Species Management Report and Plan ADF&G/DWC/SMR&P–2025–29

Moose Management Report and Plan, Game Management Unit 22:

Report Period 1 July 2015–30 June 2020, and

Plan Period 1 July 2020–30 June 2025

Sara R. Henslee

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Alaska Department of Fish and Game Division of Wildlife Conservation

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PREPARED BY:

Sara R. Henslee
Area Wildlife Biologist

APPROVED BY:

Phillip Perry
Management Coordinator

REVIEWED BY:

Joelle Hepler
Wildlife Research Biologist

PUBLISHED BY:

Susan G. Erben
Technical Reports Editor

Alaska Department of Fish and Game
Division of Wildlife Conservation
PO Box 115526
Juneau, AK 99811

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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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Please contact the authors or the Division of Wildlife Conservation at (907) 465-4190 if you have questions about the content of this report.

Cover Photo: A herd of moose in the Cripple River area near Nome. ©2023 ADF&G. Photo by Sara Henslee.

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose in Unit 22 for the 5 regulatory years 2015–2019 and plans for survey and inventory management activities in the following 5 regulatory years, 2020–2025. A regulatory year (RY) runs from 1 July through 30 June (e.g., RY15 = 1 July 2015–30 June 2016). This report is produced primarily to provide agency staff with data and analysis results to help guide and record its own efforts but is also provided on our website to inform the public about wildlife management activities. In 2016 the Alaska Department of Fish and Game's Division of Wildlife Conservation (ADF&G/DWC) launched this new type of 5-year report to more efficiently report on trends and describe potential changes in data collection activities over the next 5 five years. It replaces the moose management report of survey and inventory activities that was previously produced every 2 two years.

I. RY15–RY19 Management Report

Management Area

Unit 22 encompasses approximately 25,230 mi² of mainland in western Alaska and covers much of the Seward Peninsula and southern Norton Sound. It also includes St. Lawrence Island and Little Diomede, but moose (*Alces alces*) are not present on either of these islands. Unit 22 is divided into 5 administrative units (Units 22A, 22B, 22C, 22D, and 22E; Fig. 1). Mainland terrain varies from rugged mountains and river valleys to flat coastal wetlands. Spruce forests characterize eastern portions of the unit (Units 22A and 22B), while western portions are treeless and largely tundra covered with willow thickets along the riparian corridors.

Summary of Status, Trend, Management Activities, and History of Moose in Unit 22

Before 1930 very few moose were observed on the Seward Peninsula. However, by the late 1960s much of the suitable habitat in Unit 22 contained moose. Moose populations grew rapidly through the early 1980s and peaked in the mid-1980s in most parts of the unit. Severe winters in 1989, 1990, and 1992 caused declines in moose densities, likely because winter browse was insufficient to maintain such large populations, especially in Units 22B and 22D (Nelson 1995). Populations in these areas have never recovered and have currently stabilized at lower densities around 0.3 moose/mi^2. The Units 22A, 22B, and 22C moose populations are currently thought to be increasing, while the Units 22D and 22E moose populations are thought to be stable or declining. Habitat is no longer believed to be a major limiting factor at current population levels; rather, brown bear predation on calves is thought to be a significant factor limiting most Unit 22 moose populations (Gorn 2012).

Although moose have been present in Unit 22 for a relatively short time, they rapidly became an extremely important food source for many Seward Peninsula residents, and demand for moose by subsistence and general season hunters is high throughout the unit. Gravel roads, trails, navigable rivers, and winter trails provide hunters with access to suitable moose habitat.

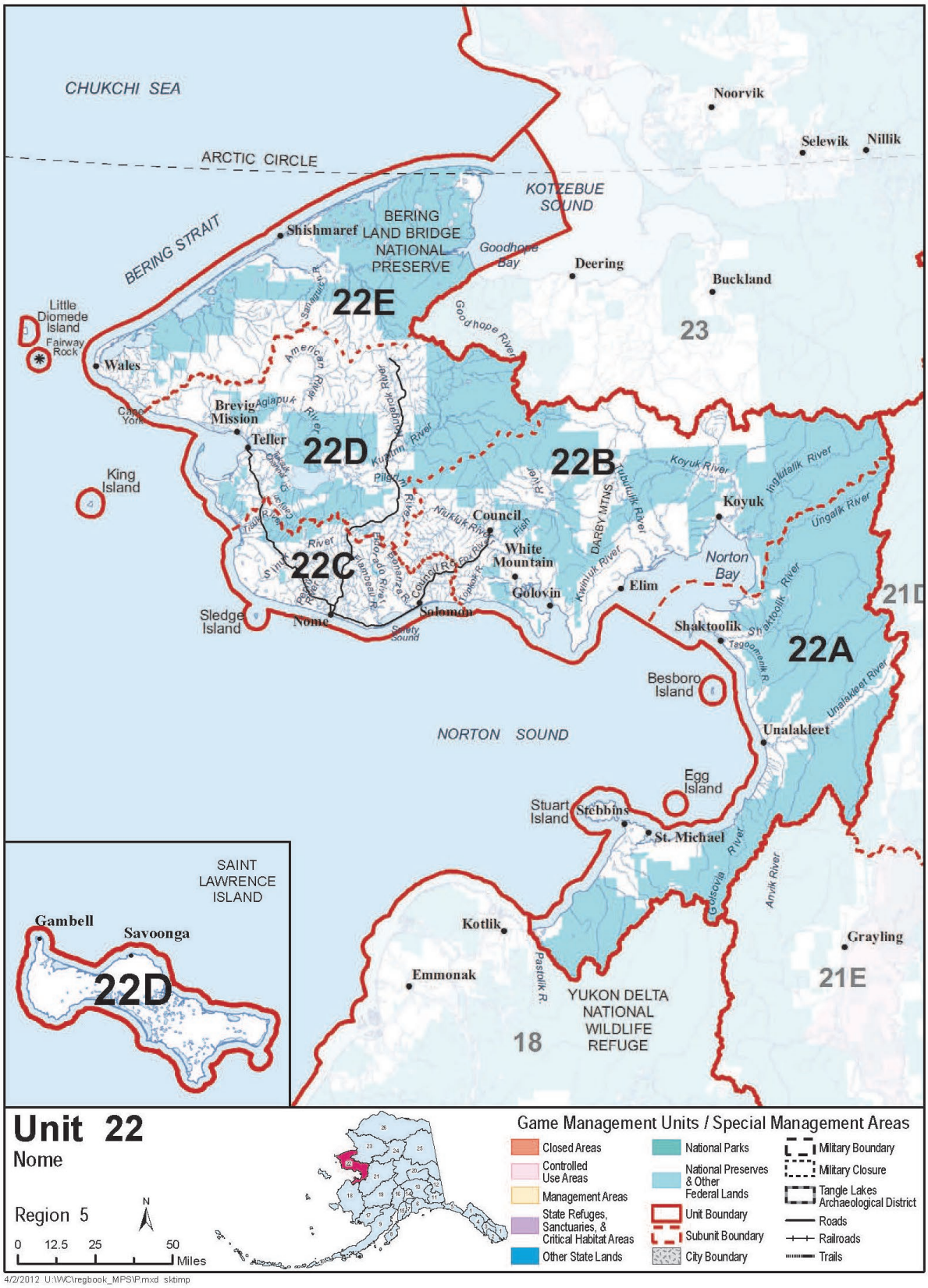

Figure 1. Map of Unit 22 in Northwest Alaska. The city of Nome is on the coast of Unit 22C.

Annual reported harvest has ranged from a low of 44 moose in 1972 to a high of 408 moose in 1986 (Gorn 2012). Beginning in 2001, the continued decline of moose populations first observed in the early 1990s prompted the Alaska Board of Game (BOG) to implement restrictions intended to reduce harvest in many parts of Unit 22.

Hunting restrictions began in the early 2000s when the BOG authorized registration permit hunts with harvest quotas in the most accessible areas of the Unit 22 road system (Unit 22B West [west of and including the Darby Mountains]), Unit 22C, and Unit 22D Kuzitrin River drainage). The fall registration permit hunt in this portion of the unit, with a season that occurs during 1–14 September, was intended to provide hunting opportunity while protecting moose during the rut. Winter registration hunts may be announced during 1–31 January; antlered bull bag limits were authorized during the same time period to allow additional opportunity if harvest quotas were not reached during fall. In Unit 22B West, a permanent winter season with a dedicated portion of the annual harvest quota was created to satisfy the season date preferences of Golovin and White Mountain residents.

Unit 22 residents take most of the annual reported harvest, which has been 150–200 moose since 2002 (Gorn 2012). Community-based subsistence harvest assessment programs were started in 1999 as an attempt to increase harvest reporting from rural community residents. Nonresident hunting opportunity exists, and that hunting effort occurs in portions of Units 22A, 22B, 22D, and 22E. A nonresident season exists in Unit 22C, but it is largely unpopular; the long-term reported harvest indicates less than 1 moose per year is harvested from the area by nonresidents.

Management Direction

Existing Wildlife Management Plans

Direction in the Seward-Kobuk-Noatak moose management plan (ADF&G 1976) has been reviewed and modified through public comments, staff recommendations, and BOG actions over the years. A record of these changes can be found in the division's management report series. The plan portion of this report contains the current management plan for moose in Unit 22.

Goals

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Continue sustained opportunity for the subsistence use of moose.
- Maximize sustained opportunities to participate in hunting moose.
- Maximize opportunities for nonconsumptive use of moose.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Harvest

The BOG in 1987 made a positive Customary and Traditional Use Determination finding for moose in Unit 22 that still remains in effect. The current unitwide Amount Reasonably Necessary for Subsistence (ANS) value was set in 1992 at 250–300 moose.

Intensive Management

In 2001 the BOG adopted a positive finding for intensive management (IM) of moose in Unit 22. Current intensive management objectives are as follows:

- Population objective: 5,100–6,800 moose.
- Harvest objective: 300–680 moose.

MANAGEMENT OBJECTIVES

1. Manage moose populations at the following levels:
    a. Unit 22A: Maintain a population of 600–800 moose.
    b. Unit 22B West (west of and including the Darby Mountains): Maintain a population of 1,000–1,200 moose.
    c. Unit 22B East (east of the Darby Mountains, and including the Kwiniuk, Tubutulik, Koyuk, and Inglutalik river drainages): Maintain a population of 800–3,000 moose.
    d. Unit 22C: Maintain a population of 450–525 moose.
    e. Unit 22D: Maintain a population of 2,000–2,500 moose.
    f. Unit 22E: Maintain a population of 600–800 moose.
    g. Unit 22 (unitwide): Maintain a population of 5,000–7,000 moose.
2. Manage for a posthunt (fall) sex ratio of 30 bulls:100 cows in Units 22A, 22B, 22D, and 22E, and 20 bulls:100 cows in Unit 22C.
3. Monitor percentage of 10-month calves (short-yearlings) in late winter as a measure of calf recruitment in Unit 22 and maintain recruitment at 15%.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Estimate late winter abundance and calf recruitment in at least one survey area annually.

Data Needs

Population abundance estimates are essential for determining sustained harvestable surplus, assessing whether IM objectives have been met, and determining overwinter survival and recruitment, or survival of calves from the previous year that are likely to become part of the harvestable segment of the population. Although abundance estimates are usually obtained in the fall in other parts of the state, poor flying weather and suboptimal snow conditions preclude fall abundance estimates in Unit 22. Instead, spring surveys are completed in February and March in at least one survey area of Unit 22 annually, with the objective to obtain an estimate of moose abundance with ≤15% relative precision. These abundance surveys also allow estimates of the percentage of 10-month (short-yearling) calves as a measure of overwinter calf survival and recruitment into the population.

Methods

Unit 22 is divided into 3 survey areas (Fig. 2). One is a combined survey area of Unit 22B West (west of the Darby Mountains) and Unit 22C (4,189 mi^2), another is a combined survey area of Units 22D and 22E (6,823 mi^2), and a final survey area is composed of Unit 22A Central (2,376 mi^2). Unit 22 moose abundance surveys have been conducted in the spring using the GeoSpatial Population Estimator (GSPE) methodology (Kellie and DeLong 2006) since 1999.

ADF&G staff in Unit 22 have gained an improved understanding of the levels of effort necessary to estimate abundance in low-density moose populations. Optimal allocation analyses conducted for each of the 3 survey areas in Unit 22 recommend sampling 30–45% of the sample units in an area, with a total sample composed of 80–85% high-stratum units and 15–20% low-stratum search units. This level of effort is necessary to obtain an estimate of moose abundance with ≤15% relative precision. This is considerably more effort than is recommended in the Geospatial Survey Operations Manual (Kellie and DeLong 2006) for surveys conducted on higher density, Interior moose populations. Accomplishing these sampling objectives in Unit 22, where winters are often characterized by brief periods of suitable weather and limited resources, is challenging.

Department staff identified Adaptive Cluster Sampling (ACS) as an alternative method for moose abundance surveys. Adapted from Turk and Borkowski (2005) for moose surveys in low-density populations, the ACS methodology uses an initial sample of GSPE grids to enumerate moose and "adapting" to adjacent survey units in each cardinal direction once a predetermined critical value of moose are observed within an initial survey unit.[1] The pilot/observer team then

[1] William Dunker, Wildlife Biologist, ADF&G, 17 December 2020, unpublished Units 22D and 22E ACS moose survey memorandum, Nome.

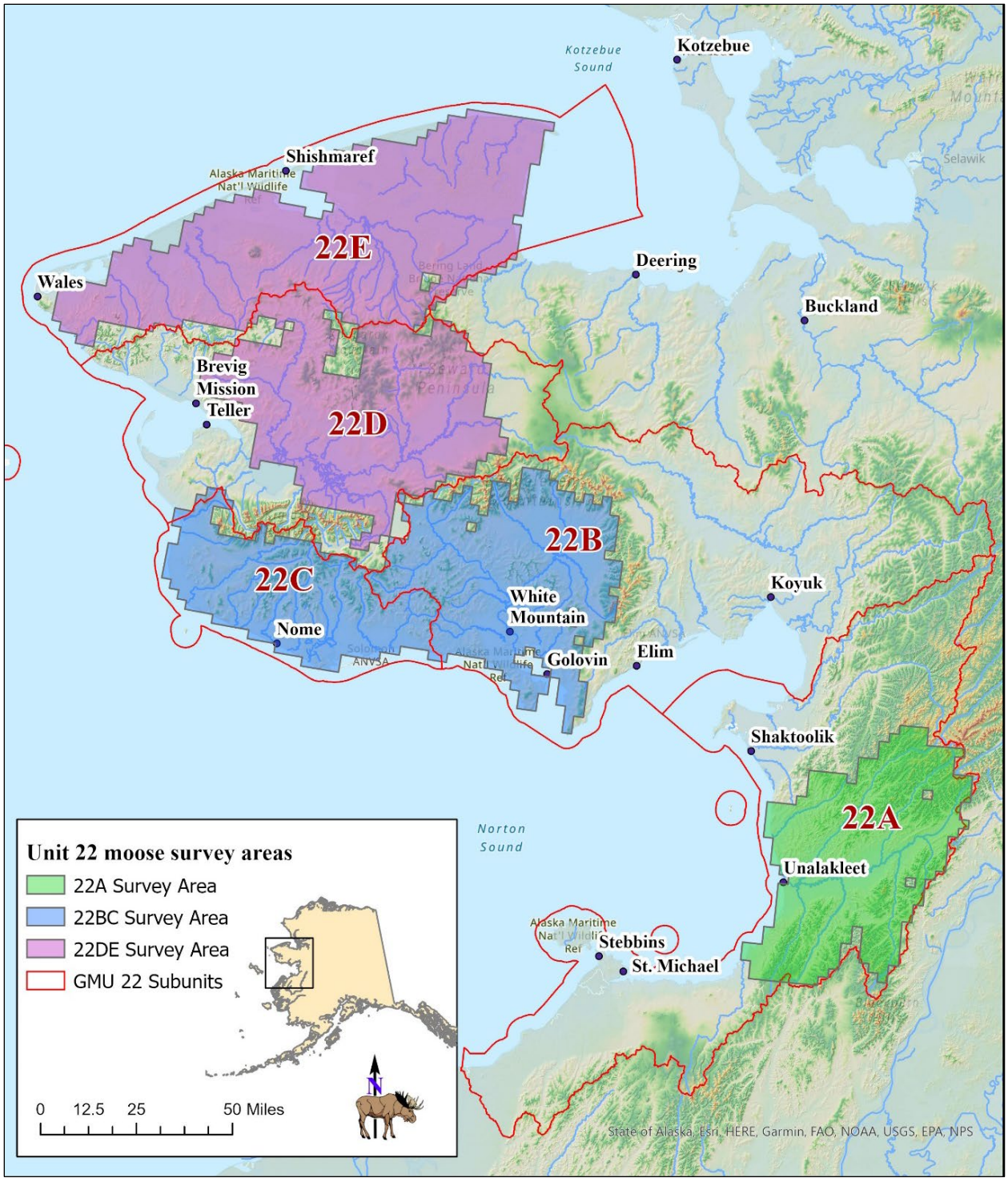

Figure 2. Moose abundance survey areas, regulatory years 2015–2019, Unit 22, Northwest Alaska.

continues to adapt to adjacent units until the critical value of moose is no longer met, and the cluster of survey units is complete. The ACS statistical methodology, as it relates to moose abundance surveys, is described in detail in Appendix A.

Estimates of recruitment (proportion of short-yearlings in a given moose population) may also be collected during a moose abundance survey. These estimates can provide supporting evidence of expected annual changes in abundance.

Results and Discussion

During RY15–RY19, the only successful GSPE moose surveys completed in Unit 22 occurred in the combined Units 22B West and 22C survey areas in 2016, and in the Unit 22A survey area in 2017. An ACS survey was completed in the combined Units 22D and 22E survey areas in 2020. Poor survey conditions precluded the completion of GSPE and ACS abundance surveys in all other areas and years. In lieu of an abundance survey, ADF&G staff completed a spring recruitment and minimum count survey in Unit 22C in 2017, in Unit 22A Remainder (that portion of Unit 22A south of and including the Golsovia River) and in Units 22D and 22E in 2018, and in Units 22B and 22C in 2019. Results from moose abundance surveys during RY15–RY19 are summarized in Table 1 and in the text below.

Table 1. Moose population estimates survey areas, regulatory years 2015–2019, Unit 22, Northwest Alaska.

		Observable moose		
Survey area	Year	Density estimate (moose/mi^2)	Population estimate	Recruitment rate (%)
Unit 22A	2017[a]	0.35	840 (90% CI[b] = 747–933)	12
Unit 22B	2016[a]	0.34	728 (90% CI = 609–848)	14
Unit 22C	2016[a]	0.29	354 (90% CI = 306–403)	19
Unit 22D	2020[c]	0.48	1,254 (90% CI = 1,056–1,451)	11
Unit 22E	2020[c]	0.17	662 (90% CI = 476–847)	13

[a] Sampled using geospatial population estimator (GSPE) methodology (Kellie and DeLong 2006).
[b] CI stands for confidence interval.
[c] Sampled using Adaptive Cluster Sampling (ACS) methodology (Turk and Borkowski 2005, Appendix A).

The current abundance of moose in Unit 22 is approximately 6,800 individuals based on all survey areas combined. Abundance has been stable since the last reporting period, RY10–RY14, and remains within the intensive management population objective of 5,100–6,800 moose. Survey results for individual administrative units are discussed below.

Unit 22A

The Unit 22A moose population appears to be increasing. A GSPE survey was completed in 2017 after 2 years of failed attempts to estimate moose abundance in the area due to poor survey

conditions. The 2017 abundance estimate of 840 moose (90% confidence interval [CI] = 747–933) indicated a continued increasing population trend of 9% annually since a survey was last completed in Unit 22A in 2012.[2] The Unit 22A population now exceeds the management objective and indicates a potential need to study the nutritional condition of moose within the area.

Unit 22B

The Unit 22B moose population appears to be stable. GSPE surveys completed in Unit 22B West in 2016 resulted in an abundance estimate of 728 (90% CI = 609–848) moose.[3] This estimate indicates stability in the population since it was last surveyed in 2013 and continues to be below the management objective.

An ACS survey was attempted for the combined Units 22B West and 22C survey area in 2019, but poor weather throughout the months of February and March prevented the completion of an abundance survey. A spring recruitment and minimum count survey was completed in Units 22B West and 22B East the same year. The minimum count was 108 moose in Unit 22B East and 253 moose in Unit 22B West.[4] The low recruitment rates observed in Unit 22B East may be indicative of a declining moose population in the area.

Unit 22C

The Unit 22C moose population appears to be stable or declining. A GSPE survey completed in the area in 2016 resulted in an estimate of 354 (90% CI = 306–403) moose.[5] The moose population in Unit 22C has continued to be below the management objective since 2013.

The spring recruitment and minimum count survey completed in 2019 resulted in a minimum count of 402 moose in the area.[6]

Unit 22D

The Unit 22D moose population is currently thought to be stable or increasing. The 2020 abundance survey using ACS methodology resulted in an estimate of 1,254 moose (90% CI = 1,056–1,451).[7] This abundance estimate indicates a 4% annual rate of increase since the area was last surveyed in 2014. The moose population remains below the management objective.

Unit 22E

The moose population in Unit 22E is likely stable. The 2020 Unit 22E abundance estimate of 662 moose (90% CI = 476–847) indicated the moose population has remained stable since the

[2] Dunker, 6 October 2021, unpublished Unit 22A Central moose survey summary, Nome.
[3] Dunker, 5 May 2016, unpublished Units 22B West and 22C GSPE moose survey memorandum, Nome.
[4] Dunker, 21 June 2019, unpublished Units 22B and 22C moose spring recruitment survey memorandum, Nome.
[5] Dunker, 5 May 2016, unpublished Units 22B West and 22C GSPE moose survey.
[6] Dunker, 21 June 2019, unpublished Units 22B and 22C moose spring recruitment survey.
[7] Dunker, 17 December 2020, unpublished Units 22D and 22E ACS moose survey.

last estimate was obtained in 2014.[8] The Unit 22E moose abundance is within the management objective.

Recommendations for Activity 1.1.

Modify.

Future moose abundance estimates for all survey areas will be completed using ACS instead of the GSPE methodology.

Given a better understanding of how moose move and distribute themselves on the Seward Peninsula, abundance survey areas will now be a combined Units 22D and 22E area, and a combined Units 22B West and 22C area.

ACTIVITY 1.2. Estimate fall composition in at least one survey area annually.

Data Needs

Estimating age-sex composition (bull:cow and calf:cow ratios) in a survey area during fall before spring abundance surveys will augment analysis for trend in abundance and gauge overwinter survival of calves. Moose classified as bulls (by age-class estimated from antler size), cows, and calves in a sample that is at least 33% of the survey area's most recent estimated abundance will provide an estimate of population composition. The number of bulls per 100 cows also provides insight into the harvestable surplus within hunt areas.

Methods

Fall composition surveys using a Piper PA-12 or PA-18 type aircraft were conducted in several areas during RY15–RY19 (Table 2). Composition counts conducted in late fall before bulls have dropped their antlers provide data on ratios of males to females in the adult portion of the population, and prewinter calf survival. Counts of yearling bulls also provide information on recruitment. Conducting these surveys in the same area periodically yields data on general trends in abundance and productivity accurate enough to detect large changes in bull-to-cow ratios.

Results and Discussion

Fall composition surveys were completed each year of the RY15–RY19 reporting period and occurred in all survey areas. Results of all composition surveys completed in Unit 22 during RY15–RY19 are summarized in Table 2.

[8] Dunker, 17 December 2020, unpublished Units 22D and 22E ACS moose survey.

Table 2. Moose fall composition from aerial surveys, regulatory years 2015–2019, Unit 22, Northwest Alaska.

Survey area	Regulatory year	Number of moose observed	Percent of population estimate (%)	Bulls:100 cows	Calves:100 cows
Unit 22A	2016	250	46	124	30
Unit 22B West	2015	222	36	41	20
Unit 22C	2015	213	49	28	20
	2017	192	50	32	17
	2018	197	50	31	20
Unit 22D Kuzitrin	2016	271	36	20	14
	2017	208	28	32	11
	2019	327	53	33	10
Unit 22D Remainder	2016	196	33	23	18
	2018	133	23	18	29
	2019	187	38	23	19
Unit 22E	2016	352	50	38	21
	2019	457	65	33	16

Unit 22A

Composition surveys were completed in Unit 22A in the Unalakleet River drainage (Unit 22A Central) during 2016 and resulted in an estimate of 124B:100C and 30c:100C.[9] The bull-to-cow ratio is well over the management objective of 30B:100C for the area and is a marked increase in the bull-to-cow ratio since the area was last surveyed in 2009 with a resulting estimate of 47B:100C. This unusually high bull-to-cow ratio may be the result of bulls migrating east into the Unalakleet River valley from the adjacent Yukon River.

Unit 22B

The composition survey completed in Unit 22B West (west of the Darby Mountains) in 2015 resulted in an estimate of 41B:100C and 20c:100C.[10] These ratios suggest a slight increase in the bull-to-cow ratio and calf-to-cow ratio since the survey was last completed in 2008. The 2015 bull-to-cow ratio in Unit 22B is above the management objective for the area.

[9] Dunker, 17 January 2017, unpublished Fall 2016 Unit 22 moose composition survey memorandum, Nome.
[10] Dunker, 3 December 2015, unpublished Fall 2015 moose composition in Unit 22B West memorandum, Nome.

Unit 22C

Three composition surveys completed in Unit 22C during RY15–RY19 indicate that the bull-to-cow ratio is now above the management objective of 20B:100C. The most recent composition survey completed in 2018 estimated a ratio of 31B:100C and 20c:100C and is indicative of an improving bull-to-cow ratio compared to RY10–RY14, where the bull-to-cow ratio was below the management objective of 20B:100C. This increase in the bull-to-cow ratio suggests that more bulls are available for harvest; subsequently, the harvest quota for Unit 22C should be increased.

Unit 22D Kuzitrin

Three composition surveys completed in the Unit 22D Kuzitrin area indicate that the bull-to-cow ratio in the area is increasing. The 2017 estimate of 32B:100C paired with the 2019 estimate of 33B:100C in the area is above the management objective of 30B:100C for the first time since 2010.[11] The cow-to-calf ratio was lasted estimated to be 10c:100C in 2019.

Unit 22D Remainder

The Unit 22D remainder bull-to-cow ratio continues to track below the management objective of 30B:100C. Composition surveys completed in the area in 2017, 2018, and 2019 estimated 23B:100C, 18B:100C, and 24B:100C, respectively.[12] This sustained poor bull-to-cow ratio prompted management action to establish a quota within Unit 22D Remainder. The calf-to-cow ratio was last estimated to be 19c:100C.

Unit 22E

Two composition surveys completed in the area during RY15–RY19 indicate the bull-to-cow ratio is above the management objective of 30B:100C. Surveys completed in 2016 and 2019 estimated 38B:100C and 33B:100C, respectively.[13] The estimate of the cow-to-calf ratio was last estimated to be 16c:100C in Unit 22E.

Recommendations for Activity 1.2.

Continue.

Attempts will be made to complete fall composition surveys in areas scheduled for a subsequent spring abundance survey. Scheduling surveys this way provides an assessment of overwinter calf survival by comparing the percent calves in the population from fall and spring.

Consideration should be given regarding the need to continue dividing Unit 22D into two survey areas (Units 22D Remainder and 22D Kuzitrin); movement data from collared moose suggests that animals in these survey areas regularly move between Units 22D Remainder, 22D Kuzitrin, and 22E (Grauvogel 1984).

[11] Dunker, 20 December 2019, unpublished Fall 2019 Unit 22 moose composition surveys, Nome.
[12] Dunker, 20 December 2019, unpublished Fall 2019 Unit 22 moose composition surveys.
[13] Dunker, 20 December 2019, unpublished Fall 2019 Unit 22 moose composition surveys.

ACTIVITY 1.3. Assess the nutritional condition of the Unit 22 moose population by estimating twinning rates, 2-year-old parturition rates, or short-yearling weights.

Data Needs

Unit 22 moose suffered a decline in density in the early 1990s suspected to be caused by severe winters and insufficient winter browse. As a result, monitoring moose nutritional condition was conducted. Indicators of nutritional health in Alaska moose populations include adult female parturition and twinning rates, 10-month-old calf (short-yearling) weights, and browse biomass removal (Boertje et al. 2007).

Methods

During RY15-RY19, research was initiated with the goal of investigating the nutritional condition of the moose population of Units 22D and 22C. A sample of approximately 100 radio-collared moose will allow managers to obtain the twinning rate of the moose populations in Units 22C and 22D.

Results and Discussion

Investigations into the nutritional condition of the moose population in Units 22C and 22D did not indicate any signs of density-dependent limitations. Short-yearling moose appeared healthy within Units 22C and 22D, weighing an average of 397 lbs—above the threshold short-yearling weight of 385 lbs proposed to indicate nutritional stress by Boertje et al. (2007). Results of a twinning survey completed in the spring of 2020 estimated the 2-year-old parturition rate to be 29% (95% C.I.: 15–46%) and the twinning rate of moose 3 years old and older to be 27% (95% C.I.: 11–50). Some of the collared cows began producing calves at 2 years old and others began producing twins at 3 years old; comparatively, in moose populations experiencing nutritional stress in Interior Alaska, cows did not begin to calve until 3 years old and produced twins at 4 years old or later (Boertje et al. 2007, 2019).

Recommendations for Activity 1.3.

Continue activity as warranted when a change in moose abundance or habitat condition is suspected. Attempt to collect an index of nutritional condition such as a browse survey in Unit 22A, where the population has surpassed the management objective.

2. Mortality-Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor mortality and harvest in Unit 22 each regulatory year.

Data Needs

The BOG has identified Unit 22 moose for intensive management with a harvest objective of 300 to 680 moose annually and has also established an Amount Necessary for Subsistence (ANS) of 250 to 300 moose annually. Annual summaries of harvest are needed to establish harvest quotas to ensure sustained yield. Monitoring harvest data and improving harvest reporting through public education, vendor support, improved communication, and by conducting community-based harvest assessment surveys in selected small communities is needed to understand harvest

in relation to moose population assessments (Activities 1.1, 1.2, and 1.3). Analysis of harvest data will facilitate department recommendations for BOG proposals.

Methods

Moose harvests were monitored using DWC's Wildlife Information Network (WinfoNet) harvest database for registration and general season moose hunts in Unit 22. Management decisions to close quota-based hunts by emergency order are also informed by monitoring the area's small community vendor activity, assessing the number of hunters in the field during impromptu aerial surveys, and recording hunt reports.

Season and Bag Limit

Unit 22 bag limits and season dates during RY15–RY19 are summarized in Appendix B.

Results and Discussion

Accurate harvest reporting is necessary for understanding patterns and levels of harvest and managing hunts. A lack of harvest reports for moose generally stems from hunter confusion or cultural values regarding hunting. Confusion with regulations can be reduced by coordinating state hunts with federal hunts. Moose hunts in Units 22A, 22B, 22D, and 22E include areas of federal land, and regulations among state and federal managers are aligned to the greatest extent possible to reduce public confusion and promote harvest reporting.

Harvest by Hunters

A summary of Unit 22 reported moose harvest is presented in Table 3. In each year and on average, reported harvests fell short of the ANS and the intensive management harvest objectives.

The average annual total harvest reported for all hunts during RY15–RY19 was 189 moose (range = 181–204; Table 3). The average annual harvest has remained stable at 186 moose since RY00 and is lower than the peak harvests during the 1980s (average annual harvest of 343 moose during RY80–RY89). Lower harvests since RY00 are partially a result of regulatory changes instituted in the 2000s to reduce harvests following indicators that the moose population was at carrying capacity (Gorn 2012).

Table 3. Reported moose harvest, regulatory years 2015–2019, Unit 22, Northwest Alaska.

Regulatory year	Moose				Total hunters	Harvest success (%)
	Male	Female	Unknown	Total		
2015	179	0	3	182	619	29
2016	191	0	0	191	591	32
2017	186	0	2	186	641	29
2018	204	0	0	204	695	29
2019	181	0	1	181	631	29

Compliance with regulations and harvest reporting is thought to be reasonably high in the parts of Unit 22 that have registration permits (i.e., Nome, Teller, Brevig Mission, White Mountain, Golovin, and Unalakleet) and more education efforts associated with the new registration hunts. However, in the remainder of unit, some residents do not acquire licenses and/or harvest tickets prior to hunting and much of the harvest is unreported.

Public education programs and a visible enforcement effort improve compliance with regulations, but the community-based harvest assessment programs started in 1999 appear to be the most effective way to collect accurate harvest data from residents of the area's small communities. This data has been essential in providing the BOG with a realistic picture of moose harvest and timing in Unit 22 and has greatly influenced the board in its regulatory decisions. If regulatory change is required in areas of the unit away from the Nome road system, this program should be continued to provide ongoing estimates of moose harvest and subsistence use of moose by community residents. A range of 100–150 harvested moose are thought to be harvested but not reported a year by residents of Unit 22's small communities without registration permits (W. Dunker, 2020, unpublished data).

Permit Hunts

Registration moose permit hunts (RM) with harvest quotas are used in the most accessible portions of Units 22B, 22C, and 22D along the Nome road system (RM840), and in the central portion of Unit 22A near Unalakleet (RM841). Registration hunts with harvest quotas require hunters to report within 24–48 hours of the harvest, depending on the hunt area. Reporting by hunters who hunt but fail to harvest a moose has improved over time, and increased emphasis on the need to report in addition to Failure to Report (FTR) listings has improved the reporting rate in registration hunts. Harvest reporting by residents of more remote Unit 22 communities has been less complete. The number of successful of hunters in the general season and permit hunts is summarized in Table 4.

Hunter Residency and Success

Alaska residents took an average of 85% of the total Unit 22 harvest each year during RY15–RY19 (range = 78–88%). Nonresidents harvested an average of 26 (range 21–33) moose annually.

Looking specifically at the RM840 road system hunt during RY15–RY19, residents of Unit 22 were responsible for an average of 98% of the annual harvest. Alaska residents living outside the unit and nonresidents took the remainder of the total harvest at an average of 0–1 moose annually. Despite the low harvest taken by these 2 user groups, Unit 22 residents have expressed concerns about the 2 user groups harvesting any moose within the RM840 road system hunt.

Harvest Chronology

The harvest of moose in Unit 22 primarily occurs in September. During RY15–RY19, 77% (n=716) of the successful moose harvest took place in September, followed by 10% (n=93) in October, 7% (n=67) in January, and 5% (n=45) in August.

Transport Methods

Hunters participating in moose hunting within Unit 22 primarily hunt using a boat or 4-wheeler; of the 3,180 records of individuals participating in Unit 22 moose hunts during RY15–RY19, 33% (*n*=1,064) used a boat and 27% (*n*=849) used a 4-wheeler. Other moderately used methods of transportation included highway vehicle (14%), off-road vehicle (ORV; 9%), and snowmachine (5%).

Other Mortality

The moose collared during 2017–2020 as 6-month-olds (Activity 1.3) provide an important index to overwinter calf mortality. Monitoring these collared females suggests that overwinter mortality is low; instead, much of the moose mortality in Units 22C and 22D is attributed to predation by brown bears. Continued monitoring of these VHF-collared cow moose will provide further causes of mortality from 6 months old through the first several years of life as the age of collared animals increases.

Table 4. Successful hunter statistics for registration moose hunts, regulatory years 2015–2019, Unit 22, Northwest Alaska.

	Successful hunters								
	General season			Registration permit (RM840, RM841, RM843, and RM855)			Drawing permit (DM845)		
Regulatory year	Male	Female	Unk	Male	Female	Unk	Male	Female	Unk
2015	50	0	1	126	0	2	3	0	0
2016	61	0	0	130	0	0	0	0	0
2017	59	0	1	126	0	1	1	0	0
2018	76	0	0	128	0	0	0	0	0
2019	64	0	0	117	0	0	0	0	0

Beginning in the spring of 2020, department staff conducted a twinning survey to observe which collared animals had calves at heel. Following up on these parturient cows in the fall may provide important information on calf survival from birth through 6 months old, which is currently lacking in Unit 22.

Alaska Board of Game Actions and Emergency Orders

The BOG addressed several Unit 22 moose proposals during its January 2017 meeting. It lengthened both the Units 22A Central resident and 22A North nonresident moose hunting seasons from 1–14 September to 1–20 September in response to an increase in moose abundance in the area. The board also closed the nonresident moose hunting season in Unit 22D Remainder in response to declining bull-to-cow ratios.

BOG meeting summary information is available on the ADF&G website within specific meeting information in the "Alaska Board of Game Meeting Information" section:

http://www.adfg.alaska.gov/index.cfm?adfg=gameboard.meetinginfo

The department issued emergency orders during RY15–RY19 to manage registration hunts for the following hunts:

- The RM841 moose permit hunt season in Unit 22A Central was extended by emergency order in 2015 and 2018 and closed early by emergency order in 2016.

- The GM000 moose hunt in Unit 22A North was opened by emergency order in 2019 during 9–15 October in response to reports of low harvest by local residents.

- The RM840 moose permit hunt along the road system in Unit 22B West (west of the Darby Mountains), Unit 22C, and Units 22D Kuzitrin and 22D Southwest is heavily moderated by emergency order closures. A summary of the quotas and average season lengths in the RM840 hunt areas are summarized in Table 5. Some members of the public continue to express dissatisfaction with the low quotas and subsequent short season lengths in the RM840 hunt areas.

More information regarding emergency orders in Unit 22 are available on the ADF&G website on the "Hunting & Trapping Announcements and Emergency Orders" page:

http://www.adfg.alaska.gov/index.cfm?adfg=wcnews.main

Recommendations for Activity 2.1.

Continue. Monitor total harvest for comparison with the IM and ANS harvest objectives. Consider developing methods to improve the RM840 registration permit hunt quality and hunter satisfaction.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor forage plants to understand sustainable density of moose.

Data Needs

Browse surveys provide context on potential density-dependent responses of the moose population because removal rates are thought to be correlated with short-term changes in moose density (Seaton et al. 2011). Managers can then use this information to help guide management actions and assess sustainable densities of moose in an area. This is especially important if the abundance or harvest objectives fall below Intensive Management objectives set by the BOG.

Table 5. Quotas, harvest, and season length for the RM840 moose permit hunt, regulatory years 2015–2019, Unit 22, Northwest Alaska.

	Unit 22B West			Unit 22C			Units 22D Kuzitrin and 22D Southwest		
Regulatory year	Quota	Harvest	Season length	Quota	Harvest	Season length	Quota	Harvest	Season length
2015	20	22	6	9	15	2	37	46	10
2016	23	24	9	11	17	2	30	39	14
2017	23	25	7	11	15	2	22	36	5
2018	23	21	6	16	15	2	22	28	3
2019	23	27	6	16	21	2	22	24	4

Browse surveys may also provide a useful index to changes in moose density, and they are a useful supplement to an abundance survey in an area. The browse removal rate suspected to indicate nutritional stress in a moose population is >35% (Boertje et al. 2007). Browse surveys help managers understand whether the Unit 22 moose populations are limited by late overwinter browse availability, which has been a concern of managers in the past (Persons 2000).

Methods

Browse survey methodology following Paragi et al. (2015) and Seaton et al. (2011) was used.

Results and Discussion

Browse surveys were completed in Unit 22C in 2017 and 2018, and in Unit 22D in 2020. In Unit 22C, the browse removal rate was estimated to be 11% in 2018. In Unit 22D, the browse removal rate was estimated to be 16% in 2017, and 11% in 2020. These data suggest that the Units 22C and 22D populations are not limited by available browse, which is substantiated by the findings of adequate twinning rates described in Activity 1.3.

Recommendations for Activity 3.1.

Continue to establish baseline data for browse removal in the Unit 22 survey areas by completing a browse survey in Units 22A Central, 22B, and 22E. Complete additional browse surveys as concerns arise regarding Unit 22 moose populations reaching or exceeding the carrying capacity of their range.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

There were no nonregulatory management needs during RY15–RY19.

Data Recording and Archiving

- GSPE data are stored on an internal database housed on a server (http://winfonet.alaska.gov/index.cfm). Field data sheets are stored in file folders located in the Nome Area Biologist's cubicle.

- Field data sheets are scanned and housed on the computer server in the Nome Area Biologist office (V:\Wildlife\Moose\) and stored in file folders located in the Nome Area Biologist's cubicle.

Agreements

Currently there are no agreements with other agencies pertaining to moose management.

Permitting

No permits were needed to conduct moose management activities in Unit 22 during RY15–RY19.

Conclusions and Management Recommendations

Moose populations in Unit 22 remain at low densities around 0.35 moose/mi^2. Populations in Units 22A, 22B West, and 22C appear to be increasing in abundance, while populations in Units 22B East, 22D, and 22E appear stable or declining. We recommend the continued application of harvest rates of 3–5% of available bulls until local moose population metrics suggest higher levels of harvest are sustainable.

The limiting factors regarding the Unit 22 moose population remain unclear. Recent browse removal surveys completed during RY15–RY19 for the first time in Unit 22 suggest low browse removal rates in Units 22C and 22D. Additionally, short-yearling weights and twinning rates collected in Units 22D and 22C do not suggest the moose population is nutritionally limited. Survival rates of collared moose from 5 or 6 months old through at least 3 years old appear to be high and suggest that overwinter mortality is uncommon. Research should be initiated in Units 22C and 22D that investigates the rate and cause of mortality in neonate moose from birth until 6 months old. This information on survival and nutritional indices will ultimately improve Unit 22 managers' understanding of the population dynamics of the moose population and assess whether the population is being held in a low-density equilibrium.

In areas of Unit 22 where abundance surveys are not completed, such as in Units 22A North, 22A Remainder, and 22B East, trend count areas should be established. This will help managers better estimate abundance in those areas as well as harvestable surplus. Efforts to complete a community harvest survey in Koyuk, Elim, and Shaktoolik should be initiated. Combined with reported harvest and community harvest survey data, harvestable surplus as well as the estimated harvest in each area may be accurately estimated.

Movement data of collared moose suggests that harvest strategies in Units 22D and 22E may need to be reconsidered. Data collected from collared moose during RY15–RY19 suggest that movement between management subunits, especially between Units 22D Kuzitrin, 22D Remainder, and 22E, is common. Future management strategies should consider combining Units 22D Kuzitrin, 22D Remainder, and 22E as a single population and manage hunts according to harvest pressures during varying times of the year.

In all of Unit 22, compliance with regulations and harvest reporting is thought to be reasonably high in parts of the unit that have registration permits (i.e., RM840 and RM841) and more education efforts associated with the new registration hunts. However, in the remainder of the unit, some residents do not acquire licenses and/or harvest tickets prior to hunting and much of the harvest is unreported. Public education programs and a visible enforcement effort improve compliance with regulations, but we have found the community-based harvest assessment programs started in 1999 to be the most effective way to collect accurate harvest data from residents of the area's small communities. This data has been essential in providing the BOG with a realistic picture of moose harvest and timing in Unit 22 and has greatly influenced the board in its regulatory decisions. If regulatory change is required in areas of Unit 22 away from the Nome road system, this program should be continued to provide ongoing estimates of moose harvest and subsistence use of moose by residents of the area's small communities. In particular, surveys are warranted in Koyuk, Elim, Shaktoolik, and Shishmaref.

II. Project Review and RY20–RY24 Plan

Review of Management Direction

MANAGEMENT DIRECTION

There are no changes in the management direction and goals for Unit 22.

GOALS

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Continue sustained opportunity for the subsistence use of moose.
- Maximize sustained opportunities to participate in hunting moose.
- Maximize opportunities for nonconsumptive use of moose.

CODIFIED OBJECTIVES

Amount Reasonably Necessary for Subsistence Uses (ANS)

The Unit 22 moose population has a positive Customary and Traditional Use Determination finding. The unitwide Amount Reasonably Necessary for Subsistence (ANS) is 250–300 moose.

Intensive Management

In 2001 the Board of Game adopted a positive finding for intensive management of moose in Unit 22. Current intensive management objectives are as follows:

- Population objective: 5,100–6,800 moose.
- Harvest objective: 300–680 moose.

MANAGEMENT OBJECTIVES

The management objectives for moose in Unit 22 have been slightly modified for RY20–RY24:

1. Manage moose populations at the following levels:
    a. Unit 22A: Maintain a population of 1,000–2,000 moose.
    b. Unit 22B West (west of and including the Darby Mountains) and Unit 22C combined: Maintain a population of 1,500–1,800 moose.
    c. Unit 22B East: Maintain a population of 800–1,500 moose.

d. Units 22D and 22E combined: Maintain a population of 2,600–3,300 moose.

e. Unit 22 (unitwide): Maintain a population of 5,000–7,000 moose.

Obtaining abundance estimates within individual moose management units often results in precision levels that do not allow managers to properly derive harvestable surplus. Moreover, movement data from collared cows and ear-tagged bulls suggest that movement between subunits, particularly between Units 22D and 22E, and Units 22B and 22C, is common. Abundance estimates for the RY20–RY24 plan period should be obtained for each survey area instead of for specific moose management units.

2. Manage for a posthunt (fall) sex ratio of 30 bulls:100 cows in all areas of Unit 22.

   The posthunt sex ratio management objective for Unit 22C has been increased from 20B:100C to 30B:100C in response to sustained bull-to-cow ratios above 30B:100C and to be consistent with other areas of Unit 22. Recent composition surveys in Unit 22C have estimated the bull-to-cow ratio in the area well above the RY15–RY19 objective of 20B:100C. The moose population in Unit 22C appears to have recovered from the low bull-to-cow ratios observed in the early 2000s, and the new management objective of 30B:100C in Unit 22C will allow for increased numbers of bulls in the population while maintaining a hunt in the area.

3. Monitor vital rates (i.e., twinning, browse removal, age of first parturition) in areas that appear to have exceeded the management objective or areas that have experienced long-term stability in order to determine the limiting factors behind population growth.

REVIEW OF MANAGEMENT ACTIVITIES

The current management direction and goals for Unit 22 moose remain appropriate and no changes are warranted for RY20–RY24. The management activities for RY20–RY24 have been slightly modified from RY15–RY19:

1. Population Status and Trend

ACTIVITY 1.1. Estimate late winter abundance and calf recruitment in at least one survey area annually.

Data Needs

No surveys occur that estimate the abundance of moose in Units 22B East, 22A North, or 22A Remainder; instead, moose densities and abundance is extrapolated from adjacent management areas. However, the habitat may not be similar enough between adjacent management areas for accurate extrapolation to occur, and consequently abundance may be overestimated or underestimated. To assess the accuracy of extrapolation methods, Trend Count Areas (TCAs) should be established in Units 22B East and 22A North to approximate the abundance of moose in those areas. These TCAs should be surveyed in the fall once every 4 years. If, after consultation with a biometrician, TCAs are determined to not be feasible for these areas, minimum count surveys may serve as an adequate alternative.

Methods

Abundance estimates in the Units 22B West and 22C, the Units 22D and 22E, and Unit 22A Central survey areas should continue to be assessed using Adaptive Cluster Sampling (ACS) methodology. Abundance surveys should be transitioned to a 4-year cycle, with the fourth year dedicated to surveying the established TCAs or minimum count surveys for Units 22B East and 22A North. The tentative spring moose survey schedule is as follows:

- 2021: Unit 22A
- 2022: Units 22B West and 22C
- 2023: Units 22D and 22E
- 2024: Units 22B East and 22A North TCAs

ACTIVITY 1.2. Estimate fall bull composition in at least one survey area annually.

Biometric consultation should occur regarding the reliability of bull-to-cow ratios to inform management strategies in small units like Unit 22D Remainder, especially regarding recent collaring data indicating movement of moose between units.

Data Needs

No change from RY15-RY19.

Methods

No change from RY15-RY19.

ACTIVITY 1.3. Assess the nutritional condition of the Unit 22 moose population by estimating twinning rates, 2-year-old parturition rates, browse removal rates, or short-yearling weights.

Data Needs

No change from RY15-RY19.

Methods

No change from RY15-RY19.

2. Mortality-Harvest Monitoring

ACTIVITY 2.1. Monitor mortality and harvest in Unit 22 annually.

Data Needs

No change from RY15–RY19.

Methods

Conduct harvest monitoring using the same methods as during RY15–RY19, but continue to consult a biometrician about better ways to estimate the non-reporting rate. We will attempt to pursue funding to complete a community harvest survey in Koyuk, Shaktoolik, and Elim, where unreported moose harvest data have not been estimated since at least 2010.

3. Habitat Assessment-Enhancement

ACTIVITY 3.1. Monitor forage plants to understand sustainable density of moose.

Data Needs

No change from RY15–RY19.

Methods

A browse survey for the Unit 22A Central area will occur during RY20–RY24 to determine if the population in the area has exceeded the carrying capacity of the habitat in that area. If a marked increase in moose abundance or decline in habitat condition is suspected in other areas, browse surveys will be repeated as possible, using the methods that were used previously in Unit 22 to quantify plant architecture and in areas where baseline information was previously obtained.

ACTIVITY 3.2. Complete habitat enhancement activities to benefit moose population recovery in Unit 22.

Data Needs

No change from RY15–RY19.

Methods

No change from RY15–RY19.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

No new issues have been identified.

Data Recording and Archiving

- GSPE and ACS data will be stored on an internal database housed on a server (http://winfonet.alaska.gov/index.cfm). Field data sheets will be stored in file folders located in the Nome Area Biologist's cubicle.

- Field data sheets will be scanned and housed on the computer server in the Nome Area Biologist office (V:\Wildlife\Moose\) and stored in file folders located in the Nome Area Biologist's cubicle.

Agreements

Currently there are no agreements with other agencies pertaining to moose management.

Permitting

No permits are expected in this period.

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Appendix A. Description of statistical analysis for Adaptive Cluster Sampling.

Initial sample selection and the subsequent sampling design are described in the 12 February 2020 unpublished Units 22D and 22E ACS survey protocol memorandum (William Dunker and Adam Craig, Wildlife Biologist and Biometrician, respectively, ADF&G, Nome). In 1990, Steven Thompson developed the following unbiased modification of the Horvitz-Thompson estimator for a population total (Turk and Borkowski 2005):

$$\hat{\tau}_{HT} = \sum_{j=1}^{J} \frac{y_j}{\alpha_j}$$

Where y_j is the sum of moose counts in network j and

α_j is the marginal inclusion probability for the j^{th} network

The marginal inclusion probability for the j^{th} network is calculated by:

$$\alpha_j = 1 - \left[\prod_{h=1}^{H} \frac{\binom{N_h - x_{hj}}{n_h}}{\binom{N_h}{n_h}} \right]$$

Where N_h is the total number of survey units in the study area in stratum h and

x_{hj} is the number of survey units in the j^{th} network of stratum h and

n_h is the size of the initial random sample in stratum h

The joint inclusion probability for all pairs of networks j and k such than j≠k is:

$$\alpha_{jk} = 1 - (1 - \alpha_j) - (1 - \alpha_k) + \left[\prod_{h=1}^{H} \frac{\binom{N_h - x_{hj} - x_{hk}}{n_h}}{\binom{N_h}{n_h}} \right]$$

The unbiased estimator of the variance is calculated as:

$$\hat{Var}[\hat{\tau}_{HT}] = \sum_{j=1}^{K} \sum_{k=1}^{K} y_j y_k \left(\frac{\alpha_{jk} - \alpha_j \alpha_k}{\alpha_{jk} \alpha_j \alpha_k} \right)$$

Confidence limits for a total abundance estimate are found by multiplying the square root of the variance estimate by the appropriate quantile from a standard normal distribution.

Appendix B. Bag limits and seasons for moose, regulatory years 2015–2019, Unit 22, Northwest Alaska.

The only changes during the 5 years (RY15–RY19) were in Units 22A and 22D.

Regulatory year(s)	Unit	Resident bag limit	Resident season (subsistence and general hunts)	Nonresident bag limit	Nonresident season
2015 and 2016	Unit 22A—that portion north of and including the Tagoomenik and Shaktoolik river drainages.	1 bull.	1 Aug–30 Sep	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side.	1–14 Sep
	Unit 22A—that portion in the Unalakleet River drainage and all drainages flowing into Norton Sound, north of the Golsovia River drainage and south of the Tagoomenik and Shaktoolik river drainages.	1 antlered bull by registration permit only or 1 antlered bull by registration permit only; during the period 1–31 Dec, a season may be announced by emergency order.	1–14 Sep 1–31 Dec (season may be announced)	–	No open season
	Unit 22A Remainder	1 bull; or 1 antlered bull.	1 Aug–30 Sep 1–31 Jan	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side.	1–30 Sep
	Unit 22B East—that portion east of the Darby Mountains, including the drainages of the Kwiniuk, Tubutulik, Koyuk and Inglutalik rivers.	1 bull; or 1 antlered bull.	1 Aug–30 Sep 1 Nov–31 Dec	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side by drawing permit only; up to 10 permits may be issued.	1 Nov–31 Dec

Continued

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Regulatory year(s)	Unit	Resident bag limit	Resident season (subsistence and general hunts)	Nonresident bag limit	Nonresident season
2015 and 2016	Unit 22B West	1 bull by registration permit only; or 1 antlered bull by registration permit only	1–14 Sep 1–31 Jan	–	No open season.
	Unit 22C	1 bull by registration permit only; or 1 antlered bull by registration permit only; during the period 1–31 Jan, a season may be announced by emergency order.	1–14 Sep 1–31 Jan	1 bull with 50-inch antlers or with 4 or more brow tines on at least one side by registration permit only.	1–14 Sep
	Unit 22D—that portion within the Kougarok, Kuzitrin, and Pilgrim river drainages.	1 bull by registration permit only; or 1 antlered bull by registration permit only; during the period 1–31 Jan, a season may be announced by emergency order.	1–14 Sep 1–31 Jan (season may be announced)	–	No open season
	Unit 22D Southwest—that portion west of the Tisuk River drainage, west of the west bank of the unnamed creek, originating at the unit boundary opposite the headwaters of McAdam Creek, to its confluence with Tuksuk Channel.	1 bull by registration permit only; or 1 antlered bull by registration permit only; during the period 1–31 Jan, a season may be announced by emergency order.	1–14 Sep 1–31 Jan (season may be announced)	–	No open season

Continued

Regulatory year(s)	Unit	Resident bag limit	Resident season (subsistence and general hunts)	Nonresident bag limit	Nonresident season
2015 and 2016	Unit 22D Remainder	1 bull; only antlered bull moose may be taken during 1–31 Jan.	10 Aug–14 Sep 1 Oct–31 Jan	1 bull with 50-inch antlers or with 4 or more brow tines on at least one side, by registration permit only.	1–14 Sep
	Unit 22E	1 bull; or 1 antlered bull.	1 Aug–31 Dec 1 Jan–15 Mar	1 bull with 50-inch antlers or with 4 or more brow tines on at least one side by registration permit only.	1–14 Sep
2017, 2018, and 2019	Unit 22A—that portion north of and including the Tagoomenik and Shaktoolik river drainages.	1 bull.	1 Aug–30 Sep	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side.	1–20 Sep[1]
	Unit 22A—that portion in the Unalakleet River drainage and all drainages flowing into Norton Sound, north of the Golsovia River drainage and south of the Tagoomenik and Shaktoolik river drainages.	1 antlered bull by registration permit only or 1 antlered bull by registration permit only; during the period 1–31 Dec, a season may be announced by emergency order.	1–20 Sep[2] 1–31 Dec (season may be announced)	–	No open season
	Unit 22A Remainder	1 bull; or 1 antlered bull.	1 Aug–30 Sep 1–31 Jan	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side.	1–30 Sep

Continued

[1] The Alaska Board of Game (BOG) changed the end of the nonresident season from 14 September in RY15–RY16 to 20 September in RY17–RY19.
[2] The BOG changed the end of the nonresident season from 14 September in RY15–RY16 to 20 September in RY17–RY19.

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Regulatory year(s)	Unit	Resident bag limit	Resident season (subsistence and general hunts)	Nonresident bag limit	Nonresident season
2017, 2018, and 2019	Unit 22B East—that portion east of the Darby Mountains, including the drainages of the Kwiniuk, Tubutulik, Koyuk and Inglutalik rivers.	1 bull; or 1 antlered bull.	1 Aug–30 Sep 1 Nov–31 Dec	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side by drawing permit only; up to 10 permits may be issued.	1 Nov–31 Dec
	Unit 22B West	1 bull by registration permit only; or 1 antlered bull by registration permit only.	1–14 Sep 1–31 Jan	–	No open season
	Unit 22C	1 bull by registration permit only; or 1 antlered bull by registration permit only; during the period 1–31 Jan, a season may be announced by emergency order.	1–14 Sep 1–31 Jan (season may be announced)	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side by registration permit only.	1–14 Sep
	Unit 22D—that portion within the Kougarok, Kuzitrin and Pilgrim river drainages	1 bull by registration permit only; or 1 antlered bull by registration permit only; during the period 1–31 Jan, a season may be announced by emergency order.	1–14 Sep 1–31 Jan (season may be announced)	–	No open season

Continued

Regulatory year(s)	Unit	Resident bag limit	Resident season (subsistence and general hunts)	Nonresident bag limit	Nonresident season
2017, 2018, and 2019	Unit 22D Southwest – that portion west of the Tisuk River drainage, west of the west bank of the unnamed creek, originating at the unit boundary opposite the headwaters of McAdam Creek, to its confluence with Tuksuk Channel.	1 bull by registration permit only; or 1 antlered bull by registration permit only; during the period 1–31 Jan, a season may be announced by emergency order.	1–14 Sep 1–31 Jan (season may be announced)	–	No open season
	Unit 22D Remainder	1 bull; only antlered bull moose may be taken during 1 Dec–31 Jan.	10 Aug–14 Sep 1 Oct–31 Jan	–	No open season.
	Unit 22E	1 bull; or 1 antlered bull.	1 Aug–31 Dec 1 Jan–15 Mar	1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side by registration permit only.	1–14 Sep


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