

Muskox Management Report and Plan, Game Management Units 19A and 21E:

Report Period 1 July 2014–30 June 2019, and

Plan Period 1 July 2019–30 June 2024

Jonathan S. Barton



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Purpose of this Report

This report provides a record of survey and inventory management activities for muskox in Units 19A and 21E for the 5 regulatory years 2014–2018 and plans for survey and inventory management activities in the following 5 regulatory years, 2019–2023. A regulatory year (RY) begins 1 July and ends 30 June (e.g., RY14 = 1 July 2014–30 June 2015). This report is produced primarily to provide agency staff with data and analysis to help guide and record agency efforts but is also provided to the public to inform it of wildlife management activities. In 2016 the Alaska Department of Fish and Game’s (ADF&G, the department) Division of Wildlife Conservation (DWC) launched this 5-year report to more efficiently report on trends and to describe potential changes in data collection activities over the next 5 years. This is the first species management report and plan on muskox related survey and inventory activities in this area.

I. RY14–RY18 Management Report

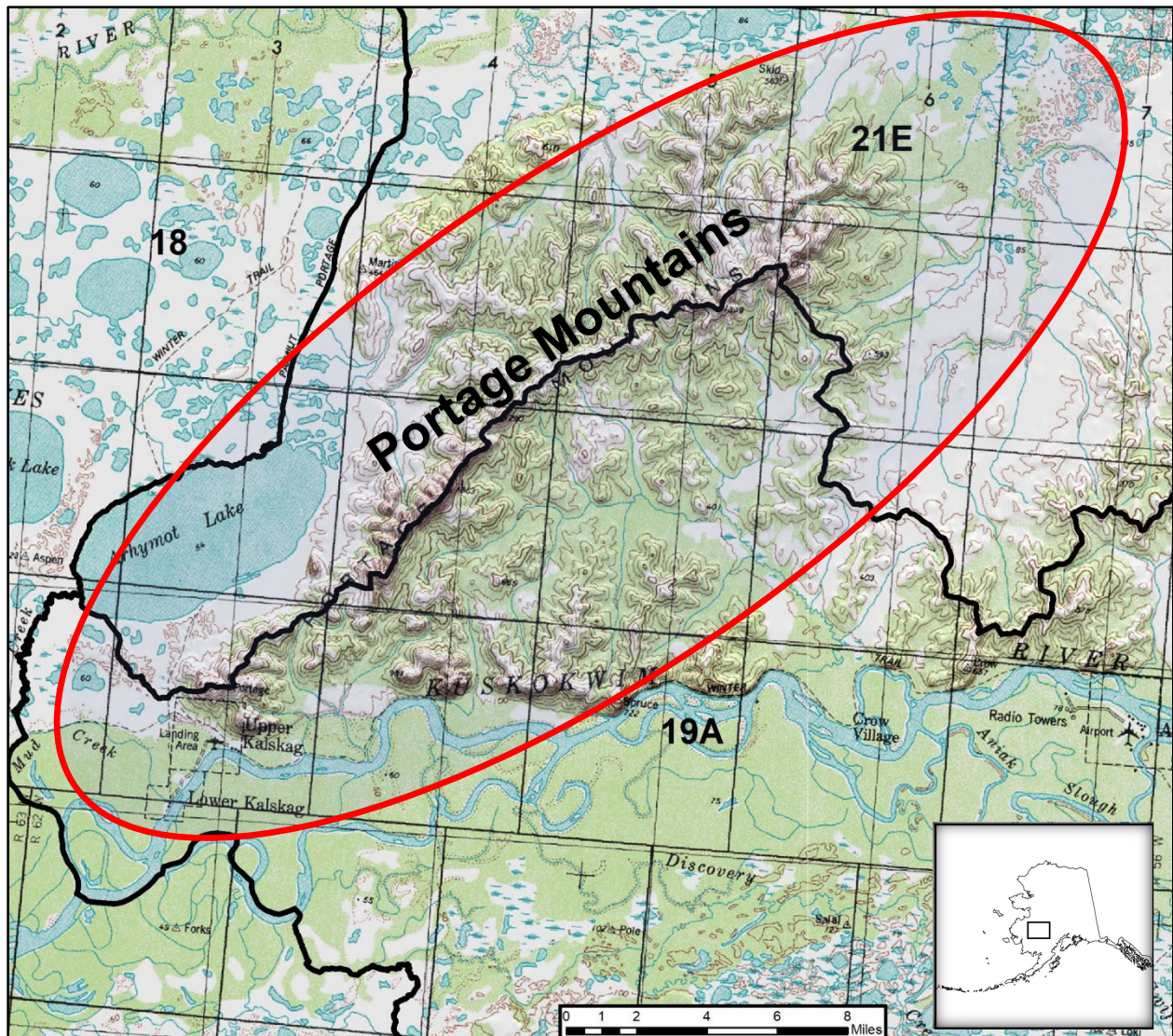
Management Area

Units 19A and 21E border Unit 18 and are situated within the Yukon–Kuskokwim Delta region (Y–K Delta) of Alaska. Unit 21E is 7,993 mi² and lies on the northwestern border of Unit 19A, includes that portion of the Yukon River and Arhymot Lake drainages upstream to the Innoko River drainage and downstream from the Iditarod River drainage. Unit 19A is 10,048 mi² and includes drainages of the Kuskokwim River downstream from and including the Moose Creek drainage to the village of Lower Kalskag. The Portage Mountains lie just north of the villages of Kalskag and Aniak, with portions of the range existing in Units 21E and 19A.

Summary of Status, Trend, Management Activities, and History of Muskox in Units 19A and 21E

Muskox in Units 19A and 21E primarily occupy habitat within and around the Portage Mountains of Alaska (Fig. 1). These mountains are located on the southern boundary of Unit 21E and northern boundary of 19A within the Yukon–Kuskokwim Delta. These muskox have been identified as the Portage Mountain herd for this reason (Fig. 1). Currently, there is little known about the distribution and movements of these muskox, as population monitoring has only been conducted since 2017.

The original species of Alaskan muskox went extinct in 1860. To reestablish the presence of muskox back on the Alaskan landscape, congress appropriated funding to the territorial legislature of Alaska for the reintroduction of muskox. Muskox were acquired and transported from Greenland to Alaska in 1930, where they remained in Fairbanks for 5 years at the University of Alaska Fairbanks. In 1935 these muskox (31 animals) were released on Nunivak Island. The herd grew to roughly 500 animals by 1965. As part of a pilot program to develop muskox transplant procedures to other areas of the state, 30 muskox from Nunivak Island were transplanted to Nelson Island in 1967 (Paul 2009). As this population continued to grow, muskox dispersed inland into the Yukon–Kuskokwim Delta region. The Portage Mountain muskox are



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Figure 1. Map showing the Portage Mountain herd area in Units 19A and 21E, Alaska.

believed to be derived from an unknown number of animals which emigrated from Nelson Island in Unit 18 within the last 20 years (Jones 2015). Muskox sightings in Units 19A and 21E have been common since 2010. Documentation and observations indicate muskox have been observed as far as Ophir along the Kuskokwim River drainage (Units 21A and 19D) and the Holitna River in Unit 19A. During March 1989, both ADF&G and U.S. Fish and Wildlife Service staff radiocollared 5 muskox (2 bulls and 3 cows) in Unit 18 south of the Yukon River between Bethel and Pilot Station. One of these, a 3-year-old female, moved 160 miles east to Lower Kalskag, just south of the Portage Mountains on the Kuskokwim River. This muskox was shot one year later in March 1990 near Toksook Bay on Nelson Island, almost 200 miles west of the last known location (Hughes 2007).

Aerial surveys began in 2017 to collect population data. Methodologies and search areas were developed to collect the most accurate information possible. Because base line data are limited on this herd, movement patterns and distribution are not well understood.

There is currently no harvest allowed for muskox in Units 19A and 21E. However, local residents support opening a hunt when the population can sustain harvest.

Management Direction

This herd will be managed to allow for growth and expansion. Management will support future harvest opportunities on sustainable yield principles, as well as provide nonconsumptive use opportunities (e.g., viewing and photography). During RY14–RY18, management goals, objectives, and activities were developed to include a healthy, growing population with the intent to provide sustainable harvest. We developed preliminary management direction to allow for growth, nonconsumptive uses, population monitoring, and to support future harvest opportunity.

EXISTING WILDLIFE MANAGEMENT PLANS

There were no existing wildlife management plans for muskox in Units 19A and 21E. However, local advisory committees expressed interest in helping to develop a muskox management plan with the public and other agencies to help direct muskox management in this area. Subsequently, we developed the following management goals, objectives, and activities during RY14–RY18 to account for these interests, and to manage on sustainable yield principles.

GOALS

The following goals were developed during RY14–RY18 to direct management decisions concerning the Portage Mountain muskox herd.

- G1. Maintain a healthy and growing muskox population.
- G2. Provide sustainable harvest opportunities for muskox in this area.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

There are no codified objectives for muskox in Units 19A and 21E.

Intensive Management

There are no intensive management objectives for muskoxen in Units 19A and 21E.

Management Objectives

These management objectives were developed beginning in May 2018, when efforts began by Region III staff to locate and count muskox .

- M1. Estimate the annual abundance and size of the Portage Mountain muskox herd (G1, G2).
- M2. Estimate muskox sex and age structure annually (G1, G2).

M3. Determine and monitor herd health and status (G1).

M4. Identify range distribution and habitat use (G1).

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct annual aerial surveys to collect minimum population counts (M1, M2, M4).

Data Needs

Minimum population counts provide data to estimate the annual abundance and size of the muskox herd. Additionally, conducting annual minimum population counts will help identify range distribution and habitat use. These surveys provide an index to evaluate population status and trends such as growth, declines, survival, and recruitment.

Methods

Annual aerial surveys were completed using Piper PA-18 Super cub fixed-wing aircraft during May and June. A pilot-observer team recorded a group number, number of individuals in the group, and took photographs for sex and age classification, and count accuracy. Waypoints were recorded in an aviation GPS unit to avoid double-counting groups and individuals. Previous sightings and a prior department aerial survey in the Portage Mountains were used to identify potential areas to find muskoxen and delineate survey boundaries. Aerial transects were conducted by following the contours of the mountains predominantly in open alpine areas down to the brush line. The transects were spaced to account for changes in contour but cover all habitat evenly.

In 2019, we conducted 2 surveys to understand seasonal distribution and variation in counts due to calving. Individual muskox were located, counted, and photographed. Surveys took an average of 3 hours.

Upon reviewing photographs, aerial counts were compared to counts using photographs to verify accuracy and determine if any individuals were missed during the aerial portion. Calves often hide under their mothers and can be difficult to spot.

Results and Discussion

The first survey in the Portage Mountains was conducted on 1 June 2017 by ADF&G Bethel area office staff while tracking mainland muskox within the Yukon–Kuskokwim Delta in Unit 18. A total of 77 muskox from 12 groups were counted in the Portage Mountains. Group size ranged 1–21 animals per group ($\bar{x} = 6$; P. Jones, Area Wildlife Biologist, ADF&G, unpublished memorandum, 08 June 2017).

On 5 June 2018, 8 groups totaling 89 muskoxen were observed and photographed by McGrath area office staff. Of those 89 individuals, 13 were calves of the year. Group size ranged 1–16 animals per group ($\bar{x} = 9$).

McGrath Area office personnel completed 2 surveys on 22 May and 13 June 2019. During the May survey, we observed 9 groups totaling 71 muskoxen. Of those, 9 muskox were calves of the year. Group size ranged 1–18 animals ($\bar{x} = 8$). Survey results are presented in Table 1. During the June survey, we observed 6 groups totaling 34 muskoxen, including 9 calves. Group size ranged 1–10 animals ($\bar{x} = 6$). Survey results are presented in Table 1.

The muskox herd is estimated at around 100 animals, based on survey counts. We used our direct minimum population count to estimate this number. Muskox become increasingly harder to find as green-up progresses due to decreased sightability in the brush, making seasonal timing a necessary consideration for accurate counts. Such variables will be considered and evaluated for future surveys. This most likely explains the decrease in observed animals in June.

Recommendations for Activity 1.1

Activity 1.1 should continue. Minimum population counts provide the necessary data to identify trends in herd abundance and health. Should there be a hunt in the future, a vital understanding of population size is crucial to identify appropriate harvest parameters.

ACTIVITY 1.2. Conduct annual aerial composition surveys (M1, M2, M3).

Data Needs

Annual composition surveys provide sex and age data used to monitor herd health, growth, and recruitment trends. Yearlings, adult females, adult males, and juveniles that are identified provide the framework to understand recruitment and reproductive potential. These data are used to estimate productivity and survival-recruitment to evaluate population status and trend.

Methods

During minimum population counts using PA-18 Super Cub fixed-wing aircraft, the pilot observer team locates muskox groups. The observer operated a Canon Rebel EOS 6D Mark II digital camera with a Canon Zoom EF 70–200 mm Ultrasonic lens to take multiple photos of the group. Photos were analyzed for sex and age composition. Animals were then classified from these photos based on body size and horn characteristics by age and sex into one of 5 categories: adult bulls 3-years and older, adult cows 3-years and older, 2-year-olds, short yearlings (born the previous spring), and calves of the year (born in the spring).

Age and sex are determined by reviewing horn characteristics and body size within survey photographs. Adult male horns are easily distinguished by large horn bases on the top of the skull with long drooping horns. Horn bases are diminished and much smaller in adult females and other muskox. Younger muskox do not display the full horn drop that the adults do. Young males have thicker horns that flare out, while females have thinner variations at this stage.

Results and Discussion

Aerial photography has proved to be a valuable tool to evaluate muskox composition. Photos gathered during the past surveys from 2017 through 2019 have accurately revealed characteristics that help classify individuals. Horn characteristics provide the primary evidence for such classifications, but body size is also considered. Table 1. displays the composition data

gathered from 2017–2019. During the May 2019 survey, camera issues prevented photos from being taken, which resulted in the high unknown number of individuals.

Table 1. Muskox survey results for Units 19A and 21E, Alaska, during 2017–2019.

Date	Adult bulls	Adult cows	2-year-olds	Yearlings	Calves	Unknown	Total
01 Jun 2017	11	21	9	9	24	3	77
05 Jun 2018	11	14	7	13	13	31	89
22 May 2019 ^a	–	–	–	–	9	62	71
13 Jun 2019	2	15	1	5	9	1	33

^a En dashes represent no data in 2019 due to camera issues during the survey.

From the composition data, components such as percentage of calves are being identified to help understand recruitment. For instance, in June 2017, 2018, and 2019, the percentage of the population estimated to be calves was 31%, 15%, and 26%, respectively. Variables like composition will compliment further efforts to evaluate recruitment, survival, and population growth.

Because surveys in 2017 and 2019 are the only base line data collected, data trends on composition are unavailable at this time. Total counts have been similar each year. The low count in June 2019 is most likely due to green-up, resulting in poor sightability.

Recommendations for Activity 1.2

Activity 1.2 should continue. Understanding the composition of this muskox herd allows ADF&G area wildlife managers to assess recruitment, survival, and overall population health.

2. Mortality, Harvest Monitoring and Regulations

ACTIVITY 2.1 Monitor muskox mortality (M3).

Data Needs

We will monitor natural, stochastic, and anthropogenic mortality to help determine herd health and status. Understanding predation as a source of mortality will provide insight into predator-prey dynamics in this area.

Methods

Mortality events will be collected opportunistically during surveys and through public observations because there is not a hunting season to provide data.

Season and Bag Limit

There is currently no season or bag limit for muskox in Units 19A and 21E.

Results and Discussion

There are few mortality data available for muskox in this area. Mortality is believed to be low, but opportunistic observations by the department, other agencies, and the public are the only

methods for collecting these data. Muskox distribution and movement patterns in Units 19A and 21E are not well understood at this time, but any variables affecting emigration from the mainland population in Unit 18 could impact stability or growth of the Portage Mountain herd.

There is little information about predation on muskox in this region. Wolves and bears are known predators on muskox populations elsewhere in Alaska (Lenart 2015); while wolves and bears are common in Units 19A and 21E, predation events on muskox are not well documented in these units.

Alaska Board of Game Actions and Emergency Orders

In February 2014, the Board of Game voted against Proposal 66 to open a preferential subsistence hunt to rural communities in Units 18 and 19.

Recommendations for Activity 2.1

Mortality monitoring with current resources should continue. Any information concerning mortality will continue to be recorded and investigated.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

- Survey data are stored and archived on ADF&G's Wildlife Information Network (WinfoNet) server (<http://winfonet.alaska.gov/index.cfm>).
- All hard copy data sheets, paper files, and relevant information are located in the McGrath area office files.
- Survey memoranda, reports, and other pertinent electronic survey and inventory information is archived in the WinfoNet Data Archive. Project Title: McGrath Area Office.

Agreements

There were no agreements for muskox during this report period.

Permitting

There was no permitting for muskox in Units 19A and 21E during regulatory years 2014–2018.

Conclusions and Management Recommendations

It is unclear how recently muskox have been established in the Portage Mountains of Units 19A and 21E. There is growing awareness and support from local villages who have expressed hopes for a healthy, sustainable population that can be hunted in the future. Determining the size of the herd will become easier as we gather more baseline data (i.e., time of year to conduct surveys,

geographic distribution). There are no records or indications of illegal harvest of muskox in the Portage Mountain herd.

During the June 2019 survey, we searched the Russian and Horn mountains for muskox; there were no muskox found in these ranges and the herd appears to be limited to the Portage Mountains. There have been muskox sightings further upriver along the Kuskokwim in old towns such as Ophir as recent as July 2017. This may be evidence that adequate habitat exists to support muskox in this area. Variables such as predation, mortality, habitat availability, carrying capacity, and reproduction will likely need to be evaluated to fully understand the range and potential of these animals.

II. Project Review and RY19–RY23 Plan

Review of Management Direction

There will be no changes to the management direction unless a hunt is initiated. Any changes in management direction will be dependent on the guidelines and management goals put into place for that hunt which would be determined if and when it is initiated.

MANAGEMENT DIRECTION

This herd will be managed for sustainable growth and future harvest opportunities on sustainable yield principles as well as nonconsumptive uses (e.g., viewing and photography).

GOALS

- G1. Maintain a healthy and growing muskox population.
- G2. Provide sustainable harvest opportunities for muskox in this area.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

There are currently no customary and traditional use findings or amounts reasonably necessary for subsistence uses in these game management units.

Intensive Management

There are no intensive management objectives for muskox in this area.

MANAGEMENT OBJECTIVES

- M1. Estimate the annual abundance and size of the Portage Mountain herd (G1).
- M2. Estimate muskox sex and age structure (G1).

M3. Determine and monitor herd health and status (G1).

M4. Identify range distribution and habitat use (G1).

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct minimum population counts (M1, M3, M4).

Data Needs

Minimum population counts provide data to estimate the annual abundance and health of the muskox herd. Conducting annual minimum population counts will help identify range distribution and provide an index to evaluate population status and trends such as growth, declines, survival, and recruitment.

Methods

There will be no changes from the RY14–RY18 report period.

ACTIVITY 1.2. Conduct composition surveys.

Data Needs

Composition surveys will be conducted annually in conjunction with minimum population counts to assess sex and age data. This information is used to monitor recruitment, heard health, and reproductive potential.

Methods

During minimum population counts, using PA-18 Super Cub fixed-wing aircraft, the pilot-observer team will locate muskox groups. The observer will operate a Canon Rebel EOS 6D Mark II digital camera with a Canon Zoom EF 70–200 mm Ultrasonic lens to take multiple photos of muskox groups from the air. Age and sex are determined by reviewing horn characteristics and body size within those photographs in the following categories: calves of the year, yearlings (12–14 months old), 2-year-old males, 2-year-old females, 3-year-old males, 3-year-old females, ≥ 4 -year-old adult males, and ≥ 4 -year-old adult females. Bull-to-cow and cow-to-calf ratios will be calculated from these data and evaluated to help direct management for sustainable harvest. This will also provide insight into herd health and status. Roto-wing aircraft such as R-44 and R-22s are preferred for composition surveys because the photographs produced provide more accurate counts and there is a lower impact on the herd. Unfortunately, there is a higher cost in using the roto-wing aircraft, therefore surveys will be conducted this way as funding allows.

ACTIVITY 1.3. Radiocollar adult muskox.

Data Needs

VHF and/or GPS satellite radiocollared adult muskox will help biologists monitor herd distribution, movements, recruitment, and survival. Marked individuals can assist in minimum population counts by revealing additional groups or animals that are more likely to be missed due to dispersal or poor sightability. Radiocollared cow muskox can further improve our ability to collect recruitment data by noting the presence of a calf in the spring. Continual monitoring of radiocollared cows and associated offspring will provide insight into survival as the year progresses.

Methods

Female muskox of ≥ 3 -years old will be captured and outfitted with VHF or GPS radio collars. Ground and aerial captures will be accomplished by darting muskox using a Pneu-dart Model 389 cartridge-fired projectile rifle. The rump or front shoulder will be targeted as the injection site. Ground darting will be conducted by a crew of 3–4 ADF&G personnel who will surround the group of muskox while 1 shooter identifies the target and administers the drug. The radio collar will be fitted once the drug has taken effect, the individual is down, and the group disperses. Oxygen will be available to administer to the muskox until the reversal is administered. A 2-cc dart with a 1.5-inch barbed 14-gauge needle will be used to administer the appropriate drug combination. The muskox will be immobilized using a combination of 1.3 ml (13mg) thiafentanil and 0.2 ml (20 mg) xylazine hydrochloride. This mixture will be reversed with 20 mg Naltrexone:1 mg Thiafentanil (5.2 ml Naltrexone) and 1 mg Atipamezole:5 mg Xylazine (0.2 ml Atipamezole). These dosages are proven for ground darting, but aerial darting may require adjustments to slightly higher dosages if initial dosages are inadequate (B. Parr, Wildlife Biologist, ADF&G personal communication, 29 December 2020).

Aerial darting will be accomplished from an R44 Robinson helicopter. The animals will be located from the air by a pilot-observer team in a Piper Super Cub. Once the muskox has been darted, the R44 will leave the area until immobilization takes place. The pilot-observer team in the Super Cub will radio the helicopter pilot to notify the team of behavioral changes in the animal that indicate sedation.

2. Mortality, Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor muskox mortality (M1, M3).

Data Needs

We will monitor stochastic, natural, and anthropogenic mortality to determine herd health and status. If a hunting season is instituted, then inseason harvest will be monitored closely.

Methods

As there is currently no hunting season, any mortality events will be collected opportunistically through surveys and public observations. If a hunting season is implemented, then reporting will

be accomplished through draw hunt, registration permit, or harvest ticket depending on the regulations and reporting requirements that are implemented.

3. Habitat Assessment and Enhancement

ACTIVITY 3.1. Assess muskox winter and summer habitat range (M4).

Data Needs

Understanding food availability in winter and summer will supplement management activities by providing data on carrying capacity and range quality. Winter habitat may be a limiting factor on herd expansion due to snow depths and food availability.

Methods

When possible, muskox winter habitat range and snow conditions may be analyzed in conjunction with distribution to inform a better understanding of habitat availability and limitations for this herd. This activity will primarily be conducted opportunistically during aerial surveys.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Data Recording and Archiving

- Harvest, capture, and survey data will be stored on an internal database housed on ADF&G's Wildlife Information Network (WinfoNet) server (<http://winfonet.alaska.gov/index.cfm>) and archived in WinfoNet under Harvest Information and Survey and Inventory Tools.
- All hard copy data sheets, paper files, and any relevant information will be in the McGrath regional office filing system.
- Capture records, survey memoranda, reports, and other pertinent electronic survey and inventory information will be archived in the WinfoNet data archive. Project title: McGrath Area Office.

Agreements

There are currently no agreements concerning this muskox population.

Permitting

There are no permits associated with management of this population.

Acknowledgments

We would like to thank ADF&G Wildlife Biologist Patrick Jones from the Bethel area for his support and assistance with muskox management activities in this region.

References Cited

- Hughes, L. 2007. Unit 18 muskox. Pages 1-11 [In] P. Harper, editor. Muskox management report of survey and inventory activities 1 July 2004–30 June 2006. Alaska Department of Fish and Game , Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 16.0, Juneau.
- Jones, P. 2015. Unit 18 muskox. Chapter 1, pages 1-1 through 1-17 [In] P. Harper and L. A. McCarthy, editors. Muskox management report of survey and inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-2, Juneau.
- Lenart, E. A. 2015. Units 26B and 26C muskox. Chapter 4, pages 4-1 through 4-26 [In] P. Harper and L. A. McCarthy, editors. Muskox management report of survey and inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.
- Paul, T. W. 2009. Game transplants in Alaska. Second edition. Alaska Department of Fish and Game, Division of Wildlife Conservation, Technical Bulletin 4, Juneau.

