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Division of Wildlife Conservation

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Management Report
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MUSKOX

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LeeAnne Ayres

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STATE OF ALASKA
Tony Knowles, Governor

DEPARTMENT OF FISH AND GAME
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DIVISION OF WILDLIFE CONSERVATION
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LOCATION

GAME MANAGEMENT UNIT: 18 (41,159 mi^2)

GEOGRAPHIC DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

Muskoxen were once widely distributed in Alaska but were extirpated by the middle or late 1800s. In 1929, with the support of the Alaska Territorial Legislature, the US Congress initiated a program to reintroduce muskoxen in Alaska. Thirty-one muskoxen were introduced from Greenland to Nunivak Island in Unit 18 during 1935-1936 as a first step toward reintroducing this species to Alaska. The Nunivak Island population grew slowly until approximately 1958, and then began a period of rapid growth. The first hunting season was opened in 1975, and the population has since fluctuated between 750 and 400 animals, exhibiting considerable reproductive potential even under heavy harvest regimes. More recently, many muskoxen were killed after they wandered onto sea ice. But relatively mild winter weather, low natural mortality, and absence of predators fostered the growth and recovery of the Nunivak muskox population, which reached approximately 500 animals again by spring 1996.

During 1967-1968, 23 subadult muskoxen were transplanted from Nunivak Island to Nelson Island, 20 miles across Etolin Strait. The Nelson Island muskox population Island exhibited an annual growth rate averaging 22% between 1968 and 1981. The first hunting season was opened in 1981 when the population approached the management goal of 200 to 250 animals. For approximately 10 years the Nelson Island muskox population remained stable, providing emigration to the mainland and stable harvests.

A census of Nelson Island muskoxen, completed in March 1994, estimated the population at 142 animals and revealed a skewed population structure (too many adult bulls) causing low calf numbers and poor herd growth. Since the population was then below the management goal, meetings were held with the United Villages of Nelson Island (UVNI) to discuss a temporary elimination of annual harvests to promote herd growth. The department authorized cessation of harvest during 1995 and 1996 to balance the sex ratio and to increase the number of mature cows in the population. The Nelson Island muskox population recovered rapidly, with 217 muskoxen observed in a helicopter survey in July 1995 and 233 muskoxen observed in an additional helicopter survey in March 1996.

More than 150 muskoxen may now reside on the mainland of the Yukon-Kuskokwim Delta, having originally emigrated from Nelson Island. Mainland muskoxen are widely distributed in small herds from the mouth of the Kuskokwim to the Andreafsky Mountains north of the Yukon River and are slowly extending their range north and east. Sightings have been documented by local residents, aircraft pilots, and agency biologists during surveys of other species. However, the mainland population seems stable at a very low density, and illegal hunting may be greatly limiting potential growth of the population. Wandering muskoxen may actually return to Nelson Island when tidal inlets freeze. This unpredictable behavior at times complicates muskox managment decisions for Nelson Island. Since mature males are the first muskoxen to disperse from

established herds, we believe the mainland muskox population in Unit 18 may lack adequate numbers of mature females needed for good calf production and subsequent expansion of the population.

MANAGEMENT DIRECTION

The following management goals and objectives have been established for muskox in Unit 18:

- Maintain a posthunt population size of approximately 250 muskoxen on Nelson Island and approximately 500 on Nunivak Island.
  - ◊ Survey populations on Nunivak Island using aerial and ground survey methods in cooperation with the FWS to estimate population size and composition.
  - ◊ Survey populations on Nelson Island with helicopters and fixed-wing aircraft to estimate population size and composition.
  - ◊ Issue drawing and registration permits for hunter harvest of muskoxen to maintain optimal size, composition, and productivity of the populations on Nunivak Island and Nelson Island, respectively.
  - ◊ Provide hunter orientation and checkout to ensure hunters understand permit requirements, do not misidentify animals they are permitted to harvest, and to obtain sex, age, and location of harvested animals.
- Determine the distribution and dispersal of muskoxen on the mainland.
  - ◊ Deploy and maintain up to 5 radiocollars on mainland muskoxen to monitor population status and dispersal.
- Finalize a cooperative muskox management plan for Nunivak Island and Nelson Island, respectively.
  - ◊ Participate in an interagency effort to finalize a reindeer-muskox management plan for Nunivak Island and verify that the goals and objectives are being carried out by all parties.

METHODS

During 27-31 August 1995 a Bell Jet Ranger helicopter was used to survey total numbers and composition of the muskox population on Nunivak Island. Muskoxen were classified as yearlings, 2-year-old males and females, 3-year-old males and females, 4-year-old and older males and females, or unclassified. We plotted all observations on 1:63,360 scale topographic maps.

During 17-18 March 1996 two Cessna 206 fixed-wing aircraft and a Cessna 185 were used on a second survey of the Nunivak Island muskox population during the reporting period. We

conducted a third survey of Nunivak muskox during 27-30 August 1996, using an R-22 helicopter.

A helicopter census and composition survey of the Nelson Island muskox population was also completed using the R-22 helicopter during July 1995. A second aerial census was completed using the helicopter during March 1996. At this time the helicopter was used to classify a group of 20 additional muskoxen located on the mainland approximately 10-20 miles east of Nelson Island.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Nunivak Island muskox population remained healthy and productive throughout the reporting period, recovering from a substantial loss of wandering muskoxen onto sea ice during 1992-94. The population had declined slowly since 1989 in response to a harvest strategy designed to reduce the population (Table 1). However, emigration of muskoxen onto pack ice around Nunivak Island and subsequent accidental drowning of animals from drifting ice floes caused unpredictable losses during the 1992-1994 reporting period. This brought the population below the management goal of 500-550 muskoxen. The reproductive potential of the Nunivak Island population has been sufficient to recover quickly from these unpredictable losses, with only a limited closure of cow harvest during the fall 1994 hunting season on Nunivak Island.

The Nelson Island muskox population remained stable in size from 1981 to 1986 at approximately 250 muskoxen during years of light to moderate snow accumulation (Table 2). The herd provided a nucleus for emigration to the mainland while sustaining high annual harvests during this period. Total muskox numbers declined on Nelson Island during the 1991-1992 regulatory year, following a 10-year period of stability with harvest rates approaching 15% (Tables 2 and 3). Reduction of harvest rates, selective harvest of bulls, and complete cessation of harvest during 1995 and 1996 were used to reverse the decline in numbers on Nelson Island. The 1994 population was approximately 65 animals below the management goal of 250 muskoxen. The herd began to recover after the 1995 calving season in response to cessation of harvest. The herd had recovered sufficiently by 1996 to allow resumption of harvest in spring 1997 (Table 2).

Mainland muskoxen are descendants of the 23 muskoxen introduced to Nelson Island during 1967-1968 and have been sighted in Unit 18 for over 20 years. The population has increased very slowly from an estimated 40 animals in 1984. Only the large groups near Dall Lake and in the Askinuk Mountains near Cape Romanzof have been regularly producing calves. We attribute low productivity and high mortality among mainland muskoxen to low densities of breeding age animals, skewed sex structure of the emigrating population (mostly males), and excessive illegal harvests. We believe excessive harvests have especially impacted the Dall Lake herd. A few muskoxen may reside in the Andreafsky Mountains north of the Yukon River. Another small herd is present in the Mud Volcanoes between the lower Yukon and Kuskokwim Rivers. Muskoxen have been occasionally reported from upland areas such as Kusilvak Mountain between the Yukon and Kuskokwim rivers, and from a few areas north of the Yukon River.

Population Size

During a helicopter survey of Nunivak Island muskoxen during 24-26 June 1994, we found 73 groups and 361 adults/subadults and 77 calves (438 total animals). This was a complete survey of the island; however, small groups of animals may have been missed. The postcalving population was approximately 100 animals below the population management goal of 500-550, probably because of the loss of a substantial number of wandering animals onto sea ice during the previous winter. Nunivak Island is often surrounded by shorefast and shifting pack ice during late winter. The shore ice may fracture away from the island, carrying wandering muskoxen out to sea.

The 1994 Nunivak Island posthunt, precalving population of 361 animals was the lowest since harvest records began in 1975. It also represented a notable decrease from the 1993 population of 438 muskoxen. The decrease was probably caused by the emigration of up to 70 animals onto pack ice where they subsequently drowned. The loss of so many animals in this unusual way had not been previously recorded. During the winter of 1993-1994 several carcasses were found floating in Etolin Straits by local residents of Mekoryuk and by a herring tender boat crewmember. Previously, the precalving population ranged from 400 to 750 muskoxen. Fortunately, by March 1996 the Nunivak Island muskox population (posthunt, precalving) had recovered to approximately 500 animals.

The Nelson Island muskox population also reversed a decline in numbers which began in 1991. No registration permits were issued for Nelson Island muskoxen during the spring of 1995 or 1996. The July 1994 census showed the Nelson Island muskox population had begun to stabilize; we counted 187 animals, only a slight decrease from the March 1993 population estimate. A year later, during a helicopter survey in July 1995, we found a large proportion of cows and 54 calves in the postcalving Nelson Island population of 217 muskoxen. We counted 233 muskoxen on Nelson Island during March 1996 (Table 2).

We do not have sufficient survey information to estimate accurately the population of mainland muskoxen. Incidental observations suggest the population is widely dispersed and may be approximately 150 animals. Some muskoxen may return to Nelson Island from the mainland, confounding census data for both areas. We believe the largest and most productive herd of mainland muskoxen in Unit 18 (approximately 15 animals) is located in relatively isolated country on the western slopes of the Askinuk Mountains south of the mouth of the Yukon. The physical features of the Askinuk Mountains resemble those on Nelson Island.

Population Composition

The composition of the Nunivak Island muskoxen population is available from the helicopter census conducted during 27-31 August 1995. We classified 498 muskoxen observed in 94 groups, ranging in size from 1 to 21 animals. We counted 100 adult males (4+-years), 133 adult females (4+-years), 27 3-year-old males, 37 3-year-old females, 20 2-year-old males, 37 2-year-old females, 44 yearlings, and 103 calves. This composition count was followed by a fixed-wing aircraft survey of the Nunivak Island muskox population on 17-18 March 1996. This posthunt survey revealed 484 muskox in 40 groups. A third Nunivak Island muskox census was conducted by helicopter on 27-30 August 1996. This postcalving, prehunt survey revealed 434 muskoxen in 103 groups, but muskoxen were probably missed during this survey.

Based on the 1994 census, the proportion of adult males and the proportion of adult females in the Nunivak population increased during the reporting period. The increase is partly the result of selective harvesting to keep balanced sex ratios, annual recruitment from the 3-year-old age class, and few unclassified animals during the census. The younger age groups have similar proportions in each age class for each sex, indicating a uniform population structure that should remain stable throughout the next reporting period.

The posthunt, postcalving composition of the Nelson Island muskox population in July 1995 was 16 adult males (4+-years), 74 adult females, 16 3-year-old males, 18 3-year-old females, 5 2-year-old males, 11 2-year-old females, 23 yearlings, and 54 calves (Table 4). Selective hunting of bulls increased the proportion of females in the population and recruitment has increased. During a helicopter survey in July 1995, we determined the postcalving Nelson Island muskox population was 217 animals. Another helicopter survey of the Nelson Island muskox population in March 1996 revealed 233 muskoxen, including 184 (1+ and older muskoxen) and 49 short yearlings. Assuming 25 animals were overlooked during the July 1995 survey, only 5 calves born in 1995 were missing during this survey. This calf mortality, from birth to 10 months age, would be only 9% of 1995 calves. This is a very low loss compared to losses estimated during 1994 and 1993 when over half of the calves died. The Nelson Island muskox population has also recovered rapidly from a population decline.

We do not have reliable composition information for most mainland muskoxen. The slow growth of the population and the absence of calves in many groups suggests that proportion of adult cows may be very low. The March 1996 helicopter survey of the Nelson Island population, however, revealed an additional 20 additional muskoxen on the mainland at Baird Inlert, about 10-20 miles east of Nelson Island. This group of 20 muskoxen had 1 mature bull (4+ yrs old); 2 (3 yrs, 10 month old bulls); 7 mature cows (4+ years old); 4 (3 yr and 10 month old cows); 3 (2+ yr. old bulls); 2 (2+ yr. old cows); and 1 short yearling (10 months old). This group of muskoxen could easily return to Nelson Island until thawing of inlets around the island in May. The population structure of this particular group indicates the possibility of considerable reproductive potential for muskoxen on the mainland.

Distribution and Movements

The largest concentrations of Nunivak Island muskoxen observed during the August 1995 census were found in the west-central and interior uplands of the island. By comparison, muskoxen were uniformly distributed around the island in coastal and interior areas during the August 1996 survey. During the March 1996 survey, 90% of the muskoxen were located across the south and west sides of the island. This is a typical late winter distribution. Few muskoxen were found in northeastern Nunivak Island, perhaps a result of hunting pressure and snowmachine activity originating from Mekoryuk. Muskoxen tend to concentrate on wind-blown, *Elymus*-covered dunes in southern Nunivak after late winter snow accumulates on the remainder of the island. In the summer they disperse throughout the island's interior.

At the time of the July 1995 census, Nelson Island muskoxen were concentrated on the cliffs near Cape Vancouver and on the hills northeast of Tununak, although some individuals and small herds were scattered on the hills in the central portion of the island and along the escarpment above

Nightmute. This is a typical distribution. During the the March 1996 survey, about half the Nelson Island herd was located on the cliffs near Cape Vancouver and the escarpments northeast of Tununak. These patterns are repetitive and the cliff areas may be used as refuges to avoid winter snowmachine traffic.

Muskoxen are not confined to Nelson Island. Both males and females often move to the mainland by crossing frozen tidal inlets during the months from November to May. Although some individuals remain on the mainland, others return to Nelson Island. The movements between the island and the mainland across weakened tidal ice during spring and fall expose muskoxen to the risk of drowning. These wanderings to and from the island also explain some of the annual fluctuations in the size of the muskox population on Nelson Island.

Local residents, pilots, and biologists have reported numerous sightings of mainland muskoxen for over 20 years. These reports continued throughout 1996. Range of mainland muskoxen currently extends southeast to the mouth of the Kuskokwim River, northeast to the Portage Lakes-Hills area near Lower Kalskag, and northwest to the Andreafsky Mountains. The animals exhibit a general habitat preference for upland tundra and riparian corridors. Solitary old males are usually the first muskoxen to be seen in new areas.

Although the population is small, the amount of range expansion and long-range movements of mainland muskoxen has been remarkable. A 4-year-old female that was probably born on Nelson Island was collared on the mainland as a 3-year-old on 30 March 1989 south of the Yukon River near Pilot Station. This animal moved approximately 160 miles east near the village of Lower Kalskag north of the Kuskokwim River in August 1989 and was subsequently shot by a hunter on 24 March 1990 near Toksook Bay on Nelson Island, approximately 200 miles west of its last known location.

Department and FWS staff radiocollared 5 muskoxen (2 bulls and 3 cows) from herds of 9 and 12 animals south of the Yukon River between Bethel and Pilot Station in March 1989. Six yearlings were present in these herds. The collared animals ranged westward to Pilot Station and Dall Lake and eastward to Kalskag and the upper Johnson River. These collared animals have since died. No additional radiocollars have been deployed during the reporting period. Radiotracking should be used to better understand the population size and distribution and movements of mainland muskoxen.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Subsistence/Resident Open Seasons	Nonresident Open Seasons
Unit 18, Nunivak Island		
Resident and Nonresident Hunters: 1 bull by drawing permit only. Up to 10 permits will be issued for the fall season and up to 35 permits will be issued for the spring season; or 1 cow by registration permit only. Thirty-five cow permits (up to 5 in the fall and up to 30 in the spring) will be issued on a first-come, first-served basis.	1 Sep-30 Sep 1 Feb-15 Mar	1 Sep-30 Sep 1 Feb-15 Mar
Unit 18, Nelson Island		
Resident and Nonresident Hunters: 1 muskox by registration permit only. Up to 30 permits will be issued on a first-come, first-served basis.	1 Feb-25 Mar	1 Feb-25 Mar
Remainder of Unit 18	No open season	No open season

Board of Game Actions and Emergency Orders. In spring 1989 the Board of Game (BOG) gave ADF&G the discretionary power to issue up to 45 bull and 45 cow permits on Nunivak Island. For the 1994–1995 regulatory year, the department staff issued 5 cow and 20 bull permits for Nunivak Island muskox. During the 1995–1996 regulatory year, 20 cow and 20 bull permits were issued. This quota was designed to allow muskox to reach the population goal of 500–550 animals and help correct the unbalanced sex ratio.

The bull muskox season on Nunivak Island was extended by 2 weeks by the board during the 1992–1994 reporting period. The season is currently 1 February through 15 March, rather than 15 February through 15 March.

During its spring 1992 meeting, the BOG gave the department the discretionary authority to issue up to 30 muskox permits on Nelson Island. The old regulation required that we issue 15 bull and

15 cow permits annually. The new regulation allows us to adjust harvest levels for each sex to compensate for changes in population size and composition. This harvest adjustment was first implemented during the spring hunt in 1993 when 30 bull-only permits were issued. No permits for Nelson Island muskoxen were issued in 1995 or 1996.

Human-induced Mortality. Hunting of Nunivak Island muskoxen was regulated by drawing permits and registration permits for fall and spring hunts for both years in the reporting period.

For the fall 1994 hunt, 5 bull drawing permits but no cow registration permits were available to hunters. This was increased to 5 bull drawing permits and 5 cow registration permits for the fall 1995 hunt. In each year the successful drawing permittees were notified by mid July of their eligibility to hunt during the September season. In fall 1994 3 of 5 drawing permit winners elected to hunt and successfully took bull muskox. The remaining 2 unused permits were carried over to the spring 1995 hunt. In fall 1995 all 5 of the 5 drawing permittees elected to hunt and took bull muskox. Registration for cow permits resumed in August 1995 on a first-come, first-served basis at Mekoryuk. Hunting by cow registration permittees occurred in September 1995. All 5 registration permittees took cow muskox in the fall 1995 hunt.

The Nunivak Island spring hunt permit drawing for bull muskoxen was limited to 15 permits in 1995 and 15 permits in 1996. A waiting list of over 400 alternate permittees each year indicates the continuing popularity of the Nunivak spring bull hunt. Two drawing permits not used for the fall 1994 hunt were added to the spring 1995 hunt, bringing bull permits to 17. All 17 spring hunters were successful in taking bull muskoxen, yielding a season total of 20 bulls harvested during the 1994–1995 regulatory year. All 15 spring 1996 hunters were successful in taking bull muskoxen, for a season total of 20 bulls also harvested during the 1995–1996 regulatory year.

The cow registration permits for the spring hunts each year were available on a first-come, first-served basis in the village of Mekoryuk. In Mekoryuk, local residents received 5 permits in 1995 and 15 permits in 1996. All 5 cow permit holders were successful during the spring 1995 hunt and 14 out of 15 were successful during the spring 1996 hunt.

On Nunivak Island hunters harvested 25 muskoxen (20 bulls and 5 cows) during the 1994–1995 season and 39 muskoxen (20 bulls and 19 cows) during the 1995–1996 season (Table 1). Historically, harvest of bulls and cows has varied and has been intentionally decreased during the reporting period to allow the herd to recover to a stable size of 500–550 animals.

Muskox hunting on Nelson Island was closed during the reporting period to allow the herd to recover from a population decline (Table 5). Previously, 30 registration permits had been issued annually at community centers, high schools, or city offices on a rotational basis among the villages of Nelson Island.

Harvest Chronology. Most cow hunters on Nunivak Island took their muskoxen between late February and mid March in increasing daylight hours and milder weather. Bull hunters on Nunivak Island usually hunted with guides or transporters, and their hunts are normally scheduled well in advance of the season.

Hunter Residency and Success. Most drawing permittees for Nunivak Island bulls were residents of Anchorage and Southcentral Alaska. Success rates were 100% for 1994–1995 and 1995–1996.

No cow registration permits were available for the fall 1994 hunt on Nunivak Island. For the registration hunt in fall 1995, we issued 3 of 5 cow permits to Mekoryuk residents; the other 2 permittees were from Bethel. For the spring hunts in 1995 and 1996, all the permits available at Mekoryuk (5 and 15 permits, respectively) were issued to local residents.

Success rate for all muskox hunters entering the field was 100% for Nunivak Island during both years. Most cow muskox hunters on Nunivak Island were able to complete their hunt in 1 day. Nunivak Island bull hunters, who were usually guided or supplied by transporters, took 2 to 3 days to complete their hunts because they were more selective.

Transport Methods. Boats were used for the fall hunt on Nunivak Island. Snowmachines are used for late winter hunts on Nunivak Island.

Natural Mortality. Little quantitative information is available concerning natural mortality of muskoxen in Unit 18. No large predators such as bears and wolves inhabit Nunivak Island and are rare or nonexistent on Nelson Island and the Delta lowland. Most natural mortalities are the results of accidents such as falling off cliffs, breaking through ice of lakes and tidal streams, and stranding on drifting sea ice. We suspect that approximately 70 muskoxen wandered onto the pack ice in winter of 1993–1994 and never returned to the main island of Nunivak. These muskoxen probably drowned after drifting out to sea. Four muskoxen carcasses were found floating at sea by Mekoryuk residents and crew on a herring tender boat traveling in Etolin Straits.

HABITAT

Assessment

The Nunivak Island lichen range is considered to be critically overgrazed by reindeer, although muskoxen harvested in recent years were reported to be in very good condition. Although reindeer are not found on Nelson Island, several muskoxen harvested there in recent years had less body fat than normal. Muskoxen on Nelson Island may be using marginal habitat along the steep marine escarpments to avoid hunters and snowmachine traffic during December through April. Concerns about the status of the range on Nelson Island are partially alleviated by the potential for emigration to the mainland.

CONCLUSIONS AND RECOMMENDATIONS

The Nunivak Herd is characterized by high productivity and low natural mortality. The proportion of adult males in the population has increased during the last 6 years; the proportion of adult females and yearlings has decreased slightly. The harvest of cows should be maintained at 35 animals per year and the bull harvest at 45 animals per year. Harvest of bulls and cows should be reduced when the posthunt, precalving population is below 550 animals.

Interagency meetings have been held in Bethel and at the village of Mekoryuk to finalize a muskox–reindeer management plan for Nunivak Island. This management plan was finalized on 9 November 1994 in cooperation between the department, FWS, Soil Conservation Service (SCS), Bureau of Indian Affairs (BIA), Alaska Soil and Water Commission, and NIMA corporation. Much of the plan addresses management of the 6000 to 8000 privately owned reindeer that inhabit Nunivak Island. The plan includes ways to reduce the reindeer herd to <3000 animals. The proper management of these reindeer affects the carrying capacity of the habitat to provide space and forage for muskoxen.

Muskoxen are still considered a priority species on Nunivak Island, but possible overgrazing of the lichen range by reindeer and erosion of the dune areas have become concerns on this unique refuge. The 3 goals for muskox populations in the plan are maintaining a minimum population of 500 muskoxen, transplanting muskoxen to other areas of Alaska, and allowing hunting opportunities for muskoxen.

Fluctuations in the observed size of the Nelson Island population are influenced by snow and ice conditions and the availability of escape terrain and forage. The Nelson Island population is not confined to the island because the animals can cross frozen tidal inlets to the mainland from November to May. The Nelson Island muskox population has provided a source for emigration to the mainland and stable harvests in recent years.

Variable annual harvests are needed to effectively manage the herd in response to emigration and other natural losses. While the population is at or below 250 animals, we recommend harvesting variable numbers of cows and bulls at a rate not exceeding 10% of the population to keep a healthy age and sex structure in the population. Harvest should be increased if the population increases above the management goal of 250 animals. Appropriate management actions for Nelson Island muskoxen need to be taken after consultation with, and support from, local hunters.

Mainland muskoxen in Unit 18 have increased in range and numbers in recent years. As many as 150 muskoxen may now reside on the mainland of Unit 18. These muskoxen are widely distributed at low densities from the mouth of the Kuskokwim River to the mouth of the Yukon River, and are extending their range north and east. No known sightings of muskox south or east of the Kuskokwim River have been documented, but there are several documented observations of muskoxen north of the Yukon River. The growth of the mainland population is the result of continued emigration from Nelson Island and production in a number of mainland herds. We recommend that hunting should remain closed on mainland muskoxen. Additional mainland muskoxen should be radiocollared and their movements monitored.

A comprehensive information and education program explaining the benefits of a larger muskox population on the mainland of Unit 18 should be prepared for the benefit of local residents. We may want to pursue a cooperative collaring project with the Yukon Delta National Wildlife Refuge and village councils to develop an educational program that encourages local residents to protect this rare and unique species.

ACKNOWLEDGMENTS

The department would like to acknowledge Randy Kacyon as the Unit 18 Area Biologist who completed all the design, planning, logistics, aerial surveys, data collection, preliminary analysis, and community meetings summarized in this report. Tragically, Randy was killed in an aircraft accident on 30 November 1996 while conducting a moose survey along the lower Yukon River. Randy achieved high standards as a wildlife management biologist and worked closely with other agencies and local residents to develop a high level of trust and respect. Successful management of the Nunivak Island and Nelson Island muskox populations was largely the result of his survey efforts and close working relationships with the residents of Unit 18.

Also, the department thanks Sam Patten for his willingness and thoroughness to help prepare and finalize this report detailing the data collected by Kacyon. His knowledge and previous work experience in Unit 18 helped prepare an accurate summarization of departmental activities in Unit 18.

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Table 1 Unit 18 hunting harvest of Nunivak Island muskox population, 1975–1996

Year	Males	Females	Unknown	Total
1975	10	0		10
1976	68	3		71
1977	58	2		60
1978	40	0		40
1979	24	0		24
1980	10	11		21
1981	12	50		62
1982	13	49	1	63
1983	24	35		59
1984	22	36		58
1985	19	42		61
1986	31	43		74
1987	32	34		66
1988	35	35		70
1989	36	33		69
1990	39	31		70
1991	40	31		71
1992	45	31		76
1993	45+2[a]	25+1[b]		73
1994[c]	34+1[d]	23		58
1995	20	5		25
1996	20	19		39
Total	680	539	1	1220

[a] Two adult bulls found dead.

[b] One 2.5-year-old cow killed accidentally.

[c] Harvest was reduced during the 1993–1994 season in response to population decline.

[d] One mature bull taken by mistake by a cow hunter.

Table 2 Nelson Island muskoxen population size in Unit 18, 1973–1996

Year	No hunting/precalving	Prehunt/precalving	Posthunt/precalving
1973	44		
1975	66		
1977	132		
1978	107		
1980	167		
1981		265	245
1982		217	190
1983		230	206
1984		200	176
1985		225	195
1986		287	263
1987		180	150
1988		213	183
1989		234	205
1990		239	208
1991		232	207
1992		214	182
1993		198	168
1994		149	123
1995	217		
1996	233		

Table 3 Number of permits and hunting harvest of Nelson Island muskoxen in Unit 18, 1981–1996

Year	Permits available		Muskox harvested		Number of applicants
	Female	Male	Female	Male	
1981	20	0	20	0	129
1982	30	0	19	8	34
1983	0	25	0	25	37
1984	15	15	9	14	33
1985	15	15	14	16	33
1986	15	15	14	10	50+
1987	15	15	14	16	34
1988	15	15	15	15	30
1989	15	15	15	14	30
1990	15	15	14	15(+2[a])	58
1991	15	15	10	14(+1[a])	34
1992	15	15	15(+2[a])	15	30
1993	0	30	0	30	37
1994	5	25	5(+1[a])	21	31
1995	0	0	0	0	0
1996	0	0	0	0	0

[a] Number of muskoxen found dead from wounding.

Table 4 Composition of Nelson Island muskoxen in Unit 18, July 1995

Age, yrs	Male	(%)	Female	(%)	Unknown	(%)	Total	(%)
4+	17	9	48	26			65	35
3+	7	4	22	12			29	16
2+	8	4	12	6			20	11
1+					28	15	28	15
0+					45	24	45	24
Total	32	17	82	44	73		187	

Table 5 Unit 18 residency of Nelson Island muskox hunt permittees, 1981–1996

Year	Permits available	UVNI villages[a]	Local[b]	Nonlocal[c]	Nonresidents
1981	20	20	0	0	0
1982	30	30	0	0	0
1983	25	21	3	1	0
1984	30	21	9	0	0
1985	30	25	5	0	0
1986	30	21	9	0	0
1987	30	29	1	0	0
1988	30	27	3	0	0
1989	30	30	0	0	0
1990	30	30	0	0	0
1991	30	30	0	0	0
1992	30	25	4	1	0
1993	30	24	4	2	0
1994	30	22	4	2	2
1995	0	0	0	0	0
1996	0	0	0	0	0
Total	405	355 (88%)	42 (10%)	6 (2%)	2(<1%)

[a] Residents of United Villages of Nelson Island (UVNI).

[b] Residents of Unit 18 not residing in the United Villages of Nelson Island.

[c] Residents of Alaska not residing in Unit 18

LOCATION

GAME MANAGEMENT UNIT: 22 (25,230 mi^2)

GEOGRAPHIC DESCRIPTION: Seward Peninsula and that portion of the Nulato Hills draining west into Norton Sound.

BACKGROUND

Historical accounts indicate muskoxen were absent from Unit 22 prior to their reintroduction in spring 1970 when 36 animals were translocated from the Nunivak Island herd to the southern portion of the Seward Peninsula. By 1980 the population had increased to 104 muskoxen, yielding an average annual growth rate of 11%. An additional 34 muskoxen from the Nunivak Island herd were translocated to the existing population in 1981. From 1983 to 1988 the population grew rapidly, and muskoxen lived throughout the northern and western portion of the Seward Peninsula. Annual growth rates during the period averaged 17%. Censuses completed in 1992, 1994, and 1996 indicated the Seward Peninsula population increased to 706, 925, and 951 animals, respectively (Table 1).

MANAGEMENT DIRECTION

The following management goals form the basis of a cooperative interagency management plan for Seward Peninsula muskoxen developed during 1992 through 1994 and follow the guidelines of the Alaska Muskox Management Policy (AMMP). Under the terms of the AMMP, the highest priority for managing muskoxen in Alaska is to promote reestablishment of animals from existing herds onto their former range. As stated in the AMMP, the highest priority for management of muskox populations on the Seward Peninsula is to allow for continued dispersal and range expansion onto suitable vacant habitats. Viewing, hunting, and esthetic enjoyment are considered the highest priority uses of muskoxen.

MANAGEMENT GOALS

1 Allow for continued increase in the size and distribution of the Seward Peninsula muskox population.

2 Provide for a limited harvest in a manner consistent with existing State and Federal laws and regulations and the other Goals and Management Objectives of this Plan.

3 Manage muskoxen along the Nome road systems of Unit 22C for viewing, education, and other nonconsumptive uses.

4 Work with local reindeer herding interests to minimize conflicts between reindeer and muskoxen.

5 Protect and maintain the habitat and other components of the ecosystem upon which muskoxen depend.

6 Encourage cooperation and sharing of information among agencies and users of the resource in developing and executing management and research programs.

METHODS

Muskox censuses were completed during spring 1994 and 1996 on the Seward Peninsula in Units 22B west of and including the Darby Mountains, 22C, 22D, 22E and 23 west of and including the Buckland River drainage. Staff from the department, the National Park Service (NPS) and the U. S. Bureau of Land Management (BLM) participated in the census. The area was apportioned into 5 survey areas which were thoroughly searched by survey aircraft outfitted with radiotracking equipment. When muskoxen were located, the survey crew determined whether the group contained any radiocollared animals. A visual count was made and the number of short yearlings noted. Upon completion of the census, the number of known active radiocollars was compared to the number actually found. We made additional flights to locate missing radiocollared animals.

Sightings of muskoxen provided by the public continued to provide a valuable source of information on distribution and migration of muskoxen throughout the Seward Peninsula.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

The Seward Peninsula muskox population continued to increase in number during the report period. Reports of muskoxen occurring east of the Seward Peninsula in the Nulato Hills and Buckland valley are becoming more commonplace. As the herd increases in size, the numbers of animals emigrating eastward will also likely increase.

Population Size

During the cooperative census completed in April 1994, 925 muskoxen were found in 52 groups in Units 22B, 22C, 22D, 22E and 23. Prior to the census, 11 muskoxen had active radiocollars. All 11 collars were found during the census effort. Group locations and total numbers of animals counted by Unit are as follows:

Unit 22B, 4 groups (11 animals);
Unit 22C, 7 groups (79 animals);
Unit 22D, 38 groups (405 animals);
Unit 22E, 12 groups (184 animals);
Unit 23, 14 groups (246 animals).

During March and April of 1996, another cooperative census was completed in the same area as the 1994 census, and 951 muskoxen were counted. Only 3 animals had active radiocollars. All 3 were found during the census. A summary of the census results is as follows:

Unit 22B, 7 groups (51 animals);
Unit 22C, 11 groups (87 animals);
Unit 22D, 31 groups (308 animals);
Unit 22E, 22 groups (327 animals);
Unit 23, 13 groups (178 animals).

MORTALITY

Harvest

Season and Bag Limit. Fifteen registration permits were available to local unit residents in Units 22D, 22E and 23 through the Federal Subsistence Management program during the 1995–1996 regulatory year. The established Federal season was September 1–January 31. Hunters were required to take their muskoxen only on Federal public lands.

Human-Induced Mortality: Local hunters harvested 14 muskoxen during the Federal subsistence season established for Unit 22 during 1995–1996. One muskox was harvested from Unit 22D, 6 from Unit 22E and 7 from Unit 23. All of the harvest occurred during January through March 1996.

Natural Mortality: Although no meaningful measure of natural mortality of Seward Peninsula muskoxen was obtained during the reporting period, we believe the severe winters of 1989 and 1990 had an effect on muskoxen survival, particularly of calves (Nelson 1993).

CONCLUSIONS AND RECOMMENDATIONS

The Seward Peninsula muskox population continued to grow and expand into suitable habitat. The number of animals observed during the survey is considered a minimum population estimate because I believe not all muskoxen on the Seward Peninsula were found during the 1996 census. Although productivity remains high, population size may be stabilizing because the population showed little growth during the 1994–1996 period. I estimate that at least 1000 muskoxen currently reside on the Seward Peninsula.

During recent years, Seward Peninsula muskoxen have become a high profile species among the public. Their success in reestablishing themselves throughout much of the unit's suitable habitat has prompted interest, primarily among local residents, in establishing and promoting a hunt. Because of this interest, department staff took the lead in developing a cooperative management plan for the Seward Peninsula. Cooperators on this plan include the department, NPS, BLM, the Alaska Department of Natural Resources (DNR), the Soil Conservation Service (SCS), Kawerak Reindeer Herders Association (RHA), and the native corporations of Bering Straits (BSNC) and Northwest Alaska (NANA) as well as the Deering IRA Council. The plan was finalized during 1994 and presented to the Alaska Board of Game.

To meet the population management goals established by the cooperative management plan for muskoxen on the Seward Peninsula, the following management activities are recommended:

1 Maintain a pool of at least 25 collared animals and monitor movements on a regular basis.
2 Complete population censuses at 2-year intervals.
3 Complete composition surveys at 2-year intervals once hunting begins.

LITERATURE CITED

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Table 1 Unit 22 population size and growth rate for the Seward Peninsula muskox population, 1970–1996

Year	Population Size Estimate[a]	Mean Annual Growth Rate (percent)[b]	Percent Radiocollared
1970	36	--	--
1980	104	11	--
1983	175	--	4
1984	225	29	6
1985	271	20	6
1988	426	16	6
1992	706	13	3
1994	925	14	2
1996	951	1	>1

[a] The estimate for 1970 refers to the size of the original translocation. The estimate for 1980 is based on aerial surveys of known herds located near Nuluk and Black Mountain. The estimates for 1983 through 1996 represent the actual number of muskoxen counted during aerial censuses.

[b] Because the population size at the time of the 1981 translocation was not known with certainty, the mean annual growth rate between 1980 and 1983 could not be accurately calculated.

LOCATION

GAME MANAGEMENT UNIT: 23 (43,422 mi^2)

GEOGRAPHIC DESCRIPTION: Kotzebue Sound and western Brooks Range

BACKGROUND

Muskoxen are indigenous to northwest Alaska; however, these populations disappeared before or during the nineteenth century for reasons unknown. The north Pacific whaling fleet is usually credited with decimating muskoxen in this region. However, muskoxen may have already disappeared from Alaska (but not Canada) by the time of their arrival. Although there is ample evidence of at least 2 genera of muskoxen (*Ovibos* and *Smybos*) in northwest Alaska from the Pleistocene epoch, there is little evidence that muskoxen existed here during the last several hundred years.

Two muskoxen populations currently exist in Unit 23, and both are the product of translocations from Nunivak Island. In 1970 the department released 36 muskoxen near Cape Thompson; an additional 34 muskoxen were released at the same location in 1977. Of the 4 attempts to re-establish muskoxen in their former ranges of Alaska, the Cape Thompson population has grown the least. The department also released 36 muskoxen on the southern portion of the Seward Peninsula near Teller in 1970; and in 1981, an additional 35 muskoxen were released in the same area. Muskoxen inhabiting the southern portion of Unit 23 (Buckland to Goodhope River drainages) stem from growth of the southern Seward Peninsula translocation.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

1 To allow for the growth and expansion of muskoxen into their historic ranges.
2 To eventually provide for subsistence and recreational hunting on a sustained yield basis.
3 To provide muskoxen for viewing and scientific study.

MANAGEMENT OBJECTIVES

1 To census each of the 2 muskoxen populations in Unit 23 biennially.
2 To monitor the sex and age composition of each muskoxen population in Unit 23.
3 To determine whether significant conflicts occur between muskoxen and reindeer or caribou.
4 To monitor effects of industrial development and tourism on muskoxen and their habitat.

METHODS

POPULATION STATUS AND TREND

Population Size

The abundance of muskoxen was determined through aerial censuses from fixed-wing aircraft. Radiotelemetry was not employed to facilitate these censuses because there were few or no

functional collars in Unit 23 during this reporting period. Search effort during the censuses focused on known ranges and on potential muskoxen habitat, e.g., ridgelines and riparian areas. We searched all other areas less intensively.

The southern portion of Unit 23 (Buckland drainage to Goodhope drainage) was censused March–April 1996. This census was part of a larger, cooperative effort with the National Park Service (NPS) and Bureau of Land Management (BLM) to census muskoxen throughout the Seward Peninsula. That portion of Unit 23 between the mouth of the Noatak River and Cape Lisburne within approximately 20 miles of the Chuckchi Sea coast was censused in April 1997 (after this reporting period).

Population Composition

Whenever possible, sex and age composition of groups was recorded during censuses. However, for large groups or groups that formed a defensive cluster in response to the airplane, we could determine only total number. To minimize disturbance and defensive behavior, groups of muskoxen were approached at 1000–2000 ft above ground level, then repeatedly counted during a gradual, low power, spiral descent. In addition, many opportunistic observations of group composition were recorded by department staff while completing other activities during this reporting period.

Distribution and Movements

The location of muskoxen groups observed during censuses was plotted on 1:250,000 U.S. Geological Survey maps and recorded using Global Positioning System (GPS) latitude/longitude coordinates.

Nine conventional NPS radiocollars were deployed by department staff (J. Dau and P. Bente) on muskoxen near Deering during 27–30 March 1996. Four cows and 4 bulls, all adults (>12 months old), were collared and an inactive collar (serial number 8126) was replaced with a new collar on 1 of the captured cows. During collaring operations, muskoxen were approached using snowmachines (with the final approach on foot) and immobilized using Carfentanil and Xylazine. The effects of Carfentanil were reversed using Naltrexone. A resident of Deering, Alfred Karmun II, was employed by the department to assist with the capture. The collars were primarily deployed to assist a University of Alaska graduate student (Claudia Ihl, M. Sc. candidate) examine behavioral interactions and forage overlap between muskoxen and reindeer. The collars were located by department staff approximately once each month since deployment to determine distribution and movements of muskoxen throughout the year.

Many muskoxen groups were observed opportunistically by department staff and the locations of these groups were recorded using GPS coordinates. In addition, casual conversations between department staff and local residents provided much information regarding the distribution of both Unit 23 muskoxen populations.

MORTALITY

Radiocollared animals provided information on muskoxen mortality in Unit 23. However, most of our understanding of muskoxen mortality is from public reports.

Harvest

Harvest of the northern Seward Peninsula muskoxen population was determined through a registration permit system administered by the Federal Office of Subsistence Management. There was no harvest for the Cape Thompson muskoxen population.

HABITAT

Assessment

The department does not monitor range condition for muskoxen in Unit 23. A cooperative project to evaluate interactions between reindeer and muskoxen on the Seward Peninsula was initiated in June 1994. Participating agencies include NPS, BLM, ADF&G and the University of Alaska Cooperative Wildlife Research Unit. One objective of this study is to determine overlap of range use between these species. This project is still in progress at this time.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Northern Seward Peninsula. During the March–April 1996 census, 188 muskoxen in 15 groups were observed in Unit 23 between the Buckland and Goodhope drainages. This included short yearlings (10–11-month-old calves) and adults. We observed 134 muskoxen in 8 groups during 1992 and 246 muskoxen in 14 groups during 1994.

The variation from 1992 to 1996 in total number of muskoxen within this portion of Unit 23 merely indicates the Unit 22–Unit 23 boundary does not delineate 2 separate biological populations. Many groups observed during all 3 censuses were near this boundary, and part of the Unit 23 variation in total number is attributable to local movements of muskoxen between units. It is more appropriate to consider muskoxen in the southern portion of Unit 23 as part of the entire Seward Peninsula population.

The annual rate of increase for the entire Seward Peninsula population from 1970 to 1980 was 11% and from 1981 to 1992 the rate was 16% (Table 1). This population appears to have stabilized from 1994 to 1996. However, the quality of the 1996 census was probably somewhat lower than in 1994 for a variety of reasons (Machida and Coady, pers. commun.). As a result, this population may have grown from 1994 to 1996, although more slowly than in previous years.

Cape Thompson. Two hundred ninety one muskoxen (short yearlings and adults) were observed in 24 groups during the March 1997 census (Table 2). This is the highest count observed since the time of the original translocation. All of the population estimates for this portion of Unit 23 represent minimum counts because high wind and fog precluded surveying the entire census area during each census. Nevertheless, during each census fog or high wind excluded us only from areas where muskoxen rarely occur; we feel these counts accurately represent their abundance through time.

Unlike census estimates in the southern portion of Unit 23, these censuses reflect growth of this muskoxen population because there is no contiguous area contributing to variation in numbers through immigration or emigration of muskoxen. If anything, the 1997 census probably underestimates growth of this population because it was conducted before calving commenced. During the 1988, 1993, and 1994 surveys, most calving had probably occurred by the time each survey was completed and neonates contributed to the total estimate.

Between 1988 and 1997, the Cape Thompson muskoxen population grew approximately 8–11% annually (Table 2), considerably slower than on the Seward Peninsula (Table 1). This may be because winter range is a limiting factor between Cape Krusenstern and Cape Lisburne or because other environmental factors are more rigorous at higher latitude.

Population Composition

All composition estimates during censuses or radiotelemetry surveys were made from fixed-wing aircraft; consequently, they should be viewed with caution. Neonates (calves 1–2 months old) are easily identified by their small size but are often difficult to see when near their mother. In dispersed groups, short yearlings can be identified by their small size and gray color; however, in dense groups they can easily be misidentified as adults.

Northern Seward Peninsula. Muskoxen composition data for the northern Seward Peninsula is not as good as for Cape Thompson (Table 3). Essentially no composition was recorded during the 1992 census because 61 of the 73 muskoxen observed were in 2 groups too large to classify by sex and age. Similar problems occurred during 1994 and 1996. All 3 northern Seward Peninsula censuses were conducted before calving commenced; therefore, no estimate of initial calf production was possible.

Cape Thompson. We conducted the 1997 census before calving commenced so we could not estimate initial calf production (Table 3). We observed 17 short yearlings:100 adult muskoxen during the April 1997 census (193 adults and 32 short yearlings). High wind precluded determining composition for 2 large groups totaling 66 individuals near Cape Thompson. Both groups contained some short yearlings; therefore, this estimate is probably a minimum ratio. Given the uncertainty associated with classifying muskoxen from fixed-wing aircraft, recruitment (short yearlings:100 adults) appears to have been relatively stable during the 3 years we have been able to estimate this parameter (Table 3).

Distribution and Movements

No single source of information completely illustrates the year-round distribution and movements of either muskoxen population in Unit 23. Instead, census results, radiotelemetry data, many opportunistic observations by department staff since 1988, and numerous conversations with local residents provide a general understanding of muskoxen distribution in Unit 23.

Northern Seward Peninsula. The Kugruk, Inmachuk, Goodhope and Cripple River drainages are all used regularly by muskoxen in this portion of Unit 23. During approximately May–October, muskoxen move up and down riparian willow corridors. Unlike caribou or reindeer, muskoxen seem relatively insensitive to insect harassment but are strongly affected by warm ambient air

temperature. Rut begins in late July and extends into October. During this time some bulls travel long distances between drainages seeking opportunities to mate.

Deep snow forces muskoxen out of riparian willow habitat and into uplands where wind minimizes snow depth. During years of little snow (e.g., 1996–1997), muskoxen may remain in riparian areas well into or throughout winter. Upland winter range consists of exposed knolls, ridges, or domes characterized by sparse, decumbent vegetation and chronic wind. Despite limited food, muskoxen usually remain within a very small area throughout winter. Muskoxen survive these conditions by relying on fat reserves and minimizing activity. Shallow snow seems far more critical than vegetation biomass or species composition in determining muskoxen winter range. Important winter areas are: 1) Pinnell River/Hannum River/Arizona Creek area; 2) ridge east of the Burnt River; 3) plateaus of upper Cottonwood Creek; and 4) ridges on the east side of Midnight Mountain. Parturition begins in mid April while muskoxen still occupy winter habitat and can extend into June while muskoxen occupy riparian areas.

Throughout the year, large mixed sex/age groups exhibit the greatest fidelity to high-use areas and the most predictable movement patterns. Small groups, especially bulls, are at the other end of this spectrum, having low fidelity and unpredictable movement patterns. Essentially all of the muskoxen that have dispersed out of their core ranges have been bulls. The Seward Peninsula population has probably been the source of muskoxen observed on the Baldwin Peninsula and in the Kobuk and Selawik River drainages.

Cape Thompson. Muskoxen in this portion of Unit 23 use the same types of summer and winter habitats as described for the northern Seward Peninsula. Important summer areas are: 1) Tigara Peninsula and lower Kukpuk River; 2) Ogotoruk Creek; 3) Rabbit and Jade Creeks; 4) lower Wulik and Kivalina Rivers; and 5) western portion of the Igichuk Hills and Krusenstern Lagoon. Important winter areas are: 1) Kemegrak and Telavirak Hills (near Cape Thompson); 2) Cape Dyer; and 3) Tahinichok Mountains. Unlike the northern Seward Peninsula population, Cape Lisburne–Cape Krusenstern muskoxen seem highly dependent on coastal habitat and rarely venture >15 miles inland. This pattern of distribution is probably related to the effects of chronically high coastal winds minimizing snow accumulation during winter and possibly lowering ambient air temperature during summer.

Two groups totaling approximately 30 muskoxen overwintered on ridges and plateaus in the extreme western portion of the Igichuk Hills during the winter of 1996–1997. Although small numbers of muskoxen have used this area repeatedly during the last 5–7 summers, this is the first time muskoxen have wintered here since their reintroduction to Cape Thompson. Bulls observed throughout the Noatak River drainage and across the western portion of Unit 26A probably emigrated from the Cape Thompson population.

MORTALITY

Harvest

Season and Bag Limit. There is no state-managed muskoxen hunt in Unit 23. In 1995 the Federal Office of Subsistence Management established a permit hunt for muskoxen in that portion of Unit 23 west of and including the Buckland River drainage. During the 1995–1996 and 1996–1997

regulatory years (1 July–30 June), the federal season was 1 September–31 January and the harvest was restricted to bulls. Seven permits for bulls were issued for 1995–1996: 4 in Buckland and 3 in Deering. Only 4 muskoxen were taken during the regular 1995–1996 season (3 in Deering and 1 in Buckland). In response to a request from Buckland residents, the Federal Board extended the season 2–11 March, and the remaining 3 permits were filled. During the 1996–1997 season, 9 federal muskoxen permits were issued in Unit 23: 4 in Buckland and 5 in Deering. Poor traveling conditions resulted in only 1 muskox being harvested during the regular season by a resident of Deering. In response to a request from Deering residents, the Federal Board extended the season 31 January–22 February, and 2 additional muskoxen were harvested by residents of Deering.

Based on the 1996 census, the 9-bull quota for Unit 23 in 1996–1997 almost doubled the 3% harvest rate established by the Cooperative Management Plan (9 permits of 188 muskoxen is 5%). This resulted from a federal staff committee member's mapping error which inflated the Unit 23 population estimate by almost 100 animals.

Board of Game Actions and Emergency Orders. For almost 15 years following the reintroduction of muskoxen to northwest Alaska, there was no regulatory action taken by the department or Board of Game (BOG). During this postintroduction period, maximum protection was provided to enable the Seward Peninsula and Cape Thompson populations to establish themselves, grow and encompass surrounding areas. The only management action taken for muskoxen during this time was to investigate several reports of poaching; no cases were successfully prosecuted.

By 1992 censuses conducted by department staff indicated the Seward Peninsula muskoxen population had grown to >700 animals. Queries to department staff from local subsistence hunters, urban sport hunters and the Reindeer Herder's Association (RHA) indicated considerable interest in hunting muskoxen in this area. Anticipating regulatory proposals to the BOG, the department initiated a cooperative muskoxen management planning process for the Seward Peninsula in 1992. Participants included NPS, BLM, RHA, ADF&G (Subsistence and Wildlife Conservation Divisions), U.S. Soil Conservation Service, Alaska Department of Natural Resources, a BOG member (Ann Ruggles), some individual village representatives, Bering Straits and NANA Regional Native Corporations, and Kawerak. In 1994, the Seward Peninsula Cooperative Muskox Management Plan was completed. This plan established 6 goals:

1 Allow continued natural increase in the size and distribution of the Seward Peninsula muskox population.
2 Provide limited hunting of muskoxen in a manner consistent with existing state and federal laws and regulations and the other goals and management objectives of this plan.
3 Manage muskoxen in Units 22B and 22C primarily for viewing, education, and other nonconsumptive uses.
4 Work with local reindeer herding interests to identify and minimize conflicts between reindeer and muskoxen.
5 Protect and maintain the habitat and other components of the ecosystem upon which muskoxen depend.

6 Encourage cooperation and information sharing among agencies and resource users in developing and executing management and research programs.

The cooperators agreed harvesting 3% of the muskoxen population would satisfy goals 1 and 2. At that time, this equaled a harvest quota of 24 muskoxen. The cooperators also agreed the harvest should at least initially be restricted to bulls.

At their January 1995 meeting, the BOG found no customary and traditional (C&T) use of muskoxen on the Seward Peninsula. The Board established a harvest quota of 24 bull muskoxen and authorized 2 hunts for Units 22D, 22E and that portion of Unit 23 west of and including the Buckland River drainage. One hunt would be administered through a registration permit system with the following conditions:

1 twelve permits available annually;
2 permits would be issued in villages within the hunt area (i.e., Buckland and Deering);
3 permits would cost $25.00 each;
4 the season would be 1 September–31 January; and
5 permits restricted to Alaskan residents.

The other hunt would be administered through a drawing permit system with the following conditions:

1 twelve permits available annually;
2 permits issued through the statewide drawing permit system;
3 each permit would cost $500.00;
4 the season would be 1 February–20 March; and
5 permits available to anyone; however, only up to 2 permits would be issued to nonresidents annually.

In February 1995 the Northwest Arctic Regional Council recommended to the Federal Subsistence Board not to authorize a federal hunt on the Seward Peninsula. Their purpose was to determine whether the state hunts would provide reasonable opportunities for rural residents to harvest muskoxen on the northern Seward Peninsula. In contrast, the Seward Peninsula Regional Council also met in February and proposed the Federal Board allocate 25 muskoxen to a federal hunt in Units 22D and 22E. When the Federal Subsistence Board met in April 1995, testimony from representatives of each of these Regional Councils prompted them to establish harvest quotas totaling 25 bull muskoxen in Units 22D (12 bulls), 22E (6 bulls) and 23 (7 bulls). The Federal Board's action ensured the entire quota of muskoxen would be harvested by local residents. It also greatly reduced (by >50%) the area available to hunters by restricting hunting to federal public lands. This requirement forced residents of some villages (e.g., Buckland and Wales) to travel long distances to hunt muskoxen on federal lands.

The department responded to the Federal Board's action in 2 ways. First, it closed the state drawing and registration permit hunts by emergency order to avoid doubling the 3% harvest rate recommended by the Cooperative Muskox Management Plan. Second, in June 1995 the

department submitted a Request for Reconsideration (RFR) to the Federal Board to reduce the federal quota in Unit 22D from 12 to 2 permits. Justification for the State's RFR was that federal lands comprise only 15% of Unit 22D, and only 35 muskoxen occurred on these lands during the 1994 census (a total of 405 muskoxen were observed in Unit 22D during that census). Harvesting 12 of these 35 muskoxen would result in a 34% harvest rate and would eliminate most or all bulls present on federal lands in Unit 22D. In August 1995 the Federal Board agreed with the biological concerns expressed in the department's RFR and reduced the number of permits as requested. In February 1996, the Norton Sound Regional Council recommended the Federal Board reauthorize 12 permits in Unit 22D. In April 1996 the Federal Board subsequently increased the number of Unit 22D permits from 2 to 8. In September 1996 the department submitted another RFR to the Federal Board requesting the number of permits in Unit 22D again be reduced to 2. This request was denied.

For the federal hunt in Units 22E and 23, the same problems of potential local overharvest of muskoxen and reduced access for hunters occurred but to a lesser degree; therefore, the department did not submit RFR's to reduce the harvest quota for Units 22E and 23. A subcommittee was formed by the Seward Peninsula cooperators group in January 1997 to address the potential problem of local overharvest of muskoxen on federal lands.

Currently, the 1st goal of the Seward Peninsula muskox management plan is being questioned. Some local residents/hunters would like to cap this population at 1000 individuals to increase the harvest and possibly establish a cow season. The RHA would like to cap the population to avoid conflicts with the reindeer industry. In addition, the cooperators group and the Northern Norton Sound Fish and Game Advisory Committee will request the BOG to reconsider its C&T finding for muskoxen in this area. These inquiries may substantially alter muskoxen hunting in the near future.

Hunter Residency and Success. Only residents of Buckland and Deering qualify for a federal muskoxen permits in Unit 23. During 1995–1996 and 1996–1997, Buckland residents experienced difficulty harvesting their quota of muskoxen. This occurs because during most years few or no muskoxen are on federal lands near Buckland.

Transport Methods. All muskoxen were taken using snowmachines during both the 1995–1996 and 1996–1997 federal hunts.

Other Mortality

One of the 9 muskoxen collared during March 1996 (an old female) died of natural causes. In general, few radiocollared adult muskoxen have died before their transmitter failed for both the Seward Peninsula and Cape Thompson populations. We rarely observe muskoxen carcasses during many hours of low-level aerial surveys or many miles of snowmachine travel in areas frequented by muskoxen. This agrees with reports from local residents that they rarely find adult muskoxen carcasses, although they do find calf carcasses. This suggests natural mortality rates for adult muskoxen have been low since they were translocated to this unit. Very low calf production (as observed in some years by department staff) or high, localized calf mortality (as observed by local residents) may influence the population dynamics of Unit 23 muskoxen populations more than long-term adult mortality since 1970.

Most mortality of adult muskoxen in Unit 23 since 1988 has been the result of illegal harvests. One 4-year-old bull was killed 2 August 1994, approximately 10 miles north of Kotzebue ostensibly in defense of life or property. Although circumstantial evidence did not support this explanation, the case was dismissed by the Assistant District Attorney.

HABITAT

Assessment

The cooperative project to evaluate interactions between reindeer and muskoxen on the Seward Peninsula is still underway; therefore, no results are available at this time. No other muskoxen habitat assessment is being conducted in Unit 23.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Muskoxen telemetry

For many years local residents have criticized the department for collaring muskoxen near Cape Thompson. Muskoxen movements in this area are limited by their fidelity to coastal areas and are very predictable. Also, this population has never sustained an open hunting season. As a result, we found the benefits of collaring muskoxen in this area were outweighed by the costs of public disapproval and risks to muskoxen associated with capture. Therefore, we discontinued this project. In contrast, muskoxen on the northern Seward Peninsula move between Units 22 and 23 and have been hunted for 2 regulatory years. The department should continue to collar muskoxen in this portion of the unit to evaluate potential effects of hunting on muskoxen distribution and effects of muskoxen movements on census results.

Since 1988, 4 female muskoxen fitted with conventional radiocollars have slipped their collar over the boss of their horns. When the transmitter has remained below their chin, this situation has not appeared to threaten the health of the individual. However, for 2 cows, the transmitter somehow became positioned on top of the nose. For 1 cow, the collar began to chafe and create a lesion. Such collars should be removed or repositioned and abscesses treated at a time when capture operations will not impact small calves in the group. This problem is probably unavoidable among collared animals because individual muskoxen experience a wide range in body weight between early fall and late spring. Collars probably slip over the small boss of female horns when their body weight is low during spring.

Conflicts between muskoxen and reindeer or caribou

Many local residents of northwest Alaska feel that muskoxen displace reindeer and caribou through behavioral interactions and the presence of muskox quiviut and feces in areas used by both species. Some reindeer herders feel this negatively affects their business, and some subsistence hunters feel muskoxen have displaced caribou from important caribou hunting locales. Until it is adequately addressed, this problem will continue to impede attempts to manage muskoxen in northwest Alaska.

Conflicts between muskoxen and people

Many local residents resent the reintroduction of muskoxen to Unit 23. In addition to the perception that muskoxen displace caribou and reindeer from important hunting and herding areas, local residents feel threatened by muskoxen when picking berries during late summer despite the fact that no one has ever been harmed by a muskox in this area (and perhaps Alaska). Local residents also resent they were not consulted before muskoxen were translocated to this unit. This negative local sentiment toward muskoxen seems to have diminished on the Seward Peninsula with the establishment of limited hunting opportunities.

Two muskoxen, reportedly bulls, took up residence on the Selawik airport 4–5 days in October 1995. Selawik villagers unsuccessfully attempted to frighten the animals away on several occasions before the muskoxen eventually left. During this time, the Kotzebue Flight Service Station issued a local notice to pilots regarding the presence of these bulls on the runways. In September 1996 a lone bull muskox walked onto the gravel runway at Kotzebue, causing temporary runway closure. This bull was quickly scared out of the airport surroundings by Department of Transportation staff. During late summer and fall 1995, a lone bull muskox was observed several times near the Kiana airport. It, too, departed the area on its own. In none of these instances did muskoxen substantially disrupt scheduled village flights or threaten people. Muskoxen are apparently attracted to elevated gravel pads.

State and Federal research and management activities

Until 1994 federal agencies conducted practically no work on muskoxen in Unit 23. Since then, federal staff have repeatedly expressed their desire to participate in aerial censuses, telemetry projects, and other work and have recently considered initiating their own projects. To avoid affecting muskoxen and angering local residents with increased levels of fieldwork that residents consider objectionable, state and federal staff need to cooperatively develop field programs.

CONCLUSIONS AND RECOMMENDATIONS

1 Two distinct populations of muskoxen inhabit Unit 23. One population ranges between Cape Lisburne and Cape Krusenstern within approximately 15 miles of the coast. The other population is part of the Seward Peninsula muskoxen population and, within Unit 23, ranges between the Buckland and Goodhope River drainages. Both populations stem from translocations initiated by the department in 1970.

2 The Cape Thompson population grew at a slower rate than the Seward Peninsula population for unknown reasons.

3 Muskoxen exhibit strong fidelity to seasonal ranges. This characteristic is most pronounced for large mixed sex/age groups which makes them particularly vulnerable to repeated harassment from hunters. Even so, muskoxen have been observed throughout Unit 23. All muskoxen observed outside core ranges have been bulls observed as solitary individuals or pairs. Bulls often colonize new areas during range expansion.

4 Muskoxen forego areas of ample food to overwinter on exposed, sparsely vegetated domes and ridges where snow depth is minimal. Muskoxen rely on body-fat reserves and use extremely conservative behavior to survive in such desolate areas through winter.

5 Muskoxen are vulnerable to human harvests. They are easy to find and normally do not flee when approached. The effects of hunting muskoxen are not limited to harvesting individuals from the population. The greater effect of harvests may lie in repeated harassment of large mixed sex/age groups as they are approached by hunters. The strong negative energy balance muskoxen use to endure most winter conditions probably reduces their ability to absorb energetic costs associated with flight and increased activity related to harassment imposed by hunting. Also, their defensive behavior predisposes them to wounding losses when bullets inadvertently pass through 1 individual and into another. This raises several recommendations regarding muskoxen hunting in Unit 23:

   A Muskoxen harvests in Unit 23 should be conservative until the department can assess their impacts at the population level.

   B Hunters should be encouraged to focus on bull groups.

   C Hunting should not be allowed after mid March. This will protect pregnant cows from harassment incidental to the harvest of bulls for at least 1 month before calving. Cows are particularly vulnerable to harassment at this time because they endure high energetic costs of birth and lactation when their fat reserves are lowest.

6 Implications of state versus federal management of muskoxen on the Seward Peninsula provide managers few options for fairly and effectively managing this population. The BOG's inability to make a positive C&T finding precludes many options for the state to ensure that local users have reasonable opportunity to satisfy their subsistence needs. At the same time, the federal hunt precludes participation in this hunt by nonlocal hunters. The federal hunt may biologically threaten muskoxen by locally overharvesting bulls on federal land. In addition, the federal hunt substantially reduces the number of muskoxen available to local hunters and creates significant logistical problems for some by restricting them to federal lands. Last-minute changes in the number of federal permits available in Unit 22D and overall reductions in the number of federal permits issued (resulting from department RFR's to the Federal Subsistence Board) have frustrated local hunters and state and federal staff. Management of Seward Peninsula muskoxen clearly illustrates some of the problems associated with dual state-federal management.

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Table 1 Unit 23 census results and population estimates for Seward Peninsula muskoxen, 1970–1996

Census year	Minimum population size	Mean annual rate of change[a]	Estimated population size[b]
1970	36		
1971		1.11	40
1972		1.11	44
1973		1.11	49
1974		1.11	55
1975		1.11	61
1976		1.11	68
1977		1.11	76
1978		1.11	84
1979		1.11	94
1980	104	1.11	
1981	139[c]		
1982		1.16	161
1983		1.16	187
1984		1.16	217
1985		1.16	251
1986		1.16	291
1987		1.16	337
1988		1.16	391
1989		1.16	453
1990		1.16	525
1991		1.16	609
1992	706	1.16	
1993		1.14	808
1994	925	1.14	
1995		1.01	938
1996	951	1.01	

[a] Mean annual rate of change = e^r

where:

e = 2.7183

$r = [\ln(N_{t2}) - \ln(N_{t1})]/t$

t = number of years between censuses

N_{t1} = pop. estimate at time 1

N_{t2} = pop. estimate at time 2

[b] Assumes constant growth rate between censuses

[c] Includes second transplant of 35 muskoxen

Table 2 Unit 23 census results and population estimates for Cape Lisburne–Cape Krusenstern muskoxen, 1970–1997

Census year	Minimum population size	Mean annual rate of change[a]	Estimated population size[b]
1988	123		
1989		1.11	137
1990		1.11	152
1991		1.11	169
1992		1.11	188
1993		1.11	209
1994	233	1.11	
1995		1.08	251
1996		1.08	270
1997	291	1.08	

[a] Mean annual rate of change = e^r

where:

e = 2.7183

$r = [\ln(N_{t2}) - \ln(N_{t1})]/t$

t = number of years between censuses

N_{t1} = pop. estimate at time 1

N_{t2} = pop. estimate at time 2

[b] Assumes constant growth rate between censuses

Table 3 Unit 23 composition data from aerial fixed-wing censuses for muskoxen populations near Cape Thompson[a] and on the northern Seward Peninsula[b], 1988–1997

	Cape Thompson				Northern Seward Peninsula		
	1988	1993[c]	1994	1997[d]	1992[d]	1994[d]	1996[d]
Groups	14	15	19	24	5	14	14
Adults	106	108	181	193		60	99
SY[e]		15	34	32		13	14
Neonates	17	35	18				
Unclassified				66	73	173	75
Total	123	158	233	291	73	246	188
SY:100 Ad		14	19	17		22	14
Neonates:100 Ad	16	28	8				

[a] "Cape Thompson" includes that area between Cape Lisburne and Cape Krusenstern within approximately 20 miles of the coast.

[b] "Northern Seward Peninsula" includes that area between the Buckland and Goodhope River drainages.

[c] Radiotelemetry survey.

[d] Census conducted before parturition.

[e] Short-yearlings are 10–11 months old.

LOCATION

GAME MANAGEMENT UNITS: 26B and 26C (26,000 mi^2)

GEOGRAPHIC DESCRIPTION: Central and Eastern Arctic Slope

BACKGROUND

Muskoxen were extirpated from northeastern Alaska by the turn of the century but were reintroduced in 1969 and 1970 when 64 animals were released. The number of muskoxen has increased steadily and at least 800 muskox now inhabit the north slope of Alaska and northwestern Canada. A small number of bulls has been harvested annually in Unit 26C since 1983 and in Unit 26B beginning in 1990. The history and current status of muskoxen in northeastern Alaska have been reviewed by Gunn (1982), Garner and Reynolds (1986), and Golden (1989).

MANAGEMENT GOALS

- Reestablish muskoxen throughout their historic range in Alaska.
- Provide the opportunity to hunt, view, photograph, and enjoy muskoxen.

MANAGEMENT OBJECTIVES

- Manage harvest below sustained yield to encourage population growth and dispersal of muskoxen.
- Maintain a bull:cow ratio of at least 50:100 and an adult bull:cow ratio of 35:100.
- Maintain direct communication with local residents of Nuiqsut, Kaktovik, and Barrow about management decisions concerning the reintroduction, conservation, and hunting of muskoxen.

METHODS

Most survey data were gathered by US Fish and Wildlife Service (FWS) biologists during this report period. They conducted precalving surveys in early April using a Cessna 185 aircraft. Ground composition counts were conducted in Unit 26C in early July. Groups of muskoxen were located from the air by helicopter and then classified from the ground as young bulls, adult bulls, cows, yearlings, or calves. A fall postrut census was usually flown each October. To facilitate locating muskoxen, approximately 20 radiocollared animals are maintained in the population.

Mandatory hunt reports for fall and spring hunts were analyzed to provide information on muskoxen taken in permit hunts.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

During the last few years the number of muskoxen in Unit 26C remained near 350, while numbers in Unit 26B increased to at least 250 by summer 1996 (PE Reynolds, FWS, unpubl data) (Table 1).

Population Composition

Annual composition data (Table 1) indicate calf production and yearling recruitment are high but variable. The overall bull:cow ratio does not meet management objectives.

Distribution and Movements

Most muskoxen in northeastern Alaska are found in Unit 26C. Approximately 40% of the population now are found in Unit 26B, and this proportion will probably continue to increase. Muskoxen continued to extend eastward into the adjacent Yukon Territory, although the number of muskoxen using this area is unknown. As the population in Unit 26C increased, dispersal to the east and west was a major factor influencing muskoxen distribution and growth of local populations. Temporary movements between areas also occur (Reynolds 1992).

MORTALITY

Harvest

	Resident Open Season	Nonresident Open Season
Unit 26B, 1 bull by Tier II permit only; up to 5 muskoxen may be taken. Evidence of sex required.	15 Sep-15 Nov 1 Mar–31 Mar	No open season
Unit 26C, 1 bull by federal permit, up to 15 permits may be issued.	15 Sep–15 Mar	No open season

Board of Game Actions and Emergency Orders. In August 1990 changes in subsistence harvest management throughout Alaska caused the Board of Game to institute Tier II hunts for muskoxen in Units 26B (Hunt No. 1010T) and 26C (Hunt No. 1012T) beginning with the 1990–1991 season. These regulations allowed Alaska residents to harvest up to 15 bulls. The FWS took over subsistence management of muskoxen in Unit 26C beginning with the 1992–1993 season, issuing up to 15 permits to Kaktovik residents. This harvest is divided among 3 areas in the subunit. The state administers a Tier II hunt in Unit 26B, Hunt No. TX108 for up to 3 bulls west of the Dalton Highway Corridor Management Area, and Hunt No. TX110 for up to 2 bulls east of the management area. The fall season for the state hunts (TX108 and TX110) in Unit 26B was extended to include the last 2 weeks of September and the first 2 weeks of November for the 1996–1997 season. The federal subsistence hunt for Unit 26C was changed in 1996 to September 15 through March 31.

Hunter/Trapper Harvest. The annual harvest of muskoxen from 1985–1986 to 1995–1996 ranged from 4 to 10 (Table 2). One cow muskoxen was illegally harvested in Unit 26C during the 1995–1996

season. The effect of weather on travel conditions and hunter motivation strongly influences the annual harvest.

Permit Hunts. The number of permits issued and hunter success are detailed in Table 2. Hunting for muskoxen in the eastern Arctic is allowed only under permit.

Hunter Residency and Success. Before the 1990–1991 regulatory year, muskoxen were hunted under a registration permit system in which nonlocal residents and nonresidents participated, taking a significant number of muskoxen. Establishing a Tier II hunt in 1990–1991 for Unit 26B and the federal registration hunt in 1992–1993 in Unit 26C allowed residents all permits (Table 3).

Transport Methods. Local hunters rely primarily on snowmachines to hunt muskoxen during March, but hunters in the fall sometimes use aircraft. (Table 4).

Natural Mortality

Natural mortality of adults, calves, and yearlings in the eastern Arctic is low. Brown bears have taken both calf and adult muskoxen and seem to be a more important predator than wolves (Reynolds et al. 1992). An air taxi operator reported several observations of brown bears with remains of calves in Unit 26B in May 1996. Mortality among cow muskoxen averaged 11% annually (Reynolds 1992). Average survival of calves (83%) and yearlings (81%) from 1987 to 1991 was high. Late winter storms contribute to mortality of calves, yearlings, and old adults, but these losses are generally minimal. The remains of several muskoxen have been noted near the Dalton Highway, probably the result of muskoxen hit by vehicles.

HABITAT

Various studies focused on the status of muskoxen habitat (O'Brien 1988), and forage apparently is not limiting population growth in Units 26B and 26C. Social factors are probably responsible for the apparent increased emigration from Unit 26C. Habitat in Unit 26B is adequate to support a larger population, and snow conditions seem more favorable for muskoxen there than in Unit 26C (P Reynolds, FWS, pers commun).

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Some concern has been expressed by North Slope residents concerning possible interactions between muskox and caribou. This controversy arose in northern Canada a few years ago but has generally subsided there. Biological evidence indicates these species are quite compatible. Efforts to explore perceived problems and exchange information with local residents helped reduce the level of concern, and these exchanges should be continued. Both muskox and the Porcupine Caribou Herd inhabiting Units 26B and 26C continue to thrive.

CONCLUSIONS AND RECOMMENDATIONS

Muskoxen are doing well under the present management regime and are extending their range westward. Immigration and good reproduction and survival increased muskoxen east of the Dalton Highway in Unit 26B. Muskoxen are well established west of the highway and continue to extend their

range and numbers to the west. The existing conservative harvest strategy should be continued. It will allow continued herd growth while providing continued benefits to local users.

The FWS will continue basic monitoring of muskoxen numbers, productivity, survival, and movements east of the Sagavanirktok River. The status of muskoxen west of the Sagavanirktok River warrants periodic surveys to collect population and distribution information. The opening of the Dalton Highway for public use increased traffic and will probably increase interest in muskoxen in this area for both the hunting and nonhunting public.

Because of the growing muskoxen population, continued range growth, and concerns of the public, the department has been instrumental in initiating a plan focusing on long-term needs for muskoxen management on the North Slope. Participants in this planning process include Alaska Department of Fish and Game, the North Slope Borough government, affected federal agencies and local villages. This draft plan will be presented before the Board of Game and Federal Subsistence Board for public review.

Frequent changes in recent permitting procedures resulting from legal decisions created confusion among resource users and excluded nonlocal Alaska residents and nonresidents. Maintaining a stable, equitable system and making permit applications and information available in a timely fashion will help reduce confusion and resentment.

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Table 1 Results of summer (postcalving) aerial muskoxen composition counts and estimated population size in Units 26B and 26C, 1986–1996[a]

Regulatory year	4+ yr adults		3 yr adults		2 yr adults		Total adults	% Yearlings	% Calves	Total muskox observed	Estimated population size
	M	F	M	F	M	F					
1986–1987	37	105	16	28	24	23	233	12.4	18.9	339	385[b]
1987–1988	49	80	15	38	23	22	227	16.2	22.6	371	410[b]
1988–1989	32	81	16	31	17	19	196	14.3	15.7	280	489[b,c]
1989–1990	42	82	18	19	17	18	196	17.0	15.2	289	470[b]
1990–1991	56	111	21	24	21	21	254	15.3	15.5	367	470[d]
1991–1992	77	150	24	37	21	34	343	11.5	20.4	504	n/a
1992–1993	97	167	22	24	22	21	353	15.9	15.9	517	539[b]
1993–1994							365	11.4	20.4	535	607[b]
1994–1995							291	16.2	16.4	432	533[b]
1995–1996							291	12.2	12.2	385	647[b]
1996–1997							176	9.2	17.2	239	582[b]

[a] Data source: PE Reynolds, US Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks.
[b] Data from precalving (spring) aerial surveys.
[c] Includes 12 muskoxen seen during ADF&G surveys.
[d] Data from postcalving (summer-fall) aerial surveys.

Table 2 Unit 26B and 26C muskoxen harvest data by permit hunt, 1986–1995

Hunt No./ Area	Regulatory year	Permits issued	Percent did not hunt	Percent successful hunters[c]	Bulls (%)	Cows (%)	Unk	Illegal	Total harvest
1010T	1986–1987	5		100	100	0			5
1012T	1987–1988	5		100	100	0			5
1014T	1988–1989	10	10	60	67	33		3	9
	1989–1990	10		100	100	0			10
	1990–1991	11		82	100	0			9[a]
	1991–1992	11		45	100	0		0	5[b]
	1992–1993	12	50	67	100	0			4
	1993–1994	12	42	57	100	0			4
	1994–1995	12	8	91	100	0			10
	1995–1996	15	40	82	89	11		1	9

[a] Two muskoxen taken in Unit 26B and 3 in Unit 26C.
[b] All muskoxen taken in Unit 26C.
[c] Of hunters who reported hunting.

Table 3 Units 26B and 26C muskoxen hunter residency and success, 1985–1996

Regulatory[a] year	Successful				Unsuccessful				Total hunters[c]
	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Total (%)	
1985–1986	2	1	0	3 (60)	2	0	0	2 (40)	5
1986–1987	3	1	1	5 (100)	0	0	0	0 (0)	5
1987–1988	2	3	0	5 (100)	0	0	0	0 (0)	5
1988–1989[c]	4	2	0	6 (60)	1	3	0	4 (40)	10
1989–1990	2	7	1	10 (100)	0	0	0	0 (0)	10
1990–1991	9	0	0	9 (82)	2	0	0	2 (18)	11
1991–1992	5	0	0	5 (45)	6	0	0	6 (55)	11
1992–1993	4	0	0	5 (67)	2	0	0	2 (33)	6
1993–1994	4	0	0	4 (57)	3	0	0	3 (43)	7
1994–1995	9	1	0	10 (91)	1	0	0	1 (9)	11
1995–1996	8	1	0	9 (100)	0	0	0	0 (0)	9

[a] Before 1987 only Alaska residents were allowed to hunt muskoxen. In 1990 muskoxen hunting on the North Slope was administered under a Tier II hunt limited to local residents.

[b] Local is a resident of Kaktovik, Nuiqsut, and Umiat.

[c] From hunters who reported that they hunted

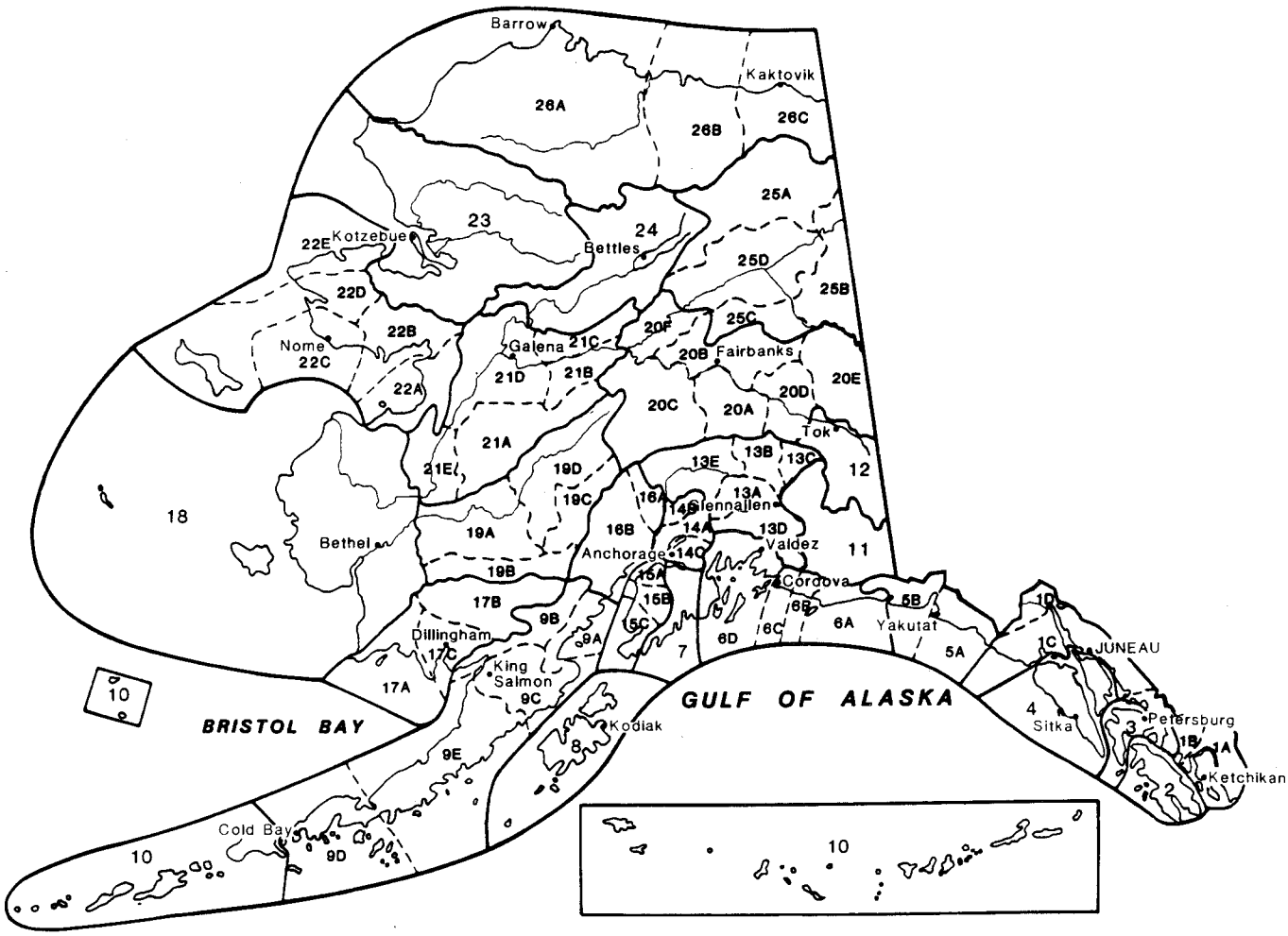
[d] A fall season was added in 1988-1989.

Table 4 Units 26B and 26C muskoxen harvest by transport method, 1986–1995[a]

Regulatory year	Percent of harvest			*n*
	Airplane	Dog team	Snowmachine	
1986–1987	0		3	3
1987–1988	2		3	5
1988–1989	3		3	8
1989–1990	9		1	10
1990–1991	2	1	6	9
1991–1992				
1992–1993			4	4
1993–1994	1		2	4
1994–1995			8	10
1995–1996	2		7	9

[a] Includes only those hunters reporting transport method.

Alaska's Game Management Units



The Federal Aid in Wildlife Restoration Program consists of funds from a 10% to 11% manufacturer's excise tax collected from the sales of handguns, sporting rifles, shotguns, ammunition, and archery equipment. The Federal Aid program allots funds back to states through a formula based on each state's geographic area and number of paid hunting license holders. Alaska receives a maximum 5% of revenues collected each year. The Alaska Department of Fish and Game uses federal aid funds to help restore, conserve, and manage wild birds and mammals to benefit the public. These funds are also used to educate hunters to develop the skills, knowledge, and attitudes for responsible hunting. Seventy-five percent of the funds for this report are from Federal Aid.

LeeAnne Ayres