacular views to wilderness travelers. Most are devoid of vegetation except for plant-covered strips or benches on the less rapidly eroding surfaces. The more precipitous of these cliffs offer secure aeries to nesting raptorial birds, including peregrine falcons, gyrfalcons, rough-legged hawks and golden eagles.

The Arctic peregrine falcon is an endangered species and is seldom seen. Breeding peregrines are much more abundant along the Colville River north of the DeLong Mountains west of the proposed refuge. Gyrfalcons are the largest of true falcons and are rare to uncommon over their range in Alaska. They are predominantly a bird of foothill tundra and arctic alpine areas during the breeding season. Rough-legged hawks are the most common of the raptors. The most northerly known nesting sites in North America for golden eagles occur on the shores of Lakes Peters and Schrader. Snowy and short-eared owls and marsh hawks are seen frequently over expanses of moist tundra.

Savannah sparrows and lapland longspurs are the most common of 27 species of birds that frequent the moist tundra plant association.

There is a remote possibility the endangered Eskimo curlew may yet exist in the proposal area. Although there is serious question whether this species still survives, it was once known to nest on the tundra of the Mackenzie Delta and possibly northeastern Alaska.

Large lowland areas of the southern slope of the Brooks Range are carpeted with a tussock-heath tundra which provides nesting habitat to longspurs, sparrows, short-eared owls and other ground nesting birds. Upland plovers are also found in these areas where there are a few scattered trees for perching.

On higher slopes above 2,500 feet elevation, the tussock-heath tundra grades into a dry alpine tundra where water pipits, rock ptarmigan, horned larks, gray-crowned rosy finches and wheatears are the characteristic birds. Wandering tattlers are found along rocky streams at these altitudes. Except for the occasional raptor, bird life is sparse above 6,000 feet.

APPENDIX V

CHECKLIST OF BIRDS OF THE PROPOSED ARCTIC NATIONAL WILDLIFE REFUGE

Birds which have been observed on the existing Arctic National Wildlife Range are listed below together with the primary areas in which they winter.

The wintering area generally follows the description of Gabrielson and Lincoln. Phylogenetic listing and common names follow the American Ornithologists Union.

Species	Abun-dance[1]	Status[2]	Primary Wintering Area
Common loon	u	b	S.E. Alaska south to Baja California
Yellow-billed loon*	c	b	S.E. Alaska south to British Columbia
Arctic loon	a	b	S.E. Alaska south to Baja California and Sonora
Red-throated loon	a	b	Aleutian Islands south to Baja California and Sonora
Red-necked grebe	c	b	S.E. Alaska
Horned grebe	c	b	S.E. Alaska south to southern California
Slender-billed shearwater*	h	u	S. Australia
Trumpeter swan*	u	p	S.E. Alaska and British Columbia
Whistling swan	c	b	British Columbia south to California, Nevada and Utah, occasionally to Atlantic Coast
Canada goose	u	p	Columbia Basin of Washington and W. Coast
Black brant*	c	p	British Columbia south to Baja California and Mexico
White-fronted goose	c	b	Texas and north central Mexico
Snow goose	a	m	California
Mallard	u	p	British Columbia, Washington, and Oregon
Pintail	a	b	Washington to California and Mexico
American green-winged teal	c	b	Washington, Oregon, and California
American wigeon	c	b	British Columbia south to California
Canvasback	u	p	California and Chesapeake Bay S. to Pamlico Sound
Greater scaup	c	b	British Columbia south to California, Great Lakes, Louisiana, Connecticut south to Virginia
Lesser scaup	u	p	British Columbia south to Mexico, Texas, Great Lakes, Connecticut south to Florida
Common goldeneye	u	u	S. Central Alaska coast to Kodiak Island
Barrow's goldeneye	u	u	Alaska south to California
Bufflehead	u	u	British Columbia south to California(USSR)
Oldsquaw	a	b	Bering Sea (USSR, northern Canada)
Harlequin duck*	u	p	Southeast coast of Alaska
Steller's eider*	u	p	Bering Sea
Common eider*	c	b	Aleutians—Alaska Peninsula—Washington
King eider*	c	b	Bering Sea
Spectacled eider*	u	p	Unknown, probably Bering Sea
White-winged scoter	u	b	Kodiak, S.E. Alaska
Surf scoter	u	b	S.E. Alaska
Red-breasted merganser	c	b	Aleutian Islands, to S.E. Alaska
Goshawk	u	b	Lowlands south to N. Mexico

[1]Abundance: a = abundant; c = common; u = uncommon; r = rare; h = hypothetical
[2]Status: b = breeding; p = possibly breeding; m = migrant; u = status unknown

Species	Abun-dance[1]	Status[2]	Primary Wintering Area
Sharp-skinned hawk	u	b	Southern B.C. to Mexico
Red-tailed hawk	u	b	Southern B.C. to Mexico
Rough-legged hawk	c	b	British Columbia possible south to California
Golden eagle	u	b	Alaska, possibly south to Montana and other mountain states
Bald eagle	r	p	S.E. Alaska
Marsh hawk	a	b	British Columbia, Alberta, possibly south to Central America
Gyrfalcon	a	b	Alaska
Pregrine falcon	c	b	British Columbia, possible south to California and Central America
Merlin	c	b	From California through Mexico
American kestrel	c	b	B.C. to western states
Spruce grouse	c	b	Boreal forest
Willow ptarmigan	a	b	Alaska
Rock ptarmigan	a	b	Alaska
Sharp-tailed grouse	u	b	Yukon Flats
Sandhill crane	c	b	Southern California, Texas, south to Baja California and Sonora
Semipalmated plover	c	b	California south to Sonora
Killdeer	u	u	B.C.—Montana and Idaho
American golden plover	a	b	Southern Half of South America
Black-bellied plover	a	b	British Columbia, California, south to Peru
Ruddy turnstone*	c	b	California south to Chile, South Pacific Islands to New Zealand
Dotterel*	u	p	Southern Europe, Northern Africa
Common snipe	a	b	South B.C. to central America
Whimbrel	u	u	California, south to southern Chile
Upland plover	c	p	E. of Rockies, N.E. California
Spotted sandpiper	c	b	British Columbia south to Peru
Solitary sandpiper	c	b	Baja California south to Ecuador, Bolivia and Argentina
Wandering tattler	c	b	Baja California to Ecuador, South Pacific Islands
Lesser yellowlegs	c	b	Texas south to Central and South America
Knot	u	u	Washington to California
Pectoral sandpiper	a	b	Bolivia, Argentina
White-rumped sandpiper	u	p	Southern South America
Baird's sandpiper	c	b	Andes Mountains, Ecuador, Bolivia, and Chile
Least sandpiper	c	b	Oregon, California south to Central America and northern Peru
Dunlin*	u	p	S.E. Alaska south to California, Baja California and Sonora
Long-billed dowitcher	a	b	Central California to Central America
Stilt sandpiper	r	u	South America
Semipalmated sandpiper	a	b	Gulf Coast to Central America and West Indies and widespread in South America
Buff-breasted sandpiper	u	p	Argentina
Hudsonian godwit	u	p	South America
Sanderling	u	p	British Columbia south through Mexico, Central America to Chile

Species	Abundance[1]	Status[2]	Primary Wintering Area
Red phalarope*	a	b	At sea, South Pacific to Falkland Islands and New Zealand
Northern phalarope	a	b	At sea, off South America, Malaya and Philippines
Pomarine jaeger*	c	b	At sea, California to Peru
Parasitic jaeger*	u	p	At sea, California to southern Chile, Australia, New Zealand
Long-tailed jaeger	c	b	At sea, off South America
Glaucous gull*	a	b	Bering Sea, Aleutians, to Kodiak
Herring gull	u	m	Alaska south to Central America
Mew gull	u	b	S.E. Alaska south to California
Bonaparte's gull	u	b	Washington south to Baja California and Jalisco
Ivory gull*	u	m	Arctic Ocean south to N. Canada
Sabine's gull*	c	b	At sea, south to Peru
Arctic tern	a	b	Central Chile south to Antarctica
Thick billed murre*	u	m	Pelagic, Bering Sea and southeast Alaska
Black guillemot*	r	b	Pelagic, Bering Sea
Great horned owl	u	b	Yukon Flats
Snowy owl	a	b	Alaska
Hawk-owl	c	b	Alaska south to Northern U.S.
Great gray owl	c	b	Alaska to northern U.S.
Short-eared owl	a	b	Southern B.C. to Mexico
Boreal owl	u	p	To southern B.C. north Idaho
Belted kingfisher	u	p	S.E. Alaska to northwestern Mexico
Yellow-shafted flicker	c	b	Yukon Flats into W. United States
Downy woodpecker	c	b	Yukon Flats into N. United States
Northern three-toed woodpecker	a	b	Yukon Flats into N. United States
Say's phoebe	c	b	California
Alder flycatcher	u	p	Central and South America
Horned lark	c	b	Southern B. C. into Oregon
Violet-green swallow	u	p	California south to Central America
Tree swallow	c	b	California south to Baja California and northern Mexico
Bank swallow	c	b	Central South America
Cliff swallow	o	b	Brazil south to Chile, Argentina
Gray jay	a	b	Yukon Flats
Common raven	a	b	Yukon Flats
Black-capped chicadee	a	b	Boreal forest
Gray-headed chickadee	u	b	Yukon Flats
Boreal chickadee	a	b	Alaska
Dipper	c	b	Alaska
American robin	c	b	Gulf Coast, Florida south to Veracruz
Varied thrush	a	b	Idaho, California and south to Baja California
Swainson's thrush	c	b	Southern Mexico and Central America
Gray-cheeked thrush	c	b	Northern part of South America
Wheatear	c	b	Northern China
Bluethroat	u	p	India, northern Africa
Townsend's solitaire	u	p	Canadian Border to N. Mexico
Arctic warbler	u	p	Tropical Asia
Ruby-crowned kinglet	u	p	South B.C., Utah, Colorado
Yellow wagtail*	c	b	Oregon and Nevada to Baja California and western Mexico

Species	Abun-dance[1]	Status[2]	Primary Wintering Area
Water pipit	a	b	Eastern China and Japan
Bohemian waxwing	c	b	South Eurasia, N.E. and S.W. United States
Northern shrike	c	b	Alaska south to Oregon, eastern California, Nevada and Utah
Orange-crowned warbler	c	b	California to Guatamala
Yellow warbler	u	b	Southern Baja California and Campeche to Panama
Yellow rumped warbler	c	b	Oregon and California south through Mexico to Panama
Blackpoll warbler	u	p	Guiana and Venezuela to Brazil and Ecuador
Northern waterthrush	a	b	Baja California and Mexico to northern South America
Wilson's warbler	c	b	Mexico to Panama
Rusty blackbird	c	b	Gulf of Mexico
Pine grosbeak	u	b	Alaska south to Oregon and Montana
Gray-crowned rosy finch	c	b	Alaska
Hoary redpoll	c	b	Alaska
Common redpoll	u	b	Alaska
White-winged crossbill	u	b	Alaska
Savannah sparrow	c	b	Western Oregon and Utah to Sonora and Baja California
Slate-colored junco	u	b	Minnesota, Michigan, and New England States to Gulf Coast
Tree sparrow	a	b	Nevada, Arizona, New Mexico, and Texas
White-crowned sparrow	c	b	British Columbia, Wyoming, Utah to Baja California and southern Mexico
Fox sparrow	u	b	Texas, Louisiana, Alabama, and northern Florida
Lapland longspur	a	b	South Canada to south United States
Smith's longspur	u	b	Southcentral United States
Snow bunting	a	b	Alaska

**Known to occur in Arctic Wildlife Range,*but not in the proposed additions

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CHUKCHI-BEAUFORT SEA*

Most bird species are present in the Chukchi-Beaufort region for only five months of the year, May through September. Most of them come here to breed. During their brief stay, birds must establish territories, choose and construct nest sites, lay their eggs and rear young. Some adult birds also molt here before returning to the wintering grounds. Birds may molt near their nest sites (whistling swans) or far from nesting areas, following a molt migration (eiders). Waterbirds follow primarily a coastal route to and from the breeding grounds.

Some birds that breed in the Chukchi-Beaufort area spend their winter as far away as the Antarctic and southern South America, while individuals of other species may overwinter in the northern Bering or southern Chukchi Sea.

In his review of birds of the Barrow area, Pitelka (1974) listed 151 species. Of these, 22 are species that regularly breed there, while an additional 13 species are occasional breeders. At Cape Thompson, along the Chukchi coast, Williamson, et al. (1966) recorded 120 species of birds, of which 65 species were breeding. The increase in breeding species is explained by the presence of sea cliffs and an increase in riparian habitat, which attract nesting seabirds and passerines, respectively. These nesting habitats are not found along the Beaufort coast.

There is some degree of interchange between North America and Asia with respect to wintering and breeding areas. Some birds spend their

* Schamel, D., et al. 1977. Bird studies. OCS Report, N.O.A.A.

winter in Asia and then move to breeding areas in North America. These include emperor geese, dunlins and possibly Lapland longspurs. Some birds show the reverse pattern, migrating from America to Asia to breed. Examples are sandhill crane, Pacific eiders, snow geese, dunlins, western sandpipers and Baird sandpipers.

Table 10 summarizes current knowledge of general habitat use and distribution of principal waterbirds in the Chukchi-Beaufort region. Although many of the species migrate along the coast in spring, this area becomes most important to birds during the post-breeding migration (Figure 12).

Spring migrant waterbirds follow primarily a coastal route to their breeding areas (Figures 13 and 14). There is some evidence that most birds migrate at sea, primarily within 10 km of shore. Not all migration is restricted to the coastal strip, however. Migrants are commonly recorded 20 km out to sea, as well as inland on the coastal plain and in mountain passes. King eiders, for example, may migrate far out to sea from Point Barrow to Banks Island, coming nearshore only when offshore leads close.

Spring migration lasts from late April or early May through mid- or late June. In the Chukchi Sea, waterfowl make extensive use of shore leads in May, while in the Beaufort Sea these leads are used most heavily in early June. At this time, rivers are beginning to flow and open water forms in river mouths. Here, birds are able to rest and feed. A sudden drop in temperature or shift in wind direction at this critical time may close the leads. Birds stranded far from feeding areas may starve. This phenomenon has most commonly been noted in

Table 10. Seasonal habitat use by principal bird species in the Beaufort and Chukchi seas.

Principal Bird Species	SPRING[1]			SUMMER[2]			FALL[3]		
	Tundra[4]	Nearshore[5]	Offshore[6]	Tundra	Nearshore	Offshore	Tundra	Nearshore	Offshore
Yellow-billed Loon	N	MF	mF	NB	F	F	B	MF	mF
Arctic Loon	N	MF	mF	NB	F	F	B	MF	mF
Red-throated Loon	N	MF	mF	NB	F	F	B	MF	mF
Whistling Swan	MFN	m	--	FNB	--	--	MFB	m	--
Canada Goose	MFN	mF	--	FNB	F	--	MFB	mF	--
White-fronted Goose	MFN	mF	--	FNB	fb	--	MFB	mfb	--
Black Brant	mFN	MFn	m	FNB	mFn	m	mFB	MFB	m
Emperor Goose **	MFN	mf	--	FNB	fb	--	MFb	mfb	--
Snow Goose	mf	mfn	--	fb	fnb	--	MFb	MFb	m
Pintail	MFN	m	--	FNB	--	--	MFB	mf	--
Greater Scaup	MFN	m	--	FNB	mf	--	MFB	mf	mf
Oldsquaw	mfN	MFn	MF	FNB	fn	f	mfb	MF	MF
Common Eider	mfN	MFN	MF	mNB	FNB	MFb	m	MfB	Mfb
King Eider	mFN	MFn	MF	mNB	MFNb	MF	mFB	Mf	Mf
Steller's Eider	mFN	MF	--	FNB	--	--	mFB	M?	--
Surf Scoter	--	--	--	--	MF	MF	--	MF	MF
White-winged Scoter	--	--	--	--	MF	MF	--	MF	MF
Red-breasted Merganser	mFN	MF	mF	FNB	mF	mF	mFB	m	m
Willow Ptarmigan	MFN	--	--	FNB	--	--	MFB	--	--
Sandhill Crane **	MFNB	mf	--	FNB	fb	--	MFB	mfb	--
Golden Plover	mFN	m	m	FNB	--	--	mFB	MF	--
Black-bellied Plover	mFN	m	--	FNB	--	--	mFB	MF	--
Ruddy Turnstone	mFN	mf	m	FNB	f		mFB	MF	--
Red Knot	MFN	mf	--	FNB	mf	--	mFB	MF	--
Pectoral Sandpiper	MFN	mf	--	FNB	mf	--	mFB	MF	--
Baird's Sandpiper	MFN	MFn	--	FNB	mFnb	--	mfb	MF	--
Dunlin	MFN	m	--	FNB	mf	--	MFB	MF	--
Semipalmated Sandpiper	MFN	mf	--	FNB	MF	--	mfb	MF	--
Western Sandpiper	MFn	mf	--	fnb	MF	--	mfb	MF	--
Red Phalarope	MFN	mf	mf	MFNB	mf	mf	mfb	MF	MF
Northern Phalarope	MFN	mf	mf	MFNB	mf	mf	mfb	MF	mf
Pomarine Jaeger	MFN	MF	mF	FNB	mf	mf	mfb	mf	MF
Parasitic Jaeger	MFN	MF	mF	FNB	mf	mf	mfb	mf	MF
Long-tailed Jaeger	MFN	MF	mF	MFNB	mf	mf	mfb	mf	MF

Table 10, cont. Seasonal habitat use by principal bird species in the Beaufort and Chukchi seas.

Principal Bird Species	SPRING[1]			SUMMER[2]			FALL[3]		
	Tundra[4]	Nearshore[5]	Offshore[6]	Tundra	Nearshore	Offshore	Tundra	Nearshore	Offshore
Glaucous Gull	MFN	MFN	MF	mFNB	MFb	m	mfb	mFb	MF
Ivory Gull *	--	--	--	--	--	--	--	--	MF
Black-legged Kittiwake	--	MfN	MF	--	fNB	F	--	mfb	MF
Ross' Gull *	--	--	--	--	--	--	--	--	MF
Sabine's Gull	mfN	MFn	mf	fNB	Fnb	mf	--	mf	MF
Arctic Tern	mN	MFn	mF	fnb	fnb	mF	mf	MF	MF
Common Murre **	--	MfN	MF	--	fNB	F	--	mfb	MF
Thick-billed Murre *	--	MfN	MF	--	fNB	F	--	mfb	MF
Black Guillemot *	--	MfN	MF	--	fNB	F	--	mfb	MF
Horned Puffin **	--	MfN	MF	--	fNB	F	--	mfb	MF
Common Raven	mF	mf	--	mf	mf	--	mf	mf	--
Lapland Longspur	MFNB	m	--	FNB	f	--	MF	mf	--

1 May and June

2 July

3 August and September

4 Mainland areas not subjected to flooding during storms

5 Beach areas subjected to flooding during storms, barrier islands, lagoons, and waters within 1 km of mainland coast

6 Waters seaward of barrier islands or more than 1 km from mainland coast

* Principally found in Chukchi, but also in Beaufort

** Limited to Chukchi

(blank) Common in both Chukchi and Beafort

USE KEY: M = migration F = feeding N = nesting B = brood-rearing

upper case indicates much use; lower case indicates lesser use

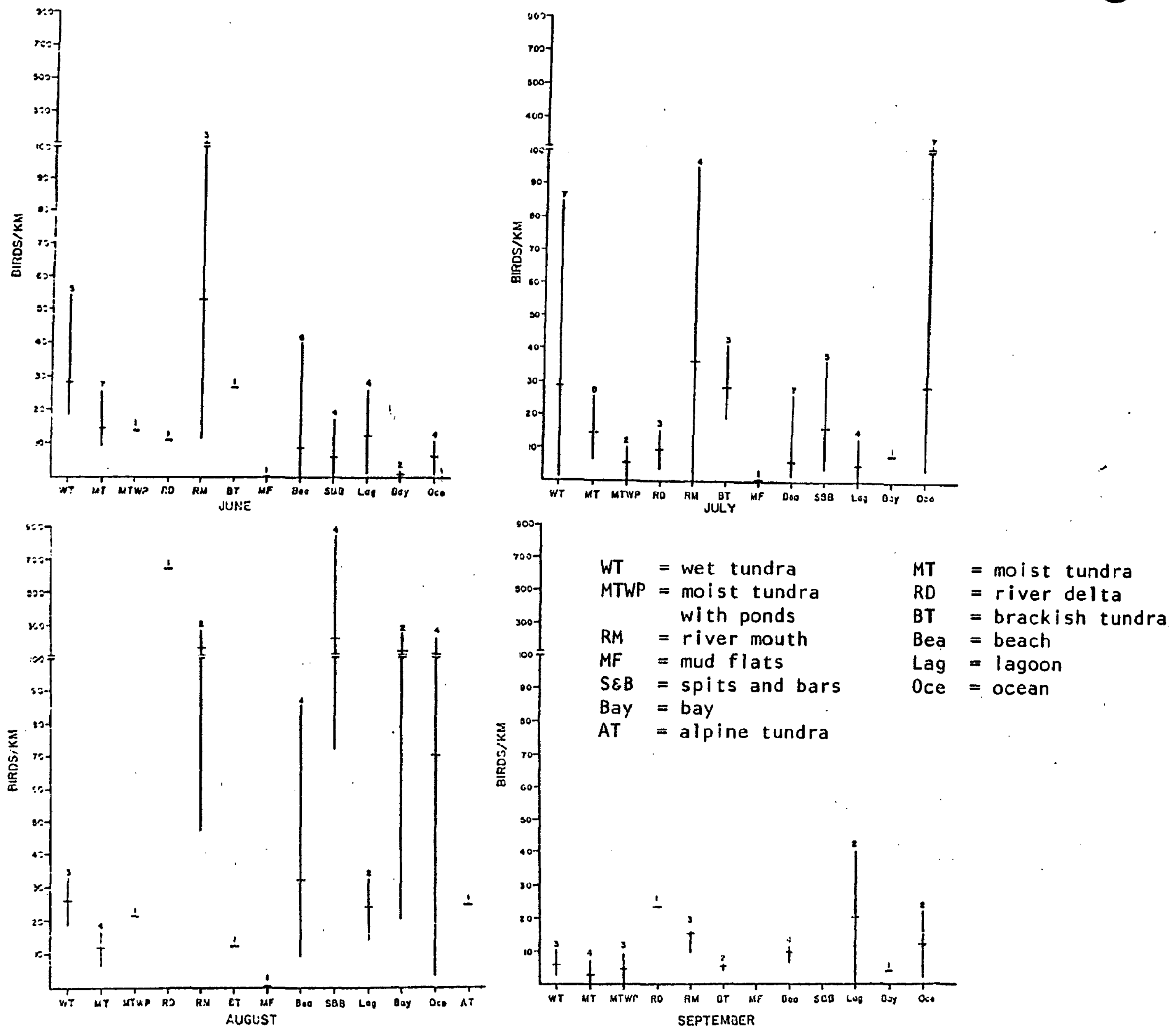


Figure 12. Birds per km per habitat along the Chukchi/Beaufort seas in June, July, August and September (from Divoky, R.U. 3/4, in prep.).

Figure 13. BREEDING, MOLTING AND FEEDING CONCENTRATIONS AND MIGRATION CORRIDORS OF MARINE BIRDS ALONG THE CHUKCHI SEA COAST, ALASKA.

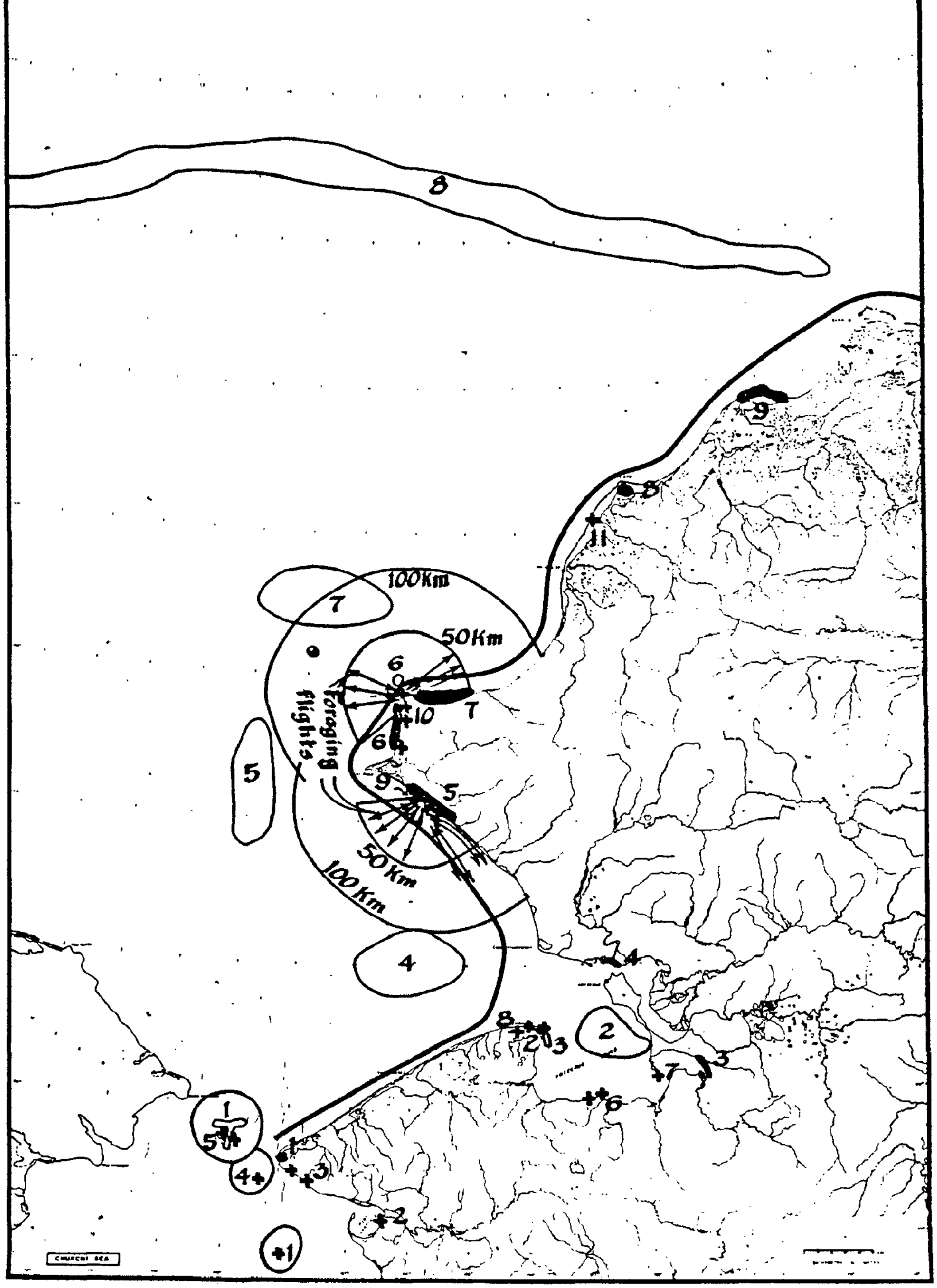
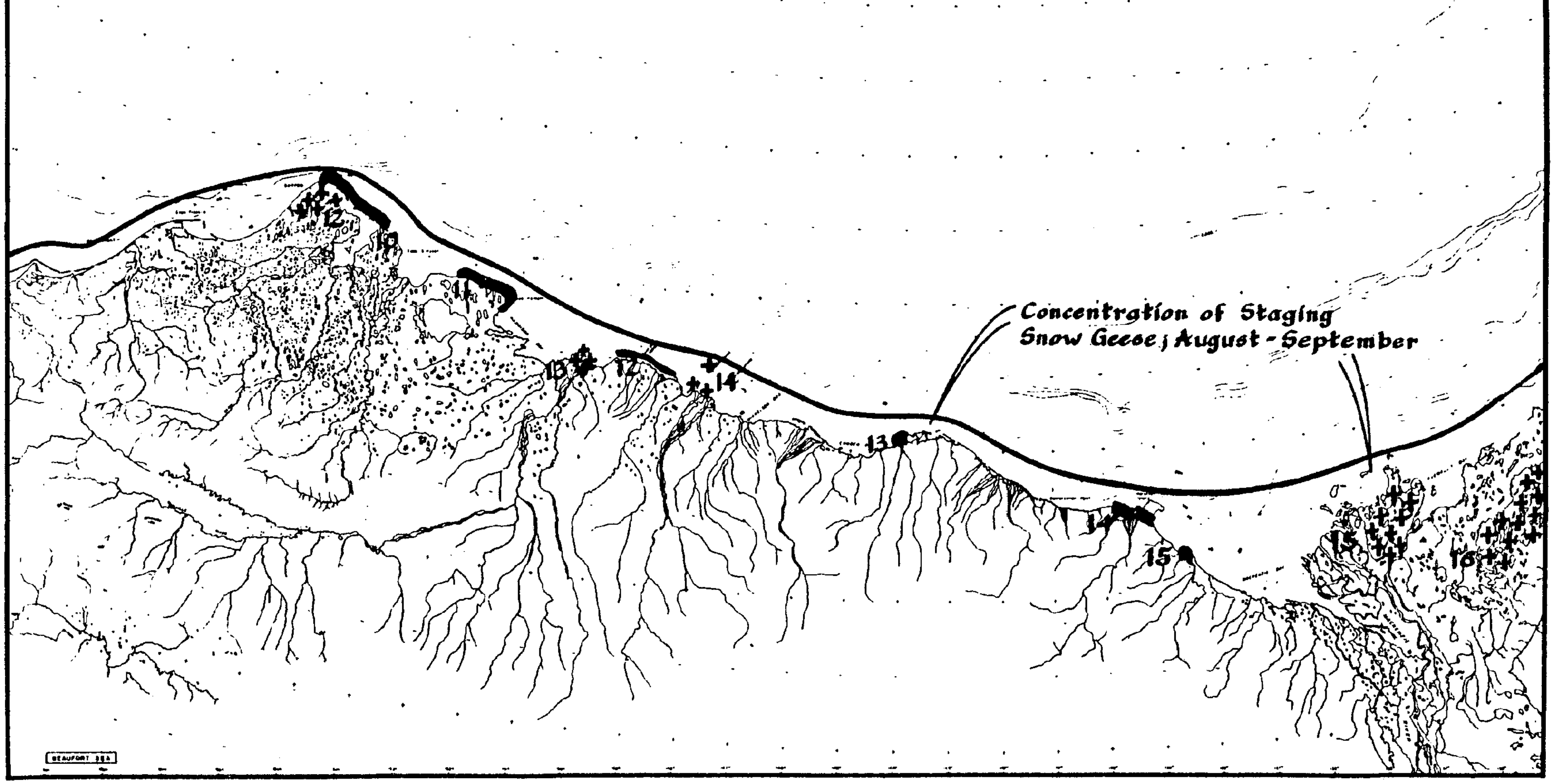


Figure 14. BREEDING, MOLTING AND FEEDING CONCENTRATIONS AND MIGRATION CORRIDORS OF MARINE BIRDS ALONG THE BEAUFORT SEA COAST, ALASKA.



KEY for Figure 13. Breeding, molting and feeding concentrations and migration corridors of marine birds along the Chukchi Sea coast, Alaska.

Breeding concentrations ++

3 York Mountain cliffs: ca. 2,000 seabirds
4 Fairway Rock: more than 100,000 seabirds
5 Little Diomede Island: ca. 1,800,000 seabirds
6 Cape Deceit vicinity: ca. 4,000 seabirds
7 Chamisso Island and vicinity: ca. 2,000 seabirds
8 Cape Espenberg: ca. 6,000 waterfowl and shorebirds
9 Cape Thompson: ca. 200,000 seabirds; foraging flights shown
10 Cape Lisburne and vicinity: more than 1,000,000 seabirds; foraging flights shown
11 Solovik Island: more than 100 waterfowl

Molting and/or nearshore feeding concentrations

1 Wales: feeding spring migrant shorebirds (10,000s)
2 Cape Espenberg bay: feeding post-breeding waterfowl and shorebirds (1,000s)
3 Escholtz Bay: post-breeding waterfowl
4 Noatak River mouth: molting eiders (1,000s)
5,6,7 Cape Thompson/Lisburne area: spring and fall migrant waterfowl and shorebirds
8 Icy Cape: fall migrant shorebirds
9 Point Franklin/Peard Bay: fall migrant shorebirds

Offshore feeding concentrations

1 Diomede Islands
2 Molting Oldsquaws (more than 30 birds/km^2)
3 Post-breeding waterfowl (more than 30 birds/km^2)
4,5,6,7 Seabirds (more than 30 birds/km^2)
8 Seabirds at approximate summer ice edge

Migration corridor (near coastline)

KEY for Figure 14. Breeding, molting and feeding concentrations and migration corridors of marine birds along the Beaufort Sea coast, Alaska.

Breeding concentrations +++

12 Barrow area: 1,000s of waterfowl and shorebirds
13 Colville River delta: 1,000s of waterfowl and shorebirds
14 Niakuk Islands: ca. 100 Glaucous Gulls
Cross Island: ca. 100 Common Eiders
Howe Island: ca. 100 Snow Geese
15 Mackenzie River delta: ca. 25,000 Whistling Swans; 2,500 White-fronted Geese
16 White-winged Scoter and scaup

Molting and/or nearshore feeding concentrations

10 Barrow spit/Plover Islands: 10,000s post-breeding and juvenile shorebirds, gulls and terns
11 Cape Halkett/Pitt Point: 1,000s post-breeding and juvenile shorebirds and Black Brant
12 Simpson Lagoon/Gwydyr Bay: 10,000s molting Oldsquaws
13 Hulahula River mouth: spring migrant Black Brant
14 Herschel Island area: post-breeding and juvenile shorebirds; molting Oldsquaws (1,000s)
15 Phillips Bay: molting Oldsquaws

Migration corridor (near shoreline)

eiders; at least 10 percent of the Beaufort Sea eider population may perish during a single spring migration. Not all river mouths receive equal use by waterfowl. The use of these areas may vary drastically not only between deltas in a single year but also at any given location between years. Contributing factors may include the availability of open water both offshore and inshore, as well as laterally along the coast.

Similarly, shorebirds use snow-free areas of tundra during spring migration. Such sites may be abundant both along the coast and inland in some springs, or limited to the headwaters of streams in others. In any given locality, the pattern of habitat availability may be similar between years, but the timing may vary greatly. Once again, this means that critical springtime shorebird habitat may shift localities annually.

In the Chukchi-Beaufort area, waterfowl and shorebirds nest along the entire coastline. They are most abundant in marsh habitat and their greatest concentrations are found in habitats consisting of ponds and narrow ridges. The greatest concentrations of nesting waterbirds along the Beaufort coast appear to be in the Barrow area and in the Colville River Delta. Along the Chukchi coast, Cape Espenberg, although small, supports high concentrations of waterbirds. It should be emphasized that many other areas of similar habitat exist along both coasts but have received less study. Many of these areas may also support high numbers of breeding birds.

Major seabird rookeries (ca. 300,000 birds) are found at the Cape Thompson and Cape Lisburne cliff complexes. A few small colonies (few to several hundred individuals) exist at a few points between Cape

Lisburne and Kilikralik Point. Small colonies are also found in Kotzebue Sound, primarily on Puffin Island, Chamisso Island and along the northern coast of the Seward Peninsula between Deering and the Goodhope River.

In general, the Chukchi-Beaufort barrier islands support very low numbers of breeding birds. Exceptions include Solovik Island in the Chukchi Sea and Cross and the Niakuk Islands in the Beaufort Sea. Both Solovik and Cross Islands have significant concentrations (ca. 100 or more birds) of common eiders. The Niakuk Islands had a significant concentration of glaucous gulls in 1976 (ca 150 nests).

The greatest bird use of barrier islands occurs during the post-breeding season. At this time, many tundra species move to the coast to feed. Beginning in mid-July, oldsquaws concentrate in bays near the islands where they feed in shallows and rest on the islands during their feather molt. In late July they are joined by juvenile red phalaropes which move to the coast from inland marshes. Phalaropes are most often found near islands and spits. They appear to be most numerous near the Barrow Spit and the Plover Islands, immediately east of Barrow and in the Peard Bay Spit-Seahorse Islands area. These areas are also important for juvenile Sabine's gulls, Arctic terns and other shorebirds.

Other areas along the Beaufort coast are also important to migrant waterbirds. Black brant feed in brackish marshes during their westward migration in August. Numerous river deltas between Prudhoe Bay and the Mackenzie River may be important to substantial numbers of these geese. West of the Colville River at Cape Halkett, Pitt Point and Icy Cape these birds occurred in large numbers in 1976. The same habitats at Icy Cape and Pitt Point (near Lonely) are also heavily used by several shorebird species, especially dunlins.

Some birds migrate into the area from breeding grounds elsewhere. Here they concentrate at various staging areas before continuing their outward migration. Snow geese (163,000 to 400,000) breed on Banks Island, Kendall Island and in the Anderson River area (Canada), then migrate to staging areas along the eastern north slope of Alaska in and near the Arctic National Wildlife Range before returning east, then south, down the Mackenzie River to wintering grounds in southern North America.

Another migration pattern is demonstrated by post-breeding male eiders. These birds return westward, beginning in early July, shortly after the eggs are laid by females. There is some evidence that Beaufort Sea male eiders make few, if any, stops before reaching the Chukchi Sea. Here, at least a few concentrations of molting eiders have been found, one near the mouth of the Noatak River.

During the entire summer, numerous birds associate with the edge of the sea ice. Black-legged kittiwakes and murres are the principal species at the ice edge, although numerous jaegers, glaucous gulls and black guillemots are also found. In September, Ross' and ivory gulls feed extensively here. Bird densities at the Chukchi ice edge in fall can be exceptionally high. In the Chukchi, birds forage in moderate concentrations (greater than 30 birds/km^2) in various locations at sea even after the ice edge has moved northward.

Tables 11 and 12 summarize current knowledge of waterbird food habits in the Chukchi-Beaufort area. Geese are principally grazers on plants in brackish marshes. While on the tundra breeding grounds, many waterbirds take insect prey, both larvae and adults. Zooplankton are a

Table 11. Food habits of principal bird species in the Chukchi and Beaufort seas. Tundra habitats.[1]

Principal Bird Species	PLANTS		ARTHROPODA			CHORDATA			
	Vegetation	Berries	Crustacea	Diptera	Trichoptera	Fish	Birds/Eggs	Mammals	Carrion
Yellow-billed Loon[2]	-	-	-	-	-	T	-	-	-
Arctic Loon[3]	-	-	T	-	T	-	-	-	-
Red-throated Loon[4]	-	-	-	-	-	-	-	-	-
Whistling Swan[5]	T	-	-	-	-	-	-	-	-
Canada Goose[3]	T	-	-	-	-	-	-	-	-
White-fronted Goose[3]	T	-	-	-	-	-	-	-	-
Black Brant[3]	T	-	-	-	-	-	-	-	-
Emperor Goose[5]	T	t	-	-	-	-	-	-	-
Snow Goose[5]	T	-	-	-	-	-	-	-	-
Pintail[4]	T	-	-	T	t	?	-	-	-
Greater Scaup[5]	t	-	?	?	?	-	-	-	-
Oldsquaw[4]	t	-	?	?	?	-	-	-	-
Common Eider[6]	t	-	T	?	?	?	-	-	-
King Eider[4]	T	-	T	t	t	?	-	-	-
Steller's Eider[5]	t	t	T	t	t?	-	-	-	-
Red-breasted Merganser[5]	-	-	?	-	-	?	-	-	-
Willow Ptarmigan[6]	T	T	-	t?	t?	-	-	-	-
Sandhill Crane[8]	-	T	-	t	t?	?	T	T	?
Golden Plover[6]	-	-	-	T	t?	-	-	-	-
Black-bellied Plover[6]	-	-	-	T	t?	-	-	-	-
Ruddy Turnstone[6]	-	?	-	T	t?	-	(t)	-	t
Pectoral Sandpiper[6]	-	-	-	T	t?	-	-	-	-
Baird's Sandpiper[6]	-	-	-	T	t?	-	-	-	-
Dunlin[9]	-	-	-	T	t?	-	-	-	-
Semipalmated Sandpiper[6]	-	-	-	T	t?	-	-	-	-
Western Sandpiper[10]	-	-	-	T	t?	-	-	-	-
Red Phalarope[6]	-	-	T	T	t	-	-	-	-
Northern Phalarope[6]	-	-	T	T	t	-	-	-	-
Pomarine Jaeger[11]	-	t	-	t	t?	-	t	T	t
Parasitic Jaeger[11]	-	t	-	t	t	-	T	t	t
Long-tailed Jaeger[11]	-	t	-	T	t?	-	T	T	t
Glaucous Gull[12]	-	t	-	t?	t?	t?	t	t	t
Sabine's Gull[12]	-	-	t	t?	t?	t?	(t)	-	-

Table 11, cont. Food habits of principal bird species in the Chukchi and Beaufort seas. Tundra habitats.[1]

Principal Bird Species	PLANTS		ARTHROPODA			CHORDATA			
	Vegetation	Berries	Crustacea	Diptera	Trichoptera	Fish	Birds/Eggs	Mammals	Carrion
Arctic Tern[6]	-	-	t?	t	t	t?	-	-	-
Common Raven[6]	-	t?	-	t?	t?	-	t	t	t
Lapland Longspur[6]	-	t	-	T	t?	-	-	-	-

1 Includes all tundra habitats above the intertidal zone and within 10 km of the coast
2 Sjolander and Agren 1976
3 Bergman 1974
4 Howard 1974
5 Bellrose 1976
6 Schamel (personal observations)
7 Boise (personal observations)
8 Holmes 1966
9 Holmes 1972
10 Maher 1974
11 Mickelson et al. 1977

USE KEY: T = primary food item t = secondary food item ? = unknown - = not taken

Table 12. Food habits of principal bird species in the Chukchi and Beaufort seas. Littoral and marine habitats.[1]

Principal Bird Species	VEGE.	ANNELIDA	MOLLUSCA	CRUSTACEA Isopoda	CRUSTACEA Amphipoda	CRUSTACEA Mysidacea	CRUSTACEA Other	INSECTA	CHAETOGNATHA	FISH	CARRION
Yellow-billed Loon[2]	-	-	-	-	-	-	-	-	-	T	-
Arctic Loon[2]	-	-	-	?	?	?	?	-	-	T	-
Red-Throated Loon[3]	-	-	-	?	?	?	?	-	-	T	-
Whistling Swan[4]	T	-	-	-	-	-	-	-	-	-	-
Canada Goose[5]	T	-	-	-	-	-	-	-	-	-	-
Black Brant[5]	T	-	-	-	-	-	-	-	-	-	-
Emperor Goose[4]	T	-	-	?	?	-	?	-	-	-	-
Snow Goose[4]	T	-	-	-	-	-	-	-	-	-	-
Pintail[4]	-	-	?	?	?	?	?	?	-	?	-
Greater Scaup[4]	?	-	?	?	?	?	?	?	-	?	-
Oldsquaw[6]	t	t	t	t	T	T	t	-	?	?	-
Common Eider[2]	-	?	t	T	?	?	?	?	?	?	-
King Eider[6]	-	?	t	T	?	?	?	t	?	?	-
Steller's Eider[4]	-	-	?	?	?	?	?	?	-	?	-
Surf Scoter[4]	-	-	?	?	?	?	?	-	-	?	-
White-winged Scoter[4]	-	-	?	?	?	?	?	-	-	?	-
Red-breasted Merganser[4]	-	-	-	?	?	?	?	-	-	?	-
Sandhill Crane[7]	-	-	-	?	?	?	-	?	-	?	?
Golden Plover[2]	-	-	?	?	?	?	?	?	?	-	-
Ruddy Turnstone[8]	-	t	?	?	t	?	?	t	?	?	t
Pectoral Sandpiper[2]	-	?	?	?	?	?	?	?	?	-	-
Baird's Sandpiper[8]	-	?	?	?	t	?	?	?	?	-	-
Dunlin[8,9]	-	t	?	t	t	?	?	t	?	-	-
Semipalmated Sandpiper[8]	-	t	?	?	?	?	t	T	?	-	-
Western Sandpiper[8,9]	-	?	?	t	?	?	?	t	?	-	-
Red Phalarope[8]	-	-	-	?	t	?	t	-	t	-	-
Northern Phalarope[2]	-	-	-	?	?	?	?	?	?	-	-
Pomarine Jaeger[10]	-	-	-	?	?	-	-	-	-	T	?
Parasitic Jaeger[10]	-	-	-	?	?	-	-	-	-	T	?
Long-tailed Jaeger[10]	-	-	-	?	?	-	-	-	-	T	?
Glaucous Gull[2]	-	-	?	T	t	?	?	t	?	T	t
Ivory Gull[11]	-	-	-	?	t	?	t	-	?	T	?
Black-legged Kittiwake[12,14]	-	-	T	t	?	?	?	t	-	T	-

Table 12, cont. Food habits of principal bird species in the Chukchi and Beaufort seas. Littoral and marine habitats.[1]

Principal Bird Species	VEGE.	ANNELIDA	MOLLUSCA	CRUSTACEA				INSECTA	CHAETOGNATHA	FISH	CARRION
				Isopoda	Amphipoda	Mysidacea	Other				
Ross' Gull[11]	-	-	-	?	T	t	t	t	t	T	-
Sabine's Gull[2]	-	-	-	?	t	?	?	?	?	?	-
Arctic Tern[2]	-	-	-	?	?	?	?	-	-	T	-
Common Murre[12]	-	-	-	?	t	?	t	-	-	T	-
Thick-billed Murre[12,14]	-	t	t	?	t	?	t	-	-	T	-
Black Guillemot[12,14]	-	-	-	?	t	?	?	-	-	T	-
Horned Puffin[12]	-	-	?	?	?	?	?	-	-	T	-
Tufted Puffin[12,13]	-	-	?	?	?	?	?	-	-	T	-
Common Raven[2]	-	-	-	-	-	-	-	-	-	-	T
Lapland Longspur[2]	-	-	-	-	?	-	?	T	-	-	-

1 Includes all salt water habitats and the intertidal area
2 Schamel (personal observations)
3 Howard 1974
4 Bellrose 1976
5 Bergman 1974
6 Divoky (personal observations)
7 Boise (personal observations)
8 Connors 1977
9 Mickelson et al. 1977
10 Maher 1974
11 Divoky 1976
12 Divoky 1977
13 Wehle (personal observations)
14 Springer and Roseneau 1977

USE KEY: T = primary food item t = secondary food item ? = unknown - = not taken major food source for many post-breeding and juvenile birds. Larger crustaceans and fish are taken by sea ducks and gulls. Birds at sea eat primarily arctic cod.

During post-breeding migration, as well as spring migration, there appears to be significant year-to-year variation in habitat use. Such a phenomenon makes the delineation of "critical" areas difficult. In several instances, the data of OCSEAP investigators show quite different trends from the results of earlier studies. The conflict involves annual variation, not faulty data, and signals the need for long-term studies. In view of this difficulty, it seems reasonable to delineate "sensitive" and "critical" areas. "Sensitive" areas refer to locations where a disturbance would probably have a measurable effect on bird numbers. A "critical" area is a subset of "sensitive" area and refers to locations where disturbances would result in widespread effects on bird populations. As such, the entire coast is potentially sensitive for birds, particularly barrier islands, gravel spits, river deltas, mudflats, cliffs and fine-grained mosaic tundra.

Bird species vary considerably in their susceptibility to oil contamination. Susceptibility probably reflects: (1) time spent at sea or in littoral areas; and (2) behavior of the bird while in this area. Species that swim and dive are more susceptible to oiling than plunging species. These criteria are reflected in the oil vulnerability indices, established by King and Sanger for waterbirds (Table 13) and Connors, et al. (in prep.) for arctic shorebirds (Table 14).

Major bird mortality would result from oil spills near breeding colonies in the Bering Strait and the Cape Thompson-Lisburne area.

Table 13. Waterbird oil vulnerability indices (from King and Sanger, 1977).

Common Loon	47
Yellow-billed Loon	65
Arctic Loon	58
Red-throated Loon	49
Slender-billed Shearwater	51
Pelagic Cormorant	63
Canada Goose	34
Black Brant	70
White-fronted Goose	36
Snow Goose	32
Mallard	36
Pintail	36
Green-winged Teal	34
Canvasback	52
Greater Scaup	52
Oldsquaw	66
Harlequin Duck	60
Stellers Eider	72
Common Eider	68
King Eider	70
Spectacled Eider	78
Surf Scoter	72
Black Scoter	72
Semi-palmated Plover	28
American Golden Plover	35
Ruddy Turnstone	44
Knot	39
Pectoral Sandpiper	32
Baird Sandpiper	34
Least Sandpiper	34
Dunlin	41
Long-billed Dowitcher	47
Semi-palmated Sandpiper	34
Western Sandpiper	47
Red Phalarope	58
Pomarine Jaeger	41
Parasitic Jaeger	43
Long-tailed Jaeger	39
Glaucous Gull	45
Ivory Gull	43
Black-legged Kittiwake	49
Ross' Gull	56
Sabine's Gull	44
Arctic Tern	32
Common Murre	70
Thick-billed Murre	70
Black Guillemot	70
Marbled Murrelet	84
Kittlitz' Murrelet	88
Parakeet Auklet	80
Crested Auklet	76
Least Auklet	80
Horned Puffin	72
Tufted Puffin	72

Table 14. Shorebird susceptibility to littoral zone disturbances near Barrow (from Connors et al., in prep.).

High	Moderate	Low
Red phalarope	Dunlin	Golden plover
Sanderling	Baird's sandpiper?	Pectoral sandpiper
Ruddy turnstone	Long-billed dowitcher?	
Semipalmated sandpiper?		
Western sandpiper?		

Spills in other open water areas in the Chukchi Sea would likely cause less mortality to birds. An oil spill in the multi-year ice of the northern Chukchi and throughout the Beaufort may present a complex problem. Oil could remain trapped under the ice for an extended period of time. In addition to endangering the under-ice prey fauna of birds, oil would also threaten birds that feed and roost in the limited open water. Oil contamination of the limited open water nearshore during spring migration is another hazard. By late June, many of the nearshore waters of the Beaufort are ice-free and birds are able to disperse. However, shorebirds and molting oldsquaws are especially abundant in lagoon areas, where oil would likely be confined and least subjected to dispersal by wave action.

Gravel removal from barrier islands and island stabilization projects would probably have little adverse effect on most birds, except if the integrity of island chains was disrupted, with concomitant loss of lagoon areas. In fact, alteration of shorelines may actually increase foraging habitat for fall migrant shorebirds, gulls and terns. However, in such instances, birds might be attracted to areas where contamination is most likely. The potential effects of increased turbidity on the foraging efficiency of birds are not known.

Recent studies have addressed the problems of waterbird reactions to various aircraft and other forms of disturbance. Abandonment of habitat by birds may depend upon: (1) season, (2) species, and (3) level and type of disturbance.

Post-breeding waterfowl vary considerably in their reaction to aircraft and noise. Snow geese are perhaps the most sensitive as flocks of these birds flushed when fixed-wing aircraft flew over at altitudes of up to 3,000 m. In contrast, helicopter overflights were found to have little effect on molting oldsquaws. On low overflights, birds dove. However, this was only a momentary disturbance and birds soon resumed pre-disturbance activities. Moreover, frequently-disturbed areas were not abandoned.

Oil exploration will certainly lead to the development of additional settlements. In the past, such areas have attracted mammalian predators (arctic foxes, wolves, brown bears) which feed on garbage and handouts. The potential harmful effects of these predators on nesting birds needs to be considered.

The most critical need for information concerns trophic relationships. All OCSEAP bird investigators have determined some key prey organisms for birds; a preliminary list is provided in Table 15. Without exception, the life histories and population dynamics of these organisms are, at best, poorly understood. This is a data gap that needs to be filled. Simultaneously, data need to be amassed concerning the distribution and abundance of prey organisms. Ideally, these data would be gathered during an integrated study of plankton, fish, birds and mammals.

Table 15. Preliminary list of key prey species for birds in the Chukchi and Beaufort seas.

PREY				PREDATOR
Mollusca,	Pelecypoda			Oldsquaw[1], Glaucous Gull[2]
	Gastropoda,	*Spiratella helicina*		Red Phalarope[2]
Polychaeta,	*Nereis* sp.			T-B Murre[3]
Arthropoda,	Crustacea,	Copepoda		Red Phalarope[2], Sanderling[2]
		Mysidacea		Oldsquaw[1]
		Isopoda,	*Saduria entomon*	Dunlin[4], Western Sandpiper[4], Glaucous Gull[4], King Eider[1]
		Amphipoda,	spp.	Oldsquaw[1], C. Murre[3]
			Apherusa glacialis	Sanderling[2], Red Phalarope[2]
			Onisimus littoralis	Baird Sandpiper[2], Red Phalarope[2]
		Euphausiacea,	*Thysanoessa raschii*	Sanderling[2], Dunlin[2], R. Turnstone[2]
			Thysanoessa glacialis	Red Phalarope[2], Ross' Gull[5]
	Insecta, Diptera, Ephydridae			Glaucous Gull[4], Dunlin[4], Western Sandpiper[4]
Chaetognatha,	*Sagitta elegans*			Red Phalarope[2]
Chordata,	Vertebrata,	*Boreogadus saida*		T-B Murre[3], C. Murre[3], B-L Kittiwake[3], Bl. Guillemot[6], R-T Loon[7], Ivory Gull[5], Ross' Gull[5]
		Eleginus gracilis		C. Murre[3], B-L Kittiwake[3]
		Myoxocephalus sp.		T-B Murre[3], C. Murre[3], Bl. Guillemot[6]

1 Divoký (in preparation)
2 Connors 1977
3 Springer and Roseneau 1977
4 Mickelson et al. 1977
5 Divoky 1976
6 Divoky et al. 1974
7 Bergman 1974

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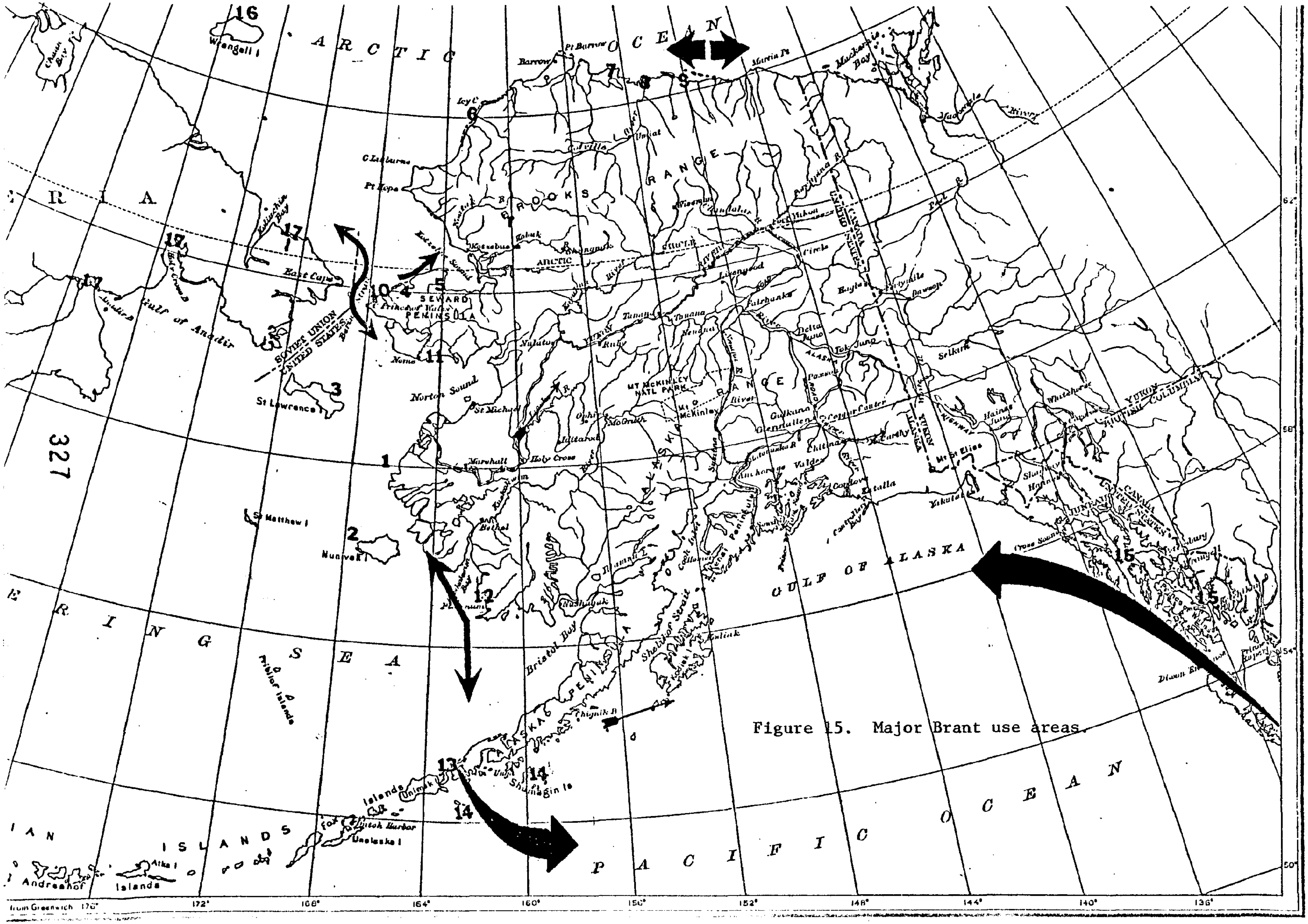

Figure 15. Major Brant use areas.

Table 16. RECOVERY DISTRIBUTION BY STATE AND FLYWAY OF GEESE BANDED DURING 1970 AND 1971 ON THE ALASKAN ARCTIC SLOPE

	Lesser Snow		Lesser Canada		Black Brant		White-fronted		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Recoveries
Pacific Flyway									
Banding Site			2	2%			83	17.7%	85
Russia	2	2%			1	2%			3
Alaska			2	2	2	4	1	.2	5
Yukon Territory					1	2			1
British Columbia	3	3	4	4	4	8			11
Alberta	11	11	2	2			42	8.9	55
Washington	2	2	78	75	6	13			86
Oregon	2	2	16	15					18
Montana	2	2							2
Nevada	1	1							1
Utah									
California	67	65			18	38			85
Mexico, West Coast	4	4			10	21			14
Central Flyway									
N.W. Territory	6	6			6	13	2	.4	14
Saskatchewan	1	1					121	25.7	122
North Dakota							4	.9	4
South Dakota							1	.2	1
Nebraska							20	4.3	20
Iowa							1	.2	1
Kansas							16	3.4	16
Missouri							1	.2	1
Oklahoma							1	.2	1
Texas							147	31.3	147
Louisiana							9	1.9	9
Mexico	1	1					21	4.5	22
TOTAL	102	100	104	100	48	101	470	100	724

Table 17. MAJOR BRANT USE AREAS - ALASKA AND RUSSIA

Map Number	Area Name	Use of Habitat	Survey Results	Habitat Size	Habitat Type	Habitat Threats & Comments
1	Yukon-Kuskokwim Delta (Cape Romanzof to Nelson Island)	Nesting	Est. 27% to 50% of all black brant breeding pairs	Est. 600+ mi^2	Coastal-sedge & beach rye	Potential off shore oil spills; most of habitat in NWR, other will be pivate (Native) Increasing human use during summer months.
	Near coastal Y-K Delta-Pt. Romanzof to mouth of Kuskokwim River	Moulting-migration	Est. 95%+ of all brant use at sometime	-	" " and eel grass	" " and Inter-tidal lands are state owned
2	Nunivak Isl.	Nesting	Only known to have occurred	Unknown	" "	Potential off shore oil spills; in NWR
		Migration	Est. 10,000+ birds in fall	"	" "	" "
3	St. Lawrence Isl.	Nesting	Only known to have occurred	Unknown	" "	Potential off shore oil spills; increasing human disturbance
4	Arctic River Delta	Nesting	$<$20 nests; 11 counted in 1976	Est. 5 mi^2	" "	" "
5	Nugnugaluktuk River Delta	Nesting	Est. less than 75 nests	Est. 5 mi^2	" "	" "
6	Ksegaluk Lagoon	Nesting	Only known to have occurred	Est. 100 mi^2	" "	" "
		Migration	" "	" "	" "	" "
7	Cape Halkett-Pitt Point Area	Nesting	Est. $<$100 nests in 1975; 30 counted in 1960	Est. 100 mi^2	Inland fresh water lakes	" " In Pet. 4 Reserve
		Moulting	9,770 in 1976; 10,300 in 1966; over 10,000 in	" "	" "	" "

Table 17, cont.

8	Colcville River Delta	Nesting	44 nests in 1960	Est. 100 mi^2	Near coastal-sedge & beach rye	" " partially state owned
9	Howe Isl. and Sagavanirktar River Delta	Nesting	Est. 100 nests	Est. 25 mi^2	-	" "
	Storkersen Point	Nesting	11 nests ave. 1971, 72 and 73	11 mi^2	Deep fresh water ponds	State owned
10	Lopp, Ikpek, Arctic and Shishmaref Lagoons	Migration-Possible molting	Est. up to 60% entire population use spring and fall	Est. 375 mi^2	Eel grass	State owned tidelands
11	Safety Lagoon	Migration	Est. 10,000+ spring and fall	Est. 25 mi^2	Eel grass	" "
12	Chagvan Bay	Migration	Est. 50,000+ spring and fall	Est. 15 mi^2	Eel grass	State owned tidelands in refuge
13	Izembek Lagoon and nearby bays	Migration	Probably entire population in fall; 25,000 in spring	25 mi^2	Eel grass	State owned tidelands in refuge
14	Izembek, Shumagin and Sanak Islands	Wintering	Est. up to 5,000; 3,610 in 1977	-	Eel grass	" " Sanak not in refuge
15	Southeast Alaska	Wintering	Est. up to 500	-	Eel grass	State owned tidelands; scattered areas
16	Wrangell Island-Russia	Breeding-moulting	1,000-1,500 Breeding pairs 1976	-	-	-
17	Other Areas in Russia	Possible breeding and moulting	Unknown	-	-	-

APPENDIX

(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 during seasonal movements associated with breeding, parturition and treks to favored forage areas they 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 percent 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 percent 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 percent 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 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 has 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 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 foods that have little nutritional value. The young terminal tips and bud ends and leaves contain most of the nutrients. When shortages exist, however, 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 of 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 easily traveled route of a snowplowed 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 usually 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 hoofs 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 breeding occurs 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, caribou must keep moving to find adequate food. This distributes feeding pressure and tends to prevent over-grazing. 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 its 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 150-160 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 fingernails, grow from the skin and are composed of a material called keratin, quite different from the bony antlers of deerlike animals. Horns continue to grow 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 because 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 three-quarter 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°N latitude in the southern Kenai Mountains to almost 70° 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 zone 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 on 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 remaining 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 three-quarter 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.

MUSKOXEN

Muskoxen (Ovibos moschatus) are short, stocky ungulates whose bulky appearance is exaggerated by a heavy coat of extremely long, coarse outer hair. Except for the head and lower legs, the muskox's shape is hidden by its skirt-length coat. During spring and summer the muskox sheds its fine underhair in great trailing strands and sheets which produces an even shaggier appearance. The outer pelage is dark brown except for a light tan "saddle" and legs. The underfur is light brown.

The amber-colored horns descend and rise to the sides in a graceful sweep. Males have longer, heavier horns than females. Adult bulls may weigh 500 to 900 pounds, and cows weigh 250 to 500 pounds. Calves weigh 25 to 35 pounds at birth and reach 100 to 170 pounds by one year of age.

Muskoxen were once distributed from Greenland west through the Canadian Arctic Archipelago and along the Arctic Slope of Alaska. They became extinct in Alaska between 1850 and 1860. Their demise is generally blamed on increased hunting by natives and introduction of firearms associated with the advent of Arctic whaling.

At the request of Alaska's Territorial Legislature, Congress (1930) appropriated $40,000 to obtain muskoxen from Greenland to restock Alaskan muskox range. Nunivak Island was designated a National Wildlife Refuge and the interim home of Alaska's new herd. Thirty-four animals were captured and moved to the University of Alaska in 1930 where they were held until released on Nunivak in 1935 and 1936. Eighteen males and 13 females comprised the original Nunivak herd.

The Nunivak population numbered between 50 and 60 by 1947, but after that date grew at a regular and substantial rate. In 1968 the population was estimated at 750 animals. The herd has since declined to about 500 animals, largely due to winter losses.

Muskoxen on Nunivak Island breed during late July and August. Cows may mature when two years old and bear a calf at three, provided good nutrition, but during the high population levels on Nunivak apparently few cows younger than four years old bred. Occasionally cows are sexually mature as yearlings and bear a calf at two years of age. Bulls probably are reproductively mature at four to six years of age. Younger bulls may be physiologically capable of breeding but socially incapable of competing for cows. When well fed, cows can produce a calf each year, but on poor range a calf every other year may be maximum. Calves are born in late April and early May on Nunivak.

Muskoxen are polygamous. One bull may control two to four cows during the breeding season. Bulls unable to compete socially do not breed. Nonbreeding bulls on Nunivak probably numbered about 200 in 1968 as a result of a very high proportion of bulls to cows.

The chief mortality factors on Nunivak Island seem to be insufficient food, old age and wandering off the island in winter and being unable to return due to shifting or melting ice, or a combination of the three. No large predators exist on Nunivak. One ear-tagged cow found after it died in 1953 was 23 years old, but average life expentancy is unknown.

Transplants from Nunivak Island to the mainland began in 1967 when the Alaska Department of Fish and Game moved eight yearlings to nearby

Nelson Island. In 1968, 16 additional animals were moved to Nelson Island. Muskoxen were reintroduced on the Arctic slope in 1969 when 52 were released at Barter Island. In 1970, 36 muskoxen were released near Nome, 36 at Cape Thompson and 13 on the Arctic Slope at Kavik River.

The Nelson Island herd has grown to about 33 animals and appears well established. Those released on the Arctic Slope have formed several small groups and are reproducing. How well they survive remains to be seen. Both the Nome and Cape Thompson groups have dispersed widely but have reproduced. Again, some time must pass before their success can be determined.

BLACK BEAR

Black bear (Ursus americanus), the smallest of the North American bears, are bulky in build and are 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 to 200 pounds, with few exceeding 300 pounds. The average weight of females is somewhat less 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.

Black bears are a forest species, and in Alaska their distribution coincides closely with distribution of forests. They have 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 black bears 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) 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 of age, though females may not breed until age 5 or 6. Breeding takes place from about mid-June through mid-July.

Gestation lasts approximately seven 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 separated from their 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 black bears 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 overwinter 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 black bears 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 foods 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 comprises less than 15 percent of the annual diet, is apparently taken whenever obtainable and is frequently carrion. Invertebrates (particularly insects) along coast areas are also sought by bears. Black bears will take an occasional prey animal, but they are 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 bears are generally low. Endoparasites such as roundworms, 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.

BROWN-GRIZZLY BEAR

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

The brown bear resembles its close relative the black bear, Ursus americanus. The brown bear, however, is usually larger, 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 and 900 pounds, with extremely large individuals weighing as much as 1,400 pounds. Females weigh one-half to three-fourths as much as equivalent aged males in given locales. An extremely large brown bear may have a skull nearly 18 inches in length. Such a bear when standing on its hind feet is about 9 feet tall. Inland, bears are usually smaller than coastal bears, perhaps because they lack the rich supply of fish.

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

Although there is no precise data on the abundance of brown-grizzly bears in Alaska, 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 today 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 averages 5.6 square miles. Activities are associated with food gathering and winter denning. Fixed frequency and location indicated that the 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 of age. 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.

Mating takes 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 sizes range from one to four cubs, although 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 determination of wild bears using tooth cementum aging techniques suggests 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 or 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 timberline, but may be found anywhere from sea level to alpine areas. On the Alaska Peninsula and Kodiak Island, 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 the Alaska Peninsula. Grassland type habitats 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 they are 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, 31 brown bears were seen fishing at McNeil River falls at the same time.

Human activities are the most significant cause of mortality. 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 death of a bear. 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 elimination of bears can be expected. The 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 United States and Central America. Their numbers have been markedly reduced over much of Canada and in small portions of Alaska. Brown bears in Europe have suffered a similar fate.

The survival of brown-grizzly bears does not depend entirely on the designation of vast tracts of unspoiled "wilderness". Instead, their future lies in the reassessment of human values to allow reasonable coexistence with them. 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.

POLAR BEAR

Polar bears (Ursus martimus) are found only in the most northerly part of the Northern Hemisphere, usually in close association with the polar ice pack. Although some biological knowledge of polar bears has been obtained, most of it in recent years, much still remains to be learned about the life history and ecology of these large carnivores.

White color and large size are perhaps the most distinctive physical characterictics of polar bears. They are more rangy in appearance than other bears and probably equal or surpass brown bear in maximum size. The largest males may weigh 1,400 pounds. Most mature males, however, weigh from 500 to 1,000 pounds, and mature females weigh from 400 to 600 pounds. The largest hides when laid out flat are about 10 feet from nose to tail and from one front claw tip across their shoulder to the other front claw tip.

Polar bears occur in all areas covered by the Arctic ice cap, but are more numerous toward the southern edge of the ice pack. The five countries with polar bear populations off their shores or on their territory are Canada, Denmark, Norway, Russia and the United States. Canada's bears are widely distributed from southern Hudson Bay throughout many of the northern arctic islands. Denmark's bears are confined to Greenland. Norway's bears are found only on the large Spitsbergan island group and surrounding sea ice. Centers of abundance in Russia are confined generally to groups of islands along the northern coast.

There is some movement of bears within the polar basin as ocean currents cause the pack ice to drift. The extent of involuntary movement around the North Pole or from one country to another caused by ice drift is still unknown. Individual animals also travel in their search for food, and males travel during the mating season. In some areas bears make extensive north and south movements as the pack ice recedes northward in the spring and advances southward in the fall. When on land bears generally stay fairly near the coast, but occasionally may range inland.

Off the Alaskan coast bears gradually move northward in the spring, generally in April, through the Bering Straits and the Chukchi Sea, preceding the northward movement of the edge of the ice pack. They spend the summer on the ice pack, apparently concentrating to a certain extent along its edge which may be from 10 to 200 miles off the north coast of Alaska. Bears then move to the south again in the fall as the ice forms, occasionally occurring as far south as St. Lawrence Island.

Polar bears mate in the spring, with most breeding activity taking place in April. The males actively seek out females and move extensively during this period. Generally in October the female hollows out a den in the snow. Bears den on large islands in Canada, Spitsbergen and Russia. Alaska does not have large north coast islands, and it is believed that some bears den on heavy pack ice off shore.

The young, weighing only a few ounces and numbering one or two or occasionally three, are born in late November or early December after a gestation period of seven to eight months. The mother and cubs leave the den in late March or early April when cubs are about the size of house cats. Some cubs remain with their mother through their third spring when they are over two years old. It is not known if all family groups remain together this long or if family breakup occurs earlier for some. Females probably breed every third year. No one knows yet how long bears live and produce offspring in their natural environment. Bears in zoos have lived to be 40 years old and have remained fertile for approximately 25 years.

The polar bear's main food is seals. Seals are hunted mainly along cracks in the ice known as leads where they congregate. Bears hunt by stalking the seals when they are out on the ice or by waiting for a seal to come through the water to its breathing hole. In the spring bears seek out seal dens with young seals. Bears also feed on carrion, such as dead whales and walrus, when it is available on beaches. On occasions when bears are inland, they feed on vegetable material and various small mammals.

Polar bears, like other game animals, are a renewable resource which can be managed so that a certain segment can be harvested each year on a sustained yield basis. People throughout the world, many of whom will never travel in the Arctic, have a deep concern for polar bears' welfare. With study and proper management, the outlook for perpetuation of the species appears favorable.

Polar bear research has been greatly accelerated in recent years. Biologists from the different countries with polar bears work with one another and exchange information, and recently an international research program was started. Findings will form the basis for management programs which should assure perpetuation of the species.