Muskox
Management Report
of survey-inventory activities
1 July 2002–30 June 2004

Cathy Brown, Editor
Alaska Department of Fish and Game
Division of Wildlife Conservation

ADF&G

Funded through
Federal Aid in Wildlife Restoration
Grants W-33-1 and W-33-2, Project 16.0
December 2005

STATE OF ALASKA

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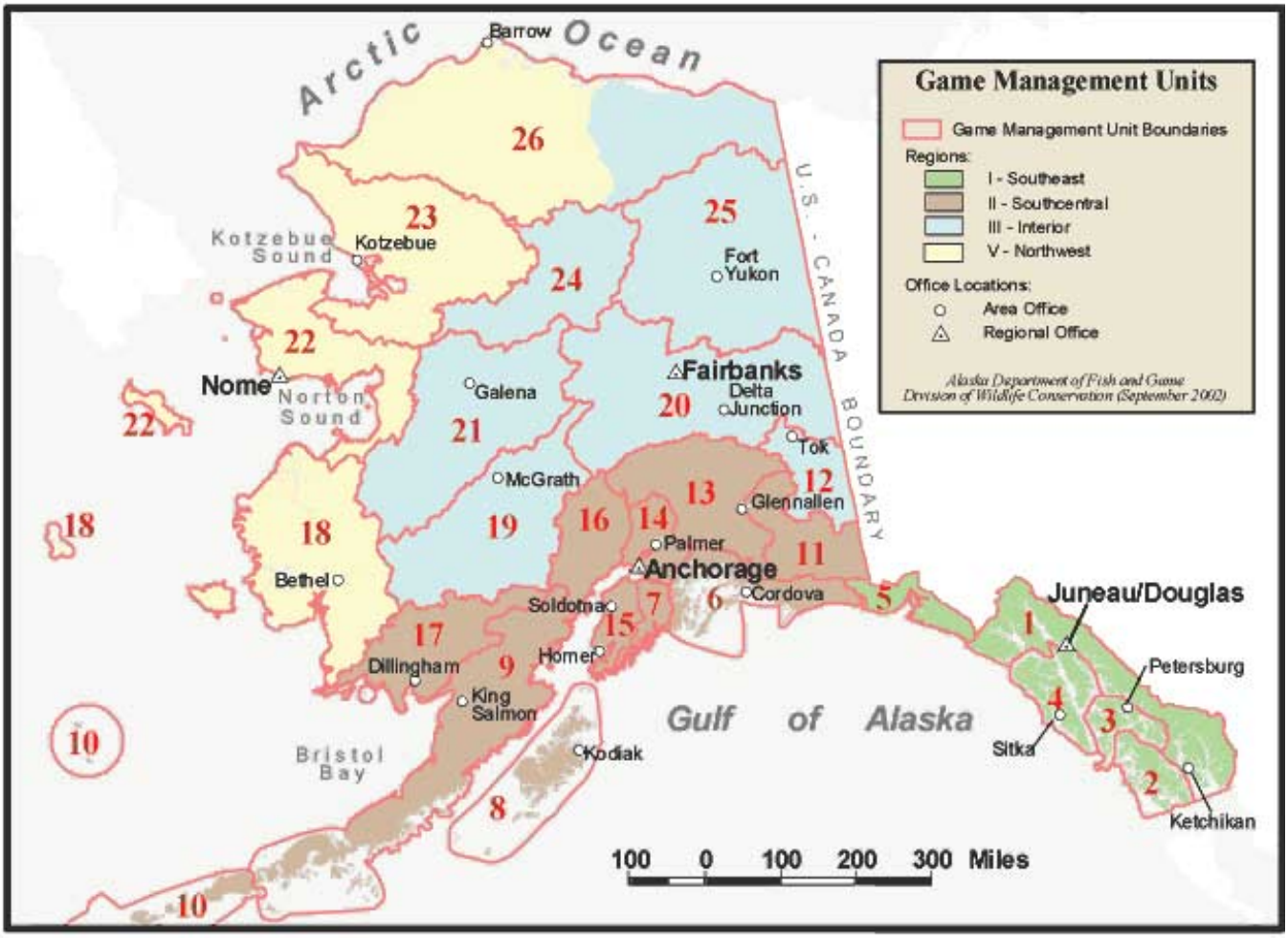
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WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
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MUSKOX MANAGEMENT REPORT

From: 1 July 2002
To: 30 June 2004

LOCATION

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

GEOGRAPHICAL DESCRIPTION: Yukon-Kuskokwim Delta

BACKGROUND

NUNIVAK ISLAND

Muskoxen were once widely distributed in northern and western Alaska but were extirpated by the middle or late 1800s. In 1929, with the support of the Alaska Territorial Legislature, the U.S. 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 400 and 750 animals, exhibiting considerable reproductive potential, even under heavy harvest regimes. Low natural mortality and absence of predators benefit the Nunivak muskox population, which had a minimum of 609 animals in fall 2001.

NELSON ISLAND

During 1967–1968, 23 subadult muskoxen were translocated from Nunivak Island to Nelson Island, 20 miles across Etolin Strait. The Nelson Island muskox population exhibited an average annual growth rate of 22% between 1968 and 1981. When the population approached the management goal of 200–250 animals in 1981, the first hunting season was opened. Partially in response to a population decline in 1994 and 1995, the Nelson Island Muskox Herd Cooperative Management Plan was initially drafted and followed in 1995. In this plan our goal is at least 250 animals. For approximately 20 years, the Nelson Island muskox population has fluctuated between a high of 297 animals and a low of 123. In 2001 the population was a minimum of 306.

YUKON–KUSKOKWIM DELTA

Having originally emigrated from Nelson Island, fewer than 100 muskoxen inhabit the mainland of the Yukon–Kuskokwim Delta. Mainland muskoxen are scattered in small groups from the Kilbuck Mountains south of the Kuskokwim River to the Andreafsky Mountains north of the Yukon River. During surveys of other species, agency biologists and aircraft

pilots have observed muskoxen. Poaching is a major factor preventing the mainland population from becoming firmly established. Wandering muskoxen may actually return to Nelson Island. This behavior complicates muskox management for Nelson Island and makes it difficult to determine the size of the mainland population.

MANAGEMENT DIRECTION

MANAGEMENT OBJECTIVES

- Survey populations on Nunivak and Nelson Islands, using fixed-wing and rotary-wing aircraft in alternate years, to estimate population size and composition.

- Maintain a posthunt population of at least 250 muskoxen on Nelson Island and 500–550 on Nunivak Island.

- Issue drawing and registration permits for harvesting muskoxen to maintain optimal size, composition, and productivity of the muskox populations on Nunivak and Nelson Islands.

- Provide hunter orientation and posthunt checkout to ensure hunters understand permit requirements, properly identify legal muskoxen, and report their harvests timely and correctly.

- Determine the distribution and dispersal of muskoxen on the mainland.

- Use the cooperative management plans for Nunivak and Nelson Islands.

METHODS

We used an Aviat A-1B Husky on Nunivak and Nelson Islands to conduct a population census in July 2002 and July 2003. During this census we classified muskoxen as yearlings, 2-year-olds, 3-year-old males, 3-year-old and older females, 4-year-old and older males or as unclassified. Note that the terminology describing these cohorts is somewhat unorthodox and is explained by the history of muskox surveys. Previously, we conducted composition counts using snowmachines in late winter. The youngest cohort was called “short yearling” or “yearling,” while the next older cohort was nearly 2 years old; members of the second cohort were called 2-year-olds, and so forth for older cohorts. As surveys were completed earlier and earlier in the year, the older terminology was retained, but the actual age of animals in the age classes for the current, midsummer surveys is about 6 to 9 months younger than the named classes.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Throughout the reporting period, the population on Nunivak Island remained healthy and productive. The trend is a stable population kept at 500-550 animals posthunt precalving by using drawing and registration permits to take about 90 animals a year.

The population on Nelson Island fluctuates much more than the Nunivak population. Several factors contribute to this. These include human induced mortality and movements on and off the island.

Population Size

During a fixed-wing census of Nunivak Island conducted on 16–18 July 2002, we counted 524 muskoxen. During a fixed-wing census of Nunivak Island conducted on 17–20 July 2003, we counted 657 muskoxen. The 2002 count was an incomplete count due to low ceilings and poor visibility. The 2003 count was in nearly perfect weather conditions.

On 3 August 2002, we censused Nelson Island muskoxen using fixed-wing aircraft and counted 293 muskoxen. On 27 July 2003 we censused Nelson Island and counted 327 muskoxen. Table 1 shows the history of population size on Nelson Island during the period 1973–2003.

We do not have survey information to estimate the population of mainland muskoxen. Incidental observations indicate the population is small and widely dispersed. Some muskoxen probably return to Nelson Island from the mainland, confounding census data in both areas.

Population Composition

On Nunivak Island for 2002 and 2003 we used a fixed wing aircraft to conduct a census of the population. In 2002 we classified the muskoxen as 143 four-year-old or older bulls, 143 three-year-old or older cows, 52 three-year-old-bulls, 99 two-year-olds, 84 yearlings and 3 unknown (Table 2). In 2003 we classified the muskoxen as 166 four-year-old or older bulls, 174 three-year-old or older cows, 27 three-year-old-bulls, 113 two-year-olds, 115 yearlings and 62 unknown (Table 3).

On Nelson Island we also used an Aviat A-1B Husky for the census. In August 2002 we found 55 four-year-old or older bulls, 94 three-year-old or older cows, 16 three-year-old-bulls, 48 two-year-olds, 73 yearlings and 7 unknown (Table 4). In July of 2003 we found 56 four-year-old or older bulls, 101 three-year-old or older cows, 19 three-year-old-bulls, 64 two-year-olds, 69 yearlings and 18 unknown (Table 5).

Distribution and Movements

During aerial surveys on Nunivak Island, muskoxen were uniformly distributed throughout the island. During winter, muskoxen avoid deep snow, and in summer they disperse throughout the interior of the island.

Nelson Island muskoxen are distributed throughout the island but are concentrated on the cliffs near Cape Vancouver and on hills northeast of Tununak. Individuals and small herds are on the hills in the central portion of the island and along the escarpment above Nightmute.

In the past, we have had reports of muskoxen in the Kilbuck Mountains, northeast to the Portage Mountains near Lower Kalskag, northwest into the Andreafsky Mountains, and west

to the Askinuk Mountains. Solitary old males are usually the first muskoxen to be seen in new areas.

Department and U.S. Fish and Wildlife Service 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. A 4-year-old female that was probably born on Nelson Island was radiocollared on the mainland as a 3-year-old on 30 March 1989 south of the Yukon River near Pilot Station. By August 1989 this animal moved approximately 160 miles east to a location near the village of Lower Kalskag, north of the Kuskokwim River. A hunter subsequently shot this muskox on 24 March 1990 near Toksook Bay on Nelson Island, approximately 200 miles west of its last known location.

MORTALITY

Harvest

Season and Bag Limit.

2002–2003 and 2003–2004 Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 18, Nunivak Island RESIDENTS and NONRESIDENTS: 1 bull by drawing permit only. Up to 10 permits will be issued for the fall season and up to 35 for spring season; or 1 cow by registration permit only, with up to 45 cow permits 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 RESIDENTS and NONRESIDENTS 1 muskox by registration permit only; up to 42 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 gave the department the regulatory authority to issue up to 45 bull and up to 45 cow permits on Nunivak Island. For the 1998–1999 and the 1999–2000 regulatory years, the department offered 5 cow and 10

bull permits for Nunivak Island muskoxen for the fall hunt and 40 cow and 35 bull permits for the spring hunt.

During its spring 1992 meeting, the board gave the department the regulatory 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 current regulation allows adjustment of harvest 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. In the 1998–1999 and 1999–2000 seasons, 15 bull and 15 cow permits were issued for Nelson Island. At the fall 2001 Board of Game meeting, the board approved a proposal to increase the maximum numbers of permits available for the Nelson Island hunt from up to 30 to up to 42.

Human-Induced Harvest. Hunting of Nunivak Island muskoxen was regulated by drawing permits and registration permits for fall and spring hunts for both years of the reporting period. The history of total harvest of bulls and cows for the period 1975–2004 is shown in Table 6. In general, permits for hunting Nunivak Island bulls are distributed through the statewide drawing permit process. When drawing permit winners decline to hunt and have not been issued a permit, we select an alternate permittee from the spring list of permit applicants. The 2003–2004 harvest from drawing permits included 6 bulls in the fall and 38 in the spring. Of these, 4 were alternate permittees. The 2002–2003 harvest from drawing permits included 6 bulls in the fall and 38 in the spring. Four of these hunters were alternate permittees.

We distribute registration permits for hunting Nunivak Island cows on a first-come, first-served basis. There were 5 permits available in Bethel for the fall hunt, 5 more for the spring hunt, and 35 permits available in Mekoryuk for the spring hunt. All hunters were successful at harvesting muskoxen in the spring hunts. One hunter did not harvest a muskox in the fall of 2003.

We distribute Nelson Island registration permits on a first-come, first-served basis. The location from which these registration permits are distributed rotates through the local villages from Newtok to Tooksok Bay, to Tununak, Nightmute, and Chefornak. The history of total applicants, total permits issued, and total harvest of bulls and cows for the period 1981–2004 is shown in Table 7. In 2002–2003, 23 bull and 15 cow permits were distributed in Newtok, and in 2003–2004, 24 bull and 15 cow permits were distributed in Tooksok Bay. Thirty-six Nelson Island hunters in 2002–2003 and all but 1 cow permit recipient in 2003–2004 were successful.

We occasionally receive reports of muskoxen taken illegally. However, the number of animals taken is difficult to determine because we may hear of the same animals from more than one source and we are sure that some muskoxen are taken illegally that we do not hear of.

Permit Hunts. All hunts for muskoxen in Unit 18 are either by drawing permit or registration permit; the Human-Induced Harvest section includes specific information regarding issued permits.

Hunter Residency and Success. Most drawing permittees for Nunivak Island are residents of Alaska. In both 2002–2003 and 2003-2004, 2 bull hunters were nonresidents. All registration hunters were residents. For information on hunter success, see the Human-Induced Harvest section of this report.

Harvest Chronology. Most cow hunters on Nunivak Island harvested their muskox between late February and mid March during periods of increasing daylight hours and milder weather. Nelson Island hunters also take most of their animals late season. Bull hunters on Nunivak Island usually hunted with guides or transporters. These hunters must fit their hunts into the times available with a particular guide or transporter and, consequently, are evenly distributed throughout the season.

Transport Methods. In fall most hunters use a boat, all-terrain vehicle (ATV), or a small aircraft to access the hunting areas. All access in the winter season is by snowmachine.

Other Mortality

No natural predators of muskoxen are present on Nunivak Island, and large predators are rare on Nelson Island. The few mainland muskoxen are in areas that have a few wolves and grizzly bears, but we have received no reports of predation on muskoxen in Unit 18. Most natural mortality is from accidents, such as freezing, stranding, falling off cliffs, and falling through the ice of rivers, bays, or tidal areas. There were no reports of natural mortality during this reporting period.

HABITAT

Assessment

No direct study of habitat was undertaken during the report period. On Nunivak Island we believe the reindeer have overgrazed the lichen range, yet muskoxen taken by hunters in recent years are reported to be in good condition. The muskoxen taken on Nelson Island are also reported in good condition. The habitat for both islands seems in excellent condition. The muskox habitat on the mainland is extensive and could support a much larger population.

Enhancement

We are meeting our muskox population goals because of the habitat on Nelson and Nunivak Island. The habitat on the mainland is essentially unused. We are not considering habitat enhancement projects.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

There were no activities related to nonregulatory muskox management issues in Unit 18 during the reporting period.

CONCLUSIONS AND RECOMMENDATIONS

The Nunivak Island muskox population is characterized by high productivity and low natural mortality. We will reduce the harvest of bulls and cows when the posthunt, precalving

population is below 500 animals. With the existing population, high harvest levels are warranted. The management goals for Nunivak Island muskoxen include maintaining a minimum population of 500–550 muskoxen, translocating muskoxen to other areas of Alaska, and providing opportunities to hunt 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 animals can reach the mainland. The recent drop in population on Nelson Island from 297 in 1999 to 233 in 2000 is probably due to emigration and illegal harvests, both of which were reported in the winter of 1999–2000.

Variable annual harvests are needed to effectively manage the population in response to emigration and other natural losses. Although the population is between 250 and 300 animals, we are harvesting variable numbers of muskoxen at a rate not exceeding 10% of the population to maintain healthy age and sex components in the population. The Nelson Island Muskox Herd Cooperative Management Plan calls for the cessation of hunting when the population is below 250 animals.

We continue to receive reports of mainland muskoxen, but illegal take of these animals is a key factor in preventing establishment of a reproductively viable population. Fewer than 100 muskoxen inhabit the extensive areas of mainland habitat. Although low numbers for mainland muskoxen are discouraging, there is still potential for a population to become established, particularly with the concern and cooperation shown by villagers from Nelson Island and with continued growth of the Nelson Island muskox population.

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 foster the establishment of a viable, harvestable mainland muskox population.

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Table 1 Unit 18 Nelson Island muskox population, 1973–2004

Year	No harvest/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		
1997		265	
1998		293	
1999		297	
2000		233	
2001		306	
2002		293	
2003		327	
2004		318	

Table 2 Unit 18 Nunivak Island muskox composition, 16–18 July 2002

Age	Male	%Male	Female	%Female	Unknown	%Unknown	Total	%Total
Adults[a]	143	27%	143	27%			286	55%
3 years	52	10%					52	10%
2 years					99	19%	99	19%
Yearlings					84	16%	84	16%
Unknown					3	1%	3	1%
Total	195	37%	143	27%	186	35%	524	100%

[a] Adults are considered 3 year and older cows and 4 year old and older bulls

Table 3 Unit 18 Nunivak Island muskox composition, 17–20 July 2003

Age	Male	%Male	Female	%Female	Unknown	%Unknown	Total	%Total
Adults[a]	166	25%	174				340	52%
3 years	27	4%					27	4%
2 years					113	17%	113	17%
Yearlings					115	18%	115	18%
Unknown					62	9%	62	9%
Total	193	29%	174	26%	290	44%	657	100%

[a] Adults are considered 3 year and older cows and 4 year old and older bulls

Table 4 Unit 18 Nelson Island muskox composition, 3 August 2002

Age	Male	%Male	Female	%Female	Unknown	%Unknown	Total	%Total
Adults[a]	55	19%	94	32%			149	51%
3 years	16	5%					16	5%
2 years					48	16%	48	16%
Yearlings					73	25%	73	25%
Unknown					7	2%	7	2%
Total	71	24%	94	32%	128	44%	293	100%

[a] Adults are considered 3 year and older cows and 4 year old and older bulls

Table 5 Unit 18 Nelson Island muskox composition, 27 July 2003

Age	Male	%Male	Female	%Female	Unknown	%Unknown	Total	%Total
Adults[a]	56	17%	101	31%			157	48%
3 years	19	6%					19	6%
2 years					64	20%	64	20%
Yearlings					69	21%	69	21%
Unknown					18	6%	18	6%
Total	75	23%	101	31%	151	46%	327	100%

[a] Adults are considered 3 year and older cows and 4 year old and older bulls

Table 6 Unit 18 harvest of Nunivak Island muskoxen, 1975–2004

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	47	26		73
1994	35	23		58
1995	20	5		25
1996	20	19		39
1997	25	24		49
1998	26	30		56
1999	43	45[a]		88
2000	46[b]	40		86
2001	45	42		87
2002	43	41		84
2003	45	43		88
2004	45	42		87
Total	998	846	1	1845

[a] One cow taken by a bull hunter

[b] Three bulls taken by cow hunters; one bull taken by a bull hunter

Table 7 Unit 18 permits and hunting harvest of Nelson Island muskoxen, 1981–2004

	Number of Permits available		Muskoxen harvested		Number of
Year	Female	Male	Female	Male	Applicants
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	58
1991	15	15	10	14	34
1992	15	15	15	15	30
1993	0	30	0	30	37
1994	5	25	5	21	31
1995	0	0	0	0	0
1996	0	0	0	0	0
1997	10	10	7	10	20
1998	10	10	10	10	20
1999	15	15	15	15	30
2000	15	15	14	15	30
2001	0	0	0	0	0
2002	21	15	14		30+
2003	15	23	14	22	30+
2004	15	24	14	24	30+

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MUSKOX MANAGEMENT REPORT

From: 1 July 2002
To: 30 June 2004

LOCATION

GAME MANAGEMENT UNIT: 22 (25,230 mi^2) and southwest portion of 23 (1920 mi^2)

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

BACKGROUND

Historical accounts indicate muskoxen disappeared from Alaska by the late 1800s and may have disappeared from the Seward Peninsula hundreds of years earlier. In 1970 thirty-six muskoxen were reintroduced to the southern portion of the Seward Peninsula from Nunivak Island. An additional 35 muskoxen from the Nunivak Island herd were translocated to the existing population in 1981. Since 1970 the population has grown steadily and in April 2002 was estimated at 2050 animals (Figure 1, Tables 1 and 2).

Muskoxen have extended their range to occupy suitable habitat throughout the Seward Peninsula. Herds are well established in Units 22C, 22D, 22E, western Unit 22B and southwestern Unit 23 (Figure 2). Migration to the east of the Seward Peninsula has occurred and muskoxen have been reported in the northern portion of Unit 22A, in Unit 23 along the Tagagawik River drainage and in the Purcell Mountains, in Unit 21 along the Yukon River drainage as far east as Ruby, and in the vicinity of Huslia in Unit 24.

MANAGEMENT DIRECTION

Muskox management on the Seward Peninsula is guided by recommendations from the Seward Peninsula Muskox Cooperators Group. The group is composed of staff from the Alaska Department of Fish and Game (ADF&G), National Park Service (NPS), U.S. Bureau of Land Management (BLM), U.S. Fish and Wildlife Service (FWS), Bering Straits Native Corporation, Kawerak Inc., Reindeer Herders Association, and Northwest Alaska Native Association, as well as residents of Seward Peninsula communities and representatives from other interested groups or organizations. The following management goals form the basis of a cooperative interagency management plan for Seward Peninsula muskoxen developed during 1992 through 1994 (Nelson 1994) and follow the guidelines of the departmental Muskox Management Policies (ADF&G 1980).

MANAGEMENT GOALS

- Allow for continued growth and range expansion of the Seward Peninsula muskox population.

- Provide for a limited harvest in a manner consistent with existing state and federal laws by following the goals/objectives endorsed by the Seward Peninsula Muskox Cooperators Group and the Seward Peninsula Cooperative Muskox Management Plan.

- Manage muskoxen along the Nome road systems of Units 22B and 22C for viewing, education, and other nonconsumptive uses.

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

- Protect and maintain the habitats and other components of the ecosystem upon which muskoxen depend.

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

MANAGEMENT OBJECTIVES

- Complete censuses at 3-year intervals to document changes in population and distribution. (Previously censuses were completed at 2-year intervals, but the cycle was lengthened to accommodate more frequent moose censuses).

- Complete composition surveys on an annual basis in at least one subunit on the Seward Peninsula to document changes in age and sex structure of the population.

- Participate in the Muskox Cooperators Group meetings and facilitate exchange of information and ideas among agencies and user groups.

- Administer a resident drawing hunt in Unit 22E and Tier II hunts in Units 22B, 22C, 22D, 22E, and 23SW (the portion of Unit 23 west of and including the Buckland River drainage) in cooperation with federal managers of federal subsistence hunts in these units.

METHODS

No muskox census was scheduled during this reporting period, but in March and April 2004 a muskox composition survey was completed in Units 22B and 22C. Global positioning system (GPS) locations of all muskox groups seen during a March moose census of western Unit 22B and Unit 22C were recorded. In April we attempted to relocate the groups with a helicopter. We succeeded in finding 31 of the 38 groups previously seen and classified 448 muskoxen by age and sex.

The Muskox Cooperators Group met in Nome in September 2003 to comment on muskox proposals submitted to the Alaska Board of Game and the Federal Subsistence Board (FSB).

Department staff provided assistance with the Tier II application process in the Nome and Kotzebue offices and traveled to all villages in Units 22B, 22D, 22E, and 23SW to help hunters fill out Tier II application forms. Department and NPS staff discussed hunt requirements and identification of muskoxen by sex and age with all first-time muskox permittees. Hunter orientation materials were also placed on the ADF&G Web site to provide information about muskox hunting to drawing and Tier II permit winners.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

No census was undertaken during this reporting period; however, an April 2004 composition survey conducted in Units 22B and 22C showed an increase in the number of muskoxen in Unit 22B. While not a complete count of muskoxen in Unit 22B, 236 muskoxen were counted and classified by age and sex. This is a 25% increase in the number of muskoxen found in Unit 22B since the 2002 census, when 189 muskoxen were counted.

In Unit 22C we classified 212 muskoxen, which was fewer than the 257 muskoxen counted in the 2002 census, but it is unlikely that the number of muskoxen in 22C has actually decreased. Some groups were probably missed during the moose census when muskox locations were recorded, and of those seen, 2 large groups could not be relocated with the helicopter for counting and classification.

The next census of the Seward Peninsula muskox population was scheduled for March 2005.

Population Composition

In March 2004 we obtained GPS locations of all the muskoxen observed during a moose census of western Unit 22B and Unit 22C, and in April we attempted to relocate the groups for sex and age classification using a helicopter. In Unit 22B we found 15 of the 20 groups seen during the moose census and classified 236 muskoxen. In Unit 22C we found 16 of 18 groups previously seen and classified 217 muskoxen. Group members were classified as bulls 4 years or older, 3-year-old bulls, 2-year-old bulls, cows 4 years or older, 3-year-old cows, 2-year-old cows, or yearlings (Tables 3 and 4).

In Unit 22B the ratio of mature bulls (4 years or older) to mature cows (cows 3 or 4 years or older) was 39:100. The yearling:cow ratio was 39:100 and yearling recruitment was 18%. All sex/age classes were well represented. Thirteen percent of the muskoxen in Unit 22B were 2-year-olds (7% bulls and 6% cows), and 15% (5% bulls, 10% cows) were 3-year-olds. The high, fairly consistent portion of yearling, 2-year-old and 3-year-old animals was similar to 2002 results (Table 5) and indicates fairly high calf survival over the last few years and a high likelihood that most yearlings are surviving to adulthood. The bull:cow ratio observed in 2004 was unrealistically low and lower than that found in 2002 (81 bulls:100 cows), probably because the 2004 muskox sightings were incidental to a moose census. We did not thoroughly

search muskox habitat, and therefore, probably missed single animals and smaller groups that generally are all bulls.

In Unit 22C the ratio of mature bulls (4-years-or-older) to mature cows (cows 3- or 4-years-or-older) was 86:100. The yearling:cow ratio was 26:100, and yearling recruitment was 10%. Thirteen percent of muskoxen classified in Unit 22C were 2-year-olds (5% bulls and 8% cows), and 20% were 3-year-olds (8% bulls, 12% cows). The yearling:cow ratio and the proportion of yearlings and 2-year-olds was considerably lower than 2002 when we found 57 yearlings:100 cows, 18% 2-year-olds and 19% yearlings (Table 6). The 10% recruitment rate was also lower than the 14–19% recruitment rates we observed in biannual censuses from 1996 to 2002. The 2004 three-year-old cohort was larger than the younger age classes and proportionally similar to the yearling cohort in 2002 (19%). These data suggest either productivity or calf survival has declined since 2002. Bulls were probably undercounted in Unit 22C, as in Unit 22B, due to our search method. In 2002 we found 97 bulls:100 cows in Unit 22C, which is the highest bull:cow ratio we have found in a Seward Peninsula subunit.

Distribution and Movements

No work was done during this reporting period to document distribution or movements of muskoxen; however, staff and public observations indicate the Seward Peninsula muskox population continued to extend its range during the reporting period. Reports of muskoxen east of the Seward Peninsula in the Nulato Hills and Selawik, Kobuk, and Yukon River drainages are becoming more common, including large groups of mixed age and sex. Figure 2 shows the distribution of muskoxen on the Seward Peninsula in spring 2002 during the most recent census.

With the exception of 2 single bulls found on the eastern slopes of the Darby Mountains in 2002, we have never found muskoxen east of the Darby Mountains in Unit 22B during spring censuses. However, sightings at other times of the year and reports by pilots and residents of Koyuk and Elim indicate that gradual colonization is occurring in eastern Unit 22B.

MORTALITY

Harvest

Season and Bag Limit. During this reporting period the state administered Tier II subsistence hunts in Unit 22B, Unit 22C, Unit 22D, Unit 22E, and Unit 23SW and a resident drawing hunt in Unit 22E. State Tier II hunts are conducted in combination with federal subsistence hunts for federally qualified subsistence users on federal public lands in Units 22B, 22D, 22E and 23SW.

2002–2003 and 2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 22B, that portion within the Fox River drainage upstream of the Fox River bridge, and within one mile of the Fox River bridge, and		

2002–2003 and 2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
within one mile of the Council Road east of the Fox River Bridge		
1 bull by Tier II subsistence hunting permit only; the total harvest may not exceed 16 bulls in Unit 22B	1 Nov–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 22B		
1 bull by Tier II subsistence hunting permit only; the total harvest may not exceed 16 bulls in Unit 22B	1 Aug–15 Mar (Subsistence hunt only)	No open season
Unit 22C, that portion west of the west bank of the Bonanza River, north of the north bank of Bonanza Channel and Safety Sound, east of the east bank of the flowage connecting Safety Sound with the confluence of the Eldorado and Flambeau rivers, and east of and including the Eldorado River drainage		
1 bull by Tier II subsistence hunting permit only; up to 3 bulls may be taken	1 Aug–30 Sep (Subsistence hunt only)	No open season
Unit 22C, that portion west of the west bank of the Sinuk River		
1 bull by Tier II subsistence hunting permit only; up to 3 bulls may be taken	1 Feb–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 22C	No open season	No open season
Unit 22D Southwest, that		

2002–2003 and 2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
portion west of the Tisuk River drainage, west of the west bank of the unnamed creek originating at the unit boundary opposite the headwaters of McAdam's Creek to its confluence with Canyon Creek, and west of the west bank of Canyon Creek to its confluence with Tuksuk Channel		
1 muskox per regulatory year by Tier II subsistence hunting permit only; however, cows may be taken only during the period 1 Jan –15 Mar. Up to 9 muskoxen may be taken; however, not more than 4 cows may be taken. Total harvest may not exceed 9 muskoxen in Unit 22D southwest	1 Sep–15 Mar (Subsistence hunt only)	No open season
Unit 22D, Pilgrim River drainage		
1 muskox per regulatory year by Tier II subsistence hunting permit only; however, cows may be taken only during the period 1 Jan–15 Mar. Up to 41 muskoxen may be taken in combination with the remainder of Unit 22D; however, not more than 17 cows may be taken, and total harvest may not exceed 41 muskoxen in Unit 22D, excluding Unit 22Dsouthwest	1 Nov–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 22D		
1 muskox per regulatory	1 Aug–15 Mar	No open season

2002–2003 and 2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
year by Tier II subsistence hunting permit only; however, cows may be taken only during the period 1 Jan–15 Mar. Up to 41 muskoxen may be taken in combination with Unit 22D Upper Pilgrim River; however, not more than 17 cows may be taken and total harvest may not exceed 41 muskoxen in Unit 22D excluding Unit 22D southwest.	(Subsistence hunt only)	
Unit 22E		
1 muskox per regulatory year by Tier II subsistence hunting permit only; however, cows may be taken only during the period 1 Jan–15 Mar. Up to 50 muskoxen may be taken; however, not more than 25 cows may be taken. The total harvest may not exceed 50 muskoxen in Unit 22E	1 Aug–15 Mar (Subsistence hunt only)	No open season
1 bull 4-year-old or older by drawing permit only; up to 10 permits may be issued	1 Feb–15 Mar	No open season
Remainder of Unit 22	No open season	No open season
Unit 23 southwest, that portion on the Seward Peninsula west of and including the Buckland River drainage		
1 muskox per regulatory year by Tier II subsistence hunting permit only; however, cows	1 Aug–15 Mar (Subsistence hunt only)	No open season

2002–2003 and 2003–2004 Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
may be taken only during the period 1 Jan–15 Mar. Up to 17 muskoxen may be taken; however, not more than 7 cows may be taken. The total harvest may not exceed 17 muskoxen in Unit 23 southwest		

Board of Game Actions and Emergency Orders. The Board of Game made no changes to Seward Peninsula muskox regulations during this reporting period, and no emergency orders were issued.

Human-Induced Harvest. In 2002–2003, 47 bulls and 9 cows were harvested by Tier II permit, 4 bulls were taken by drawing permit, and 8 bulls and 5 cows were taken with federal permits for a total harvest of 73 muskoxen (59 bulls and 14 cows). In Unit 22B, 6 bulls were taken (bulls-only hunt); in Unit 22C, 5 bulls were harvested (bulls-only hunt); in Unit 22D, 24 bulls and 3 cows were taken; 18 bulls and 9 cows were taken in Unit 22E; and 6 bulls and 2 cows were harvested in Unit 23SW. Table 7 shows the number of permits issued and filled in 2002–2003 for state and federal hunts in each unit and community.

In 2003–2004 a total of 53 Tier II permits were filled (42 bulls and 14 cows), 3 bulls were taken by drawing permit and 16 federal permits were filled (10 bulls and 6 cows) for a combined harvest of 72 muskoxen (52 bulls and 20 cows). In Unit 22B, 3 bulls were taken (bulls-only hunt); in Unit 22C, 5 bulls were taken (bulls-only hunt); in Unit 22D, 33 muskoxen were harvested (24 bulls and 9 cows); 26 were taken in Unit 22E (17 bulls and 9 cows); and 5 muskoxen were harvested in Unit 23SW (3 bulls and 2 cows). Table 8 shows the number of permits issued and filled in 2003–2004 for the state and federal hunts in each unit and community.

During this reporting period the allowable harvest rates recommended by the Cooperators and adopted by the state and federal boards were 5% in Unit 22B (bulls only), 3% in Unit 22C (bulls only), 5% in Units 22D and 23 SW (including up to a 2% cow harvest), and 8% in Unit 22E (including up to a 4% cow harvest). Actual harvest rates in all subunits in both state and federal hunts have consistently been lower than the harvest quotas, so we issued 15–33% more permits than the harvest quota depending on previous success rates in the hunt area. In 2003–2004, at the request of the Cooperators, additional permits were issued mid-season in some hunt areas where it was unlikely existing permit holders would fill their permits. However, quotas were still not reached. Additional permits above the harvest quota were not issued in the Unit 22E drawing hunt since there was no data on which to base the probable success rate.

During the 2002–2003 regulatory year actual harvest rates were 3% in Unit 22B, 2% in Unit 22C, 3.5% in Unit 22D, and 4% in Units 22E and 23SW. In 2003–2004 the actual harvest rate was 1.5% in Unit 22B, 2% in Unit 22C, 4% in Units 22D and 22E and 2% in Unit 23 SW.

In all hunt areas there were considerably more applicants for Tier II permits than there were permits available. In 2002 there were 286 applicants for 83 Tier II permits, 133 for Unit 22B permits, 95 for Unit 22C, 163 applicants for Unit 22D, 72 for Unit 22E and 46 for Unit 23SW. In 2003, 270 people applied for 83 Tier II permits, 134 applied for Unit 22B permits, 106 for Unit 22C, 169 for Unit 22D, 75 for Unit 22E and 60 for Unit 23SW.

A number of nonhunting kills occurred during this reporting period. In June 2003 in Unit 23SW two adult bull muskoxen that were reportedly knocking down grave markers were shot and pushed over a bluff at Cape Deceit near Deering. The perpetrator was reported by residents of Deering and was cited by the Alaska State Troopers.

In August 2003 troopers investigated the slaughter of 3 muskoxen (a mature bull, a mature cow, and a 2 year-old cow) found at Hastings Creek in Unit 22C. They had been shot many times by a small caliber rifle, and no meat was salvaged. The same month, a Brevig resident reported finding a bull muskox that had been shot and left unsalvaged at California Creek, west of Brevig in Unit 22D. The perpetrators were not found in either case.

In March 2003 a Shishmaref hunter was given permission to kill a crippled, mature bull muskox with severely overgrown hooves near the Serpentine River.

Permit Hunts. Hunting during this reporting period was by Tier II subsistence hunting permit or by drawing permit (22E only) on state-managed lands and by federal subsistence permit on federal public lands. Trophy destruction of muskoxen taken in Tier II hunts is required if the skull is removed from Unit 22 or Unit 23 to ensure applicants are primarily subsistence hunters. See the previous section for a harvest summary of permit hunts.

Hunter Residency and Success. During 2002–2003, 83 Tier II permits were issued for Seward Peninsula muskox hunts, and 47 were filled, for a 57% success rate. Forty-three federal permits were issued, and 13 were filled, resulting in a 30% success rate. In 2003–2004, eighty-three Tier II permits were issued in May and at the Cooperators request we evaluated harvest success in season and issued an additional 11 permits in February 2004 for a total of 94 permits. Fifty-six of 94 Tier II permits were filled for a 60% success rate. Sixteen of 45 federal permits were filled for a 36% success rate. Tables 7 and 8 show the number of permits issued and filled during this reporting period in the state and federal hunts in each unit and community.

In 2002–2003 all Unit 22B Tier II permits were awarded to residents of Unit 22B. Residents of Elim, Golovin, and White Mountain received a total of 7 state Tier II permits, and 6 of them were filled. The 4 federal permits were issued to hunters in Koyuk and Golovin to ensure that residents in every Unit 22B village had an opportunity to hunt muskoxen, but none of the federal permits were filled. In 2003–2004, six Tier II permits went to Unit 22B residents of Elim, Golovin, and White Mountain and 1 permit went to a resident of Unalakleet in Unit 22A. Only one 22B Tier II permit was filled. Four federal permits were issued to residents of Golovin, Koyuk, and White Mountain, and 2 were filled. The lower overall success rate in 2003–2004 was reportedly due to stormy weather in early March when most village muskox hunters choose to hunt. In general, there is considerable interest in Unit 22B villages in hunting muskoxen, especially in light of declining moose populations.

Nome residents were awarded the 11 of the 12 Tier II permits issued for Unit 22C during the reporting period. The remaining permit went to a Unalakleet resident. During both years 5 of the 6 permits were filled. Success for hunters in the 1 August–30 September hunt in an eastern, roadless portion of Unit 22C improved during this reporting period, and 3 of 4 permits were filled. In the winter hunt west of the Sinuk River, 7 of 8 permits were filled. In general, Nome hunters are highly motivated and successful at taking muskoxen.

Success rates in Unit 22D varied by community (Tables 7 and 8). Permittees from White Mountain have had 93% success, in spite of long travel distances required to find animals on state-managed lands in Unit 22D. Nome hunters were relatively successful, averaging a 73% success rate during this reporting period. Success rates in Brevig have been variable, but are higher in the state Tier II hunt (averaging 62%) than in the federal hunt (averaging 13%) on distant federal lands. Teller residents typically have a lower success rate. During this reporting period, Teller residents filled 22% of their Tier II permits and 25% of their federal permits.

In Unit 22E during this reporting period, the harvest quota increased from 23 to 51 muskoxen due to population growth and a harvest rate increase. Although the number of muskoxen harvested in Unit 22E increased slightly, the hunter success rate dropped from 70% or higher to 52%. We do not know if we have exceeded the demand for muskoxen by Unit 22E residents, or if the permit system itself discourages harvest, but many Unit 22E residents appreciate the increased opportunity to hunt muskoxen at a time when moose are less abundant. Shishmaref hunters have been relatively successful under both state and federal hunts. Muskoxen inhabit federal and private lands close to the village and are easily accessible to all permit holders. In Wales state permits are more readily filled than federal permits because federal lands are distant. Prior to 2002, few Wales residents succeeded in obtaining state Tier II permits because they were outscored by Shishmaref residents, who were more successful at harvesting muskoxen in the federal hunt, but elimination of the alternative resources question on Tier II applications for Unit 22 and 23 muskox hunts helped alleviate this problem.

In 2002–2003 in Unit 23SW, 89% of state Tier II permits were filled and 0% of federal permits were filled. The Tier II success rate was unusually high, perhaps because there were few applicants from Buckland and Deering, and 4 of the permits went to lower scoring applicants from Kotzebue, who tend to be highly motivated to hunt muskoxen. In 2003–2004 9 of 10 Tier II permits went to residents of Buckland and Deering, and only 3 permits were filled. Two of 6 federal permits were filled. Buckland is far from federal lands, and the success rate for Buckland residents with federal permits is typically low.

Several factors contribute to inconsistent or low success rates in villages. Most of the applicants are traditional subsistence hunters whose hunting activities are directed by traditional food preferences, economics, practicality, and convenience. When hunters apply in May for a muskox permit, they have no way of knowing whether hunting muskoxen many months later will be the most desirable and practical means of feeding their family and dependents or whether transportation will be available to hunt muskoxen. If not, the permits are not transferable, so some inevitably go unfilled. Access to muskox habitat during snow-free months can be difficult for hunters living off the road system, so hunters from many villages wait to hunt until the later part of February and early March, when days are longer

and they can travel by snowmachine. If the weather is stormy during that time period, often little harvest occurs. Federal permits are least likely to be filled when long distances must be traveled to reach federal lands.

In the drawing hunt, 14 permits were issued during the reporting period. Nine of the permittees hunted, and 7 hunters were successful. All 5 of the hunters who hired a local guide in Shishmaref were successful. One of the other successful hunters was from Nome, and the other hunted with a relative from Nome.

Harvest Chronology. During this reporting period 100% of the harvest in Unit 22B occurred in February–March. In Unit 22C, 70% of the harvest took place in February–March and 30% in August–September. In Unit 22D, 58% of the harvest occurred during January–March, 19% of the harvest was taken in August, 3% in September, 12% in October, 7% in November, and 1% in December. In Unit 22E, 85% of the harvest occurred in January–March, and 15% in August–October. In Unit 23SW, 77% of the harvest occurred in January–March, and 23% occurred in August–October.

Transport Methods. In all units the majority of the Seward Peninsula muskox harvest occurred during the winter months, and snowmachines were used for transportation. The method of transport used during snow-free months varied by unit. In Unit 22C, 4-wheelers were used during the August–September season. In Unit 22D, 42% of the harvest was taken from August to November, and those hunters used 4-wheelers (58%), highway vehicles (25%), and boats (17%) for transportation. In Unit 22E, 4-wheelers were used when taking muskoxen from August to October, and in Unit 23SW, harvesters used 4-wheelers and boats from August to October.

Other Mortality

During this reporting period we had no meaningful measure of natural mortality of Seward Peninsula muskoxen. We frequently observe old muskoxen and believe mortality from disease and predation has been relatively low. However, there is increasing evidence that predation is becoming more common as bears learn to prey on muskoxen and wolf numbers increase on the Seward Peninsula.

Pat Reynolds, FWS biologist, reports that bears became increasingly successful at preying on muskoxen in the Arctic National Wildlife Refuge. Bear predation on adult muskoxen and impacts of predation events on calf survival are believed to be affecting muskox population dynamics in the refuge (Reynolds et al. 2002). As more Seward Peninsula bears learn to prey on muskoxen, we can expect predation to have a greater impact on growth of the muskox population. Increasing numbers of wolves associated with wintering Western Arctic herd caribou are also likely to increase predation on muskoxen.

During this reporting period, 2 crippled bull muskoxen with severely overgrown hooves were shot, 1 in Unit 22E and 1 in Unit 22D. It was reported that these animals could barely walk and could not run without falling. A hunter with a permit harvested 1 bull, and the other was a "mercy killing." The hooves from both animals were sent to the ADF&G veterinarian for examination and showed the bulls had suffered from laminitis. It is not clear if laminitis was the cause or result of hoof overgrowth. Possible causes of laminitis include nutritional

imbalances, mineral deficiencies, plant toxins, or systemic infections. Chronic selenium poisoning can also cause severe hoof abnormalities. If similar cases are found in the future, we plan to conduct a full necropsy with tissue sample collection and micronutrient analyses and work with the ADF&G veterinarian to diagnose the problem.

In June 2004 two young muskox calves were separated from their herds in separate instances along the Teller Road in Unit 22D SW. In one case, the calf died before department staff could locate it, and in the other case, we were able to capture the calf and successfully reunite it with its herd.

HABITAT

Assessment

There were no muskox habitat assessment activities on the Seward Peninsula during the reporting period.

Enhancement

There were no muskox habitat enhancement activities on the Seward Peninsula during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Seward Peninsula Muskox Cooperators Group

In September 2003 representatives of the Seward Peninsula Muskox Cooperators Group met in Nome primarily to discuss and comment on muskox proposals that had been submitted to the Alaska Board of Game (BOG) and the Federal Subsistence Board (FSB). The Muskox Cooperators Group unanimously opposed a BOG public proposal eliminating all cow bag limits and reducing the bull harvest quotas for muskoxen in Units 22D, 22E, and 23SW. It was later rejected by the BOG. The Cooperators also opposed an amended federal proposal to open federal lands in Units 22B and 22D to hunters possessing a state Tier II permit. This proposal was withdrawn and resubmitted to the FSB as a proposal to expand the customary and traditional (C&T) use determination for muskoxen in Units 22B and 22D to allow Nome residents and others in Unit 22 to hunt muskoxen in those units. The FSB amended and adopted the proposal, giving residents of Unit 22C a positive C&T determination for western Unit 22B and residents of Unit 22C and White Mountain a positive C&T determination for the Kuzitrin drainage in Unit 22D. The Cooperators expressed frustration because harvest in most hunt areas has consistently been below established harvest quotas. The group asked ADF&G to issue additional Tier II permits in season if harvests appear likely to be below the quota. The department responded by issuing 11 additional Tier II permits in 4 of 7 hunt areas. Representatives from Unit 22E expressed interest in transitioning from a Tier II hunt to a Tier I registration hunt in Unit 22E. Some representatives from Unit 22C voiced frustration about the limited opportunities Unit 22C residents have to harvest muskoxen and asked that the 3% harvest quota be increased in the future. The next Cooperators meeting is planned to follow the 2005 muskox census.

Conflicts with Humans and Wildlife

More Seward Peninsula residents have come to value muskoxen as a subsistence resource since hunting has been allowed, and negative attitudes toward muskoxen have decreased. However, resentment lingers over the reintroduction of muskoxen to the Seward Peninsula without consultation and awareness of local people. Some Seward Peninsula residents, especially in Teller and Shishmaref, favor capping or reducing the population in their immediate areas. Subsistence gatherers complain that muskoxen compete with them for greens and trample traditional berry-picking areas, and repeated instances of muskoxen rubbing against grave markers in the Deering cemetery have angered Deering residents. Although there are no reports of anyone being harmed by muskoxen, their presence near villages, camps, and berry-picking areas is often frightening. When threatened, muskoxen generally hold their ground rather than flee; this behavior contributes to people's dislike of them because it is sometimes impossible to drive them from areas where they are not wanted. Over time, increased hunting pressure around villages and camps will hopefully drive the animals away from the villages and reduce conflicts.

Muskox and Reindeer

For many years after muskoxen were introduced to the Seward Peninsula, reindeer herders complained that muskoxen compete with and displace reindeer. There is widespread concern across the Arctic about displacement of caribou by muskoxen, and these concerns cannot be dismissed. However, habitat and diet selection studies have found that although reindeer and muskoxen often occupy the same feeding areas, they select different forage species (Ihl and Klein 2001). Neither interspecies avoidance nor competition for habitat has been documented on the Seward Peninsula or Nunivak Island. At Reindeer Herders Association meetings during this reporting period, complaints about muskoxen were not voiced. We do not know whether concerns have been allayed or simply overshadowed by more immediate problems associated with caribou wintering on the Seward Peninsula.

Muskox Viewing

The Unit 22 road system provides a unique opportunity to view muskoxen in their natural habitat. There are few places where wild muskoxen are so easily accessible and where local residents, tourists, photographers, cinematographers, and wildlife enthusiasts from around the world seek out and enjoy watching these unusual animals. The Seward Peninsula Muskox Cooperators have maintained their commitment to protect viewing opportunities in Unit 22C and along much of the Nome road system. As recommended by the Cooperators, all but the most remote parts of Unit 22C remain closed to hunting to allow herd growth, minimal harassment, and easily accessible viewing opportunities for the public. Where hunts in Unit 22B and southern Unit 22D were approved, the season along the road system generally was delayed so muskoxen could not be hunted from the road when the road is open to vehicle traffic. Since 1998 muskox hunting along the northern Kougarok Road in Unit 22D has provided evidence that hunting is likely to displace muskoxen, driving them away from the road and spoiling opportunity for viewing.

CONCLUSIONS AND RECOMMENDATIONS

The most recent muskox census in 2002 showed the Seward Peninsula muskox population increased an average of 7% annually since 2000, which is half of the 14% average annual increase exhibited since reintroduction in 1970. Although undercounting in a few sample units may have contributed to the observed reduction in growth rate, other factors suggest that population growth may in fact be slowing, and densities on the western part of the Seward Peninsula may be reaching a critical limit. Muskox density is highest in Unit 22D (0.16 muskoxen/mi^2), and the population there has shown little growth since 1998. Recruitment rates in Unit 22D, however, have remained high, and we believe muskoxen from Unit 22D have been emigrating to Units 22C and 22E. The Unit 22D yearling:cow ratio observed in the 2002 composition survey was somewhat lower than that observed in other units, except Unit 23SW. It may be that habitat, suitable wintering areas, density related behavioral factors, predation, other natural mortality, or other factors are limiting further population growth. In 2002 densities in Units 22C and 22E were approaching the density in Unit 22D, and the 2004 composition survey in Unit 22C found a reduced yearling:cow ratio and a lower proportion of 2 year-old animals than in 2002. If speculation is correct that a critical density is being reached, we will see future growth of the population primarily in Unit 22B and in areas to the east of the Seward Peninsula. If population growth levels off, it will be important to determine what is limiting growth so we can ensure that our harvest strategy is appropriate.

Range extension to areas east of the Seward Peninsula continued, with more frequent observations of muskoxen in the Nulato Hills and Selawik, Kobuk and Yukon River drainages, including sightings of large groups of mixed age and sex.

It is increasingly important to develop a regular schedule of composition surveys to monitor changes in population structure as population growth slows and harvest rates increase. The method employed in 2004, in which muskox group locations were recorded during a moose census and groups were revisited at a later date with a helicopter for classification, worked very well in Units 22B and 22C. We recommend continuation of that method, with a 3-year rotation between units. A muskox composition survey in Unit 22D would follow the moose census in Units 22D and 22E, and a Unit 22E composition survey would follow the Seward Peninsula muskox census. Composition surveys in Unit 23SW will be scheduled following the muskox or moose census, as time permits. This schedule will provide more frequent data and spread out the expenditure of money and staff time more manageably than our original plan to conduct a peninsula-wide composition survey every 6 years immediately following a census, as we did in 2002.

At their September 2003 meeting, the Seward Peninsula Muskox Cooperators brought several issues to our attention that will be addressed at the 2005 Cooperators meeting when proposals are developed for the submission to the state Board of Game and the FSB. Unit 22E representatives suggested that the Tier II hunt in Unit 22E be replaced by a Tier I registration hunt to provide more hunting opportunity and increase harvest. Follow-up by ADF&G and NPS staff has found substantial support in Unit 22E villages for a muskox registration hunt. Harvest in Unit 22E has been well below the harvest quota since the harvest rate was increased in 2002, which may signal that subsistence need for muskoxen is being met and may justify a transition to a Tier I hunt. The request for a higher harvest rate in Unit 22C

seems reasonable based on the high bull:cow ratio found during both the 2002 and 2004 composition surveys in Unit 22C. The challenge will be finding a way to increase the harvest rate while protecting viewing opportunities along the road system.

At the Cooperators urging, ADF&G issued additional Tier II permits in season to increase hunting opportunity in hunt areas where harvest has consistently been below allowable harvest quotas. The department and federal managers have been operating under the Cooperators 2001 guidelines that recommended no more than 33% more permits than the harvest quota be issued for a given hunt area. We will ask the Cooperators to revisit that issue and ask for their support in issuing as many additional permits as past success rates indicate are needed to reach the quota.

In 2002 the drawing hunt in Unit 22E began providing some long-awaited opportunity for other Alaska residents and those who want to hunt for trophies. Success rates during the first 2 years of the hunt indicate we can safely issue additional permits without exceeding the quota, and we issued 10 drawing permits in 2004. Whether the muskox population increases or stabilizes, we must work to establish hunting opportunities for a wider range of users while still ensuring adequate opportunity for local subsistence hunters.

Muskox viewing continues to be a high priority in areas near Nome and along much of the road system, and the Cooperators have attempted to structure hunts to ensure that hunting does not affect the animals in areas most important for viewing. Near Nome and on the road system, we must watch for changes in behavior and distribution of muskoxen that are attributable to hunting and recommend adjustments to hunt areas or timing as necessary.

Some local residents continue to be upset by the muskoxen near villages and camps and by competition between muskoxen and subsistence users for greens and berries at traditional gathering sites. Traditional knowledge about muskoxen has long been lost and fear of muskoxen and lack of understanding of their behavior are partly responsible for current negative attitudes. Efforts to educate residents about muskox behavior may be helpful. Hunting has been the best antidote for resentment toward muskoxen. Now that hunting muskoxen is allowed, more people are learning to value this new resource for its meat and qiviut, the warm wool undercoat.

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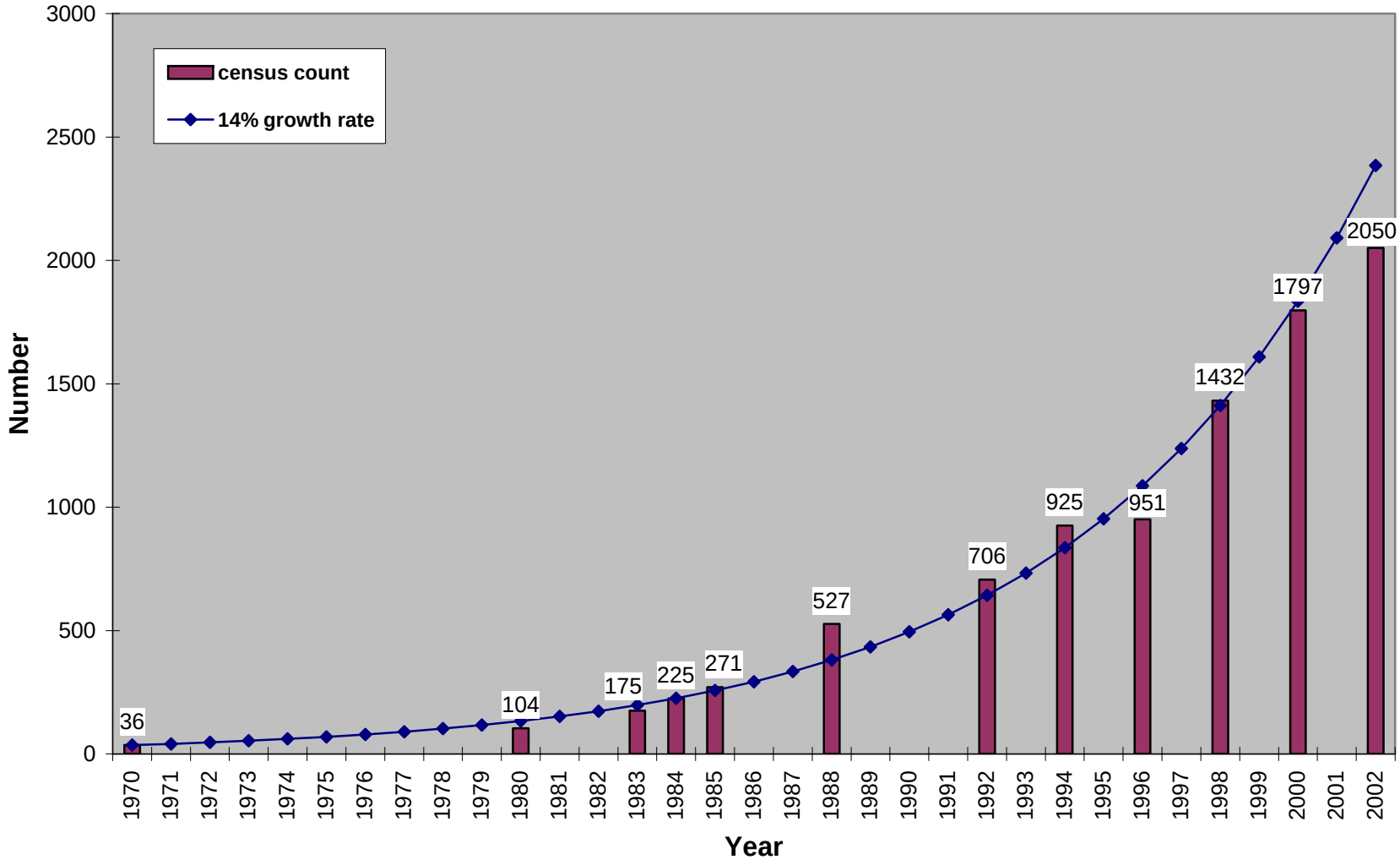

Figure 1 Estimated and counted number of Seward Peninsula muskoxen, 1970–2002

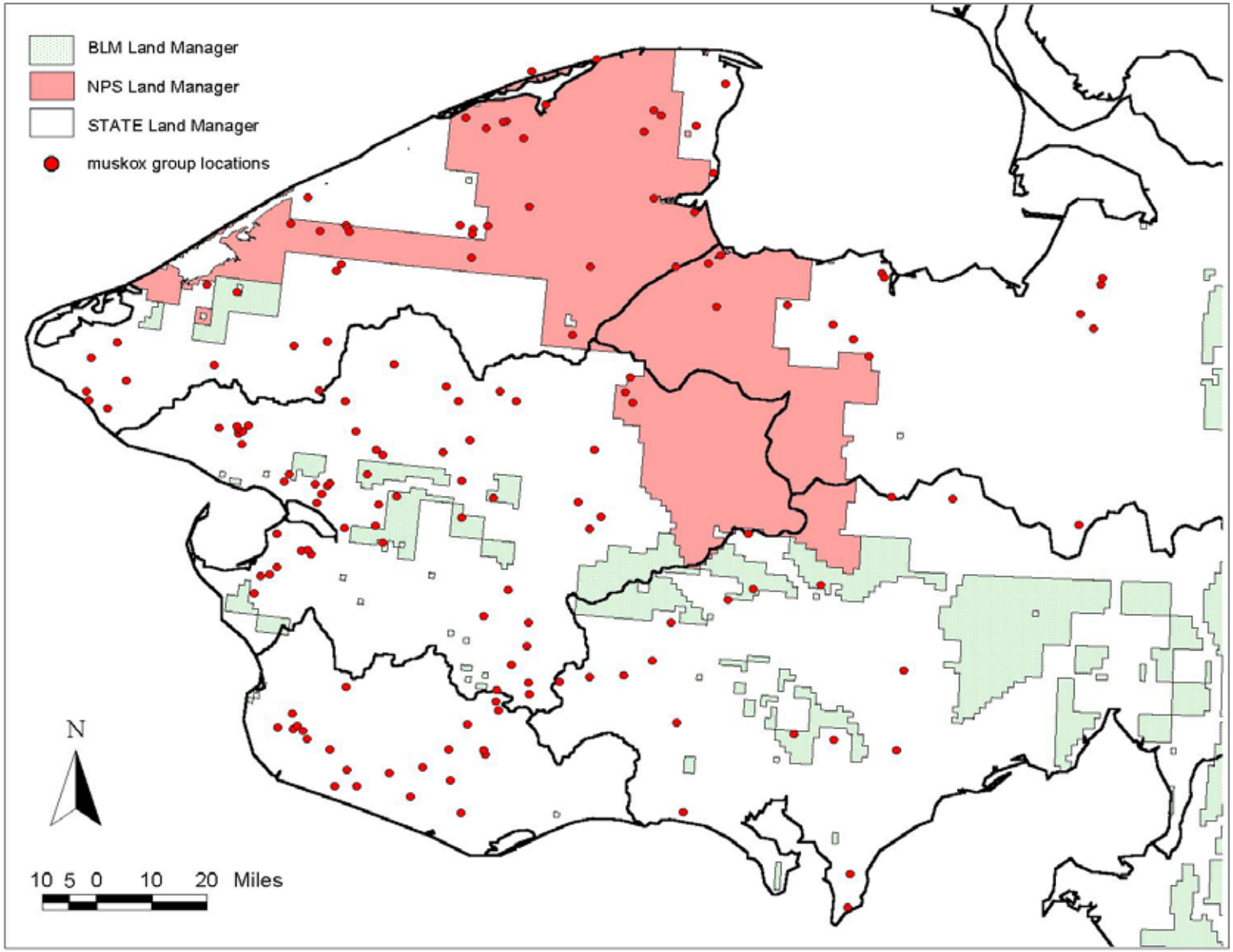

Figure 2 Location of Seward Peninsula muskox groups, spring 2002 census

Table 1 Seward Peninsula muskox census results, Units 22 and 23 Southwest, spring 2002

Unit	Groups	Total
22B	18	189
22C	22	257
22D	57	771
22E	45	632
23SW	15	201
Total	156	2050

Table 2 Seward Peninsula muskox census results, Units 22 and 23 Southwest, 1992–2002

	Unit					
Year	22B	22C	22D	22E	23SW	Total
1992	3	49	340	180	134	706
1994	11	79	405	184	246	926
1996	51	87	308	327	178	951
1998	27	124	714	362	205	1432
2000	159	148	774	461	255	1797
2002	189	257	771	632	201	2050

Table 3 Age and sex classification for 15 groups of muskoxen in Unit 22B[a], 9 Apr 2004

Location	Total	≥ 4-yr-old bull	3-yr-old bull	2-yr-old bull	≥ 4-yr-old cow	3-yr-old cow	2-yr-old cow	Year-ling.
Unit 22B								
Group 45, Topkok	12	4	2	3	2	0	0	1
Group 2, Topkok	2	2	0	0	0	0	0	0
Group 47, Bluff	6	6	0	0	0	0	0	0
Group 51, Bluff	2	2	0	0	0	0	0	0
Group 52, Bluff	32	2	1	1	11	3	3	11
Group 53, Bluff	25	4	0	1	11	3	2	4
Group 28, Cape Darby	19	2	0	3	9	1	1	3
Group 29, Kachavik	17	5	1	1	5	3	0	2
Group 8, Kachavik	17	1	1	0	7	3	0	5
Group 5, Aggie Creek	37	3	2	4	12	3	3	10
Group 54, Aggie Creek	2	2	0	0	0	0	0	0
Group 31, Horton Creek	3	3	0	0	0	0	0	0
Group 39, Big Four Creek	16	3	2	0	10	0	1	0
Group 33, Casadepaga	11	1	0	0	5	1	2	2
Group 34, American Creek	35	2	2	3	14	6	3	5
Subtotal	236	42	11	16	86	23	15	43
Percentage	100%	18%	5%	7%	36%	10%	6%	18%

[a] Muskox groups were located 6–17 Mar during a Unit 22B/C moose census and were relocated 9 Apr by helicopter and classified by age and sex

Table 4 Age and sex classification for 16 groups of muskoxen in Unit 22C[a], 7 and 9 April 2004

Location	Total	≥ 4-yr-old bull	3-yr-old bull	2-yr-old bull	≥ 4-yr-old cow	3-yr-old cow	2-yr-old cow	Year-ling.
Unit 22C								
Group 40, E. of Penny River	30	6	2	1	11	5	2	3
Group 41, E. of Penny River	4	4	0	0	0	0	0	0
Group 19, W. of Penny River	6	6	0	0	0	0	0	0
Group 17, E. of Cripple River	19	8	0	1	7	1	0	2
Group 14, Coastal Bluffs W of Cripple	17	2	1	2	5	3	3	1
Group 36, Coastal Hills W of Cripple	9	9	0	0	0	0	0	0
Group 15, Coastal Bluffs W of Cripple	4	4	0	0	0	0	0	0
Group 21, Moon Mountains	11	3	2	0	3	2	1	0
Group 22, Moon Mountains	27	5	2	1	13	5	1	0
Group 43, Moon Mountains	20	5	3	1	2	4	4	1
Group 26, American Creek	4	3	0	1	0	0	0	0
Group 49, Btwn Stewart and Sinuk	25	6	2	2	7	0	2	6
Group 44, Cripple River	1	1	0	0	0	0	0	0
Group 37, Coal Creek	14	2	0	0	4	2	4	2
Group 55, Ingstrom Mountain	3	3	0	0	0	0	0	0
Group 30, Newton Peak	23	3	6	1	4	3	0	6
Subtotal	217	70	18	10	56	25	17	21
Percentage	100%	32%	8%	5%	26%	12%	8%	10%

[a] Muskox groups were located 6–17 Mar during a Unit 22B/C moose census and were relocated 7 and 9 Apr by helicopter and classified by age and sex

Table 5 Age and sex classification for 16 groups of muskoxen in Unit 22B[a], 28–29 March 2002

Location	Total	≥ 4-yr-old bull	3-yr-old bull	2-yr-old bull	≥ 4-yr-old cow	3-yr-old cow	3- or 4-yr-old cow	2-yr-old cow	Year-ling	Calf	Unk.
Unit 22B											
Group 23, Cape Darby	5	5	0	0	0	0	0	0	0	0	0
Group 24, Bluff	12	2	1	2	3	2	0	1	1	0	0
Group 26, Darbys	2	2	0	0	0	0	0	0	0	0	0
Group 27, N. of Battleship	16	3	2	2	6	0	0	0	3	0	0
Group 28, Headwaters of Aggie Cr	20	2	1	1	5	2	0	4	5	0	0
Group 29, Btwn Bear and Fox R.	3	3	0	0	0	0	0	0	0	0	0
Group 30, American Creek	43	4	3	3	11	4	5	1	12	0	0
Group 31, Lost Creek	43	1	5	4	10	6	5	5	6	0	1
Group 32, Above Casadepaga	1	1	0	0	0	0	0	0	0	0	0
Group 33 NW of Casa River mouth	3	3	0	0	0	0	0	0	0	0	0
Group 34, Darby Mountains	2	2	0	0	0	0	0	0	0	0	0
Group 35, Above Kingsley Creek	2	2	0	0	0	0	0	0	0	0	0
Group 36, Bendelebens	8	4	1	1	1	0	0	1	0	0	0
Group 37, Bendelebens	9	2	0	0	1	3	0	1	2	0	0
Group 38, Bendelebens	3	2	0	0	1	0	0	0	0	0	0
Group 39, Bendelebens	6	1	0	0	0	2	0	0	3	0	0
Subtotal	178	39	13	13	38	19	10	13	32	0	1
Percentage	100%	22%	7%	7%	21%	11%	6%	7%	18%	0%	1%

[a] 178 of 189 (94%) muskoxen found in the 2002 census in Unit 22B were classified during this composition survey

Table 6 Age and sex classification for 15 groups of muskoxen in Unit 22C[a], 27 March 2002

Location	Total	≥ 4-yr-old bull	3-yr-old bull	2-yr-old bull	≥ 4-yr-old cow	3-yr-old cow	3- or 4-yr-old cow	2-yr-old cow	Year-ling.	Calf	Unk.
Unit 22C											
Group 1, E. of Army Peak	18	1	2	0	4	5	2	1	3	0	0
Group 2, Banner Creek	2	2	0	0	0	0	0	0	0	0	0
Group 5, Cripple Creek	9	9	0	0	0	0	0	0	0	0	0
Group 6, Osborne Creek	6	6	0	0	0	0	0	0	0	0	0
Group 9, Hill E. of Sinuk	1	1	0	0	0	0	0	0	0	0	0
Group 12, Engstrom Hill	13	3	0	2	3	1	0	1	4	0	0
Group 13, Moon Mountains	6	6	0	0	0	0	0	0	0	0	0
Group 14, Moon Mountains	33	5	3	3	9	6	0	3	4	0	0
Group 15, Moon Mountains	25	1	2	2	5	6	1	1	7	0	0
Group 16, Moon Mountains	7	7	0	0	0	0	0	0	0	0	0
Group 17, Moon Mountains	13	2	3	0	3	1	0	0	4	0	0
Group 18, Fox Creek	37	3	4	8	5	3	2	4	8	0	0
Group 19, Gasman Creek	14	0	0	5	1	3	0	3	2	0	0
Group 20, E. of Johnson Creek	11	2	0	0	2	2	0	1	4	0	0
Group 21, Upper Eldorado River	13	1	0	0	3	3	0	2	4	0	0
Subtotal	208	49	14	20	35	30	5	16	40	0	0
Percentage	100%	24%	7%	10%	17%	14%	2%	8%	19%	0%	0%

[a] 208 of 257 (81%) muskoxen found in the 2002 census in Unit 22C were classified during this composition survey

Table 7 Results of state and federal muskox hunts on the Seward Peninsula, 2002–2003

Hunt area	Muskox harvest quota[a]	Cow harvest quota	Nr state permits issued[b]	Nr state permits filled, bulls	Nr state permits filled, cows	Nr federal permits issued[b]	Nr federal permits filled, bulls	Nr federal permits filled, cows	Combined harvest, bull	Combined harvest, cow	Combined harvest, total
Unit 22B											
TX105	9	0	7	6	NA	4	0	NA	6	0	6
Elim	NA	NA	5	4	NA	0	NA	NA			
Golovin	NA	NA	1	1	NA	1	0	NA			
Kovuk	NA	NA	0	NA	NA	3	0	NA			
White Mtn	NA	NA	1	1	NA	0	NA	NA			
Unit 22C											
TX100	2	0	2	1	NA	0	NA	NA	1	0	1
Nome	NA	NA	2	1	NA	NA	NA	NA			
TX101	4	0	4	4	NA	0	NA	NA	4	0	4
Nome	NA	NA	3	23	NA	NA	NA	NA			
Unalakleet	NA	NA	1	1	NA	NA	NA	NA			
Unit 22D											
TX102	31	12	31	22	2	6	0	0	22	2	24
Brevig	NA	NA	6	2	1	5	0	0			
Nome	NA	NA	16	12	1	0	NA	NA			
Stebbins	NA	NA	1	0	0	0	NA	NA			
Teller	NA	NA	1	1	0	1	0	0			
White Mtn	NA	NA	7	7	0	0	NA	NA			
TX103	7	3	9	2	1	0	NA	NA	2	1	3
Teller	NA	NA	9	2	1	NA	NA	NA			
Unit 22E	51		28	10							
TX104	44	25	21	6	4	30	8	5	18	9	27
Shishmaref	NA	NA	11	4	4	21	6	5			
Wales	NA	NA	10	2	0	9	2	0			
DX098	7	NA	7	4	NA	NA	NA	NA			
Unit 23SW											
TX106	10	4	9	6	2	4	0	0	6	2	8
Ambler	NA	NA	1	0	0	0	NA	NA			
Buckland	NA	NA	2	2	0	1	0	0			
Candle	NA	NA	1	0	1	1	NA	NA			
Deering	NA	NA	1	1	0	2	0	0			
Kotzebue	NA	NA	4	3	1	0	NA	NA			

[a] Based on a 5% harvest rate in Units 22B, 22D, and 23SW, a 3% harvest rate in Unit 22C and an 8% harvest rate in Unit 22E.

[b] Based on previous success rates in TX102, 20% more permits than the harvest quota were issued to achieve a harvest closer to the quota. In TX 103 33% more permits were issued, in TX104 13% more permits were issued, in TX105 25% more permits were issued and in TX106 33% more permits were issued.

Table 8 Results of state and federal muskox hunts on the Seward Peninsula, 2003–2004

Hunt area	Muskox harvest quota[a]	Cow	Nr state permits issued[b]	Nr state permits filled, bulls	Nr state permits filled, cows	Nr federal permits issued[b]	Nr federal permits filled, bulls	Nr federal permits filled, cows	Combined harvest, bull	Combined harvest, cow	Combined harvest, total
Unit 22B											
TX105	9	0	7	1	NA	4	2	NA	3	0	3
Elim	NA	NA	3	0	NA	0	NA	NA			
Golovin	NA	NA	2	1	NA	1	0	NA			
Koyuk	NA	NA	1	0	NA	2	0	NA			
Unalakleet	NA	NA	1	0	NA	0	NA	NA			
White Mtn	NA	NA	0	NA	NA	1	2	NA			
Unit 22C											
TX100	2	0	2	2	NA	0	NA	NA	2	0	2
Nome	NA	NA	2	2	NA	NA	NA	NA			
TX101	4	0	4	3	NA	0	NA	NA	3	0	3
Nome	NA	NA	4	3	NA	NA	NA	NA			
Unit 22D											
TX102	31	12	31[c]	19	7	6	2	0	21	7	28
Brevig	NA	NA	7	3	2	3	1	0			
Delta Junction	NA	NA	1	0	0	0	NA	NA			
Nome	NA	NA	19	13	2	0	NA	NA			
Teller	NA	NA	0	0	0	3	1	0			
White Mtn	NA	NA	7	3	3	0	NA	NA			
TX103	7	3	9[c]	3	2	0	NA	NA	3	2	5
Teller	NA	NA	8	1	2	NA	NA	NA			
Nome	NA	NA	3	2	0	NA	NA	NA			
Unit 22E	51		33	11							
TX104	44	25	26[c]	8	5	29	6	4	17	9	26
Shishmaref	NA	NA	20	4	5	16	4	2			
Wales	NA	NA	6	4	0	13	2	2			
Drawing	7	NA	7	3	NA	NA	NA				
Unit 23SW											
TX106	10	4	10[c]	3	0	6	0	2	3	2	5
Ambler	NA	NA	1	0	0	0	NA	NA			
Buckland	NA	NA	6	2	0	2	0	1			
Deering	NA	NA	3	1	0	4	0	1			

[a] Based on a 5% harvest rate in Units 22B, 22D and 23SW, a 3% harvest rate in Unit 22C and an 8% harvest rate in Unit 22E.

[b] Based on previous success rates in TX102, 20% more permits that the harvest quota were issued to achieve a harvest closer to the quota. In TX 103 33% more permits were issued, in TX104, 13% more permits were issued, in TX105 25% more permits were issued and in TX106 33% more permits were issued.

[c] In February an additional 3 permits were issued for TX102, an additional 2 permits were issued for TX103, an additional 5 permits were issued for TX104 and an additional 1 permit was issued for TX106.

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MUSKOX MANAGEMENT REPORT

From: 1 July 2002
To: 30 June 2004

LOCATION

GAME MANAGEMENT UNIT: 23 (43,000 mi^2)

GEOGRAPHICAL DESCRIPTION: Western Brooks Range and Kotzebue Sound

BACKGROUND

Muskoxen are indigenous to northwest Alaska; however, they disappeared before or during the 19th century for unknown reasons. The North Pacific whaling fleet is often credited with decimating muskoxen in this region. However, muskoxen may have already disappeared from Alaska (but not northwestern Canada) by the time whalers arrived. Although there is ample evidence of several genera of muskoxen in northwest Alaska from the Pleistocene period (McDonald and Ray 1989), there is little evidence that muskoxen existed south of the Brooks Range during the last several hundred years.

Two muskox populations currently inhabit Unit 23, and both are products of translocations from Nunivak Island. The Alaska Department of Fish and Game (ADF&G) released 36 muskoxen on the southwestern portion of the Seward Peninsula near Teller in 1970. In 1981 ADF&G released an additional 35 muskoxen in the same area. Muskoxen inhabiting the southwestern portion of Unit 23 between the Buckland and Goodhope Rivers are part of the Seward Peninsula population that resulted from these translocations near Teller. The Unit 22 Muskox Management Report (pages 13–37) covers the Seward Peninsula muskox population for Unit 22 and the southwestern portion of Unit 23.

In 1970 the department also released 36 muskoxen near Cape Thompson, and in 1977 the department released an additional 34 muskoxen at the same site. Of the 4 translocations of muskoxen to Alaska, the Cape Thompson population has grown the least. Currently, the “Cape Thompson” muskox population inhabits that portion of Unit 23 from the mouth of the Noatak River to Cape Lisburne within 15–20 miles of the Chukchi Sea. This unit report covers only the Cape Thompson muskox population in northwestern Unit 23.

In addition to the relatively discrete Seward Peninsula and Cape Thompson populations, muskoxen are widely scattered throughout the remainder of the unit. Most muskoxen outside the 2 core ranges occur in small groups of 1–4 individuals, and most are bulls. However, mixed sex-age groups have been observed in the Selawik drainage during recent years. Muskoxen in the Noatak drainage probably emigrated from the Cape Thompson area, and those in the Selawik and Kobuk drainages probably came from the Seward Peninsula.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

1. To allow for growth and expansion of muskoxen into historic ranges.
2. To initially provide for subsistence hunting and eventually provide for general season hunting of muskoxen on a sustained yield basis.
3. To provide for nonconsumptive uses of muskoxen, e.g., viewing and photography.

MANAGEMENT OBJECTIVES

1. To census the Cape Thompson population at least once every 3 years.
2. To monitor the sex and age composition of the Cape Thompson muskox population.
3. To minimize effects of development (e.g., mines and roads), hunting, and tourism on muskoxen and their habitat.

METHODS

POPULATION STATUS AND TREND

Population Size

The Cape Thompson muskox population has been censused on an irregular basis since 1987 using fixed-wing aircraft. The census area has included that portion of Unit 23 between the mouth of the Noatak River and Cape Lisburne within approximately 20 miles of the coast of the Chukchi Sea. It has also included a small portion of Unit 26A near Corwin Bluff. Search effort has focused on known ranges and prime muskox habitat along ridgelines and riparian areas. We search other areas less intensively. To minimize disturbance, we approach groups of muskoxen at 1000–2000 ft above ground level and repeatedly count them during a gradual, low power, spiral descent. These censuses have provided minimum population counts with no estimates of sightability or confidence intervals.

Population Composition

Composition information was collected during July 2004 using a helicopter for transportation and ground-based observations of muskox groups. We located as many groups as possible using 2 fixed-wing planes and the helicopter to search for groups between the Noatak River mouth and Cape Lisburne. The National Park Service (NPS) paid for all helicopter support, and the department contributed one staff member to this project.

Distribution and Movements

Locations of muskoxen observed during censuses were recorded using Global Positioning System (GPS) coordinates. Locations of muskoxen observed opportunistically during other work were also recorded using GPS coordinates. In addition, casual conversations between department staff and local residents, commercial operators, hunters, and nonconsumptive users provided information regarding the distribution of muskoxen in Unit 23.

MORTALITY

No radio collars were deployed in this population during the reporting period; therefore, we did not estimate annual population mortality rates. We did examine kill sites to try to determine causes of muskox mortality.

Harvest

Harvest during the 2003–2004 and 2004–2005 regulatory years was monitored through the Tier II hunt report system and through phone calls to permit holders.

HABITAT

Assessment

The department did not monitor muskox range condition in Unit 23 during the reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

From 1970 to 1998 the Cape Thompson muskox population grew approximately 8% annually (Fig. 1, Table 1). Since 1998, this population has grown only 1–2% annually. The size of the area that composes the core habitat of this population has not increased in proportion to its population size. This population may be experiencing density-dependent limitations on growth.

Population Composition

Department and NPS staff classified 269 muskoxen during July 2004 (Table 2). This was almost 75% of the total population. We observed 44 calves:100 adult cows (i.e., cows $\geq$3 yrs old) and 60 bulls:100 cows (including all bulls and cows >yearlings). We probably underestimated the proportion of mature bulls in the population because these animals are often found alone or in very small groups that could easily have been missed.

Distribution and Movements

The original transplant of 36 muskoxen was released on 4 April 1970 near a coastal lagoon approximately 10 miles northwest of Cape Thompson. By the end of 1970, individuals from this group had been observed along the coast from the Tigara Peninsula to Cape Krusenstern, near the mouth of the Kelly River, and near Noatak village. The stress associated with this translocation combined with the absence of mature animals in the original group may have caused some individuals to make long distance movements they wouldn't have attempted under normal situations. It is surprising, though, that within 8 months of their release, individuals from the original transplant were spread throughout roughly 75% of the entire area that has constituted the core range of this population for 35 years.

During 1970–1973, all but 2 observations of muskoxen were within their core range (one muskox was observed near the Kelly River mouth and another was observed near Eagle Creek in GMU 26A). Unfortunately, no observations of muskoxen were recorded during 1974–1976. During 1977–1979, almost all muskoxen were observed within 5–6 mi of the coast, although a

lone animal was observed on the east side of the Noatak Flats. During the 1970s, most muskoxen inhabited the area between Iviangik Mountain and Cape Thompson; however, a few individuals were observed along the coast between the Wulik River mouth and Cape Krusenstern.

During the 1980s, muskoxen appeared to settle into 2 general areas along the northwest coast of Unit 23: the Tahinichok Mountains and the area between Cape Thompson and Iviangik Mountain. In the 1990s the gap between these 2 fairly discrete subpopulations was filled as the population grew. In addition, in 1996 muskoxen began to use the Igichuk Hills more consistently than prior to that time. During the 1990s, we began to more frequently see and receive reports of scattered bulls in inland areas, for instance, the Wulik Peaks, the upper Squirrel drainage, and even the upper Noatak River drainage.

During 2000–2004, muskoxen have generally shifted their distribution southward toward the Igichuk Hills. For example, we've seen relatively few muskoxen on the Tigara Peninsula, near Iviangik Mountain, or near Cape Thompson. In contrast, we've seen increased used of the area between Ogotoruk Creek and the Asikpak River. Similarly, during this time almost no muskoxen used the Tahinichok Mountains, but they were plentiful in the Igichuk Hills year-round. The exception to this trend has been 20–30 muskoxen that have resided roughly 10–15 miles east of Cape Lisburne since at least 2000.

The strong fidelity muskoxen exhibit for coastal areas is probably attributable to their dependence on high winds to minimize snow depth on exposed ridges during winter and lower ambient air temperature during summer. Although snow depth in this coastal region is minimal, the quantity and quality of forage appears to be limited during winter.

Lone bulls are now regularly observed throughout the unit. Additionally, several mixed sex-age groups have been observed in the Selawik River drainage during recent years.

MORTALITY

Harvest

Season and Bag Limit. Since its inception during the 2000–2001 regulatory year, 6 permits have been issued annually for the Tier II muskox hunt in northwest Unit 23 (TX107). The season throughout this reporting period has been 1 August–15 March, and the bag limit has been one bull. The NPS has never allowed muskox hunting on Cape Krusenstern National Monument, and there has never been a nonresident or resident general season hunt for muskoxen in Unit 23. However, the Federal Subsistence Board passed a proposal from the Cape Krusenstern Subsistence Resource Commission establishing a federal subsistence hunt for residents of Sheshalik and Sealing Point. This hunt will be administered for the first time during the 2005–2006 regulatory year, and the quota will be 2 bulls. The season and bag limit will be identical to those for the Tier II hunt.

2002–2003 and 2003–2004

Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Unit 23, Southwest, that portion on the Seward	(see Unit 22 report)	(see Unit 22 report)

2002–2003 and 2003–2004

Units and Bag Limits	Resident/Subsistence Hunters	Nonresident Hunters
Peninsula west of and including the Buckland River drainage		
Unit 23, that portion north and west of the Noatak River		
1 bull by Tier II subsistence hunting permit only; up to 15 bulls may be taken.	1 Aug–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 23	No open season	No open season

Board of Game Actions and Emergency Orders. There were no board actions or emergency orders issued that affected muskoxen in Unit 23 during this reporting period.

Human-Induced Harvest. During 2002–2003, 5 hunters reported taking 4 bulls and 1 cow. The harvested cow was mistakenly taken after it was misidentified as a bull. The hunter reported his mistake and was issued a warning citation by the Department of Public Safety. The head and hide of the cow were confiscated, but the hunter was allowed to keep the meat. Harvests of muskoxen from the Seward Peninsula portion of Unit 23 are reported in the Unit 22 muskox management report.

Permit Hunts. See section above.

Hunter Residency and Success. All Tier II permits have been issued to residents of Point Hope, Kivalina, Noatak or Kotzebue since the inception of this hunt. Five of 6 hunters (83%) were successful in 2002–2003.

Harvest Chronology. Most hunting was conducted during late February through the end of the season (15 Mar).

Transport Methods. Most hunters accessed their hunting area via snowmachine during both reporting periods, although one hunter used a boat during the 2004–2005 season (after the reporting period).

Natural Mortality

Wolves have not appeared to be a significant predator of muskoxen since their reintroduction to Unit 23. During October 2003, I observed 2 wolves approach to within 5 m (~15 ft) of 2 mature bull muskoxen. Neither the wolves nor the muskoxen behaved in a manner that suggested either regarded this as a potential predator-prey event: the wolves deliberately walked up to the muskoxen, looked at them for several minutes, and then calmly walked away. The 2 bulls were roughly 50 ft apart and did not come together in a defensive manner. Interestingly, within

minutes of leaving the muskox, the wolves encountered a group of rutting moose and immediately gave chase to a cow. Similarly, during the February 2005 muskox census, an NPS biologist observed 4 wolves closely approach a group of 20 muskoxen. The wolves began to play and watch the muskoxen but then walked away (J. Lawler, NPS, personal communication).

However, wolves may be learning muskoxen are a potential source of food. While conducting muskox composition surveys in July 2004, I observed a group of 5 muskoxen fleeing a disturbance. We then saw 3 wolves running into a willow thicket below the muskoxen. As we completed the composition count, an additional mature cow muskox came running out of the willows near where we had seen the wolves. She behaved as if she had just lost her calf. I suspect the wolves had taken her calf, but we did not attempt to confirm this to avoid disturbing any of the animals involved. Additionally, wolves reportedly killed 2 calf muskoxen during March or April of 2005 (Ross Schaeffer Jr., local hunter, personal communication).

Other Mortality

During April 2005, the carcass of a mature bull muskox was found along the edge of the Noatak River just below the lower canyons (John Rae, local hunter, personal communication). Based on tooth wear, the bull was very old. The cause of death could not be determined.

Illegal harvests have been a continuous and probably small source of muskox mortality in northwest Unit 23 since at least the late 1980s.

HABITAT

Assessment

There were no muskox habitat assessment activities in Unit 23 during the reporting period.

Enhancement

There were no muskox habitat enhancement activities in Unit 23 during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Conflicts among muskox, caribou, and reindeer

Many local residents of northwest Alaska still feel that muskoxen displace caribou and reindeer through behavioral interactions and the presence of muskox quiviut (undercoat) and feces in areas where they are sympatric. Until this concern is adequately addressed, it will continue to impede management of muskoxen in northwest Alaska.

Conflicts between muskox and people

Some 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 picking berries during late summer feel threatened by muskoxen even though no one has ever been harmed by a muskox in this area (and perhaps Alaska). Also, after >30 years, local residents still resent that they were not consulted before muskoxen were introduced to this unit. This negative local sentiment toward muskoxen has diminished slightly with the establishment of limited hunting opportunities.

During August and September, when muskoxen are rutting, bulls sometimes wander into communities, including Kotzebue, and onto airport runways. These muskoxen have usually been chased away without harming people, muskoxen, or property. However, there has been property damage at Deering, where muskoxen have repeatedly pushed over grave crosses by using them as scratching poles. In fact, muskoxen that had knocked over crosses in the Deering cemetery in June 2003 and again in June 2005 were killed in defense of life or property.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

1. Two distinct populations of muskoxen inhabit Unit 23. One population ranges between Cape Lisburne and Cape Krusenstern within 15–20 miles of the coast. The other population in the southwestern portion of Unit 23 is part of the Seward Peninsula muskox population. Both populations stem from translocations initiated by ADF&G in 1970. Muskoxen are scattered in small groups of primarily bulls throughout much of the rest of Unit 23.

2. The Cape Thompson population grew approximately 8% annually during 1970–1998. Since 1998, this population has increased roughly 1–2% annually.

3. Muskoxen exhibit strong fidelity to seasonal ranges. This characteristic is most pronounced for large mixed sex/age groups.

4. Muskoxen use riparian areas during summer and exposed, sparsely vegetated domes and ridges where snow cover is minimal during winter. Muskoxen use body-fat reserves and extremely conservative behavior to survive through winter.

Recommendations

1. Muskoxen are vulnerable to human harvests. They are easy to find and do not run far when approached. The effects of hunting muskoxen are not limited to the numeric effects of removing individuals from the population. An indirect effect of hunting muskoxen is the energetic costs of disturbance experienced by entire groups that are contacted by hunters (or other sources of disturbance, e.g., viewers). This could increase mortality rates in years when snow conditions are severe. Muskox defensive behavior predisposes them to wounding losses when bullets pass through one individual and into another. I suggest:

    a. Muskox harvests in the northwest portion of Unit 23 should be conservative until the department can assess their impact on the population.

    b. Harvest should be limited to bulls, and hunters should be encouraged to focus on bull groups rather than mixed sex-age groups.

    c. Hunting should not be allowed after mid March to protect pregnant cows from disturbance as they approach parturition. Cows are already at high-energy demands during late pregnancy when their fat reserves are lowest.

2. Census muskoxen and collect sex-age composition data at least once every 2–3 years.

3. Local license vendors should be trained and encouraged to help residents with Tier II applications.

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Table 1 Muskox census results for the northwest portion of Unit 23, 1988–2005

	May 1988	Jun 1994	Mar 1997	Jun 1997	Jun 1998	Jun 1999	Jun/Jul 2000	Jul 2001	Jan 2004	Feb 2005
Groups	14	19	24	26	39	34	41	37	43	41
Individuals[a]	106	215	291	212	322	299	327	236	363	369
Calves[b]	17	18		49	65	75	97	23		
Total	123	233	291	261	387	374	424	259	363	369
Calves:100 Adults	16	8		23	20	25	30	10		

[a] "Individual" defined as any muskox >2 months old (i.e., excluding calves)

[b] "Calf" defined as any muskox ≤2 months old

Table 2 Sex and age composition of the Cape Thompson muskox population during July 2004, Game Management Unit 23 (percentage of total population in parentheses)

Age	Males	Females	Unknown Sex	Total
Adults (4+ yrs old)	51 (19)	98 (36)		149 (55)
3 yrs old	4 (1)	10 (4)		14 (5)
2 yrs old	17 (6)	11 (4)		28 (10)
Yearlings			27 (10)	27 (10)
Calves			48 (18)	48 (18)
Unknown age			3 (1)	3 (1)
Total	72 (27)	119 (44)	78 (29)	269

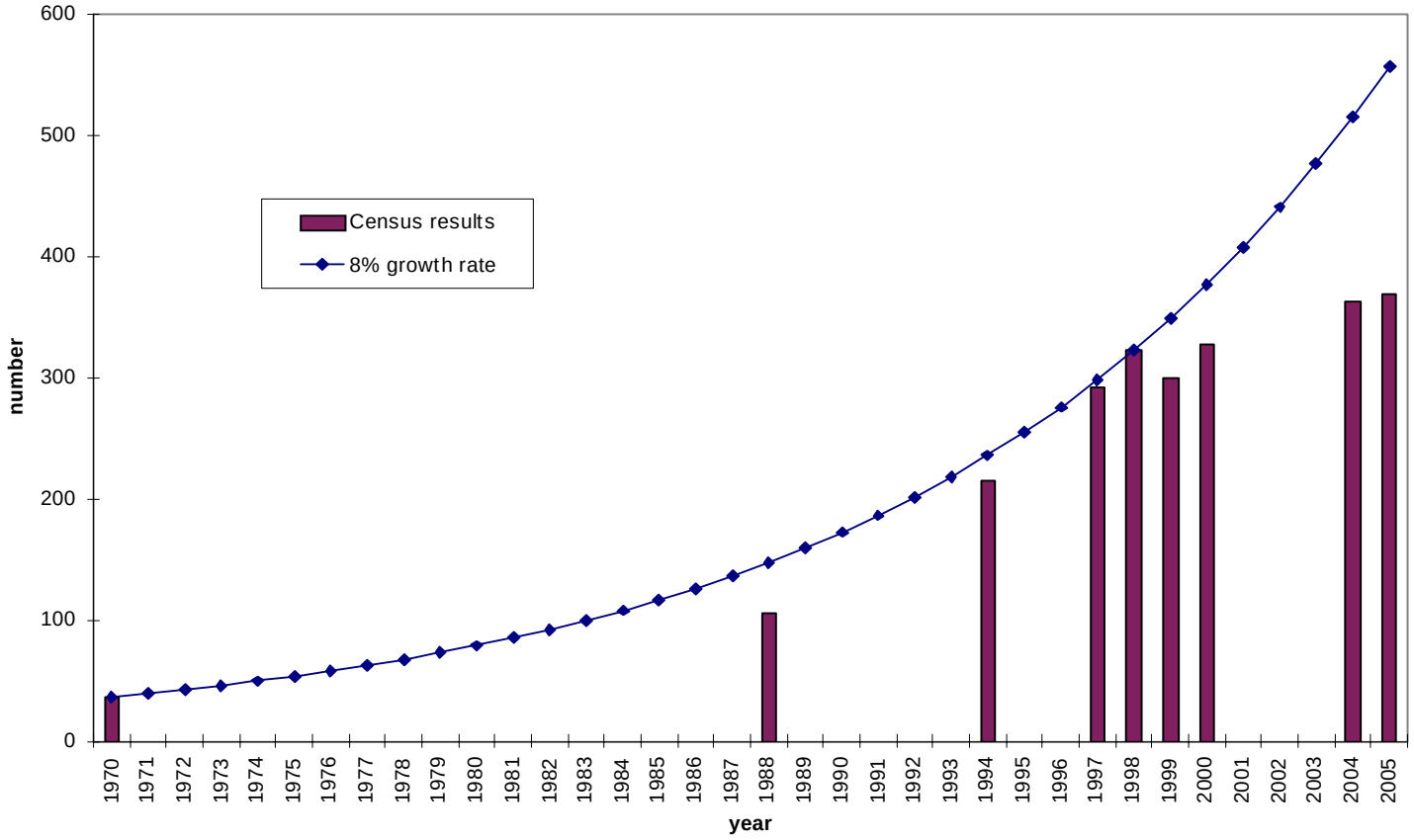

Figure 1 Muskox census results in the northwestern portion of Game Management Unit 23 during 1970–2005 compared to a theoretical 8% population growth rate

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MUSKOX MANAGEMENT REPORT

From: 1 July 2002
To: 30 June 2004

LOCATION

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

GEOGRAPHIC DESCRIPTION: Central and Eastern Arctic Slope

BACKGROUND

Muskox populations in Alaska declined or, in some areas, disappeared before firearms were widely available. Even before the availability of firearms, hunting appears to have been an important factor in the disappearance of muskoxen (Lent 1998). The last records of muskoxen in Alaska were in the late 1800s or early 1900s when hunters used firearms to take groups and individual muskoxen. The Alaska Department of Fish and Game (ADF&G) reintroduced muskoxen from Nunivak Island to the eastern North Slope in 1969 and 1970 when 51 animals were released on Barter Island and 13 were released at Kavik River. The number of muskoxen increased steadily during the 1970s and 1980s in Unit 26C, and expanded eastward into Yukon, Canada, and westward into Unit 26B and eastern Unit 26A during the late 1980s and early 1990s. The population was considered stable during the mid 1990s at around 500–600 muskoxen in Units 26B and 26C with perhaps an additional 100 animals in Yukon, Canada. Beginning in 1999, calf production, yearling recruitment, and number of adults declined substantially in Unit 26C. Muskox numbers in Unit 26B appeared stable to slightly increasing during the 1990s through 2003.

ADF&G first opened a hunting season in Unit 26C in 1982 and in Unit 26B in 1990. Several regulatory scenarios have been in effect since then (Lenart 2003). The North Slope Muskox Harvest Plan is the template for managing muskoxen in Unit 26B. Consistent with that plan, in March 1998 the Alaska Board of Game determined that a harvest of no more than 20 muskoxen (Tier II hunt TX108) was necessary to provide a reasonable opportunity for subsistence use in Unit 26B west of the Dalton Highway. The board also decided that no more than 5 muskoxen were required to meet subsistence needs in Unit 26B east of the Dalton Highway. Tier I Hunt RX110 replaced Tier II Hunt TX110. Permits were made available in Nuiqsut and Kaktovik, and the season announced by emergency order when snow conditions, weather, or other factors were suitable for hunting muskoxen. A drawing permit hunt (DX112) was also established; 3 permits were issued for taking bull muskoxen in Unit 26B, east of the Dalton Highway. The board determined that it was possible to have subsistence and drawing hunts in the same area because the population could be managed as 2 subpopulations: bulls and cows. The $25 resident muskox tag fee was waived for subsistence hunters in Units 26B and 26C. Hunters have harvested small numbers of muskoxen annually in Units 26C and 26B since the seasons opened. Some season and boundary changes were made since 1998 (Lenart 2003).

MANAGEMENT DIRECTION

We initiated a management planning process on the North Slope in April 1996 to address concerns by North Slope residents about possible interactions between muskoxen and caribou and about the future management of muskoxen. Participants of the North Slope Muskox Working Group included representatives from local villages, ADF&G, the North Slope Borough, and affected federal agencies. The group developed the North Slope Muskox Harvest Plan, and all agencies, including ADF&G, signed the plan in February 1999. Some goals and objectives in this report were adopted directly from the plan.

MANAGEMENT GOALS

1. Provide opportunities to harvest muskoxen while maintaining healthy, stable muskox populations.

2. Minimize any detrimental effects that muskoxen may have on caribou and caribou hunting.

3. Cooperate and share information about muskoxen among users (e.g., local and nonlocal residents and local, state, and federal agencies) to develop and implement harvest, management, and research programs.

4. Provide opportunities to view and photograph muskoxen.

MANAGEMENT OBJECTIVES

1. Maintain a stable population of 500–650 muskoxen in Units 26B and 26C.
   - Conduct precalving surveys in early April to obtain a minimum count.
   - Conduct ground-based composition counts to determine herd composition.
   - Maintain 8–10 radio collars on adult female muskoxen to assist in locating groups of muskoxen during precalving surveys and composition counts.
   - Administer 3 permit hunts and monitor results of the hunts.

2. Adjust harvest level in Unit 26B to stabilize the muskox population by harvesting at a rate of no more than 10% per year of the spring precalving population in Unit 26B.
   - Administer 3 permit hunts and monitor results of the hunts.

METHODS

POPULATION SIZE AND COMPOSITION

ADF&G and U.S. Fish and Wildlife Service (FWS) biologists cooperated to collect population data. To obtain a minimum count of muskoxen, we conducted precalving surveys in late March or early April by flying transects and drainages in Units 26B and 26C using a Cessna 185. Whenever possible, 2 observers were in the back and 1 was in the front of the aircraft. Bright, sunny days provided the best survey conditions. Transects were flown at approximately 90 mph at 500–1000 ft above ground level, depending on visibility. Systematic surveys were not done in Unit 26B west of the Dalton Highway (Unit 26B West) until March 1997. In Unit 26B West,

6-mile long transects oriented north–south were distributed from 70ºN to 69º15'N. In April 1999 transects extended farther south to 69ºN, and transects were also flown in the area approximately halfway between the Itkillik and Colville Rivers. In Unit 26B, east of the Dalton Highway (Unit 26B East), we surveyed major drainages and some of the smaller adjacent tributaries and bluffs beginning in 1986. In April 2000, the transect method also was applied to Unit 26B East. In 2001 and 2002 we again surveyed major drainages and smaller adjacent tributaries and bluffs in Unit 26B East. Staff from the Arctic National Wildlife Refuge surveyed major drainages and smaller adjacent tributaries and bluffs in Units 26C beginning in 1978. In 2002 they surveyed the area using a grid (Reynolds 2002; P. Reynolds, FWS, personal communication). In addition to flying surveys, we tracked radiocollared females to locate groups of muskoxen.

To determine herd composition, we conducted ground-based composition counts in Units 26B and 26C in late June or early July. We first located groups of muskoxen by radiotracking from a fixed-wing aircraft or helicopter, then classified animals from the ground as >4 years old, 3 years old, 2 years old, yearling, or calf and as male or female. In 2003, some groups were classified from an R-44 or R-22 helicopter, but it proved difficult to classify animals from helicopters.

We monitored 8–10 radiocollared adult females to locate muskoxen in precalving surveys in April and composition counts in June during 1995 through 2005. In April 1999 ADF&G deployed radio collars on 12 adult (≥3 years old) female muskoxen in 11 groups distributed between the Itkillik River and the Ivishak River in Unit 26B using methods described by Lenart (1999). Since 1999, adult female muskoxen were captured and radiocollared in June or July by darting them with a CO_2 powered short-range projector pistol. In spring the following numbers of radio collars were deployed on muskoxen: 2 in 2001, 1 in 2002, 2 in 2003, and 5 in 2004.

HARVEST

For Unit 26B we monitored harvest and hunting effort through harvest reports submitted by hunters. Total harvest, residency, success rates, chronology of harvest, and methods of transportation were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002 through 30 Jun 2003). We obtained harvest data from FWS for Unit 26C.

We grouped population and harvest data as: 1) Units 26B and 26C combined, 2) Unit 26B, 3) Unit 26C, 4) Unit 26B West, and 5) Unit 26B East.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

In Unit 26B the number of muskoxen observed during precalving surveys (late March or early April) increased steadily during the early 1990s and fluctuated slightly during the mid 1990s before stabilizing at approximately 250–300 muskoxen from 1999 through 2003 (Table 1). No surveys were conducted in 2001, but we estimated a minimum population of 258 from a composition count completed in June by excluding calves and including observations of adults

not classified. Factors that influenced the fluctuation during the mid 1990s probably were immigration into Unit 26B from Unit 26C, lack of systematic precalving surveys in Unit 26B West until spring 1997, emigration out of the area, and recruitment.

In April 2003, we observed 302 muskoxen in Unit 26B and concluded that the population was stable. In 2004 and 2005, complete surveys were not conducted, but areas that had been used previously during winter were surveyed thoroughly. In 2004 only 198 muskoxen were observed, 100 fewer than observed in 2003. Reduced numbers were observed in Unit 26B East, but numbers in Unit 26B West remained relatively constant during 1999–2004 at 90–115 muskoxen (Table 1). In general, fewer large groups (i.e., 20–44 muskoxen) were found in both Unit 26B East and Unit 26B West in 2004. In addition, one group of muskoxen was located much farther west in Unit 26A than in previous years (Judy Creek, ~ 30 miles west of the Colville River).

In 2005, 186 muskoxen were observed; however, only 62 were observed in Unit 26B West. We suspect that some of the Unit 26B West animals were killed in May 2004 due to a flood on the Colville River during breakup. In June 2004 we found 6 dead adult muskoxen on the Colville River at Ocean Point and 7 (2 yearlings, 5 calves) on the Colville Delta. These groups had been located in April 2004 in groups of 18 and 16, respectively. We do not know if the flood killed other animals in those groups. In addition, numbers in Unit 26B East were still lower than in 2003 (198 in 2003 and 131 in 2005).

Although the overall number of muskoxen may have decreased in 2004 and 2005, the number of calves observed in early June was relatively high, indicating good productivity (Table 1). In addition, recruitment of yearlings (proportion of 1-year-old muskoxen in the population of muskoxen >1-year old) during 2000–2005 (excluding 2003) remained relatively constant (range: 10–17%). Yearling recruitment in 2003 was low (5%), but this was probably related to sampling problems (see Population Composition section below). Thus, some yearling recruitment occurred, and the population appeared stable to slightly increasing at least until 2003. Muskoxen are long-lived, yet because this population is not increasing at a higher rate or may be declining, it suggests that mortality closely tracked or exceeded recruitment during 1999 through 2005. Some of the mortality in Unit 26B may have been caused by brown bears. There is evidence that brown bears have become efficient predators on muskoxen on the eastern North Slope (Reynolds et al. 2002). At the minimum, it appears that the population of muskoxen in Unit 26B is beginning to change its distribution and form smaller groups versus larger groups. Factors involved may include brown bear predation, habitat, and weather.

The number of muskoxen observed in Unit 26C during precalving surveys seemed stable during 1990 through 1998 (range: 282–332; Table 1). Population counts suggest a decline in the Unit 26C muskox population began in 1999. The decline continued through this reporting period; only 9 muskoxen were observed in Unit 26C in June 2005 (Table 1). Initially, emigration into Unit 26B and Yukon, Canada, could have caused fewer muskoxen to be observed. However, number of calves observed in early June and yearling recruitment also were lower in Unit 26C beginning in 1999. Thus, Reynolds (2002) suggested factors other than emigration may have influenced the population, including 1) annual variation in weather affecting female body condition, calf survival, and yearling recruitment (e.g., crust forming on snow and long winters with deep snow making foraging difficult and late green-up of summer forage particularly in 2000 and 2001); 2) adults calving in alternate years; 3) brown bears becoming more efficient

predators on muskoxen; 4) muskoxen going out onto the coastal ice and not returning; and 5) disease making muskoxen more vulnerable to environmental conditions. For example, muskoxen in Alaska had a high serum antibody prevalence for malignant catarrhal fever (MCF) virus (95%; *n* = 104; Zarnke et al. 2002). However, there was no evidence that muskoxen were experiencing clinical signs of MCF.

The combined number of muskoxen observed during precalving surveys in Units 26B and 26C declined considerably; 491–603 were observed during 1995 through 2000, but only 331 muskoxen were observed in 2003 (Table 1). Complete surveys in Unit 26B were not conducted in 2004 and 2005; therefore, we are uncertain about current muskox numbers in Unit 26B and 26C combined. However, the population is probably <400, because few muskoxen remain in Unit 26C. Approximately 550–650 muskoxen inhabited the eastern North Slope of Alaska and northwestern Canada in 2003 and 2004, with high numbers reported in Canada (e.g., 221 in 2002, P. Reynolds, FWS, personal communication). By 2005 we estimated 450–550 muskoxen in eastern Alaska and northwestern Canada, and it is probable that the trend is downward.

Population Composition

In Unit 26B, percent calves was moderately high (range: 16–26%) during the previous 6 years (2000–2005; Table 1). The ratio of calves:100 females >2 years old was also high during 2000–2004 (range: 36–60:100). The number of bulls observed annually probably accounted for the differences in trend observed between percent calves and calves:100 females. Yearling recruitment (proportion of 1-year-old muskoxen in the population of muskoxen >1-year old) was moderately high during 2000 through 2002 (range: 13–16%); but was low in 2003 (5%) and higher in 2004 and 2005 (10% and 17%; Table 1). The low value in 2003 can be attributed to difficulty in locating nursery groups and groups moving frequently, particularly in Unit 26B East. Bull (>3 years):100 cow (>2 years) ratios fluctuated annually with a low bull:cow ratio one year and a high bull:cow ratio the next year (Table 1). Variability in bull:cow ratios may correlate to difficulty in locating bull groups, which is related to search effort.

We also separately examined composition data from Unit 26B West and Unit 26B East for 1997–2004 (Table 2). In general, percent calves and yearling recruitment during 1997 through 2004 was slightly more variable in Unit 26B East compared with Unit 26B West. Calves:100 cows >2 years old was variable for both Unit 26B West and Unit 26B East. However, no overall trends were observed. We suggest that sample sizes were too small to examine these populations separately. In addition, because distribution is changing, it may be difficult to continue to examine Unit 26B West and Unit 26B East separately.

In Unit 26C, percent calves was low during 1999 through 2001 (range: <1–7%) and yearling recruitment also was low (range: 0–9%; Table 1). Percent calves was slightly better in 2002 (10%), and no data were available for percent yearlings because muskoxen were classified as calves or muskoxen older than calves. Muskoxen were difficult to locate in June 2001 and 2002 and only 47 and 71 muskoxen were classified, respectively. No data were available for 2003 and 2004. Annual bull (>3 years):cow (>2 years) ratios ranged from 40 to 60 during the previous 5 years (1997–2001; no data available for 2002–2004; Table 1). We did not calculate combined composition data from Units 26B and 26C during 2002–2005.

Distribution and Movements

Muskoxen were reintroduced to the eastern North Slope in 1969 at Barter Island and in 1970 at Kavik River. The number of muskoxen increased steadily during the 1970s and 1980s in Unit 26C, and they extended their range eastward into Yukon, Canada, as far as Babbage River and westward into Unit 26B and the eastern part of Unit 26A as far as the Kogru River. Common drainages where muskoxen have been observed in Unit 26B include the Colville, Itkillik, Kuparuk, Sagavanirktok, and Canning Rivers and in Unit 26C include the Sadlerochit, Hulahula, Okpilik, Jago, and Aichilik Rivers. There also have been anecdotal reports of lone bulls and small groups of muskoxen south of the Brooks Range in Unit 25A, near Arctic Village, since 1980. In 1999, three muskoxen were illegally harvested from a group of 10 muskoxen located north of Arctic Village. Of the 3 harvested animals, 2 were cows. This was the first documentation of a mixed-sex group south of the Brooks Range. There also was a sighting of a lone bull on the Yukon River in Unit 25B, near Eagle. In March 2004 we observed a group of 3 bull muskoxen in the Wind River on the south side of the Brooks Range. In addition, there was a sighting of a lone bull near Coldfoot in summer 2004. We suspect that the animals found on the south side of the Brooks Range originated from the Units 26B and 26C population. In addition, a few bull muskoxen and some small groups have recently been sighted at the Gisasa, Kateel, and Hogatza Rivers. Other reports of lone bulls have occurred in Nulato, Ruby, and on the Yukon River across from Galena. We do not know if these small groups are mixed-sex or males only. However, we suspect that these animals originated from the Seward Peninsula.

Muskoxen tend to form larger groups of 6–60 during the winter season and remain in one location for a long time. During summer they form smaller groups of 5–20 and move more frequently. Details of long-range movements were noted in spring 1999 within Unit 26B (Lenart 2003). Recently, one large group of muskoxen (~50) that had been wintering near the confluence of the Ribdon and Sagavanirktok Rivers for several years could not be located in June 2003, even though the group had been there in April 2003. Only a small number (9) of these animals have been located since then. By April 2004 and 2005, in addition to the 50 missing Ribdon muskoxen, there were approximately 50 less muskoxen than had been observed previously in the Sagwon Bluffs and Ivishak River groups. Some of these animals had moved to the Toolik River. Nonetheless, it has been increasingly difficult to locate groups in June and keep track of those groups until the arrival of the helicopter for composition counts. Groups are smaller and move long distances in a short amount of time.

MORTALITY

Harvest

Seasons and Bag Limits. For RY00, the season for the Tier II (TX108) was lengthened by opening the hunt on 1 August versus 15 September. The season has remained the same since RY00. Seasons and bag limits for the remainder of Unit 26B have remained the same since RY98 (see below). In Unit 26C in RY02, only 2 federal permits were issued in response to the declining population. The season was closed during RY03 and RY04.

Location/Regulatory year	Permits; Hunt type; Bag limit	Resident Open Season	Nonresident Open Season
Unit 26B			
1990–1991 through 1994–1995	2; Tier II; 1 bull	1–31 Oct; 1–31 Mar	No open season
Unit 26B, west of Dalton Hwy			
1995–1996	3; Tier II; 1 bull	1–31 Oct; 1–31 Mar	No open season
1996–1997 through 1997–1998	3; Tier II; 1 bull	15 Sep–15 Nov; 1–31 Mar	No open season
1998–1999 through 1999–2000	9; Tier II; 1 muskox	15 Sep–31 Mar	No open season
2000–2001 through 2004–2005	9[a]; Tier II; 1 muskox	1 Aug–31 Mar	No open season
Unit 26B, east of Dalton Hwy			
1995–1996	2; Tier II; 1 bull	1–31 Oct; 1–31 Mar	No open season
1996–1997 through 1997–1998	2; Tier II; 1 bull	15 Sep–15 Nov; 1–31 Mar	No open season
1998–1999 through 2004–2005	Tier I; 1 muskox (harvest quota of 4); and 3; Drawing; 1 bull	To be announced; season closed no later than 31 Mar and 20 Sep–10 Oct; 10–30 Mar	No open season
Unit 26C			
1990–1991 through 1991–1992	9; Tier II/Federal; 1 bull	1–31 Oct; 1–31 Mar	No open season
1992–1993 through 1993–1994	10; Federal; 1 bull	1–31 Oct; 1–31 Mar	No open season
1994–1995 through 1995–1996	10; Federal; 1 bull	1 Oct–15 Nov; 1–31 Mar	No open season
1996–1997 through 1997–1998	15; Federal; 1 bull	15 Sep–15 Mar	No open season
1998–1999 through 2001–2002	15; Federal; 1 bull (3 permits for females)	15 Sep–31 Mar	No open season
2002–2003	2; Federal; 1 bull		No open season
2003–2004 and 2004–2005	0	No open season	No open season

[a] In RY00, 10 Tier II permits were issued because of a discrepancy in scoring.

Alaska Board of Game Actions and Emergency Orders. During the March 2002 meeting, the Alaska Board of Game considered a number of proposals related to bow hunting and the use of motorized vehicles in the Dalton Highway Corridor Management Area (DHCMA), some of which affected muskox hunting opportunities for the DX112 hunt during RY02–RY03. The board established the North Slope Closed Area, which is closed to big game hunting. The area includes the portion of Unit 26B within ¼ mile of the Dalton Highway from Atigun Pass north to the Prudhoe Bay Closed Area. The board also established a requirement that hunters who use the DHCMA mark arrows with their bow hunter education certification number. The board extended the restrictions on the use of motorized vehicles in the DHCMA to apply to the Prudhoe Bay Closed Area and limited the use of licensed highway vehicles in the DHCMA to publicly maintained roads. Muskox seasons and bag limits were not changed. The boundary for the Tier II hunt (TX108) was extended westward to include Unit 26A, east of longitude 153°.

In August 2002 the Federal Subsistence Board reduced the total muskox harvest in Unit 26C to 2 bulls for the RY02 hunting season. However, if late winter–early spring muskox surveys in subsequent years indicate more muskoxen are present in Unit 26C, the number of permits issued can be increased up to 3% of the estimated muskox population in Unit 26C and will be for bulls only.

During the March 2004 meeting, the Board of Game rescinded several of the regulations related to bow hunting along the Dalton highway that were in effect in RY02. The North Slope Closed Area was eliminated, along with the requirement that hunters mark their arrows. In addition, limiting the use of licensed highway vehicles in the DHCMA to publicly maintained roads was more clearly defined to allow "no motorized vehicles, except licensed highway vehicles on the following designated roads: 1) Dalton Highway; 2) Bettles Winter Trail during periods when BLM and the City of Bettles announce that the trail is open to winter travel; 3) Galbraith Lake road from the Dalton Highway to the BLM campground at Galbraith Lake, including the gravel pit access road when it is open; 4) Toolik Lake road, excluding the driveway to Toolik Lake Research Facility; 5) The Sagavanirktok River access road 2 miles north of Pump station 2; 6) any constructed roadway or gravel pit within ¼ mile of the Dalton Highway."

Hunter Harvest. Hunting for muskoxen in the eastern North Slope has only been allowed by permit. The number of permits available and weather conditions such as cold, snow, and fog influenced the harvest. The total reported harvest in Units 26B and 26C has been 5–18 since RY90 when both units were opened to hunting and has been <4% of the estimated total population observed during precalving surveys (Table 3). In all of Unit 26B, reported harvest was 0–14 during RY90 through RY04 and was <5% of the Unit 26B segment of the population. For RY02, RY03 and RY04, harvest was 9, 3, and 8, respectively. During RY95 through RY04, harvest in Unit 26B West was 1–5 (<6%) and in Unit 26B East it was 1–9 (≤6%; Table 3). Reported harvest in Unit 26C was 5–15 during RY90 through RY02 (<4%; no open season in RY03 and RY04). Restrictions in regulations ensure a low harvest. Some hunters may not have reported their harvests, despite the permit systems.

Hunter Residency and Success. Before RY90, muskoxen were harvested under a registration permit system in which both residents and nonresidents could participate (Golden 1989; Lenart 1999). From RY90 through RY97, state Tier II or federal subsistence permits were issued only to local residents (Unit 26; Table 3). Beginning in RY98, nonlocal residents could participate in the registration and drawing hunts east of the Dalton Highway in Unit 26B; residency and success for these hunts are in Table 4. Success rates for all years in Unit 26B were high (Table 3) and success rates for Unit 26C were not available, but we suspect success rates were good for all the hunts (> 50%). Hunters were predominantly local residents (Tables 4 and 5).

Transport Methods and Harvest Chronology. Hunters relied primarily on snowmachines to hunt muskoxen. However, hunters also used aircraft in some fall hunts during the early 1990s. Beginning in RY96 and continuing through RY04, a few hunters used boats (Table 6).

Chronology of harvest depends mostly on weather (e.g., snow, fog, temperature, and rivers freezing). During RY95 through RY04, approximately 50% of the harvest occurred in March for Units 26B and 26C combined. The remaining 50% was distributed between September, October, November, January, and in April after the season was closed.

Natural Mortality

We have few data on natural mortality in the eastern Arctic. Natural mortality among adults is presumed to be low. Brown bears kill both calf and adult muskoxen and have been a more important predator than wolves in Unit 26C (Reynolds et al. 1992). Muskox mortality from

predation was rarely observed before the last few years, but recently incidental observations indicate that predation by brown bears has increased (Reynolds et al. 2002). Wolves seem to be more abundant in Unit 26B than in Unit 26C and may become a more important source of mortality in the future. Late winter storms contribute to mortality of calves, yearlings, and old adults, but these losses are generally minimal. In May 2004, during breakup, the Colville River flooded and killed at least 13 muskoxen in 2 groups (6 adults, 2 yearlings, 5 calves).

Other Mortality

Some human-caused mortality is capture-related, and some occurs on the Dalton Highway from vehicles hitting muskoxen. Causes of many of the mortalities are unknown. Mortality rate for radiocollared females is shown in Table 7.

HABITAT

Various studies of the status of muskox habitat (O'Brien 1988) indicated forage was not limiting muskox population growth in Units 26B and 26C during the 1980s. Social factors were probably responsible for the apparent increased emigration from Unit 26C. There is some speculation that changes in forage quality and quantity on winter ranges in Unit 26C affected reproduction and survival (Reynolds 2002). These changes may be related to annual variability in weather and related to snow depth, length of snow season, and icing conditions (Reynolds 2002). Recently, muskox distribution in Unit 26B has changed, and it is possible some of the redistribution may be influenced by habitat, particularly during the winter. During 1997 through 2003, large groups of muskoxen (i.e., 50–60) wintered in the same location for several years. In 2004 and 2005, distribution was somewhat different, and overall group sizes were smaller. Perhaps habitat in the earlier locations was overexploited, and muskoxen are currently searching for new wintering areas.

CONCLUSIONS AND RECOMMENDATIONS

The overall population size in Units 26B and 26C declined considerably beginning in 2001, but the dynamics of populations in the 2 units was different; calf production and survival, yearling recruitment and number of adults declined in Unit 26C. The major factors influencing the decline probably were annual variation in weather affecting female body condition and winter foraging, and brown bears becoming more efficient predators. However, to account for the low number of muskoxen observed in Unit 26C, emigration was also most likely involved, and disease may also have played a role (Reynolds 2002). In Unit 26B, calf production and survival and yearling recruitment were stable, but since 2004, numbers of muskoxen may have declined. Because precalving surveys in 2004 and 2005 were incomplete, it is difficult to determine whether the population has declined or if lower observed numbers are related to distributional changes. Both anecdotal and radiocollar data indicate mortality rate of adult muskoxen in Unit 26B was moderately high during the past few years. For example, in RY03, we observed 6 dead adult muskoxen that drowned in a flood, 2 dead and 3 injured muskoxen caused by brown bear predation, and 5 of 11 radiocollared muskoxen that were found dead. We suspect that 3 of the 5 mortalities of radiocollared muskoxen were caused by brown bears. Additionally, multiple mortalities of muskoxen suspected to be caused by predation in Unit 26B have been reported since 2000 (Reynolds et al. 2002). Distribution of muskoxen during winter has changed moderately and distribution, group size, and frequency of movement during summer have

changed markedly. Changes in distribution could be related to expansion into new habitat, snow and icing conditions during spring, and brown bear predation. Brown bear predation could be influencing summer movements and group sizes by splitting larger groups into smaller groups and by causing groups to move into the mountains or farther west into Unit 26A to escape predation. In Unit 26B, however, calf production and yearling recruitment have been good; but perhaps mortality rates exceed recruitment. Harvest rates of muskoxen were below 5% of the entire population (Units 26B and 26C combined) and within each subpopulation (Unit 26B, Unit 26B West, Unit 26B East, and Unit 26C). Thus, harvest did not limit population growth. Nonetheless, the population in Unit 26C has almost disappeared in a short time, and some decline appears to have occurred in Unit 26B as well. There is a possibility that muskoxen could become scarce on the eastern North Slope in the future, if present trends continue. We recommend continuing to monitor this population to determine productivity, distributional changes, population size, and causes of mortality.

During the report period (RY02 and RY03), we partially met our first goal to provide opportunities to harvest muskoxen while maintaining healthy, stable muskox populations. ADF&G administered 3 hunts in Unit 26B and FWS administered 1 hunt in Unit 26C. However, the population was not stable. In response to declining numbers in Unit 26C, the Federal Subsistence Board reduced the number of permits available for the Unit 26C hunt in RY02 and closed the RY03 and RY04 seasons. Members of the North Slope Muskox Working Group and the community of Kaktovik supported these decisions.

We worked with local residents to address Goal 2 to minimize detrimental effects that muskoxen may have on caribou and caribou hunting; no such effects were noted during RY02–RY03.

We met Goal 3 by cooperating with FWS to share information on population data and interpretation of data, and by cooperating in the field to conduct composition counts and surveys. FWS intends to continue monitoring muskox numbers, productivity, survival, and movements east of the Canning River in Unit 26C. ADF&G and FWS will continue working cooperatively to collect and interpret muskox population and harvest data in Units 26B and 26C.

We met our fourth goal of providing opportunities to view and photograph muskoxen. Viewing and photography were possible, particularly near the Dalton Highway where small groups congregate during summer. Improvements to the Dalton Highway have increased public use and resulted in increased traffic and greater interest in muskoxen by both hunters and nonhunters.

We did not meet our first objective to maintain a stable population of 500–650 muskoxen in Units 26B and 26C because the estimated population during RY02–RY03 was <400 muskoxen. We recommend that members of the North Slope Muskox Working Group meet to discuss and address the changes in the dynamics of the muskox population on the eastern North Slope.

We met our second objective to adjust harvest level in Unit 26B to stabilize the muskox population by harvesting at a rate of no more than 10% of the spring precalving population annually in Unit 26B. The harvest rate was less than 10% annually during RY02–RY03. In RY02 (April 2003), we determined that the population of muskoxen in Unit 26B was stable at

approximately 300 animals. However, because of incomplete precalving surveys in April 2004 and 2005, we are uncertain if muskox numbers in Unit 26B are stable or declining.

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TABLE 1 Units 26B and 26C muskox precalving survey estimates and composition counts, 1987–2005[a]

Location[d]/Year[e]	Precalving survey estimate[b]		Postcalving composition surveys[c]									
	Muskoxen observed	Unit 26B (West)[f]	Muskoxen classified (excluding calves)		Bulls >3 yr:100 cows>2 yr (number bulls >3 yr)		Calves:100 cows>2 yr (number cows >2 yr)		Yearling recruitment %[g] (*n*)		Percent calves (*n*)	
UNIT 26B												
1990	122		83	(69)	41	(14)	41	(34)	16	(11)	17	(14)
1991	156		98	(75)	69	(24)	66	(35)	12	(9)	24	(23)
1992	224		193	(162)	43	(33)	40	(77)	19	(31)	16	(31)
1993	237		131	(103)	41	(21)	55	(51)	10	(10)	21	(28)
1994	166		91	(76)	46	(13)	54	(28)	25	(19)	17	(15)
1995	330		145	(123)	55	(29)	42	(53)	12	(15)	15	(22)
1996	266		44	(41)	35	(8)	13	(23)	11	(5)	7	(3)
1997	279	92	123	(107)	49	(23)	34	(47)	22	(24)	13	(16)
1998	207	79	97	(78)	24	(10)	45	(42)	13	(10)	20	(19)
1999	237	96	194	(162)	62	(44)	45	(71)	14	(23)	17	(32)
2000	277	90	172	(131)	35	(24)	60	(68)	13	(17)	24	(41)
2001	258[h]	107[h]	286	(239)	64	(63)	48	(98)	16	(39)	16	(47)
2002	284	102	241	(203)	39	(41)	36	(105)	13	(24)	16	(38)
2003	302	115	172[i]	(162)	94	(55)	48	(58)	5	(7)	16	(28)
2004[j]	198	99	153	(123)	52	(37)	42	(71)	10	(11)	20	(30)
2005[j,k]	186	62	151	(111)	47	(31)	61	(66)	17	(16)	26	(40)
UNIT 26C												
1990	332		286	(242)	42	(42)	44	(101)	19	(46)	15	(44)
1991	282		377	(305)	36	(52)	50	(144)	15	(45)	19	(72)
1992	283		324	(273)	56	(64)	45	(114)	19	(51)	16	(51)
1993	326		404	(323)	43	(62)	57	(143)	16	(51)	20	(81)
1994	318		341	(285)	53	(63)	47	(120)	18	(51)	16	(56)
1995	321		240	(215)	58	(51)	28	(88)	15	(32)	10	(25)
1996	332		195	(157)	41	(31)	51	(75)	11	(17)	20	(38)
1997	324		362	(324)	48	(70)	26	(146)	14	(46)	11	(38)
1998	331		211	(186)	42	(38)	28	(90)	11	(20)	12	(25)
1999	254		272	(257)	60	(76)	14	(127)	8	(21)	7	(15)
2000	246		184	(183)	40	(39)	1	(97)	9	(17)	<1	(1)
2001	168		47	(59)	48	(13)	<1	(27)	0	(0)	2	(1)
2002	35		71	(64)	n/a	n/a	n/a	n/a	n/a	n/a	10	(7)
2003	29		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2004	30		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
2005	9		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	

Location[d]/Year[e]	Precalving survey estimate[b] Muskoxen observed	Unit 26B (West)[f]	Postcalving composition surveys[c] Muskoxen classified (excluding calves)		Bulls >3 yr:100 cows>2 yr (number bulls >3 yr)		Calves:100 cows>2 yr (number cows >2 yr)		Yearling recruitment %[g] (*n*)		Percent calves (*n*)	
UNITS 26B & 26C												
1990	454		369	(311)	41	(56)	43	(135)	18	(57)	16	(58)
1991	438		475	(380)	50	(76)	63	(179)	14	(54)	20	(95)
1992	507		517	(435)	51	(97)	43	(191)	19	(82)	16	(82)
1993	563		535	(426)	43	(83)	56	(194)	14	(61)	20	(109)
1994	484		432	(361)	51	(76)	48	(148)	19	(70)	16	(71)
1995	651		385	(338)	57	(80)	33	(141)	14	(47)	12	(47)
1996	598		239	(198)	40	(39)	42	(98)	11	(22)	17	(41)
1997	603		485	(431)	48	(93)	28	(193)	16	(70)	11	(54)
1998	538		308	(264)	36	(48)	33	(132)	11	(30)	14	(44)
1999	491		466	(419)	61	(120)	25	(198)	10	(44)	10	(47)
2000	523		356	(314)	38	(63)	25	(165)	11	(34)	12	(42)
2001	426[h]		333	(285)	41	(54)	36	(132)	8	(24)	14	(48)
2002	319		312	(267)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	14	(45)
2003	331		n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)
2004[j]	228		n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)
2005[j]	195		n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)	n/a	(n/a)

[a] Data source for Unit 26C for all years and for Unit 26B for 1987 through 1997; P.E. Reynolds, U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks.

[b] Precalving survey estimates were determined during late March or early April and based on total muskoxen observed.

[c] Postcalving composition classification was conducted during the second week of June through early July.

[d] Unit 26C surveys encompassed the Canning to Clarence Rivers. Unit 26B surveys occurred east of the Sagavanirktok River until RY96 when the entire subunit from Colville to Canning Rivers was surveyed.

[e] Beginning in 2000, 3-year-old bulls were included in the "Bulls > 3 yr" category for Unit 26B.

[f] Number of muskoxen observed west of the Sagavanirktok River in Unit 26B and eastern Unit 26A. This number is also included in total number of muskoxen observed.

[g] Yearling recruitment is the proportion of 1-year-olds in the population of muskoxen > 1 year old.

[h] Muskoxen observed for Unit 26B was estimated from June composition by excluding calves and including observations of adults not classified.

[i] Some groups of muskoxen were classified from an R-44 or R-22 helicopter. Groups were difficult to locate in Unit 26B East; thus, overall classification of the herd may not be representative.

[j] Incomplete surveys in Unit 26B for the precalving survey estimate.

[k] Bulls and cows were classified as > 1 year old.

TABLE 2 Postcalving composition surveys, Units 26B West and 26B East, 1997–2004

	Unit 26B West[a] (*n*)				Unit 26B East[b] (*n*)			
Year	% Bulls >2yr	Yearling recruitment %[c]	% Calves	Calves:100 Cows >2yr	% Bulls >2yr	Yearling recruitment %[c]	% Calves	Calves:100 Cows >2yr
1997[d]	14 (4)	38 (10)	10 (3)	30 (10)	25 (24)	17 (14)	14 (13)	35 (37)
1998[e]								
1999[d]	20 (15)	14 (9)	17 (13)	38 (34)	25 (29)	14 (14)	16 (19)	51 (37)
2000	13 (9)	14 (8)	19 (13)	43 (30)	16 (15)	13 (9)	29 (28)	74 (38)
2001	21 (24)	12.5 (11)	22 (25)	68 (37)	22 (39)	18.5 (28)	13 (22)	36 (61)
2002	12 (13)	16 (14)	20 (22)	44 (50)	21 (28)	9 (10)	12 (16)	29 (55)
2003[f]	24 (24)	10 (6)	25 (26)	87 (30)	46 (31)	1.5 (1)	3 (2)	9 (23)
2004[g]	21 (17)	8 (6)	11 (9)	22 (41)	24 (20)	6 (5)	25 (21)	58 (36)

[a] Unit 26B West includes that portion of Unit 26B, west of the Dalton Highway.
[b] Unit 26B East includes that portion of Unit 26B, east of the Dalton Highway.
[c] Yearling recruitment is the proportion of 1-year-olds in the population of muskoxen ≥1 year old.
[d] Includes 3-year-old bulls and older for bull classification (no 2-year-olds included).
[e] No survey.
[f] We had difficulty in locating nursery groups in Unit 26B East. Considered a poor composition count.
[g] A group of 33 muskoxen were located in Unit 26B West, but were included in Unit 26B East because this group originated in Unit 26B East and returned to Unit 26B East.

TABLE 3 Units 26B and 26C muskox harvest data by permit hunt, regulatory years 1986–1987 through 2004–2005

Regulatory year	Hunt/ Area[a]	Unit	Permits available[b]	Returned reports	Total hunters	Successful hunters[c]	Bulls	Cows	Total harvest
1995–1996	TX108	26B (West)	3	3	1	1	1	0	1
	TX110	26B (East)	2	2	2	2	2	0	2
	RX113 (F)	26C	10	n/a	n/a	9	8	1[d]	9
1996–1997	TX108	26B (West)	3	3	3	2	2	0	2
	TX110	26B (East)	2	2	1	1	1	0	1
	RX113 (F)	26C	15	n/a	n/a	15	12	3[d]	15
1997–1998	TX108	26B (West)	3	3	3	2	2	0	2
	TX110	26B (East)	2	2	1	1	1	0	1
	RX113 (F)	26C	15	n/a	n/a	10	9	1[d]	10
1998–1999	TX108	26B (West)	9	9	4	4	3	1	4
	RX110	26B (East)	14	9	5	3	3	0	3
	DX112	26B (East)	3	3	3	3	3	0	3
	RX113 (F)	26C	15	n/a	n/a	8	8	0	8
1999–2000	TX108	26B (West)	9	9	5	1	1	0	1
	RX110	26B (East)	3	3	0	0	0	0	0
	DX112	26B (East)	3	3	2	2	2	0	2
	RX113 (F)	26C	15	n/a	n/a	8	8	0	8
2000–2001	TX108	26B (West)	10[e]	10	6	5	4	1	5
	RX110	26B (East)	20[f]	6	6	6	6	0	6
	DX112	26B (East)	3	3	3	3	3	0	3
	RX113 (F)	26C	15	n/a	n/a	6	5	1	6
2001–2002	TX108	26B (West)	9	9	3	3	3	0	3
	RX110	26B (East)	5	5	4	4	4	0	4
	DX112	26B (East)	3	2	2	2	2	0	2
	RX113 (F)	26C	15	n/a	n/a	2	2	0	2
2002–2003	TX108	26B (West)	9	7	6	5	unk	unk	5
	RX110	26B (East)	2	2	1	1	1	0	1
	DX112	26B (East)	3	3	3	3	3	0	3
	RX113 (F)	26C	2	n/a	n/a	n/a	0	0	0
2003–2004	TX108	26B (West)	9	9	5	2	2	0	2
	RX110	26B (East)	unk[g]	0	0	0	0	0	0
	DX112	26B (East)	3	3	1	1	1	0	1
	RX113 (F)	26C	0	0	0	0	0	0	0
2004–2005	TX108	26B (West)	9	9	4	4	3	1	4
	RX110	26B (East)	4	5	3	1	1	0	1
	DX112	26B (East)	3	3	3	3	3	0	3
	RX113 (F)	26C	0	0	0	0	0	0	0

[a] Hunt areas: RX = registration; TX = Tier II; DX = drawing; F = federal hunt; 1007, 1013, 113 = Unit 26C; 1010 and 110 = east of Dalton Hwy and since RY99 = east of Dalton Hwy Mgmt Corridor; 112 = west of Dalton Hwy; 1012 = east of Jago River; 1014 = west of Jago River; Hunt RX1013 (F) and RX113 (F) are not registration hunts—it is a lottery.
[b] Permits available may not always equal permits issued in federal hunts because unused permits are reissued. In hunt RX110, unlimited number of permits available; harvest quota = 4.
[c] Determined from returned reports.
[d] Illegal animal.
[e] Only 9 permits were supposed to be issued, but due to a mistake in scoring, 10 were issued and this was not considered a biological problem.
[f] Approximately 20 permits were issued in Nuiqsut, but the vendor did not retain the overlays, so we are uncertain about the exact number issued.
[g] Vendor did not retain overlays.

TABLE 4 Unit 26B East muskox hunter residency and success, regulatory years 1998–1999 through 2004–2005

Hunt [a]/ Regulatory year	Successful			Unsuccessful			Total hunters
	Local[b] resident	Nonlocal resident	Total (%)	Local[b] resident	Nonlocal resident	Total (%)	
RX110							
1998–1999	2	1	3 (60)	1	1	2 (40)	5
1999–2000	0	0	0 (0)	0	0	0 (0)	0
2000–2001	4	2	6 (100)	0	0	0 (0)	6
2001–2002	4	0	4 (100)	0	0	0 (0)	4
2002–2003	1	0	1 (100)	0	0	0 (0)	1
2003–2004	0	0	0 (0)	0	0	0 (0)	0
2004–2005	0	1	1 (33)	0	2	2 (67)	3
DX112							
1998–1999	0	3	3 (100)	0	0	0 (0)	3
1999–2000	0	2	2 (100)	0	0	0 (0)	2
2000–2001	0	3	3 (100)	0	0	0 (0)	3
2001–2002	0	2	2 (100)	0	0	0 (0)	2
2002–2003	0	3	3 (100)	0	0	0 (0)	3
2003–2004	0	1	1 (100)	0	0	0 (0)	1
2004–2005	0	3	3 (100)	0	0	0 (0)	3

[a] RX110 = Tier I registration hunt in Unit 26B, east of the DHCMA; DX112 = drawing hunt in Unit 26B, east of the Dalton Highway.
[b] Local resident is a resident of Unit 26.

TABLE 5 Units 26B and 26C muskox hunter residency and success, regulatory years 1986–1987 through 2004–2005

Regulatory year[b]	Successful				Unsuccessful[a]				Total hunters[d]
	Local resident[c]	Nonlocal resident	Nonresident	Total	Local resident	Nonlocal resident	Nonresident	Total	
1986–1987	3	1	1	5	--	--	--	0	5
1987–1988	3	3	0	6[e]	--	--	--	0	5
1988–1989	4	4	0	8	--	--	--	0	8
1989–1990	2	7	1	10	--	--	--	0	10
1990–1991	10	0	0	10	--	--	--	0	10
1991–1992	5	0	0	5	--	--	--	0	5
1992–1993	10	0	0	10	--	--	--	1	11
1993–1994	9	0	0	9	--	--	--	0	9
1994–1995	9	0	0	9	--	--	--	2	11
1995–1996	12	0	0	12	--	--	--	0	12
1996–1997	18	0	0	18	--	--	--	1	19
1997–1998	13	0	0	13	--	--	--	1	14
1998–1999	14	4	0	18	--	--	--	5	23
1999–2000	9	2	0	11	--	--	--	4	15
2000–2001	15	5	0	20	--	--	--	1	21
2001–2002	9	2	0	11	--	--	--	0	11
2002–2003	6	3	0	9	--	--	--	1	10
2003–2004	2	1	0	3	--	--	--	3	6
2004–2005	4	4	0	8	--	--	--	2	10

[a] No data for "Unsuccessful" hunters because of lack of reporting in Unit 26C.
[b] Before RY86 only Alaska residents were allowed to hunt muskoxen. In RY90 through RY97 muskox hunting was limited to local residents of Unit 26. In RY98, that portion of Unit 26B, east of the Dalton Highway was opened to include all Alaska residents.
[c] Local is a resident of Unit 26.
[d] From hunt reports received.
[e] One illegal muskox.

TABLE 6 Units 26B and 26C muskox harvest by transport method, regulatory years 1986–1987 through 2004–2005

Regulatory year	Harvest by transport method					
	Highway vehicle	Airplane	Dog team/ski	Snowmachine	Boat	Total
1986–1987	0	0	0	3	0	3
1987–1988	0	2	0	4	0	6
1988–1989	0	2	0	4	0	6
1989–1990	0	9	0	1	0	10
1990–1991	0	1	1	6	0	8
1991–1992	0	0	0	5	0	5
1992–1993	0	0	0	10	0	10
1993–1994	0	1	0	8	0	9
1994–1995	0	0	0	9	0	9
1995–1996	0	2	0	10	0	12
1996–1997	0	0	0	17	1	18
1997–1998	0	0	0	12	1	13
1998–1999	1	0	0	15	2	18
1999–2000	2	0	0	9	0	11
2000–2001	2	0	0	16	3	21
2001–2002	2	0	0	7	2	11
2002–2003	2	1	0	3	3	9
2003–2004	1	0	0	1	1	3
2004–2005	3	0	1	1	3	8

Table 7 Mortality rate for radiocollared females

Year (1 Jun–30 May)	Number of radiocollared muskoxen	Number of mortalities	Percent mortality
1999–2000	14	3	21%
2000–2001	11	1	9%
2001–2002	11	3	27%
2002–2003	9	1	11%
2003–2004	11	5	45%

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.

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