Species Management Report and Plan ADF&G/DWC/SMR&P–2022–26

Seward Peninsula Muskox Management Report and Plan, Game Management Unit 22:

Report Period 1 July 2014–30 June 2019, and

Plan Period 1 July 2019–30 June 2024

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2022

Alaska Department of Fish and Game Division of Wildlife Conservation

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Hunters are important founders of the modern wildlife conservation movement. They, along with trappers and sport shooters, provided funding for this publication through payment of federal taxes on firearms, ammunition, and archery equipment, and pay state hunting license and tag fees. These taxes and fees fund the federal Wildlife Restoration Program and the State of Alaska's Fish and Game Fund, which provided funding for the work reported on in this publication.

Species management reports and plans provide information about species that are hunted or trapped and management actions, goals, recommendations for those species, and plans for data collection. Detailed information is prepared for each species every 5 years by the area management biologist for game management units in their areas, who also develops a plan for data collection and species management for the next 5 years. This type of report is not produced for species that are not managed for hunting or trapping or for areas where there is no current or anticipated activity. Unit reports are reviewed and approved for publication by regional management coordinators and are available to the public via the Alaska Department of Fish and Game's public website.

This species management report and plan was reviewed and approved for publication by Phillip Perry, Management Coordinator for the Division of Wildlife Conservation.

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This document, published in PDF format only, should be cited as:

Dunker, B. R., and S. R. Germain. 2022. Seward Peninsula muskox management report and plan, Game Management Unit 22: Report period 1 July 2014–30 June 2019, and plan period 1 July 2019–30 June 2024. Alaska Department of Fish and Game, Species Management Report and Plan ADF&G/DWC/SMR&P-2022-26, Juneau.

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Contents

List Figures

List of Tables

Purpose of this Report

This report provides a record of survey and inventory management activities for Muskox (*Ovibos moschatus*) for the previous 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 report more efficiently on trends and to describe potential changes in data collection activities over the next 5 years. It replaces the Muskox management reports of survey and inventory activities that were previously produced every 2 years.

I. RY14–RY18 Management Report

Management Area

The Seward Peninsula Muskox population (SPMP) is located in western Alaska with muskoxen distributed throughout the Seward Peninsula and northern Nulato Hills. This includes all of Unit 22 north of the Unalakleet River, the southwestern portion of Unit 23, and the westernmost portions of Units 24D and 21D (Fig. 1). This area includes isolated groups of rugged mountains (2,500–4,700 ft), extensive upland areas with broad hills (500–2,000 ft), broad river valleys, sharp V-shaped valleys, and flat coastal wetlands. The western portion contains moist and wet tundra communities composed of sedge tussocks. Dominant willow and alder communities are found in riparian and upland areas. Alpine tundra communities exist at higher elevations. Eastern portions of the area contain isolated spruce-hardwood forests. The climate of this area is characterized by long, cold winters and short, cool summers. Average daily minimum temperatures during winter range from −2°F to 2°F, with average daily maximum temperatures ranging from 13°F to 18°F. Average daily minimum temperatures during summer range from 31°F to 44°F, with an average maximum of 55°F to 58°F (NOAA 2021). The range of the SPMP is approximately 32,300 mi^2 in area. This area is subdivided into individual management areas for the purposes of hunt management and the summarization of survey and inventory activities (Fig. 1).

Summary of Status, Trend, Management Activities, and History of the Seward Peninsula Muskox Population

Historical accounts indicate that muskoxen disappeared from Alaska by the late 1800s and may have disappeared from the Seward Peninsula hundreds of years earlier. In 1970, 36 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 (Machida 1997).

Abundance, age, sex composition, and recruitment rates are estimated throughout the range of SPMP biennially. Adult female survival is estimated annually. This information is used to

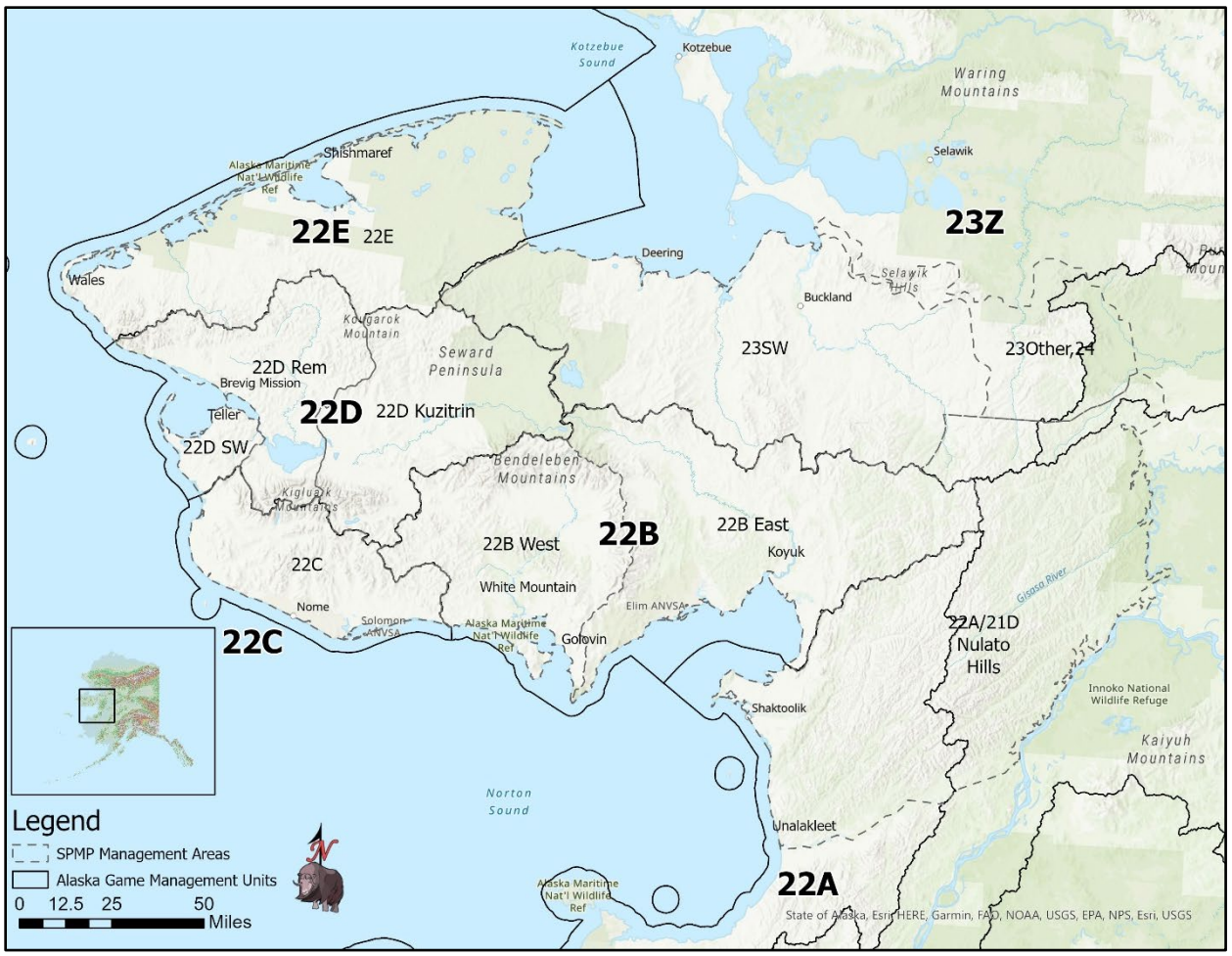

Figure 1. Seward Peninsula Muskox Population (SPMP) management areas, Unit 22, Alaska.

monitor the abundance, trend, and distribution of the population. It is also used to estimate the harvestable surplus and establish harvest quotas within individual hunt areas.

From 1970–2010, the initial population of 71 animals grew in abundance relatively quickly across broad areas of the Seward Peninsula. SPMP experienced 12% annual growth between 1970 and 2007. The population was stable between 2007 and 2010 with an annual rate of change of less than 3%. SPMP peaked at 2,903 animals in 2010. Thereafter the population experienced a period of rapid decline from 2010 to 2012. The 2012 population estimate of 2,223 muskoxen in the 'expanded count area' indicated that the SPMP experienced a 13% annual rate of decline during 2010–2012. Population estimates from 2015 and 2017 indicate that the population has remained relatively stable since 2012.

Concurrent with the changes in abundance, the population slowly expanded its range eastward. As a result, survey techniques have been adapted through time in order to effectively monitor the abundance and distribution of the population (Gorn and Dunker 2015).

Declines in the mature bull-to-cow ratio corresponding to increases in harvest (1995–2010) prompted changes in harvest guidelines, management strategies, and hunt structure (Schmidt and Gorn 2013). These changes were intended to increase the mature bull-to-cow ratio and promote population growth. This more conservative harvest strategy was implemented throughout RY14–RY18.

Management Direction

Muskox management on the Seward Peninsula is guided by recommendations from the Seward Peninsula Muskox Cooperators Group (the Cooperators) and local Fish and Game Advisory Committee groups. The Cooperators group is composed of staff from the department, U.S. 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, Northwest Alaska Native Association, residents of Seward Peninsula communities, and representatives from other interested groups or organizations.

The management goals listed below form the basis of a cooperative interagency management plan for Seward Peninsula muskoxen (ADF&G 1994) and follow muskox management policy guidelines developed by the department (ADF&G 1980).

Existing Wildlife Management Plans

Seward Peninsula Cooperative Muskox Management Plan (ADF&G 1994).

Goals

G1. Allow for continued growth and range expansion of SPMP.

G2. Provide for sustained yield harvest in a manner consistent with existing state and federal laws by following the goals and objectives endorsed by the Seward Peninsula Muskox Cooperators Group and the Seward Peninsula Cooperative Muskox Management Plan (ADF&G 1994).

G3. Manage muskoxen along the Nome road systems in Units 22B and 22C for viewing, education, and other nonconsumptive uses.

G4. Work with local reindeer herding interests to minimize conflicts between reindeer and muskoxen.

G5. Protect and maintain the habitats and other components of the ecosystem upon which muskoxen depend.

G6. Encourage cooperation and sharing of information among agencies and users of the resource in developing and executing management and research programs.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

A positive customary and traditional use determination has been made for muskox in Unit 22 and in the portion of Unit 23 south and west of the Kobuk River drainage. The amount reasonably necessary for subsistence (ANS) is set at 100–150 muskox with a nested ANS of 10–25 in Unit 22E (5 AAC 99.025).

A negative customary and traditional use determination has been made for muskox in Units 21D and 24D (5AAC 99.025).

Intensive Management

Muskox are not eligible for intensive management programs.

MANAGEMENT OBJECTIVES

M1. Complete population surveys at 2-year intervals to document changes in abundance and distribution.

M2. Complete rangewide composition surveys at 2-year intervals to document large-scale patterns in the age and sex structure of the population. Complete supplemental composition surveys on an annual basis to track trends of sex-age cohorts in selected areas.

M3. Participate in the Muskox Cooperators Group meetings and facilitate exchange of information and ideas among agencies and user groups.

M4. Administer Tier I/II subsistence 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.

MANAGEMENT ACTIVITIES

Monitoring population status and trend as well as harvest and mortality are key components of the management program for SPMP. These activities are intended to meet the management goals identified in the Seward Peninsula Cooperative Muskox Management Plan (ADF&G 1994) as well as muskox management policy guidelines developed by the department (ADF&G 1980). Survey and inventory (S&I) management activities used to monitor the SPMP are described below.

1. Population Status and Trend

ACTIVITY 1.1. Estimate population abundance and distribution (Goals G1, G2, G6, and objectives M1, M4).

Data Needs

The completion of abundance surveys within the known range of SPMP serves 3 primary roles. This information is used to inform the public, cooperating federal agencies, advisory committees, and the Alaska Board of Game about the status, trend, and distribution of the population. Estimates of abundance are also used to estimate the harvestable surplus, set harvest quotas, and provide recommendations for permit issuance. Lastly, the completion of abundance surveys provides a sample of muskox groups used for planning the execution of sex and age composition surveys.

Methods

Abundance surveys are scheduled to be completed every 2 years on the Seward Peninsula. The current extent of the population's range is based on observations of collared muskox, harvest reporting, reports from the public, and field observations. We use distance sampling techniques described in detail by Buckland et al. (2001, 2004) to estimate abundance. Methods for aerial surveys and subsequent analyses to estimate the population follow Schmidt et al. (2010), Schmidt and Gorn (2013), and Gorn and Dunker 2013.

Surveys for muskoxen completed during 1970–2007 on the Seward Peninsula provided a minimum count of the population. As the population expanded its range eastward, additional areas were added to the survey (Fig. 1). Unit 22A north of the Unalakleet River ('22A'), southeastern Unit 23, and western Unit 24 ('23 Other, 24') were added during the 2010 survey in response to population expansion into previously unoccupied and unsurveyed habitat (Gorn and Dunker 2013). In 2015, the survey area was further expanded to include additional areas within the Nulato Hills. This addition incorporated an area of contiguous habitat in the western portion of Unit 21D suspected to contain muskox ('21D Nulato Hill E'; Gorn and Dunker, 2015). The areas covered during minimum count surveys (1970–2007) are defined as the 'core count area' and include Units 22B, 22C, 22D, 22E, and '23 Southwest'. Survey results that include the 'core count area' and management areas added after 2010 are grouped together and defined as the 'expanded count area' (Fig. 2).

Results and Discussion

To estimate the abundance of SPMP, distance sampling surveys have been completed since 2010. A population survey was subsequently scheduled to be completed in the spring of 2014. Inadequate snow cover during the winter of 2013–2014 resulted in that survey being canceled. Consequently, a survey was completed in the spring of 2015 and again in 2017 following the biennial cycle. A persistent weather pattern in the spring of 2019 (RY18) resulted in poor flying conditions throughout the month of March. As a result, transects could only be flown in Units 22A, 21D, and 24D; an estimate was calculated for this subset of the range.

The 2015 SPMP distance sampling survey resulted in an estimated 1,853 animals (95% credible interval (CrI) = 1,541–2,285) in the 'core count area' and 2,287 animals (95% CrI = 1,895–2,832) in the 'expanded count area' (Fig. 2; T. Gorn, Wildlife Biologist 3, ADF&G, Nome, 2015 muskox survey summary, 6 May 2015). Individual hunt area estimates were also calculated to guide hunt administration in areas open to hunting (Table 1).

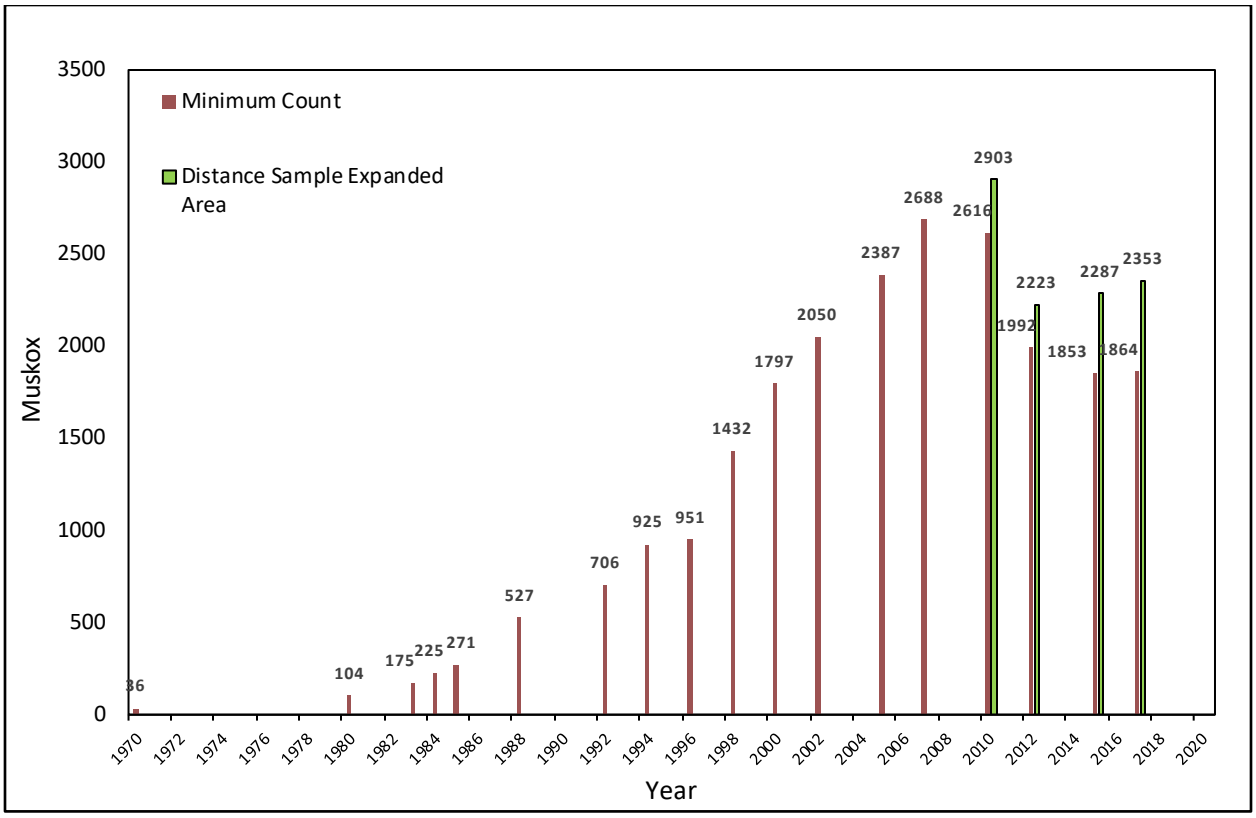

Figure 2. Seward Peninsula, Alaska muskox population survey results from minimum count and distance sampling surveys, 1970–2017.

Table 1. Seward Peninsula muskox population survey results with coefficients of variation and 95% credibility intervals by management area; spring 2015.

		Coefficient of	Credible interval	
Management area	Mean	variation	2.5%	97.5%
21D	146	36%	78	278
22A	194	23%	136	306
22B East of Darby Mountains	181	27%	112	305
22B West of Darby Mountains	274	15%	216	377
22C	358	11%	302	456
22D Kuzitrin Drainage	187	22%	131	290
22D Southwest	78	24%	57	129
22D Remainder	258	15%	207	352
22E	291	20%	204	433
23 Southwest	192	32%	104	340
23 Southeast and 24	71	41%	39	149

The 2017 SPMP distance sampling survey estimated 1,864 animals (95% CrI = 1,515–2,342) in the 'core count area' and 2,353 muskoxen (95% CrI = 1,908–2,936) in the 'expanded count area' (W. Dunker, Wildlife Biologist 3, ADF&G, Nome, 2017 Seward Peninsula muskox population survey summary, 20 July 2017). Individual hunt area estimates were also calculated to guide hunt administration in those areas currently open to hunting (Table 2, Fig. 2).

Table 2. Seward Peninsula muskox population survey results with coefficients of variation and 95% credible intervals by management area; spring 2017.

Management area	Mean	Coefficient of variation	Credible interval 2.5%	Credible interval 97.5%
21D	173	36%	82	317
22A	233	24%	154	369
22B East of Darby Mountains	165	36%	80	302
22B West of Darby Mountains	203	24%	133	322
22C	386	12%	318	494
22D Kuzitrin Drainage	136	34%	70	249
22D Southwest	142	17%	110	202
22D Remainder	278	16%	214	389
22E	306	23%	200	475
23 Southwest	247	30%	134	431
23 Southeast and 24	68	51%	25	151

A portion of the overall survey area was flown in the spring of RY18 prior to the survey being cancelled due to poor weather. A total of 38 transects in the eastern most portions of the survey area (management areas '22A', '21D, Nulato Hills E', and portions of Unit 24D) were flown. An estimate of abundance for this portion of the survey area was calculated to inform a proposal for initiating hunting in the area made at the 2020 Arctic/Western Region Board of Game meeting. The population survey estimate for this portion of the survey area was 552 muskox (95% CrI = 364–934). A comparison of the minimum counts obtained during 2010–2019 suggests that the population is likely stable or increasing (Table 3).

Table 3. Distance sampling survey minimum counts for muskox by management area conducted during spring 2010–2019, Seward Peninsula and Nulato Hills, Alaska.

Management areas	2010	2012	2015	2017	2019
21D	17	38	76	70	113
22A	61	51	136	190	219
23 Other, 24	92	89	39	54	–[a]
Total	70	178	251	314	332

[a] Data unavailable; the survey could not be completed due to poor weather.

Recommendations for Activity 1.1

Modify. Distance sampling surveys should be completed with a goal to estimate the abundance of muskox within SPMP at the rangewide level with a relative precision of ±15%.

Distinguishing between 10-month-old and 22-month-old muskox during fixed-wing survey flights can be challenging. Ground-based composition survey results are believed to be a more accurate means of estimating recruitment. Beginning in 2017, aerial survey pilot-observer teams were instructed to focus on obtaining an accurate total count of individuals in a group. This should continue to be the primary focus of pilot-observer teams in future distance sampling surveys, especially when a rangewide composition survey is planned to occur the same year.

Classifying muskoxen in a group that is completely made up of bulls can be completed accurately and effectively during fixed-wing abundance surveys. Doing so reduces the total number of groups that need to be relocated and surveyed later during rangewide composition surveys because their group composition is already known. Such efforts should continue because they improve the efficiency of composition surveys and make achieving sampling objectives simpler.

The distance sampling survey methodology currently uses transects spaced at 4-mile intervals throughout the range of the population. Small increases in transect spacing stand to significantly reduce the overall cost of the survey with minimal reductions in the precision of our estimates. Such modifications should be considered in the future.

ACTIVITY 1.2. Monitor the sex and age composition of the population (Goals G1, G6, and Objectives M2, M4).

Data Needs

The completion of composition surveys within the known range of SPMP serves 3 primary roles. This information is used to inform the public, cooperating federal agencies, advisory committees, and the Alaska Board of Game about the sex and age composition of the population. Estimated proportions of mature bulls in the population ($\hat{p}_{MB}$) are used to estimate the harvestable surplus. This information is used to set harvest quotas and provide recommendations for permit issuance. Composition survey information is also used to estimate the proportion of 10-month-old calves ($\hat{p}_{shrtyrl}$) in the population as an index of recruitment. This information is used to evaluate the status and trend of the population.

Methods

Composition surveys are scheduled to be completed every 2 years in conjunction with the SPMP distance sampling survey (Activity 1.1). In 2015 and 2017 muskox groups observed during the SPMP distance sampling survey were divided into 3 classes based on the number of animals in a group: small (1–16 muskox), medium (17–33 muskox), and large (≥34 muskox). Our overall goal was to classify at least 150 muskoxen per management area (Fig. 1). This sample was to be composed of individuals from each group class in proportion to the number of groups encountered in each class during the population survey. Groups from each class were randomly selected to ensure that a representative sample was selected from throughout the area.

For example, in management area 22C, 60% of the groups observed during the population survey were small groups. In this case our objective during the composition survey was to sample a random selection of small groups wherein approximately 90 muskoxen would be classified by age and sex. In management areas where less than 150 muskoxen total were observed, all groups

encountered were sampled. All management areas were treated independently except management areas '22A' and '21D, Nulato Hills E' were combined (the 'Expanded Area'). The 'Expanded Area' was combined into one area since there were very few groups and muskoxen overall in each management area and sampling each individual area would be cost prohibitive.

The SPMP distance sampling survey was canceled in 2019. This made completing a rangewide composition survey a management priority. A proportional sample of 150 muskox was selected from the typical group size classes that were observed during survey flights completed in management areas '22A' and '21D, Nulato Hills E'. A proportional sample of 500 muskox was also selected from the typical group size classes that were observed during reconnaissance flights, radio tracking flights, and S&I activities for other species within the 'core count area' (Appendix E).

All composition surveys completed during RY14–RY19 were ground-based surveys conducted in early spring (March–May). Groups were accessed either by snowmachine or R-44 helicopter. A team of 2 trained ADF&G or NPS biologists used binoculars and a spotting scope to classify muskoxen into 1 of 8 sex/age classes[1] based on body size, horn characteristics, and conformation.

Ratios of mature bulls:100 cows (males ≥ 4-years old:100 females ≥ 3-years old) and ShrtYrl:100C (10-month-old calves:100 females ≥ 3-years old) as well as proportion estimates including the proportion of short yearlings in the population ($\hat{p}_{ShrtYrl}$) and the proportion of mature bulls in the population ($\hat{p}_{MB}$) were calculated. A 95% confidence interval (CI) is reported for $\hat{p}_{shrtyrl}$ and $\hat{p}_{MB}$. Several unit estimates include information from multiple management areas so comparisons to previous composition survey results can be made; Unit 22A includes management areas '22A' and '21D, Nulato Hills E', Unit 22B includes management areas '22B East' and '22B West', and Unit 22D includes management areas '22D Kuzitrin', '22D Rem', and '22D SW'.

Results and Discussion

Rangewide and unit estimates of mature bulls:100 cows (MB: 100C), ShrtYrl:100 cows, $\hat{p}_{ShrtYrl}$ and $\hat{p}_{MB}$ estimates, along with 95% confidence intervals are listed in Table 4 and the Appendix, respectively. The rangewide MB:100C (mature bulls:100 cows) estimate has increased from a low of 29 MB:100C in 2012 to 40 MB:100C in 2019. This is believed to be in response to reduced harvest levels during RY12–RY19 (Fig. 3). Similar increases in MB:100C have been observed in Units 22B and 22C. Other units, including Units 22E and 22D, have not realized increases in MB:100C and are still below historic levels. Rangewide estimates of recruitment during RY14–RY18 averaged 13%, which is consistent with the long-term average recruitment rate of 13% observed during 1992–2019 (W. Dunker, Wildlife Biologist 3, ADF&G, Nome, 2019 Seward Peninsula muskox composition survey summary, 19 July 2019).

[1] Sex/age classifications: 1) bull ≥ 4-years old (mature bulls, MB), 2) bull = 3-years old, 3) bull = 2-years old, 4) cow ≥ 4-years old, 5) cow = 3-years old, 6) cow = 2-years old, 7) 10-month-old calves (short yearlings (ShrtYrl), and 8) calves.

Recommendations for Activity 1.2

Modify. Rangewide composition surveys should be completed with sufficient sampling to estimate the proportion of short yearlings and the proportion of mature bulls with a 95% confidence interval of ±5%.

Table 4. Rangewide composition estimates for Seward Peninsula muskox population, Unit 22, Alaska, during 1992–2019.

Year	No. muskox	Mature bulls: 100 cows	Short-yearlings: 100 cows	$\hat{p}_{ShrtYrl}$ [a]	95% CI[b]	$\hat{p}_{MB}$ [c]	95% CI[b]
1992	353	33	29	11%	9–13%	12%	10–14%
2002	1,345	44	44	18%	17–19%	18%	17–19%
2012	1,449	29	23	12%	11–13%	15%	14–16%
2015	1,062	39	17	8%	7–9%	20%	18–22%
2017	1,271	36	29	15%	14–16%	18%	17–19%
2019	597	40	30	15%	13–17%	20%	17–23%

Note: The results of surveys completed during regulatory years 2014–2018 along with previous composition survey results are provided for context.

[a] Proportion of short yearlings.
[b] CI stands for confidence interval.
[c] Proportion of mature bulls.

Management areas '22B East', '22D Kuzitrin', '22D Southwest', and '23 Other, 24' have consistently had minimum counts of less than 150 muskox. In areas such as these our current protocol dictates that we classify all the individual muskox observed in the area. In the future, these areas will be added to their neighboring management areas when composition surveys are conducted. This will still provide proportion estimates of mature bulls at a spatial scale adequate for hunt management and population monitoring while allowing a survey to be completed faster.

ACTIVITY 1.3. Monitor collared adult female muskox (Goal G1 and Objective M2).

Data Needs

The department began a muskox collaring program in 2008 to monitor adult female muskox survival rates. Monitoring adult female survival on an annual basis allows the department to monitor the population status and trend during years in between abundance and composition surveys. Monitoring these collars also provides information about distribution patterns, individual and group movements, timing, and causes of mortality. It also facilitates the completion of other S&I activities (Gorn 2009).

Methods

A sample of 20–30 collared adult female muskox is maintained by deploying radio collars (Telonics MOD-600, collar adjustment range 28–40 inches) on cow muskox ≥3 years of age in Units 22C, 22D, and 22B. Female muskox 30–40 months of age are targeted for capture in order to maintain a known-age sample of females. Captures are conducted using ground-based capture techniques in accordance with the DWC capture protocol for muskoxen and Institutional Animal

Care and Use Committee (IACUC) protocols submitted for approval annually (#2014-18, #2015-35, #2016-37, and #0075-2018-69).

Most captures completed during RY14–RY18 used a combination of carfentanil and xylazine. A drug study was completed in 2018 to determine the appropriate dose and drug combination to use with thiafentanil for muskox captures (B. Parr and B. Dunker, Wildlife Biologist 3, ADF&G, Nome, 2018 muskox thiafentanil drug trial memorandum, 3 January 2019).

The location and status of collared muskox were monitored with radiotracking flights using fixed-wing department aircraft based in Nome. Radiotracking flights have a scheduled frequency of at least 2 flights per month. Annual survival estimates were calculated for a 12-month collar-year period (October–September). Collared muskox with an unknown fate (not mortality, i.e., collar died, muskox slipped collar, muskox left study area and was not detected again) and hunting mortalities were censored from the sample and not included when estimating survival (Gorn and Dunker 2015). The proportion of muskox that survived annually is reported with 95% confidence intervals. In the event a mortality is detected, mortality sites are visited promptly after detection to determine the timing and cause of mortality.

Results and Discussion

Collars deployed during the reporting period (RY14–RY18) include 11 in 2014, 9 in 2015, 9 in 2016, and 5 in 2018. Capture efforts were not initiated in 2017 due to a limited number of 30-month-old cows available for capture as determined by field observations and estimates of short-yearling recruitment from the 2015 composition survey. The average survival rate observed during the RY14–RY18 reporting period was approximately 92% (Table 5).

Table 5. Annual survival rates of adult female muskox in the Seward Peninsula muskox population, Alaska, 2008–2019.

Year	Active collars	Survival rate	95% Confidence interval
2008	23	91%	72–99%
2009	23	96%	78–100%
2010	22	77%	55–92%
2011	27	74%	54–89%
2012	19	84%	60–97%
2013	22	95%	77–100%
2014	25	76%	55–91%
2015	28	89%	72–98%
2016	34	94%	80–99%
2017	40	90%	76–97%
2018	35	91%	77–98%
2019	35	94%	81–99%

Declines in abundance from 2010–2012 (Fig. 2) corresponded to low estimates of adult female survival in 2010 and in 2011 (Table 5). The timing of mortality is believed to indicate that brown bear predation is a likely cause of mortality in adult female muskox. The month that mortality occurred was identifiable for 10 of 16 mortality events that occurred during the reporting period;

of those 10 mortality events, 9 occurred between the months of April and October. It is difficult to identify the primary cause of mortality unless the mortality site visit occurs within 1–10 days after death, which is often not possible.

The degree to which these results are representative of survival rates throughout the range of SPMP is limited by several factors. The average number of collars deployed on SPMP ($\bar{x} = 32$) during the reporting period represents 1% of the Seward Peninsula population based on the 2017 population estimate (Fig. 2). Collars are not randomly distributed throughout the population so localized events such as icing, deep snow, or different predator regimes may influence the observed survival rates. Lastly, the selection of animals for capture is not truly random, as obviously injured or diseased animals were intentionally not selected for collaring (Gorn and Dunker 2015).

Recommendations for Activity 1.3

Modify. Deploying GPS-enabled collars in the future would allow us to expand the distribution of the collared sample beyond the range of what can reasonably be monitored using fixed-wing aircraft. GPS collars may also reduce the time between when a mortality event occurs and when staff are able to complete a kill-site visit. Furthermore, it would allow us to monitor movement, range expansion, and habitat use throughout a larger portion of the population's range.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor harvest data and improve harvest reporting through public education and improved communication.

Data Needs

Accurate harvest reporting is necessary to understand patterns and levels of harvest. This also assists hunt managers with their understanding of sustainable harvest rates which are used to manage hunts.

Methods

During this reporting period (RY14–RY18) hunter harvest within the SPMP range was monitored with Tier I (RX104) and Tier II permits (TX095, TX096, TX102, TX103, TX104, TX105 and TX106) issued by the department. Harvest data from these hunts were compiled in ADF&G's Wildlife Information Network (WinfoNet) muskox harvest database. Hunters who did not report on their permits were contacted by the department. Harvest was monitored cooperatively with federal hunt administrators and the department cooperated with enforcement efforts of the Alaska Wildlife Troopers during the hunting season.

Education and outreach activities for state administered hunts occurred annually during the Tier II subsistence permit application period (1 Nov–15 Dec). The Alaska Subsistence Permit Hunt Supplement was distributed each season to permit vendors and posted to the department website (hunt.alaska.gov). These publications provided detailed information about the application process, hunt areas, season dates, and hunt conditions. In addition, department staff traveled to each of 8 remote communities within the hunt area (Shishmaref, Wales, Brevig Mission, Teller, White Mountain, Golovin, Elim, and Koyuk) and visited with hunters interested in applying for

Tier II muskox permits. Staff answered questions regarding the application process and reviewed permit conditions. Department staff were also available at the Nome ADF&G office to answer questions and assist with the application process throughout the application period.

Season and Bag Limit

Table 6. Generalized regulatory language in 5 AAC 85.050 (2), regulatory years 2014–2018, Unit 22, Alaska.

Units and bag limits	Resident open season subsistence and general hunts	Nonresident open season
(2)		
Unit 22(A) and Unit 23 that portion south and west of the Kobuk River drainage and North and east of the Buckland River drainage	No open season	No open season
Units 22(B), 22(C), and 22(D) and Unit 23, Southwest, that portion on the Seward Peninsula west of and including the Buckland River drainage, as follows:		
If the harvestable portion is 99 muskoxen or less:		
1 muskox by Tier II subsistence hunting permit only	1 Aug–15 Mar (Subsistence hunt only)	No open season
If the harvestable portion is greater than 99 muskoxen but less than 151 muskoxen:		
1 muskox by registration permit only	1 Aug–15 Mar (Subsistence hunt only)	No open season
If the harvestable portion is greater than 150 muskoxen:		
1 muskox by registration permit only;	1 Aug–15 Mar (Subsistence hunt only)	No open season
or		
1 bull 4-year-old or older by drawing permit only; up to 60 permits may be issued; 10 percent of animals may be issued to nonresident hunters, in combination with Unit 22(E)	1 Aug–15 Mar	1 Aug–15 Mar

-continued-

Table 6. Page 2 of 2.

Units and bag limits	Resident open season subsistence and general hunts	Nonresident open season
Unit 22(E)		
If the harvestable portion is 9 muskoxen or less:		
1 muskox by Tier II subsistence hunting permit only	1 Aug–15 Mar (Subsistence hunt only)	No open season
If the harvestable portion is greater than 9 muskoxen, but less than 26 muskoxen:		
1 muskox by registration permit only	1 Aug–15 Mar (Subsistence hunt only)	No open season
If the harvestable portion is greater than 25 muskoxen:		
1 muskox by registration permit only;	1 Aug–15 Mar (Subsistence hunt only)	No open season
or		
1 bull 4-year-old or older by drawing permit only; up to 60 permits may be issued; 10 percent of the permits will be issued to nonresident hunters, in combination with Units 22(B), (C), and (D) and Unit 23, that portion on the Seward Peninsula west of and including the Buckland River drainage	1 Aug–15 Mar	1 Aug–15 Mar

Table 7. Specific hunts administered during regulatory years 2014–2018, Unit 22, Alaska.

Units and bag limits	Resident open season subsistence and general hunts	Nonresident open season
Unit 22A	No open season	No open season
Unit 22B, that portion east of the Darby Mountains, including drainages of Kwiniuk, Tubutulik, Koyuk and Inglutalik rivers		
1 bull by Tier II permit only (TX105)	1 Aug–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 22B		
1 bull by Tier II permit only (TX105)	1 Jan–15 Mar (Subsistence hunt only)	No open season
Unit 22C Inner Nome Area, that portion of the Snake River drainage downstream of the Glacier Creek confluence and including the Glacier Creek drainage, that portion of the Nome River drainage downstream of and including the Basin Creek and Shephard Creek drainages, and all drainages flowing directly to Norton Sound between the mouths of the Nome River and the Snake River.		
1 bull, by bow and arrow, muzzleloader, or shotgun only, by Tier II permit only (TX095, TX096)	1 Aug–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 22C	No open season	No open season
Unit 22D Southwest, that portion west of the Tisuk River drainage, west of the west bank of Canyon Creek beginning at McAdam's Creek continuing to Tuksuk Channel		
1 bull by Tier II permit only (TX103)	1 Jan–15 Mar (Subsistence hunt only)	No open season

-continued-

Table 7. Page 2 of 2.

Units and bag limits	Resident open season subsistence and general hunts	Nonresident open season
Unit 22D, Kuzitrin River drainage		
1 bull by Tier II permit only (TX102)	1 Jan–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 22D		
1 bull by Tier II permit only (TX102)	1 Aug–15 Mar (Subsistence hunt only)	No open season
Unit 22E		
1 bull by Tier I registration permit only (RX104, Administered RY14–RY17)	1 Aug–15 Mar (Subsistence hunt only)	No open season
Unit 22E		
1 bull by Tier II registration permit only (TX104, Administered RY18)	1 Aug–15 Mar (Subsistence hunt only)	No open season
Unit 23 Southwest, that portion on the Seward Peninsula west of and including the Buckland River drainage		
1 bull by Tier II permit only (TX106)	1 Aug–15 Mar (Subsistence hunt only)	No open season

Subsistence hunt conditions:
1. Subsistence hunts open to Alaska residents only.
2. Tag fee waived for subsistence hunting.
3. One muskox permit per hunter per calendar year.
4. Season will be closed by emergency order when quota is reached.
5. All Skulls require trophy destruction be completed at the kill site subject to permit conditions
6. Aircraft may not be used to transport muskox hunters, muskox, or muskox hunting gear.

Results and Discussion

Permit Hunts

Tier I and Tier II permits were issued for hunts administered in Units 22B, 22C, 22D, 22E, and Unit 23 southwest during RY14–RY18. Federal registration permits were issued to federally qualified subsistence users by U.S. Bureau of Land Management (BLM) and National Park Service (NPS). Trophy destruction was required to be completed before leaving the kill site for all muskoxen taken in Tier I and Tier II muskox hunts within the range of SPMP.

The combined number of permits issued annually is agreed upon among all cooperating agencies administering hunts within the range of the SPMP. Harvest guidelines adopted in RY12 recommend that harvest rates for the SPMP be maintained at or below 2% with harvest not to exceed 10% of the mature bulls in the population. The harvestable surplus is estimated for the population as a whole and then distributed among the individual hunt areas based on their respective abundance and composition estimates.

Guidelines in the Seward Peninsula Muskox Cooperative Management Plan and recommendations from entities including the Seward Peninsula Muskox Cooperators Group as well as local Advisory Council and Advisory Committee have been used to determine the distribution of permits among the state and federal permitting systems. During RY14–RY18, the number of state permits issued annually was equal to the estimated harvestable surplus. Federal hunt administrators issued approximately one-third of the estimated harvestable surplus as federal registration permits in addition to the state permits issued.

RY14–RY17 muskox hunting in Unit 22E was administered as a Tier I registration permit hunt. A limited number of permits were issued on a first come first served basis at license vendors in Wales and Shishmaref. Beginning in RY18, muskox hunting in Unit 22E was administered as a Tier II permit. The change in hunt administration followed 3 consecutive years during which the estimated harvestable surplus was below the lower end of the nested ANS for Unit 22E (10–25 muskox). Population trend information for Unit 22E suggested that the harvestable surplus was unlikely to exceed 10 bulls in the foreseeable future and that transitioning to a Tier II hunt administration was prudent.

Tier II subsistence hunts in Unit 22C were modified in RY14 to address muskox conflicts in the vicinity of Nome. Members of the public expressed a desire to allow for the harvest of muskox near Nome during the summer and early fall when these animals oftentimes pose a threat to public safety. The areas close to Nome had historically been closed to hunting during RY01–RY11 to allow for muskox viewing opportunities. Harvesting muskox during the summer and early fall in this historically closed area was intended to deter muskox from frequenting the area. The open season for muskox hunting by Tier II subsistence permit in Unit 22C was extended from 1 January–15 March to 1 August–15 March. The open area for TX096 was expanded to include the Inner Nome Area, a weapons-restricted hunt area.

Harvest by Hunters

The harvestable surplus of muskox within the portion of the SPMP range where hunting is allowed (Units 22B, 22C, 22D, 22E, 23SW, and the Expanded Area) averaged 36 bull muskox

during RY14–RY18. An average combined total of 48 state Tier I, state Tier II, and federal registration permits were issued annually during RY14–RY18. The average annual combined state and federal reported harvest was 27 muskox and a 56% success rate. This is 1.4% of the 2017 estimated abundance of muskox within the 'core count area', and 8% of the 2017 estimated population of mature bulls within the 'core count area' (Fig. 3).

The harvest guidelines implemented in RY12 were met during each year within RY14–RY18. General harvest information for specific hunt types (Tier I and Tier II), harvest history, harvest by residency, hunt area harvest, harvest chronology, and transportation methods used are available to the public for hunt planning on the ADF&G website: https://secure.wildlife.alaska.gov/index.cfm?adfg=harvest.main.

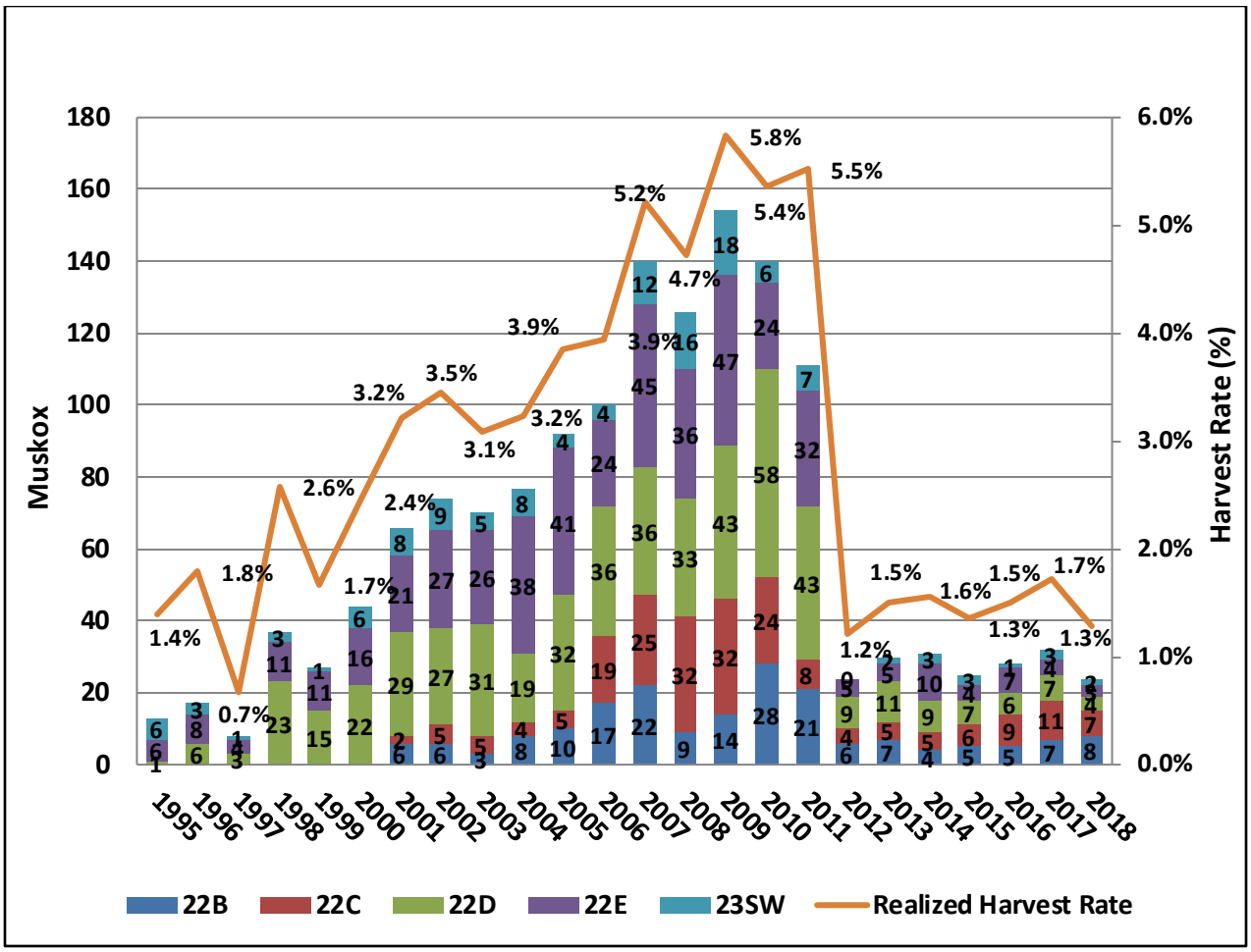

Figure 3. Seward Peninsula muskox population total annual harvest, 1995–2018.

Other Mortality

The killing of muskox in defense of life and property (DLP) on the Seward Peninsula is not uncommon. When necessary, muskox that pose a threat to public safety may be removed by department staff. During RY14–RY18 there were 5 DLP shootings of muskox (4 in Nome, 1 in Wales) and 2 agency removals (Nome). All 5 DLP shootings were a consequence of an

encounter in which muskox attacked or were aggressive toward dogs housed outdoors. The 2 agency removals involved mature bulls in early August. This is the early part of the breeding season for muskox. During this time, muskox bulls are easily agitated and often times respond aggressively when disturbed.

Alaska Board of Game Actions and Emergency Orders

In November 2011, BOG adopted hunting regulations that provided the department the flexibility to manage hunts based on the number of muskox available for harvest relative to ANS. This included drawing permit hunts, and either Tier II subsistence permit hunts, Tier I subsistence permits hunts, or a combination of subsistence Tier I and Tier II permit hunts. The board also added all of Unit 22A and the portion of Unit 23 south and west of the Kobuk River drainage to the area defined in regulation as having a positive customary and traditional use determination for muskox.

No additional actions that affect Seward Peninsula muskox were taken by the BOG during RY14–RY18. Detailed meeting information and board actions affecting Seward Peninsula muskox can be found at the Alaska Department of Fish and Game website: http://www.adfg.alaska.gov/index.cfm?adfg=gameboard.meetinginfo.

No emergency orders were issued for permit hunts administered within the range of SPMP during RY14–RY18. Changes to the hunt area and season dates for Tier II subsistence permit hunts TX095 and TX096 were made prior to the start of the hunt and distribution of permits. Due to the limited number of permit holders affected by this regulatory change, permit holders were notified of the regulatory change and the department released an advisory announcement.

Recommendations for Activity 2.1

Modify. The hunt area currently covered by Tier II permit TX105 includes all of Unit 22B. Muskox are not evenly distributed throughout the hunt area. Muskox are commonly observed in either management area '22B West' or in the easternmost portions of management area '22B East' in the Nulato hills and South of Granite Mountain. Few muskox have been observed in the Kwiniuk River and Tubutulik River drainages in the central portion of the unit. The abundance of muskox in the '22B East' management area has increased as the distribution of the population has shifted south and east over time. During RY14–RY18 only 2 muskox were harvested from '22B East' for an estimated 16% success rate for permit holders. Additional opportunity may be provided to allow for the take of the harvestable surplus from the area. However, issuing additional permits given the current structure of the hunt may require emergency order closure of the hunt in '22B West'. Closures may be necessary given the level of interest in the area, its proximity to Nome, and the higher estimated success rates observed during RY14–RY18 (54%). The preferred method for directing additional effort specifically to '22B East' would be to create a separate hunt in the area and issue any additional permits necessary for that area specifically.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Nome area DWC staff regularly respond to public safety concerns regarding muskox in the Nome Area. Reports are received directly at the Nome ADF&G office during regular business hours and after-hours reports are provided to staff by the Nome Police Department. Each situation is unique and requires careful consideration to determine the most appropriate response.

Typically, muskox that pose a threat to public safety are moved to an area where the threat to public safety is reduced. These efforts often include herding the animals away from homes and private property and hazing the animals with nonlethal deterrents. This is considered a short-term solution intended to eliminate an immediate threat to public safety. The department has several options for removing an animal that poses a persistent threat to public safety when the situation arises. If viable alternatives cannot be identified, staff may decide to kill the animal. If time allows and the animal's removal is determined to be the most appropriate course of action, then department staff will facilitate harvest of the animal for subsistence uses. During the 1 August–15 March TX095/TX096 season, department staff directly contact permit holders regarding any muskox available for harvest that poses a threat to public safety. Alternatively, the department may issue a public safety permit in accordance with 5 AAC 92.033. Public safety permits are issued using the TX095 allocation order for the current regulatory year. Potential permittees are contacted in descending order beginning with the next eligible applicant in the allocation order until a permittee that meets and agrees to the conditions of the permit as determined by department staff is identified.

Educating the public about steps they can take to reduce their risk in situations involving muskox is an important component of our approach to mitigating muskox conflicts. Such efforts are accomplished through the distribution of muskox safety and viewing informational materials; social media; muskox safety presentations for 4th and 5th grade students; and consultations with local organizations, Nome area residents, and law enforcement officials. The information included in this outreach can be found online at: http://www.adfg.alaska.gov/index.cfm?adfg=livewith.muskoxen.

Several management actions have been taken in an effort to mitigate the public safety concerns associated with muskox in the local areas around Nome. It has been suggested that muskox may move into areas around Nome to seek refuge from brown bear predation. This may be particularly true during the calving period which begins in late April and continues into the early part of June. This was an important consideration when evaluating proposals submitted by members of the public intended to liberalize brown bear hunting regulations in Unit 22C during the 2014 and 2017 Arctic and Western Region board cycle. The Unit 22C brown bear hunting regulations were liberalized by the Board of Game in 2015 to allow hunters to harvest 1 brown bear every regulatory year. The board liberalized brown bear hunting again in 2017 when the Unit 22C spring bear hunting season was extended, with an open spring bear hunting season of 1 April–31 May. Brown bear harvest appears to have increased in response to these regulatory changes and will need to be evaluated in the future to determine whether these increases in harvest have an impact on the number of conflicts with muskox in the Nome area.

Changes were also made during the RY14–RY18 reporting period to the Unit 22C muskox hunting regulations in response to the public's desire for hunters to harvest muskox during the time of year when conflicts with muskox in the Nome area are common (May–September). In RY14, the TX095 and TX096 Tier II permit hunt season was expanded to open 2 months earlier, with a new season of 1 August–31 March. The TX096 hunt area was also expanded to include the Inner Nome area, which is a weapons-restricted hunt area that includes the immediate area around Nome. This created a larger pool of permitted hunters that were eligible to harvest muskox from the immediate area around Nome. Hunter harvest during the 1 August–30

September time period has been very low. A total of 46 TX095 and TX096 permits were issued during RY14–RY18; however, only 2 muskox were harvested during August–September.

Data Recording and Archiving

All electronic files such as survey memoranda, reports, survey data, and maps are located on the Nome server (V:\WILDLIFE\MUSKOX). All hard copy data sheets, paper files, etc. are stored in a file cabinet in the ADF&G office in Nome.

Agreements

Contributions to survey and inventory activities from NPS were made through a Cooperative Agreement (P17AC00139).

Permitting

Institutional Animal Care and Use Committee (IACUC) protocols #2014-18, #2015-35, #2016-37, and #0075-2018-69

Conclusions and Management Recommendations

Despite several years of conservative harvest strategies, the Seward Peninsula Muskox Population has remained stable since the initial population decline observed in 2012. Though the mature bull-to-cow ratio has increased during the RY14–RY18 reporting period, population growth has not followed a similar trend. Research should be initiated to investigate the limiting factors of the SPMP and should focus on influences on recruitment rates.

Muskox abundance and composition surveys should be moved to a 4-year cycle from a 2-year cycle unless vital rates warrant more frequent assessment of the population. Attempting to complete both a moose and muskox abundance survey involves a great deal of effort and cost to ADF&G staff and weather has become increasingly unpredictable in the spring months. Changing the muskox abundance and composition survey schedule to occur once every 4 years would allow staff to focus on assessing one population per year and could increase the likelihood of the survey being completed that year. Additionally, as time allows efforts to detect muskox groups outside of the suspected SPMP range should be conducted to ensure the census area includes all areas that muskox may be found in Unit 22 and adjacent units to the south and west as their range continues to expand. Finally, consultation with biometricians should occur to review the current distance sampling methodology for the muskox abundance survey and determine how efficiency can be increased.

Muskoxen have become increasingly abundant in and around the vicinity of Nome, and as a result conflicts between nuisance muskox and dogs or humans have become commonplace. As many as 100 muskoxen have been observed near Nome in the summer months. The Tier II hunts in the Inner and Outer Nome areas (TX095 and TX096, respectively) were designed to address nuisance muskox issues, but permit holders prefer to harvest their muskox in the winter months when muskoxen are not in residential areas or considered a nuisance. ADF&G staff dedicate large amounts of time in the summer moving muskox out of residential areas as locals call and

report muskox conflicts in residential areas or near dog lots. Managers should continue to assess the trend of muskox near Nome and work with the Cooperators to reduce nuisance muskox issues while still allowing for muskox viewing and nonconsumptive uses of muskox.

II. Project Review and RY19–RY23 Plan

Review of Management Direction

MANAGEMENT DIRECTION

The RY14–RY18 management direction and goals for SPMP were generally appropriate and continue to follow the guidance provided by the Seward Peninsula Muskox Cooperators Group and the Seward Peninsula Cooperative Muskox Management Plan. Working within this framework both the state and federal regulatory bodies have effectively provided for harvest opportunities consistent with applicable state and federal laws while also addressing specific management needs as necessary through time.

During the 2020 Interior and Eastern Arctic Alaska Board of Game meeting regulations were adopted that allow for the harvest of muskox in Units 22A, 21D, and 24D, which were previously closed to muskox hunting. At this meeting, the board also made a negative customary and traditional use determination for muskox in Units 21D and 24D.

GOALS

Goals for RY19–RY23 are as follows:

G1. Allow for continued growth and range expansion of the SPMP.

G2. Provide for sustained yield harvest in a manner consistent with existing state and federal laws by following the goals and objectives endorsed by the Seward Peninsula Muskox Cooperators Group and the Seward Peninsula Cooperative Muskox Management Plan (ADF&G 1994).

G3. Manage muskoxen along the Nome road systems in Units 22B and 22C for viewing, education, and other nonconsumptive uses.

G4. Work with local reindeer herding interests to minimize conflicts between reindeer and muskoxen.

G5. Protect and maintain the habitats and other components of the ecosystem upon which muskoxen depend.

G6. Encourage cooperation and sharing of information among agencies and users of the resource in developing and executing management and research programs.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

A positive customary and traditional use determination has been made for muskox in Unit 22 and Unit 23 south and west of the Kobuk River drainage. The amount reasonably necessary for subsistence (ANS) is set at 100–150 muskox with a nested ANS of 10–25 in Unit 22E (5 AAC 99.025).

A negative customary and traditional use determination has been made for muskox in Units 21D and 24D.

Intensive Management

Muskox are not eligible for intensive management programs.

MANAGEMENT OBJECTIVES

The RY14–RY18 management objectives for SPMP were generally appropriate. The addition of specific sex and age composition and sampling objectives will allow us to evaluate whether individual management objectives have been met. Board action taken during the 2020 Interior and Eastern Arctic Alaska Board of Game meeting requires that our management objectives regarding the administration of hunts within the range of SPMP be expanded to include Unit 22A.

The management objectives during RY19–RY23 will be as follows:

M1. Complete population surveys at 4-year intervals to document changes in abundance and distribution (modified from 2-year intervals during RY14–RY18).

- Sampling should be sufficient to allow for the abundance of muskox throughout the range of the population to be estimated with a relative precision of ≤15%.
- Complete rangewide composition surveys at 4-year intervals to monitor mature bull:100 cow ratios and recruitment.
- Rangewide composition surveys should be completed with sufficient sampling to estimate the proportion of short yearlings ($\hat{p}_{ShrtYrl}$) and the proportion of mature bulls ($\hat{p}_{MB}$) with a 95% confidence interval of ±5%.
- Manage the muskox harvest to maintain mature bull-to-100 cow (MB:100C) ratios at or above 40:100.

M2. Participate in the Muskox Cooperators Group meetings and facilitate exchange of information and ideas among agencies and user groups.

M3. Administer Tier I/II subsistence hunts in Units 22A, 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.

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Estimate population abundance and distribution (Goals G1, G2, G6, and Objectives M1, M4).

Data Needs

No change from RY14–RY18. Population survey information from within the known range of SPMP will serve 3 primary roles: 1) to inform the public, cooperating federal agencies, advisory committees, and the Alaska Board of Game about the status, trend, and distribution of the population; 2) to estimate the harvestable surplus, set harvest quotas, and provide recommendations for permit issuance; and 3) provide a sample of muskox groups to allow for completing sex and age composition surveys.

Methods

Aerial survey methods and analyses will be the same as those described in the RY14–RY18 Management Report (above). Transect spacing will be increased from 4 miles to 5 miles to increase survey cost- and time-efficiency. Surveys will also only occur once every 4 years unless drastic changes in the muskox population warrant more frequent surveys. The next muskox census and composition surveys are scheduled to be completed in the spring of 2021 and 2024.

ACTIVITY 1.2. Monitor the sex and age composition of the population (Goals G1, G6 and Objectives M2 and M4).

Data Needs

No change from RY14–RY18. The completion of composition surveys within the known range of SPMP will serve 3 primary roles; 1) to inform the public, cooperating federal agencies, advisory committees and the Alaska Board of Game about the sex and age composition of the population, 2) to estimate the number of mature bulls in the population as needed to determine the harvestable surplus, set harvest quotas, and provide recommendations for permit issuance, and 3) to estimate the proportion of 10-month-old calves ($\hat{p}_{shrtyrl}$) in the population as an index of recruitment in order to evaluate the status and trend of the population.

Methods

Ground-based composition surveys are to be conducted throughout the range of SPMP every 4 years in conjunction with the SPMP distance sampling survey (Activity 1.1).

Beginning in RY21 new hunt opportunities will be provided in the SPMP range. As a result, Units 22A and 21D should be the focus of any supplemental composition surveys completed annually to monitor the effects of harvest on the sex and age composition of the population. Reconnaissance flights will be completed in order to locate enough muskox groups for eventual composition sampling.

Composition surveys will be completed in early spring after the close of hunting, but prior to calving (15 March–15 April). Muskox groups observed prior to the completion of composition

surveys will be divided into 3 classes based on group size: small (1–16 muskox), medium (17–33 muskox), and large (≥34 muskox). Individuals from each group class will be selected in proportion to the number of groups encountered in each group class during the population survey and reconnaissance flights. Groups will be randomly selected.

Sampling objectives for individual areas will be as follows:

- Units 22E, 22D, and 22C, as well as management area '22B West' will be sampled independently with the objective of classifying a proportional sample of 150 muskox from each area.
- Management areas '22A', '22B East' and '21D, Nulato Hills E' will be sampled collectively with the objective of classifying a proportional sample of 150 muskox from the combined area.
- Management areas '23 Southwest' and '23 Other, 24' will be sampled collectively with the objective of classifying a proportional sample of 150 muskox from the combined area.
- The combined sample of muskox from the above-mentioned subsets of the overall study area will be used as the sample for rangewide composition surveys completed in conjunction with the SPMP distance sampling survey during the RY19–RY24 plan period. The overall sampling objective for rangewide surveys should be 500–900 muskox.

This will reduce our range wide sampling objective from a maximum of 1,500 muskox to a maximum of 900 muskox. Groups will be accessed either by snowmachine or R-44 helicopter to complete ground-based composition surveys. A team of 2 trained observers will use binoculars and a spotting scope to classify muskoxen into one of 8 sex/age classes[2] based on body size, horn characteristics, and conformation. Small groups composed of bulls only should be classified from fixed-wing aircraft when first observed and randomly included in the composition sample.

ACTIVITY 1.3. Monitor collared adult female muskox (Goals G6 and Objectives M1).

Data Needs

No change from RY14–RY18. Monitoring adult female survival on an annual basis allows the department to monitor the population status and trend during years in between abundance and composition surveys. Monitoring these collars also provides information about distribution patterns, individual and group movements, timing, and causes of mortality. It also facilitates the completion of other S&I activities. Adequate adult female muskox survival rates will be considered anything above 85%.

[2] Sex/age classifications: 1) bull ≥ 4-years old (mature bulls, MB), 2) bull = 3-years old, 3) bull = 2-years old, 4) cow ≥ 4-years old, 5) cow = 3-years old, 6) cow = 2-years old, 7) 10-month-old calves (short yearlings (ShrtYrl), and 8) calves.

Methods

A sample of 20–30 collared adult female muskox will be maintained by deploying GPS enabled radio collars (Telonics TGW-4660-4, collar adjustment range 28–40 inches) on cow muskox ≥3 years of age in Units 22B, 22C, 22D, and 22E. Female muskox 30–40 months of age will be targeted for capture in order to maintain a known-age sample of females. Captures are to be conducted using ground-based capture techniques in accordance with the DWC capture protocol for muskoxen and Institutional Animal Care and Use Committee (IACUC) protocols submitted for approval annually.

The location and status of collared muskox will be monitored either during aerial radiotracking flights using fixed-wing aircraft, ground-based radio tracking efforts conducted along the Nome road system, or satellite-based mortality and location information uploads. Radiotracking flights have a scheduled frequency of at least 2 flights per month. Annual survival estimates will be calculated for a 12-month collar-year period (October–September). Collared muskox with an unknown fate (not mortality, i.e., slipped collar, collar died, or muskox left area and was not detected again) and hunting mortalities will be censored from the sample and not included when estimating survival (Gorn and Dunker 2015). The proportion of muskox that survived annually will be reported with 95% confidence intervals. Mortality sites are to be visited promptly after detection to determine the timing and cause of mortality.

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor harvest data and improve harvest reporting through public education and improved communication (Goal G2 and Objectives M1 and M3).

Data Needs

No change from RY14–RY18. Accurate harvest reporting is necessary to understand patterns and levels of harvest. This also assists hunt managers with their understanding of sustainable harvest rates which are used to manage hunts.

Methods

Board action will require that the department begin administering a hunt in Unit 22A in accordance with the regulatory changes made during the 2020 Interior and Eastern Arctic Board of Game meeting (5AAC 85.050 (2)). Except for those changes brought about by this board action, there has been no changes to the methods used to administer hunts within the range of the SPMP.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

Strategies and management changes were adopted or implemented during RY14–RY18 to address conflicts with muskox. Education and outreach activities remain the backbone of these efforts and should continue. No other changes to the methods used to address this issue are expected for the plan period. Documentation of incidences involving muskox should continue to be a priority to effectively track the effects of management strategies implemented over time.

Data Recording and Archiving

RECORDING

- ArcGIS version 10.6 will be used to store and analyze spatial data.

ARCHIVING

- All electronic files such as survey memoranda, reports, survey data, and maps are located on the Nome server (V:\WILDLIFE\MUSKOX). All hard copy data sheets, paper files, etc. are stored in a file cabinet in the ADF&G office in Nome.

Agreements

The cooperative agreement with NPS is due to expire in 2021. In the future, additional agreements of this sort will be considered pending department review.

Permitting

Institutional Animal Care and Use Committee (IACUC) protocols are submitted for approval annually (#2014-18, #2015-35, #2016-37, and #0075-2018-69).

Acknowledgments

The long-standing cooperative nature of muskox management on the Seward Peninsula requires close cooperation and coordination between the department and federal cooperators including the BLM, NPS, and USFWS. Thanks goes to Josh Schmidt, Bruce Seppi, Letty Hughes, Ken Atkinson, Jeanette Koelsch, Bruce Ubelaker, Tom Sparks, Ed Mallek, and Brad Scotten for their contributions to the SPMP S&I program. The department relies heavily on the contributions of various pilots from across the state to complete surveys for muskox on the Seward Peninsula including Eric Sieh, Andy Greenblat, Jared Cummings, Jesse Cummings, Lance Williams, Russell Rowe, and Patrik Toerdal. Department staff have also contributed substantial portions of their time in support of SPMP S&I activities including Lincoln Parrett, Warren Hansen, Brynn Parr, and Sara Germain. Much of the work outlined in this document is a continuation of efforts by previous Unit 22 area biologists to better understand the SPMP and inform management. A special thanks is due to Tony Gorn for his work laying the foundation for the SPMP S&I program as it exists today.

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Appendix. Composition estimates for muskox in Units 22A, 22B, and 22C, Alaska, 2002–2019.

Unit	Year	Mature bulls: 100 cows	Short-yearlings: 100 cows	Proportion of short yearlings	95% CI[a]	Proportion of mature bulls	95% CI[a]
22A	2012	69	69	23%	15–31%	23%	15–31%
22A	2015	64	21	8%	6–10%	24%	21–27%
22A	2017	48	32	15%	11–19%	23%	18–28%
22A	2019	59	28	12%	7–17%	25%	18–32%
22B	2002	58	48	18%	17–19%	22%	20–24%
22B	2004	39	39	18%	13–23%	18%	13–23%
22B	2007	48	35	15%	14–16%	21%	20–22%
22B	2009	38	26	11%	6–16%	17%	12–22%
22B	2010	30	25	14%	11–17%	17%	13–21%
22B	2012	28	19	10%	8–12%	16%	13–19%
22B	2015	44	12	6%	4–8%	22%	18–26%
22B	2017	44	13	7%	5–9%	25%	22–29%
22C	2002	70	57	19%	17–21%	23%	20–26%
22C	2004	86	26	10%	6–14%	32%	26–38%
22C	2007	57	37	16%	15–17%	25%	24–26%
22C	2008	31	33	16%	12–20%	15%	11–19%
22C	2009	35	19	9%	6–12%	16%	12–20%
22C	2011	21	32	17%	13–21%	11%	8–14%
22C	2012	26	22	12%	10–14%	14%	12–16%
22C	2015	45	7	4%	2–6%	26%	21–31%
22C	2017	47	22	11%	8–14%	23%	19–27%
22D	2002	33	41	19%	17–21%	15%	13–17%
22D	2006	42	36	16%	13–19%	19%	16–22%
22D	2010	54	18	9%	6–12%	26%	21–31%
22D	2011	29	24	13%	10–16%	15%	12–18%
22D	2012	22	13	8%	5–11%	13%	10–16%
22D	2015	26	19	11%	9–13%	15%	12–18%
22D	2017	27	38	19%	16–21%	13%	11–15%
22E	2002	49	49	17%	14–20%	17%	14–20%
22E	2005	35	32	15%	13–17%	16%	14–18%
22E	2010	51	32	15%	12–18%	23%	20–26%
22E	2011	53	59	21%	17–25%	19%	15–23%
22E	2012	33	28	13%	10–16%	15%	12–18%
22E	2015	39	21	10%	6–14%	18%	13–23%
22E	2017	29	62	28%	22–33%	13%	9–17%
23SW	2002	33	31	14%	12–16%	15%	13–17%
23SW	2010	19	18	11%	9–13%	11%	9–13%
23SW	2011	22	10	6%	2–10%	13%	7–19%
23SW	2012	24	22	11%	7–15%	12%	8–16%
23SW	2015	32	26	14%	9–19%	17%	12–22%
23SW	2017	19	24	14%	9–19%	11%	7–16%

[a] CI stands for confidence interval.


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