

Moose Management Report and Plan, Game Management Units 21A and 21E:

Report Period 1 July 2010–30 June 2015, and
Plan Period 1 July 2015–30 June 2020

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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 area, 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 website.

This species management report and plan was reviewed and approved for publication by Doreen I. Parker McNeill, Management Coordinator for the Division of Wildlife Conservation, Fairbanks.

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Purpose of this Report

This report provides a record of survey and inventory management activities for moose (*Alces alces*) in Units 21A and 21E for the previous 5 regulatory years (RY; RY10–RY14) and plans for survey and inventory management activities in the 5 years following the end of that period (RY15–RY19). A regulatory year begins 1 July and ends 30 June (e.g., RY10 = 1 July 2010–30 June 2011). This report is produced primarily to provide agency staff with data and analysis to help guide and record its own efforts but is also provided to the public to inform them of wildlife management activities. In 2016 the Alaska Department of Fish and Game’s (ADF&G) Division of Wildlife Conservation launched this 5-year report to more efficiently report on trends and describe potential changes in data collection activities over the next 5 years. It replaces the moose management reports of survey and inventory activities that were previously produced every 2 years and supersedes the 1976 draft Alaska wildlife management plans (ADF&G 1976).

I. RY10–RY14 Management Report

Management Area

Units 21A and 21E include the entire Innoko River drainage as well as the portion of the Yukon River between Paimiut and Blackburn Island. Additionally, Arhymot Lake, which drains into the Kuskokwim River, is also part of Unit 21E. Units 21A and 21E encompass approximately 18,792 mi².

Maps for Unit 21 can be found on ADF&G’s website at <http://www.adfg.alaska.gov/index.cfm?adfg=huntingmaps.bygm&gmu=21>

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

Currently, moose are found throughout Units 21A and 21E. The major factors influencing moose abundance in the area include predation, weather, and hunting. Hunting pressure is primarily focused along the major river corridors.

Units 21A and 21E have distinct differences in moose habitat, user access, and hunting practices. Unit 21A contains the upper Innoko River drainage, and access is largely restricted to aircraft. There are no communities in Unit 21A, and hunters there are primarily nonlocal Alaskans and nonresidents. The villages of Grayling, Anvik, Shageluk, and Holy Cross are located in Unit 21E, and the lower Innoko and Yukon rivers are easily accessible by boat.

Direction for moose management plans has been modified over the years by Alaska Board of Game regulatory actions and ADF&G management direction. The Paradise controlled use area (CUA) has existed since 1977 and was implemented to reduce conflicts between user groups. Paradise CUA, which lies primarily in Unit 21E between the Yukon and Innoko rivers, is closed to the use of aircraft for hunting moose including the transportation of moose hunters and their gear. This restricts access in the Paradise CUA primarily to residents with boats.

Survey work has increased in Unit 21A with regular fall composition surveys beginning in 2007, and the first geospatial population estimator (GSPE) survey (Ver Hoef 2001, 2008) was conducted in March 2013. In Unit 21E aerial composition surveys as well as GSPE surveys have been the primary means of assessing the population status. We collaborate closely with Innoko National Wildlife Refuge (INWR) and the Bureau of Land Management to complete these surveys.

Management Direction

The *Yukon–Innoko Moose Management Plan* (YIMMP; Yukon–Innoko Moose Management Working Group 2006) guides moose management in Units 21A and 21E. This plan established that moose management in the area will be proactive to maintain an abundant moose population that provides for high levels of consumptive use.

EXISTING WILDLIFE MANAGEMENT PLANS

The *Yukon–Innoko Moose Management Plan* (YIMMP; Yukon–Innoko Moose Management Working Group 2006).

GOALS

The following management goals are based on recommendations in YIMMP:

- Maintain or increase moose numbers and harvest in Units 21A and 21E.
- Manage predation on moose to maintain abundant moose populations.
- Work to maintain optimal moose habitat.
- Develop cooperative programs between state, federal and native organizations for moose management.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

Unit 21 has a positive finding for customary and traditional uses for moose and amounts reasonably necessary for subsistence (ANS) uses of 600–800 moose from the unitwide population on an annual basis.

Intensive Management

- Unit 21E intensive management (IM) population and harvest objectives: 9,000–11,000 moose with 550–1,100 moose available for harvest annually.
- Unit 21E moose survey area (MSA) density objective: 1.0 moose/mi² (observable moose).
- Unit 21E MSA harvest objective: a minimum of 203 moose.

MANAGEMENT OBJECTIVES

Objectives and activities are based on recommendations in YIMMP.

Population Objectives

1. Manage to achieve the IM population objective of 9,000–11,000 moose in Unit 21E.
2. Maintain a minimum posthunt bull:cow ratio of 25–30 bulls:100 cows in Unit 21A and in Unit 21E.
3. Maintain a minimum posthunt calf:cow ratio of 30–40 calves:100 cows in Unit 21E.
4. Maintain at least 20% calves in the late winter moose population in Unit 21E.

Harvest Objectives

5. Maintain a harvest of $\leq 4\%$ of the estimated moose population in Unit 21A.
6. Maintain a harvest of $\leq 4\%$ of the estimated moose population in Unit 21E until the IM population objective has been met.
7. Provide for a sustained harvest of up to 40 antlerless moose in a winter season in Unit 21E.
8. Provide for the harvest of approximately 310 moose in Unit 21E by residents of Unit 21E and other Alaska residents.

MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct composition-trend surveys in Unit 21A and Unit 21E annually.

Data Needs

Composition data allow us to assess if we are meeting our management objectives for bull:cow and calf:cow ratios.

Methods

During November 2010–2012 fall composition surveys were conducted annually in Unit 21A. In 2010 a line transect survey was attempted by INWR in which the pilot flew precisely on predetermined transects; however, effort was high and sample size was low. In 2011–2012 GSPE survey units were selected by INWR in an area similar to previous composition surveys. Each unit was flown at approximately half the intensity (20–25 minutes) compared to a GSPE population estimate. In all years each moose or group of moose was circled to determine composition.

During November 2010 and 2011 we flew fall composition surveys in Unit 21E between the Innoko and Yukon rivers. Surveys were flown in PA-18 or similar aircraft at roughly 70 mph on east-west transects approximately $\frac{3}{4}$ miles apart and 500 feet above ground level. Surveys began

at a point 14 miles south of Shageluk and ended at a point 5 miles north of Holy Cross. Each moose or group of moose was circled to determine composition.

Results and Discussion

Unit 21A

In November 2011 we classified 163 moose including 82 bulls:100 cows and 44 calves:100 cows. In November 2012 we classified 160 moose including 69 bulls:100 cows and 28 calves:100 cows (Table 1).

Unit 21E

In November 2010 we classified 287 moose including 61 bulls:100 cows and 51 calves:100 cows. In November 2011 we classified 201 moose including 64 bulls:100 cows and 47 calves:100 cows (Table 1).

Recommendations for Activity 1.1

Continue.

ACTIVITY 1.2. Assess twinning rates.

Data Needs

Twinning rates are an important indicator of nutritional status and habitat quality.

Methods

Twinning surveys were conducted in Unit 21A and Unit 21E during late May or early June 2010–2014 from PA-18 or similar aircraft flown at approximately 70 mph and 500 feet above ground level. In Unit 21A we sampled the area by flying approximately 1–5 mile transects perpendicular to the Innoko River from Grouch Creek upstream to Rennie’s Landing. Additionally, Tolstoi Creek starting near Boob Creek mine downriver to the Dishna River, and along the Dishna River to its confluence with the Innoko River were also flown. In Unit 21E we flew in east-west transects approximately 1 mile apart along the Yukon River from Paimiut to Holy Cross and then between the Yukon and Innoko rivers from Holy Cross north to Anvik and Shageluk. All moose observed were recorded; however, only cows with calves were classified as adult cow with single or twin/triplet calves. Radiocollared adult females were used to increase observations during 2010–2012 in Unit 21E. Twinning rate was calculated as the number of cows with twins/triplets divided by the number of cows with calves.

Results and Discussion

Twinning surveys were attempted in Unit 21A in 2010 and 2012, however sample sizes were low (<17 each year), and data were not analyzed.

The twinning rate in Unit 21E was 55% (18 of 33) in 2010, 41% (22 of 54) in 2011, 32% (18 of 56) in 2013, and 31% (16 of 51) in 2014. The most recent 2-year average is 32% suggesting adequate habitat is available (Boertje et al. 2007).

Table 1. Units 21A and 21E fall aerial moose composition, Interior Alaska, regulatory years^a 2010–2012.

Survey area	Regulatory year	Bulls:100 cows	Calves: 100 cows	Total calves	Total adults	Total moose
Unit 21A	2011	82	44	32	131	163
	2012	69	28	23	137	160
Unit 21E	2010	61	51	69	218	287
	2011	64	47	45	156	201

^a Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).

Recommendations for Activity 1.2

Continue.

ACTIVITY 1.3. Assess population size through GSPE surveys.

Data Needs

Estimates of population size help us to determine the harvestable surplus in relation to IM objectives and ANS.

Methods

To estimate moose population size and density in Units 21A and 21E, we conducted aerial surveys in late February or early March using the GSPE method (Ver Hoef 2001, 2008; Kellie and DeLong 2006). We conducted a survey in 2013 in Unit 21A and in 2012 in Unit 21E. All survey units were stratified as high or low density at the start of each survey. A simple random sample of survey units was selected from each stratum, and additional survey units were selected to fill gaps in the randomized coverage. A sightability correction factor (SCF) was obtained in Unit 21E. Radiocollared moose were used to estimate sightability using the ratio of unseen to seen collars (SCF= 1/[not seen/seen]).

Results and Discussion

Unit 21A

In 2013 we estimated 1,047 moose ($\pm 24\%$, 90% confidence interval [CI]) with a density of 0.30 moose/mi² (Table 2). This was the first GSPE conducted in Unit 21A. Although we were not able to obtain an SCF, this survey still provided important information which informed the 2014 Board of Game process.

Unit 21E

In 2012 we estimated 5,701 moose (Table 2; $\pm 16\%$, 90% CI), which included an SCF in the low density stratum of 1.33 and in the high stratum of 1.10. The density of moose corrected for sightability was 1.1 moose/mi². This was the first survey in Unit 21E which included an SCF and provides a baseline from which to compare subsequent surveys. Unit 21E is also an IM area and having sightability data is essential to determining IM activities.

Table 2. Summary of spring geospatial moose population estimates^a in Units 21A and 21E, Interior Alaska, survey years 2012 and 2013.

Location and survey year	Survey area (mi ²)	Strata size (mi ²)		Area searched (mi ²)		Total search area (mi ²)	No. of moose estimated by strata and density (moose/mi ²)		Total estimate @ 90% CI ^b	Average density moose/mi ²	No. of sample units counted
		Low	High	Low	High		Low	High			
<i>Unit 21A</i>											
2013 GSPE ^c	3,821	3,244	577	315	577	892	681 (0.2)	366 (0.3)	1,047 ± 24%	0.3	150
<i>Unit 21E</i>											
2012 GSPE	5,070	4,104	966	229	696	925	1,331 (0.3)	3,583 (3.7)	4,914 ± 11%	1.0	150

^a Population estimates are of observable moose and do not include a sightability correction factor in this table (corrected estimate for 2012 is 5,701 ± 16% at 90% CI).

^b CI = confidence interval.

^c GSPE = geospatial population estimate.

Recommendations for Activity 1.3

Continue.

2. Mortality–Harvest Monitoring and Regulations

ACTIVITY 2.1. Monitor harvest through registration permits, general season harvest reports, and drawing permits; analyze harvest data; and assess the accuracy of these data in selected areas when possible.

Data Needs

Unit 21E has been identified by the Board of Game for IM of moose. There are also subsistence regulations in place which set ANS throughout Unit 21. Annual summaries of harvest are necessary to understand harvest in relation to IM, subsistence, and sustained yield. Analysis of harvest data also informs department recommendations to the Board of Game.

Methods

Reporting on registration permits, general season hunts, and drawing permits is collected from hunters. These data are then tallied and assessed using ADF&G's Wildlife Information Network (WinfoNet).

Results and Discussion

Accurate harvest reporting is essential to managing moose in Units 21A and 21E. We will continue to work with the local Fish and Game advisory committees and license vendors to stress the importance of harvest reporting. We will also continue to work from the McGrath office to follow up with individuals to ensure accurate harvest reporting.

Season and Bag Limit

Regulations for Units 21A and 21E can be found on ADF&G's website at <http://www.adfg.alaska.gov/index.cfm?adfg=wildliferegulations.hunting>

Harvest by Hunters

Summaries of reported harvest by subunit are presented in Tables 3a and 3b. Harvest appears to have increased dramatically in Unit 21E in RY14, however this was the first year of the new registration hunt RM836. This level of harvest more accurately reflects the actual level of harvest, and prior to RY14, nonreporting was a significant issue.

Harvest information for specific hunt types, harvest success, harvest chronology, and transportation are available to the public for hunt planning on the ADF&G website at <https://secure.wildlife.alaska.gov/index.cfm?adfg=harvest.main>

Table 3a. Unit 21A reported moose harvest, Interior Alaska, regulatory years^a 2010–2014.

Regulatory year	Bulls	Cows	Unknown	Total	Total hunters	Harvest success (%)
2010	35	0	0	35	86	41
2011	33	0	2	35	81	43
2012	34	0	2	36	81	44
2013	28	0	1	29	74	39
2014	45	0	0	45	90	50

^a Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).

Table 3b. Unit 21E reported moose harvest, Interior Alaska, regulatory years^a 2010–2014.

Regulatory year	Bulls	Cows	Unknown	Total	Total hunters	Harvest success (%)
2010	108	1	0	109	169	64
2011	105	0	0	105	154	68
2012	96	0	2	98	142	69
2013	120	1	0	121	170	71
2014	230	2	1	233	380	61

^a Regulatory year begins 1 July and ends 30 June (e.g., regulatory year 2010 = 1 July 2010–30 June 2011).

Other Mortality

Under regulation 5 AAC 92.019 hunters are permitted to take moose for customary and traditional Alaska Native funerary or mortuary religious ceremonies. In Unit 21E 6 were taken under this regulation during RY10, 11 during RY11, 11 during RY12, 5 during RY13, and 13 during RY14.

Predation is likely an important factor affecting moose population dynamics in Units 21A and 21E, based on calf mortality studies in adjacent areas on the lower Nowitna, Koyukuk, and Kuskokwim drainages (Osborne et al. 1991; Gasaway et al. 1992; Boertje et al. 2009). Keech et al. (2011) found that the primary cause of moose calf mortality in Unit 19D was predation by black bears, grizzly bears, and wolves. Deep snow has also been shown to affect moose survival (Coady 1974).

Alaska Board of Game Actions and Emergency Orders

Beginning in RY14 the nonresident season in Unit 21A was aligned with the resident season and changed from 5–20 September to 5–25 September.

In 2010 the Board of Game adopted an IM plan (Title 5 Alaska Administrative Code [AAC] 92.124) authorizing wolf control in Unit 21E if the moose population falls below 1.0 observable moose/mi². The moose population is currently above this threshold, and no wolf control is planned at this time.

In 2010 the Board of Game also aligned the nonresident season with the resident season in Unit 21E, and beginning in RY10, season dates changed from 5–20 September to 5–25 September. In RY14 the Board of Game changed the fall moose hunt from a general harvest ticket to a registration permit to improve harvest reporting. In addition, in RY14 the allocation of nonresident permits changed from 80% nonguided and 20% guided to 70% nonguided and 30% guided. Harvest by nonresidents remains below 30 moose which was identified in YIMMP as the maximum desired nonresident harvest.

Beginning in RY10 a federal permit (FM2104) was issued for the Unit 21E winter hunt. This permit was available only to residents of Unit 21E and Russian Mission. Beginning in RY12 residents of Kalskag, Lower Kalskag, Aniak and Chuathbaluk were also granted a customary and traditional use determination on federal lands, and a new hunt was created (FM2105). The season for this hunt overlaps with FM2104; however, hunters with a FM2105 permit may only hunt in southern Unit 21E. Prior to implementing these permits, a state general season harvest ticket was required for the federal winter hunt. Participation in these hunts is low.

No emergency orders were issued during RY10–RY14.

Recommendations for Activity 2.1

Continue.

3. Habitat Assessment–Enhancement

None.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

In January 2005 the Yukon–Innoko Moose Management Working Group convened to develop a plan to proactively manage moose populations in the area. YIMMP was the result of this process (Yukon–Innoko Moose Management Working Group 2006). This plan is now 10-years old and may need to be reevaluated in the next 5–10 years.

Maintaining or improving moose habitat was recommended by the working group, and habitat quality was assessed in Unit 21E in 2006. However, no habitat assessment work has been conducted in Unit 21A (Paragi et al. 2008). Continued habitat assessments may be conducted; however, twinning surveys, an index of population nutrition, will be our primary metric of habitat quality.

In 2011 ADF&G staff placed 10 snow stakes in Unit 21E to assess snow depth. Nine of the stakes fell the first winter, and all were repaired in summer 2012. Seven more fell again and only 3 snow stakes remained. Repairs were again made in summer 2014. Currently we do not have funding to monitor the remaining snow stakes.

Low snow winters have made conducting a GSPE in Unit 21E more difficult in recent years. The winter 2015 survey was canceled due to low snow, and in 2016, we were able to conduct the survey. However, snow was also marginal at the beginning of this survey, by the time the survey

was completed, the snow had mostly melted from the southern portion of the survey area. New survey techniques may need to be developed to alleviate this issue.

Data Recording and Archiving

GSPE data are stored in the GSPE moose survey application in WinfoNet. Other moose survey data are located in files in the McGrath office.

Agreements

None.

Permitting

None.

Conclusions and Management Recommendations

Moose populations in Units 21A and 21E appear to be stable to increasing. The current population estimate for Unit 21A is 2,442 observable moose. Because this estimate is not corrected for sightability, it is a conservative estimate. The 2012 population estimate for all of Unit 21E is 6,959 moose. This estimate is below the Unit 21E IM objective of at least 9,000 moose (9,000–11,000).

The objective to maintain a minimum posthunt bull:cow ratio of 25–30 bulls:100 cows in Units 21A and 21E was met. The objective to maintain a minimum posthunt calf:cow ratio of 30–40 calves:100 cows in Unit 21E was met in RY10–RY11. No composition data were collected in RY12–RY14 in Unit 21E. Unit 21A has a negative finding for IM, and there are no management actions we can take to improve calf:cow ratios. The objective to maintain at least 20% calves in the late winter moose population in Unit 21E was not met when measured in 2012. We found 19% calves in the population during that survey.

The objective to maintain harvest of $\leq 4\%$ of the estimated population in both Units 21A and 21E was met during RY10–RY14. Winter harvest under the federal permit hunt was less than 40 antlerless moose, and this objective was also met. Finally, the opportunity for Alaska residents to harvest up to 310 moose in Unit 21E does not exist. The current estimate of harvestable surplus is 278 moose. Actual harvest is below this level, and with the new registration permit in place, we are better able to assess harvest.

Monitoring moose numbers in Unit 21E continues to be a priority. If the population falls below 1 moose/mi² (observable) the department has been authorized to conduct wolf control. To monitor this, we will need continued funding for GSPE surveys as well as maintaining radio collars on moose to obtain estimates of sightability.

Generally, we have sufficient resources to conduct 1 population estimate (or a portion of 1) per year; 3 fall composition surveys, dependent upon weather; and 1–3 spring twinning surveys. Therefore, we conduct a single moose population estimate each year and rotate these surveys on

a 3-year cycle, recognizing that we will occasionally be unable to conduct surveys due to weather. Unit 21A is not part of this cycle, but we will continue to monitor moose here, opportunistically, and in close cooperation with INWR.

II. Project Review and RY15–RY19 Plan

Review of Management Direction

MANAGEMENT DIRECTION

There are no suggested changes in the management direction.

GOALS

YIMMP was finalized in 2006 and guides moose management in Units 21A and 21E. This plan established that moose management in the area would be proactive to maintain an abundant moose population that provides for high levels of consumptive use. The following management goals, management objectives, and activities are based on recommendations in YIMMP:

1. Maintain or increase moose numbers and harvest in Units 21A and 21E.
2. Manage predation on moose to maintain abundant moose populations.
3. Work to maintain optimal moose habitat.
4. Develop cooperative programs between state, federal, and native organizations for moose management.

CODIFIED OBJECTIVES

Amounts Reasonably Necessary for Subsistence Uses

- C1. Unit 21 has a customary and traditional use finding for moose with ANS uses of 600–800 moose in all of Unit 21.

Intensive Management

- C2. Unit 21E IM population objective is 9,000–11,000 moose.
C3. Unit 21E IM harvest objective is 550–1,100 moose.
C4. Unit 21E MSA density objective 1.0 moose/mi² (observable moose).
C5. Unit 21E MSA harvest objective a minimum of 203 moose.

MANAGEMENT OBJECTIVES

Population Objectives

- M1. Achieve the IM population objective of 9,000–11,000 moose in Unit 21E.

- M2. Maintain a minimum posthunt bull:cow ratio of 25–30 bulls:100 cows in Unit 21A and Unit 21E.
- M3. Maintain a minimum posthunt calf:cow ratio of 30–40 calves:100 cows in Unit 21E.
- M4. Maintain at least 20% calves in the late winter moose population in Unit 21E.

Harvest Objectives

- M5. Maintain a harvest of $\leq 4\%$ of the estimated moose population in Unit 21A.
- M6. Maintain a harvest of $\leq 4\%$ of the estimated moose population in Unit 21E until the IM population objective has been met.
- M7. Provide for a sustained harvest of up to 40 antlerless moose in a winter season in Unit 21E.
- M8. Provide for the harvest of approximately 310 moose in Unit 21E by residents of Unit 21E and other Alaska residents.

REVIEW OF MANAGEMENT ACTIVITIES

1. Population Status and Trend

ACTIVITY 1.1. Conduct composition–trend surveys in Unit 21A and Unit 21E annually. (objectives C2, C3, C4, M1, M2, M3)

Data Needs

No change from prior reporting period. Composition data will allow us to assess if we are meeting our management objectives for bull:cow and calf:cow ratios.

Methods

We will evaluate bull:cow ratio estimates (90% CI) in relation to the lower limit of the bull:cow ratio management objective for Units 21A and 21E.

Before the next survey, consistent methods will be considered, and survey areas will be designed and planned to optimize sample size and repeatability. In addition, biometricians will be consulted prior to the surveys to determine the best method to compare survey ratios with the management objective, optimum precision desired, and sample size needed to attain that precision will be investigated with regional biometricians.

ACTIVITY 1.2. Assess spring twinning rates. (objectives C2, M1)

Data Needs

No change from prior reporting period. Twinning surveys need to be conducted to collect twinning rate data which serve as indicators for body condition and productivity for cows. An

assessment of body condition and productivity are integral to management on a sustained yield basis of the long-term and for the goal of protecting moose habitat.

Methods

- No change from prior reporting period, but specified desired precision of multi-year mean unitwide twinning rates (95% CI \pm 5–8%) for assessing status among categories in objective C2 will be reviewed with a biometrician to determine, through power analysis, the optimum number of collars to deploy to achieve this precision.
- Evaluate 2-year average twinning rates in Unit 21E in relation to the objectives outlined in the IM operational plan for Unit 21E.
- If the 2-year average twinning rate is \geq 20% we will continue to promote population growth. At a rate of 15–20%, we will attempt to stabilize moose numbers through harvest. If the 2-year average twinning rate is $<$ 15% we will attempt to reduce the number of moose through harvest. Predator control will not be initiated or will be suspended if harvest alone is insufficient to reduce moose numbers.

ACTIVITY 1.3. Assess population size through GSPE surveys and compare to objectives (objectives C1–C3, M1, M4–M8).

Data Needs

We seek to estimate annual abundance, productivity and survival-recruitment-escapement to evaluate population status and trend. Periodically scheduled estimates of abundance with associated precision will be used to monitor population size and calf:cow ratios to evaluate whether IM population and harvest objectives are being met, if harvestable surplus is adequate for ANS objectives, and estimate harvestable surplus to provide for maximum hunter opportunity through seasons and bag limits.

Methods

We will continue to assess moose densities in Unit 21E with GSPE surveys (Kellie and DeLong 2006) conducted in late winter. We recognize the challenges of observing moose in late winter surveys (e.g., shadows in dense cover on sunny days) and intend to estimate an SCF with each GSPE using radiomarked moose or other appropriate techniques.

Due to resource constraints, we will attempt to conduct a GSPE survey in Unit 21E every 3 years. However, funding, weather, and other area priorities may prevent this. All GSPE surveys will be designed to achieve precision of at least \pm 20% at the 90% confidence interval, but actual precision will vary with survey conditions and funding.

Desired precision will be evaluated through biometric review prior to surveys. Consultation with biometricians will be sought to ensure that trends can be evaluated, given the low frequency of surveys. Biometric review will also be sought prior to future GSPE surveys to optimize the allocation of high-to-low strata sampled, establish sightability trials, as well as to refine the comparison of survey results with the IM objectives.

2. Mortality–Harvest Monitoring

ACTIVITY 2.1. Monitor harvest through registration permits, general season harvest reports, and drawing permits; analyze harvest data; and assess the accuracy of these data in selected areas when possible (objectives M5, M6, M7, M8).

Data Needs

No change from prior reporting period. Unit 21E has been identified by the Board of Game for IM of moose. There are also subsistence regulations in place which set ANS throughout Unit 21. Annual summaries of harvest are necessary to understand harvest in relation to IM, subsistence, and sustained yield. Analysis of harvest data also informs department recommendations to the Board of Game.

Methods

- Harvest will be assessed using data from harvest reports stored in the harvest database in WinfoNet.
- Monitor total harvest for comparisons with the IM harvest objective (methods will be those described in “I. RY10–RY14 Management Report | 2. Mortality–Harvest Monitoring and Regulations | Methods” this document).
- Compare reported harvest to the lower limit of the IM harvest objective using 3-year running means to account for annual variation in harvest.

3. Habitat Assessment–Enhancement

None.

NONREGULATORY MANAGEMENT PROBLEMS OR NEEDS

In January 2005 the Yukon–Innoko Moose Management Working Group convened to develop a plan to proactively manage moose populations in the area. YIMMP was the result of this process (Yukon–Innoko Moose Management Working Group 2006). This plan is now 10-years old and will need to be reevaluated in the next 5–10 years.

Maintaining or improving moose habitat was recommended by the working group, and habitat quality was assessed in Unit 21E in 2006. However, no habitat assessment work has been conducted in Unit 21A. Continued habitat assessments may be conducted; however twinning surveys, an index of population nutrition, will be our primary metric of habitat quality.

In 2011 ADF&G staff placed 10 snow stakes in Unit 21E to assess snow depth. Nine of the stakes fell that first winter, and all were repaired in summer 2012. Seven more fell again and only 3 snow stakes remained. Repairs were again made in summer 2014. Currently we do not have funding to monitor the remaining snow stakes.

Low snow winters have made conducting a GSPE in Unit 21E more difficult in recent years. The winter 2015 survey was canceled due to low snow, and in 2016, we were able to conduct the survey. However, snow was also marginal at the beginning of this survey, and by the time the

survey was completed, the snow had mostly melted from the southern portion of the survey area. New survey techniques may need to be developed to alleviate this issue.

Data Recording and Archiving

GSPE data are stored in WinfoNet using the moose survey application. Other moose survey data are located in files in the McGrath office. Historic data will be archived in the WinfoNet data archiving system as time permits.

Agreements

The *Yukon–Innoko Moose Management Plan* (YIMMP; Yukon–Innoko Moose Management Working Group 2006).

Permitting

ADF&G Collecting Permit (Josh Peirce #09-045).

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