Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 –PO Box 115526
Juneau, AK 99811-5526

CHAPTER 32: MOOSE MANAGEMENT REPORT

From: 1 July 2011
To: 30 June 2013

LOCATION

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

GEOGRAPHICAL DESCRIPTION: Western Brooks Range and Kotzebue Sound

BACKGROUND

Moose began to appear in the eastern portion of Unit 23 during the 1920s and expanded their range to the Chukchi Sea coast by the mid to late 1940s (LeResche et al. 1974). Moose currently rank second to caribou as a source of terrestrial meat for most residents of the unit. Moose are also avidly sought by Alaska resident (nonlocal) and nonresident hunters who live outside this unit. Commercial services associated with moose hunting provide substantial income to guides, outfitters, and transporters who operate in Unit 23. The wide distribution and accessibility of moose throughout the unit makes them important to nonconsumptive users (e.g., viewers and photographers).

From the time moose appeared in Unit 23 through the late 1980s, public comments, trend count surveys, and observations by department staff suggested moose populations increased throughout the region. Severe winters and extensive spring flooding during 1988–1991caused starvation among adult moose and weakened calf cohorts in at least 2 years. These factors, combined with predation by grizzly bears and wolves, likely caused moose populations to decline throughout the unit. From the mid-1990s through this reporting period calf recruitment throughout most of the unit has been low, and moose density has remained at low levels in large portions of the unit (Dau 2008; Westing 2012).

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Sustain moose populations at stable or increasing levels in all major drainages.
- Maintain healthy age and sex structures of moose populations within Unit 23.
- Monitor human and natural mortality factors affecting moose.
- Improve public understanding of regulations and their purpose.

MANAGEMENT OBJECTIVES

- Annually monitor the size and sex/age composition of moose populations in the Noatak, Kobuk, Selawik, and Northern Seward Peninsula drainages on a rotational basis through aerial surveys.

- Maintain a Unit 23 adult moose population of 8,100–10,000.

    - Noatak River and northern drainages 2,000–2,300 moose.

    - Upper Kobuk River drainage 600–800 moose.

    - Lower Kobuk River drainage 2,800–3,400 moose.

    - Northern Seward Peninsula drainages 700–1,000 moose.

    - Selawik River Drainage 2,000–2,500 moose.

- Maintain a minimum fall ratio of 40 bulls:100 cows in all areas but the Lower Kobuk, where bull:cow ratios are known to be skewed by its disproportional use by maternal cows. This objective is higher than the standard ratio of 20–30 bulls:100 cows used in most areas of Alaska because moose populations in Unit 23 are widely distributed and occur at low densities.

- Analyze harvest data for changes that may indicate a potential conservation concern.

- Evaluate hunting regulations and recommend changes if necessary.

- Through public education, vendor support, and communication, increase the understanding of regulations and improve reporting compliance.

METHODS

During this reporting period, moose population trend and sex/age composition data were collected through aerial surveys using the geospatial technique (Geospatial Population Estimate, or GSPE; Kellie and DeLong 2006). Geospatial surveys have been performed in the spring to monitor density of moose since 1999 due to difficult fall survey conditions. Surveys are conducted in coordination with federal partners that include the U.S. Fish and Wildlife Service (USFWS), the National Park Service (NPS), and the Bureau of Land Management (BLM). Two spring moose surveys were conducted in Unit 23 since the last report was prepared:

1. Lower Kobuk River drainage (March 2012; cooperative project with NPS, USFWS). In 2012, stratification involved 1 aircraft, a Cessna 185 with a 4-person crew (pilot, navigator and 2 observers) surveying 30–31 March. Sample units (n = 250) received aerial intensive coverage from 3 aircraft during the period 2–11 April.

2. Lower Noatak River drainage expanded to include Wulik River, Kivalina River, Cape Krusenstern National Monument (CKNM), and excluding the Upper Squirrel River

drainage (March 2013; cooperative project with NPS, USFWS, and BLM). This survey area is referred to as the 'Lower Noatak (new)'. In 2013, stratification involved 2 aircraft, a Cessna 185 with a 4-person crew (pilot, navigator and 2 observers) surveying 19–26 March, and a Cessna 206 with a 3-person crew surveying 25–26 March. Sample units (n = 259) received aerial intensive coverage from 4 aircraft during the period 19–22 March and 2 planes continued intensive surveys until 26 March. Sightability surveys (replicate intensive survey flights, n = 30) were completed by a second aircraft team immediately after initial intensive surveys were completed.

In defining geospatial moose survey areas we excluded areas that were obviously not moose habitat, for example, high alpine areas typical of sheep habitat and very large lakes. For most moose survey areas, sample units were subjectively excluded; however, for some areas, quantitative GIS-based exclusion criteria were generated. Despite these exclusions, large areas of open tundra, as well as the headwaters of rivers and creeks, were surveyed even though such areas were often poor quality moose habitat. These marginal areas have been included in GPSE surveys because they were utilized when moose densities were higher in the late 1980s. Even now, at lower densities, a few moose still use these areas of poor, marginal habitat. Using broad, inclusive GSPE surveys covering large geographic areas (e.g., >4,000 mi^2) has been effective by 1) ensuring that a broad range of moose habitat types and quality will be included, 2) reducing the effects of snow-induced movements of moose on survey results, and 3) reducing 'adjustments' to survey boundaries through time to fit changing environmental conditions. Adult moose densities, rather than total moose densities, are reported as a measure of abundance to avoid natural, short-term variation associated with calf production and survival.

In addition to spring abundance surveys, moose were classified during fall geospatial composition surveys in cooperation with federal partners (USFWS, NPS) using methods described by Westing (2012). The technique during fall surveys is a streamlined approach to GSPE design focusing on desktop stratification to determine 'high' and 'low' strata. Additionally, 150 sample boxes are considered acceptable to adequately characterize the area, despite the understanding that confidence intervals will widen as a result. Two fall moose surveys were conducted in Unit 23 since the last report was prepared:

1. Lower Kobuk River drainage (October 2011; cooperative project with NPS, USFWS). In 2012, Sample units (n = 153) received aerial intensive coverage from 4 aircraft during the period 29 October–17 November.
2. Lower Noatak River (new) drainage (November 2012; cooperative project with NPS, USFWS). In 2012, sample units (n = 217) received aerial intensive coverage from 3 aircraft during the period 9–16 November.

Harvest information was derived from harvest reports. Community-based harvest assessments were also used to estimate moose harvests by Unit 23 residents and are believed to be a more accurate indicator of local resident harvests. Hunters, both successful and unsuccessful, reported the drainage in which they hunted. The term "nonlocal hunters" refers to any hunter, resident or nonresident, residing outside of Unit 23. "Local hunters" refers to residents of Unit 23. "Nonlocal Alaskan" hunters refer to residents of Alaska who reside outside Unit 23.

Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY11 = 1 July 2011–30 June 2012). Harvest data were compiled from harvest reports submitted by hunters, from subsistence harvest surveys, and from talking to hunters.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Spring geospatial population estimates 2000–2013 indicate Unit 23 adult moose densities ranged from 0.03 to 0.59 adult moose/mi^2 (Table 1).

The 2013 total moose estimate of the Lower Noatak survey area (excluding Upper Squirrel River) was 1,478 ± 19% (90% CI). This is a 32% decline from the 2008 estimate of the same area when the population was 2,273 ± 18%. The spring 2013 GPSE population estimate is consistent with the 2012 GSPE fall composition survey estimate of 1,289 moose, which helps confirm a substantial population decline since 2008.

Because sightability (e. g., through use of a sightability correction factor, SCF) has not been uniformly applied to Unit 23 geospatial population estimates, we likely underestimate the population. Sightability of moose is probably high in those portions of this unit with open cover. Even so, moose densities are undoubtedly underestimated to some degree even where trees are sparse (Quayle et al. 2001). Given the relatively low density of moose throughout Unit 23, using these slightly conservative estimates for management purposes affords a small measure of additional protection for these populations.

Sightability analysis in 2013 showed that of 30 units sampled, 5 sample units were ‘low’ strata determined by real time stratification. The remaining 25 sample units were classified as ‘high’ strata, with 14 containing moose. The sightability surveys found 2 additional moose, so the preliminary SCF is expected to be less than 1.10.

Population Composition

Spring (March–April) calf:adult ratios were 8–11:100 during this reporting period (Table 1). Due to conflicts with other projects, we have not conducted moose parturition surveys in Unit 23. Calf:cow ratios in fall composition surveys range widely, 12–34:100 cows, as some areas naturally contain higher concentrations of maternal cows.

Previous reconnaissance surveys conducted 2004–2007 found a unitwide mean bull:cow ratio of 39:100 (Table 2). Bull:cow ratios ranged 26–50:100 among drainages covered. Based on spring survey density estimates, the proportion of moose population observed each year was 20–35%.

The fall 2012 geospatial composition estimate for the Lower Noatak River drainage resulted in a bull:cow ratio of 45:100. The fall 2011 geospatial composition estimate for the Lower Kobuk River Drainage resulted in a bull:cow ratio of 49:100 (Table 2). These data are not comparable to reconnaissance surveys and are therefore not indicative of a change in sex and age composition. Rather, these data may suggest that bulls are more likely to be missed in non-randomized surveys. Conversely, reconnaissance surveys and the geospatial composition estimate show the

same calf:cow ratio in the Lower Noatak drainage in 2004–2007 and 2012 (13:100 and 12:100 respectively) but the Lower Kobuk drainage estimates in 2004–2007 and 2011 differ by half (34:100 and 17:100 respectively. Calf:cow ratios can fluctuate greatly from year to year due to poor cohort success. However, it is also important to note the extremely wide confidence intervals accompanying this survey. The two factors strongly influencing confidence intervals are the proportion of moose sampled and variation in group size.

Distribution and Movements

As moose densities declined in portions of Unit 23 during the late 1980s and early 1990s, moose almost disappeared from some localized areas. Examples of this are Aklumayak Creek and the Kaluktavik River, both small tributaries of the middle Noatak River that held many moose prior to this decline. In contrast, moose density in some locales, for example, the Mulgrave Hills and the northeast portion of the Selawik Hills, appeared unaffected by this decline. This contraction of moose distribution is probably influenced by habitat quality and possibly by behavior of moose, (e.g., movement to traditional rutting areas during fall and the tendency for moose to congregate during periods of deep snow; Coady 1974).

MORTALITY

Harvest

Seasons and Bag Limits. A regulatory year (RY) begins on 1 July and ends on 30 June (e g. RY11 = 1 July 2011–30 June 2012).

Regulatory year *RY11 and RY12* Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 23 north of and including the Singoalik River drainage:		
One bull with 50-inch antlers or antlers with 4 or more brow tines on one side.	1 Sep–20 Sep (general hunt) (harvest ticket)	1 Sep–20 Sep (drawing permit only)
OR		
One moose by registration permit only; however, antlerless moose may be taken only from 1 Nov–31 Dec; a person may not take a calf or a cow accompanied by a calf.	1 Jul–31 Dec (registration hunt)	
Remainder of Unit 23:		
One bull with 50-inch antlers or antlers with 4 or more brow tines on one side.	1 Sep–20 Sep (general hunt) (harvest ticket)	1 Sep–20 Sep (drawing permit only)
OR		
One moose by registration	1 Aug–31 Dec	

Regulatory year *RY11 and RY12* Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
permit only; however, antlerless moose may be taken only 1 Nov–31 Dec; a person may not take a calf or a cow accompanied by a calf.	(registration hunt)	

Board of Game Actions and Emergency Orders. The board reauthorized antlerless moose seasons for RY11 and RY12. No emergency orders were issued during RY11 and RY12.

Hunter Harvest. Community-based harvest assessments indicate approximately 350–450 moose are harvested annually by residents of Unit 23. This number appears to have been stable since about 2000 and slightly exceeds the upper range of the Unit 23 'Amount Necessary for Subsistence' level of 325–400 moose annually (ADF&G Subsistence Division, unpublished data). The community-based estimate of moose harvest is substantially higher than the 72 and 75 moose unit residents indicated on harvest reports in RY11 and RY12, respectively. Although establishment of registration permit hunt RM880 appears to have improved compliance with licensing and reporting requirements for local moose hunters, community harvest data suggest compliance is still far from complete. However, compliance among Kotzebue hunters is likely higher than other communities and it seems unreasonable that only 20% of harvested moose are reported. Harvest ticket and registration permit data are likely reasonably accurate for nonlocal hunters based on field contacts by the local Alaska wildlife trooper. Combining harvest report data for nonlocal hunters (82 moose in RY11 and 81 moose in RY12) with community harvest assessments for local hunters (mean harvest of 342 moose annually, Table 3) indicates the total annual moose harvest in Unit 23 was roughly 400–425 moose during each year of this reporting period.

All community-based estimates of moose harvests in Unit 23 were determined when caribou were abundant and generally available at least sometime during the year. If caribou availability decreases through spatial or temporal shifts in distribution or population decline, harvest of moose by local residents will almost certainly increase.

Based on harvest report data, there has been a stable trend in total annual moose harvest since the late 1970s (Table 4; Fig. 1). In contrast, the total number of moose hunters generally has increased since the early 1980s (Figs. 1 and 2). Prior to RY03, when regulations were restructured, most of this increase in hunters was due to nonlocal Alaskan hunters and nonresident hunters (Fig. 2). However, after RY03 harvest reports indicate that the number of local moose hunters increased rapidly. This is likely not indicative of an actual increase in local moose hunters, but is a product of better effort and harvest tracking with the establishment of the RM880 hunt.

As overall hunter numbers in Unit 23 increased, success rates slowly declined (Fig. 3). However, in the years following establishment of nonresident drawing moose hunts (RY05 to present), success rates among that group increased.

As in the past, the reported harvest of female moose was small during RY11 and RY12 in terms of absolute numbers (11 and 10 taken respectively; Table 5), and in relation to total harvest (8% and 6%, respectively). However, the number and proportion of females in the harvest was higher than the 10-year and 20-year average. This is likely due, at least in part, to the lack of caribou in the western part of the traditional fall caribou migration corridor. Hunters may have had to shift their effort to moose once it became clear that they would not have access to caribou. Community based harvest estimates provide only total numbers of moose, and could not be used to ascertain this conclusion.

Since the early 1980s, numbers of moose hunters and harvest levels have generally declined in the Noatak River drainage and increased in the Kobuk River drainage (Fig. 4). Effort in the Wulik–Kivalina drainages and the drainages of the Northern Seward Peninsula has remained low and stable over time. The Selawik River drainage was increasingly used until 2002. Since that time, the Selawik has received a decreasing number of hunters. This may be attributable to the scarcity of caribou in southern portions of the unit until late fall (October) during most recent years and the desire of many hunters to conduct a multi-species hunt. However, this may also have been influenced by commercial service trends and authorizations within the Selawik National Wildlife Refuge.

Permit Hunts. At the 2003 Board of Game meeting, 2 types of permit hunts were established for moose in Unit 23: an optional registration hunt (RM880) for resident hunters, and mandatory drawing permit hunts (DM871–877) for nonresident hunters. These permit hunts, along with other changes in seasons and bag limits, were intended to incrementally reduce moose harvests in Unit 23 in response to low moose densities, disproportionate hunting pressure, and user conflict issues.

Drawing permit hunts for nonresident hunters were instituted during RY05. Seven hunt areas, each corresponding to a guide-outfitter area, were created and the number of permits available for each area was calculated using the mean nonresident harvest during RY00 through RY04. This regulatory change markedly reduced numbers of nonresident moose hunters but only moderately reduced their harvest levels (Figs. 1 and 2).

The resident registration hunt (RM880) was instituted in RY04 and is described by Dau (2008). During this reporting period, most local resident moose hunters (mean = 91%) participated in RM880 (Table 6). In contrast, approximately half of nonlocal Alaskan moose hunters (mean = 56%) hunted under the general hunt. However, this pattern may be changing as a higher proportion of nonlocal hunters acquire RM880 permits. RM880 permits provide a longer season and allow for the take of "any bull." Additionally, RM880 hunters may take an antlerless moose beginning 1 November. Therefore, the RM880 permit is attractive as it provides the most liberal hunt opportunity.

Hunter Residency and Success: As mentioned previously, the number of hunters in Unit 23 generally increased from the early 1980s until RY05, when the overall number of moose hunters in Unit 23 dipped below the level of previous years (Fig. 1). This was primarily due to the sharp reduction in nonresident hunters that resulted from establishing nonresident drawing hunts in the unit; however, the following year the total number of hunters increased sharply. This was mostly accounted for by an increase in the number of local resident hunters as they learned about

RM880 (Fig. 2). The number of nonlocal Alaskan hunters has remained mostly constant but did decline slightly when RM880 came in place. Nonlocal Alaskan hunters may be more affected by changes in the economy than changes in regulations. Participation by nonlocal Alaskan hunters has now returned to pre-RM880 levels.

Harvest Chronology: As in the past, most moose were harvested in September, a time when several factors contribute to successful hunting: mild weather conducive to airplane and boat access, seasons open for residents and nonresidents, and antlers free of velvet. In RY11, 75% of the reported harvest occurred during September, and in RY12, this percentage was 80%. Nine and 11% of the total harvest was taken during August during these regulatory years, respectively. Similar to RY10, the harvest in December was 7% and 9%, respectively, in RY11 and RY12. Increased harvest of moose in December is likely due to the absence of caribou in portions of Unit 23.

Transport Methods: Airplane was the primary mode of transportation for most hunters who reported hunting moose in Unit 23 until RY05 (Table 7). As participation in registration hunt RM880 by local residents has increased since it was initiated in RY04, the number of boat hunters has exceeded numbers of airplane hunters in each year since RY04. Establishment of RM880 may have merely brought into the regulatory system some local hunters who did not report hunting moose in the past. If so, the actual shift in transport method may not be as dramatic as suggested by harvest report data. Alternatively, if uncertain availability of caribou caused local hunters to shift efforts to moose, this change in transport methods is probably real rather than an artifact of variable compliance with licensing and reporting requirements.

Other Mortality

Predation by brown bears, black bears, and wolves certainly affects moose population dynamics in Unit 23; however, the relative importance of predators in relation to other factors affecting moose, such as weather conditions, snow depth, forage, disease, and human harvests is unknown. The localized high density and disproportionately high calf:cow ratio in the Kobuk River delta, an area almost devoid of large predators due to its location in relation to Kotzebue and primary human travel routes year round, further suggests that predators may be affecting moose in more remote portions of the unit.

HABITAT

Assessment

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

Enhancement

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

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Conflicts among local subsistence hunters, nonlocal hunters, and commercial operators, previously reported by Dau 2002 and Westing 2012, are ongoing at less than peak levels reported in 2002. User conflicts are still perceived by some, but may have decreased for the following reasons:

- Annual meetings of the Unit 23 User Conflict Workgroup (formed in 2008 to address conflicts among users in Unit 23).

- Outreach materials created and distributed by ADF&G that help identify ways to mitigate and minimize conflicts among user groups.

- Economic factors that have reduced the number of hunters visiting the area.

- Regulatory changes have influenced the number of nonresidents and nonlocal Alaska residents using the area.

- Continuation of the pilot orientation requirement for all individuals transporting hunters or their gear in Unit 23.

CONCLUSIONS AND RECOMMENDATIONS

Continued monitoring of the moose populations in Unit 23 is essential to our understanding of moose management in areas with low moose densities. Adult density appears to be stable based on comparison of GPSE results in 3 large sample areas that have been surveyed at least twice since 2000 (Lower Noatak - Upper Squirrel, Northern Seward Peninsula; and Upper Kobuk). Calf recruitment has remained low in all areas.

The department should continue with the strategy of monitoring moose abundance by conducting spring population estimates over large areas (4,000–10,000 mi^2). Covering large areas minimizes the effects of moose movements on density estimates, and ensures the full range of habitat and snow conditions are included. Snow and light conditions are optimal for observing moose during spring. Sampling areas should rotate each year so data are collected regularly from each area.

Collecting information on sex and age composition is essential for monitoring the effects of potentially selective harvest. Use of a geospatial approach provided better results with measures of precision compared to reconnaissance surveys, but requires more time and resources. The department continues to examine ways to increase sampling efficiency.

As hunters continue to improve their understanding of the requirements for hunting in Unit 23, reporting compliance will continue to improve. However, community-based harvest assessments in villages throughout Unit 23 will likely continue to be the most accurate way to monitor local harvests.

Future effort in Unit 23 should focus on habitat assessment using browse surveys, parturition surveys or twinning surveys (or some combination of these assessments.)

REFERENCES CITED

Coady, J. W. 1974. Influence of snow on behavior of moose. Le Naturaliste Canadien 101: 417–436.

Dau J. 2002. Unit 23 moose management report. Pages 496–515 [*In*] C. Healy, editor. Moose management report of survey and inventory activities 1 July 1999–30 June 2001. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 1.0, Juneau.

_____. 2008. Unit 23 moose management report. Pages 558–578 [*In*] P. Harper, editor. Moose management report of survey and inventory activities 1 July 2005–30 June 2007. Alaska Department of Fish and Game, Division of Wildlife Conservation, Project 1.0, Juneau.

Kellie, K. A. and R. A. DeLong. 2006. Geospatial survey operations manual. Alaska Department of Fish and Game, Division of Wildlife Conservation, Fairbanks.

LeResche, R. E., R. H. Bishop, and J.W. Coady. 1974. Distribution and habitats of moose in Alaska. Le Naturaliste Canadien 101:143–178.

Quayle, J. F., A. G. MacHutchon, and D. N. Jury. 2001. Modeling moose sightability in South-Central British Columbia. Alces 37(1): 43–54.

Westing, C. 2012. Unit 23 moose management report. Pages 560–582 [*In*] P. Harper, editor. Moose management report of survey and inventory activities 1 July 2009–30 June 2011. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2012-5, Juneau.

PREPARED BY:

Brandon Saito
Wildlife Biologist III

APPROVED BY:

Peter Bente
Management Coordinator

Please cite any information taken from this section, and reference as:

Saito, B. 2014. Unit 23 moose management report. Pages 32-1 through 32-21 [*In*] P. Harper and L. A. McCarthy, editors. Moose management report of survey and inventory activities 1 July 2011–30 June 2013. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2014-6, Juneau.

While this unit report was actually published in 2017, it is part of the set of 2014 unit species management reports, so we suggest citing the report as a 2014 report to maintain its relationship to the other 2014 unit reports.

Product names used in this publication are included for completeness but do not constitute product endorsement.

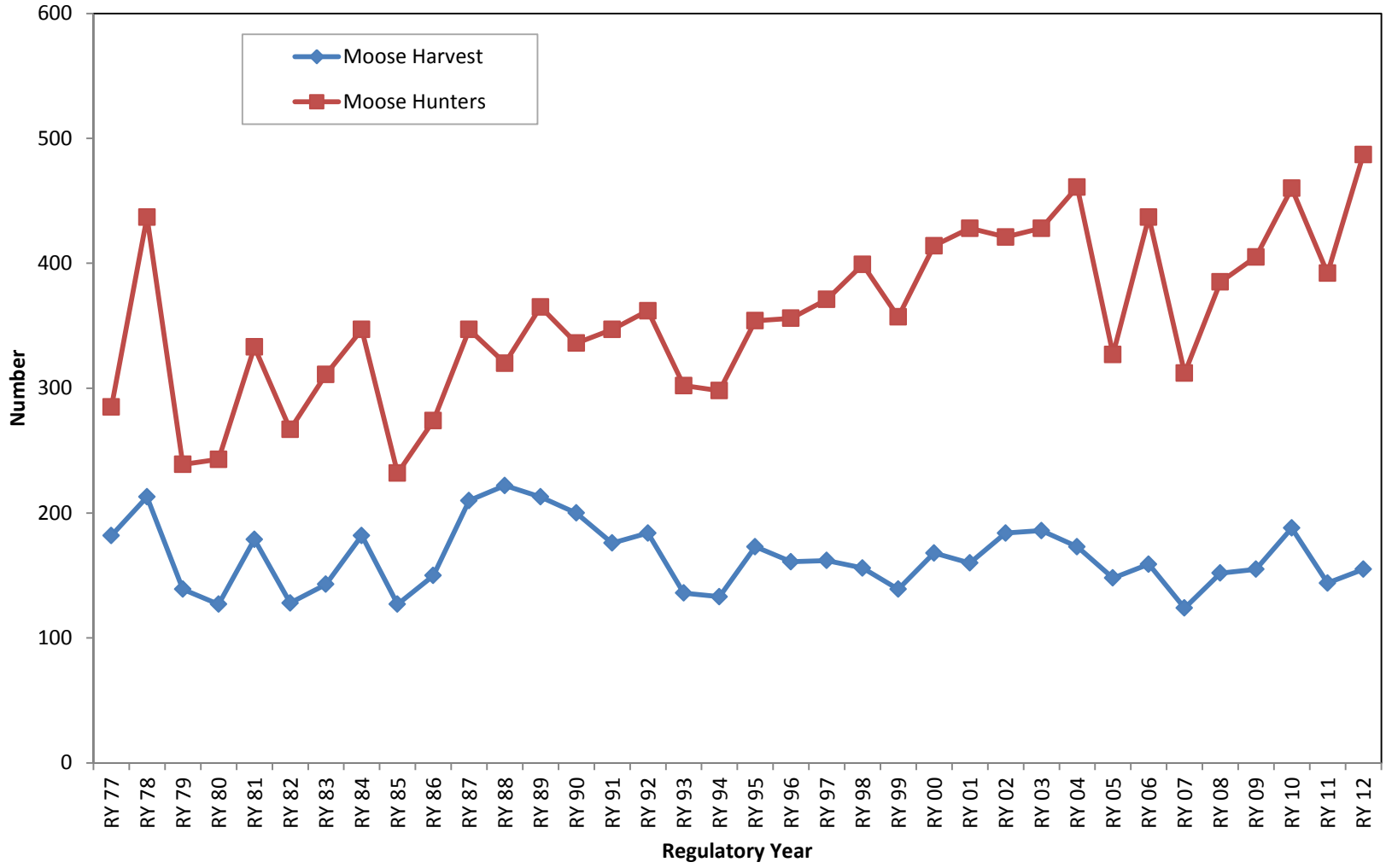

Figure 1. Unit 23 moose hunters and harvests (harvest and registration report data), RY77 through RY12.

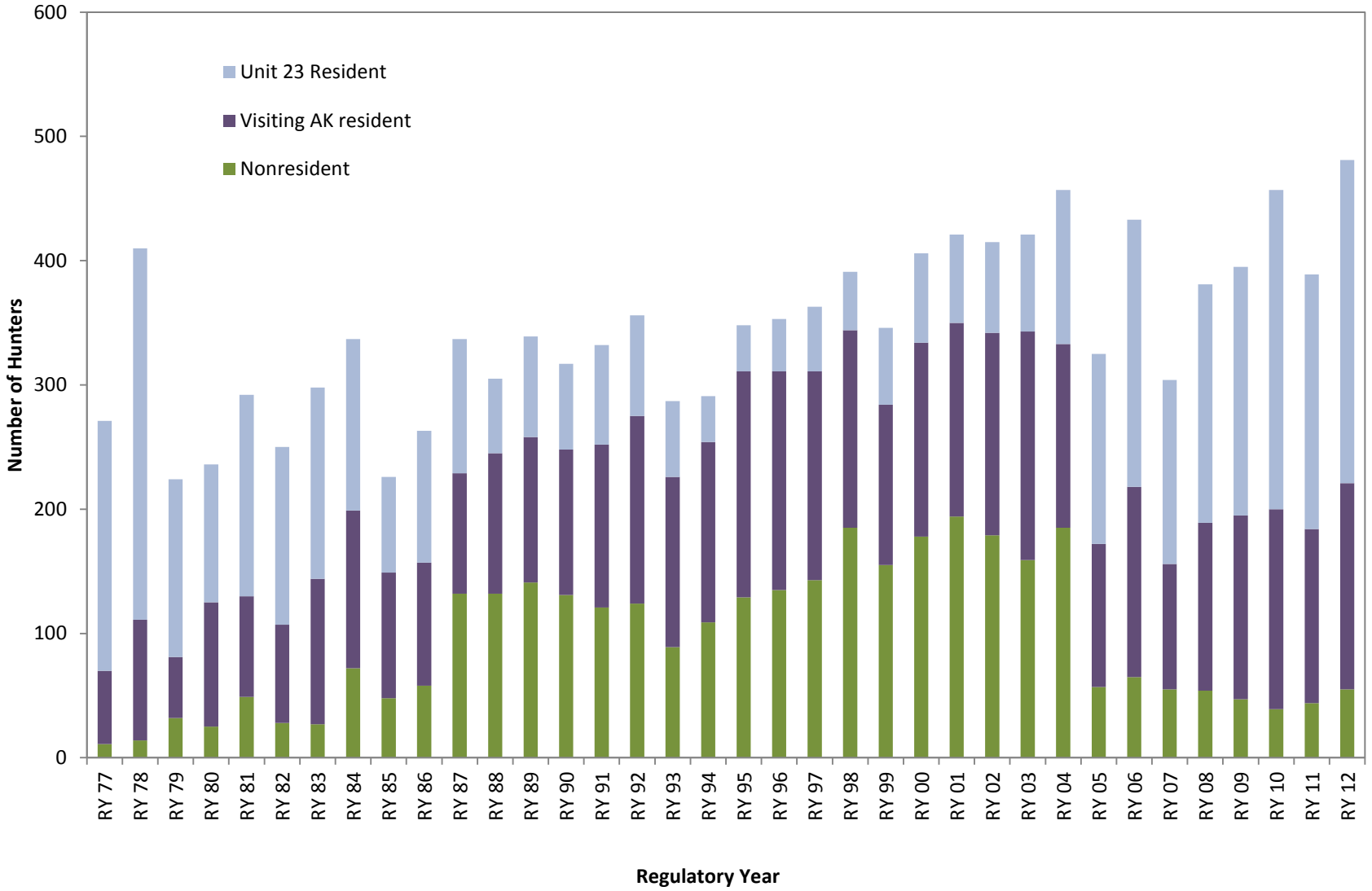

Figure 2. Numbers of moose hunters in Unit 23 by residency (harvest and registration report data), RY77 through RY12.

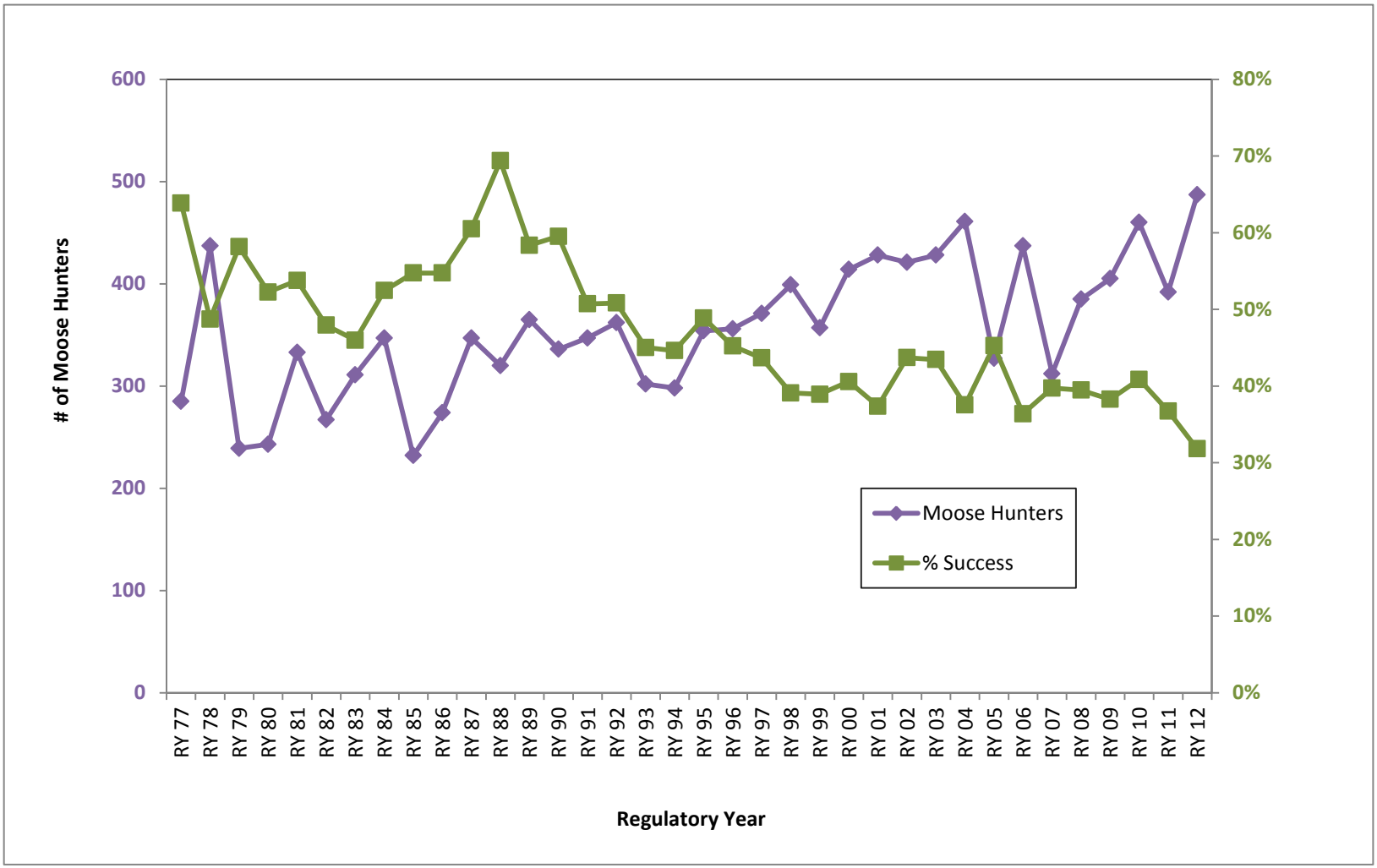

Figure 3. Unit 23 moose hunter effort and success (harvest and registration report data), RY77 through RY12.

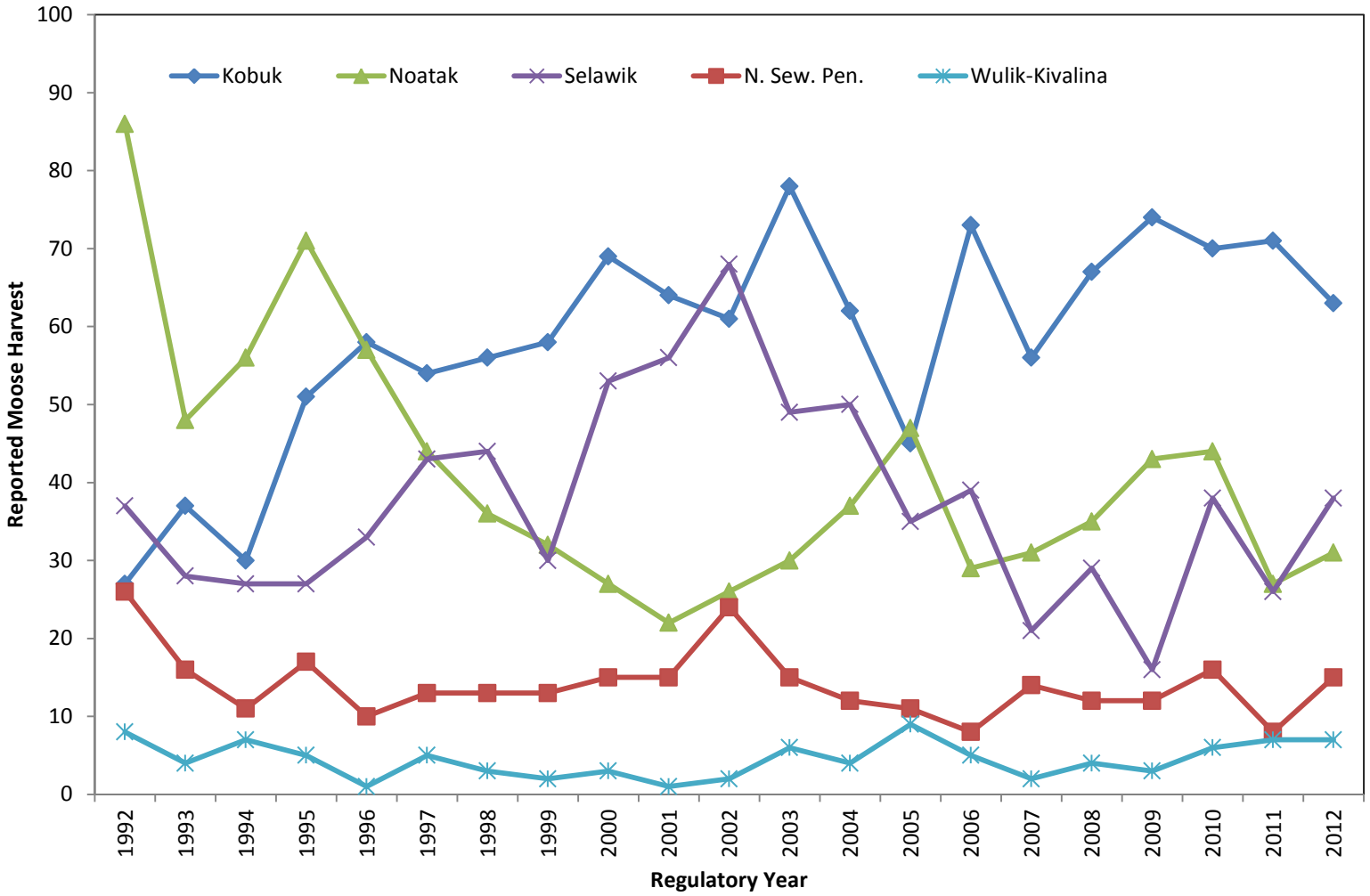

Figure 4. Unit 23 moose harvest by drainage (harvest and registration report data), RY83 through RY12.

Table 1. Unit 23 spring geospatial moose survey results, 2000–2013 (all surveys conducted cooperatively by ADF&G, NPS, USFWS and BLM, except as noted).

Area	Year	Size (mi^2)	Survey estimate (No.)			90% CI[b]	Density (No./mi^2)		Calves:100 Adults
			Adults	Calves	Total[a]		Adult	Total	
Selawik	2007	6,580.1	2,114	208	2,319	±16	0.35	0.32	10
Selawik	2011	6,559.0	1,569	170	1,739	±18	0.24	0.27	11
Lower Noatak	2000	2,111.2	710	59	779	±19	0.34	0.37	8
Lower Noatak	2001	2,111.2	1,325	130	1,453	±18	0.63	0.69	10
Lower Noatak-Upper Squirrel	2001	5,230.2	1,580	151	1,731	±18	0.30	0.33	10
Lower Noatak-Upper Squirrel	2005	5,349.7	1,630	208	1,838	±19	0.30	0.34	12
Lower Noatak (prev), includes-Upper Squirrel-Wulik-Kivalina-Cape Krusenstern	2008	7,161.6	2,094	297	2,388	±19	0.29	0.33	15
Lower Noatak (new), includes Wulik, Kivalina, Cape Krusenstern	2013	6,404.5	1,349	143	1,478	±19	0.21	0.23	11
Upper Noatak	2010	4,485.6	136	16	152	±18	0.03	0.03	12
N. Seward Peninsula[c]	2002	5,888.5	575	38	612	±14	0.10	0.10	7
N. Seward Peninsula[c]	2004	5,882.9	728	86	810	±9	0.12	0.14	12
N. Seward Peninsula	2009	5,773.2	904	74	966	±27	0.16	0.17	8
Upper Kobuk	2003	4,001.5	760	91	856	±19	0.19	0.21	12
Upper Kobuk	2006	4,001.5	653	96	737	±22	0.16	0.18	15
Lower Kobuk-Lower Squirrel	2006	4,870.5	2,891	511	3,398	±15	0.59	0.70	18
Lower Kobuk- Squirrel	2012	5,338	2,363	181	2,546	±17	0.44	0.48	8

[a] Generated as Total Moose in the geospatial model and, therefore, does not usually equal the sum of adults and calves.

[b] Expressed as a percentage of the estimate.

[c] Survey completed by ADF&G.

Table 2. Late fall (October-early December) moose classification counts from western portions of Unit 23, 2004–2007 and Geospatial composition estimate, 2008–2012. (Data not comparable between survey methods).

	Bull antler size			Cows with calves					Total moose		Ratio (per 100 cows)			
Area	Sp-Fk	Med	Large	0 ca	1 ca	2 ca	3 ca	Lone calf	Observed (% of GSPE)	Spring GSPE (year conducted)	Bulls	90% CI	Calves	90% CI
2004–2007 Avg Reconnaissance Surveys [a]														
Lower Noatak-Upper Squirrel	22	82	94	352	38	5	0	0	641 (35)	1,838 (2005)	50		13	
N. Seward Peninsula	7	24	28	131	15	2	0	0	224 (28)	810 (2004)	41		12	
Lower Kobuk-Lower Squirrel	20	63	31	302	116	10	0	2	677 (20)	3,398 (2006)	26		34	
Selawik	20	52	34	222	41	4	0	0	558(24)	2,319 (2007)	40		18	
Total	69	221	187	1,007	210	21	0	2			39		21	
Geospatial Composition Estimate [bc]														
Selawik (2008)	131	452	375	1,455	230	34	0	0	464 (20)	2,319(2007)	54	±19%	18	±31%
N. Seward Peninsula (2009)	23	98	85	380	17	0	0	0	152 (16)	966 (2009)	53	±54%	4	±73%
Selawik (2010)	42	475	335	1,492	286	32	0	0	474 (20)	2,319 (2007)	47	±29%	19	±23%
Lower Kobuk (2011)	24	538	562	1,917	340	17	0	1	685 (27)	2,546 (2012)	49	±24%	17	±25%
Lower Noatak (2012)	11	189	200	786	91	11	0	0	199 (14)	1,478 (2013)	45	±30%	12	±42%

[a] Data from reconnaissance surveys are presented as averaged raw counts from the period 2004–2007. Totals (percentages) may not equal the sum (proportion) of contributing values.

[b] Data are estimates generated from geospatial composition estimate. Totals may not equal the sum of contributing values. Each census estimate column is an independent computer-generated estimate using the census method noted in the census method column.

[c] Survey conducted cooperatively by ADF&G, NPS, and USFWS .

Table 3. Estimated moose harvest in Unit 23 villages from community harvest estimates 1991–2013 (CSIS information from Subsistence Division, 2010 except as noted).

Village	Year of survey	Mean human population in survey years	Mean number moose reported harvested	Per capita moose harvest	Estimated village population in 2012	Estimated annual moose harvest in 2012–2013
Ambler	2002, 2009, 2012	271	10	0.04	283	11
Buckland	2003, 2009	421	13	0.03	421	13
Deering	1994, 2007	159	8	0.05	153	8
Kiana	1999, 2006, 2009	387	13	0.03	378	13
Kivalina	1992, 2007, 2010	380	11	0.03	367	11
Kobuk	2004, 2009, 2012	135	6	0.04	164	7
Kotzebue	1991, 2013	3,362	154	0.05	3,076	154
Noatak	1994, 1999, 2001, 2007, 2010, 2011	481	7	0.02	545	11
Noorvik	2002, 2008, 2012	621	35	0.06	585	35
Point Hope[a]	1992	685	14	0.02	674	14
Selawik	1999, 2006, 2011	797	50	0.06	856	51
Shungnak	1998, 2002, 2008, 2012	258	12	0.05	275	14
Unit 23 Total					**7,777**	**342**

[a] North Slope Borough, unpublished data.

Table 4. Numbers of moose hunters (effort) and harvest by residency (harvest and registration report data), RY91 through RY12.

	Nonlocal AK			Nonresident			Unit 23 resident			Unknown	Total		
Regulatory year	Harvest	Effort	% Success	Harvest	Effort	% Success	Harvest	Effort	% Success	Harvest	Harvest	Effort	% Success
RY91	60	131	46	69	121	57	38	80	48	9	176	347	51
RY92	63	151	42	69	124	56	48	81	59	4	184	362	51
RY93	52	137	38	41	89	46	36	61	59	7	136	302	45
RY94	61	145	42	58	109	53	12	37	32	2	133	298	45
RY95	85	182	47	60	129	47	24	37	65	4	173	354	49
RY96	80	176	45	60	135	44	19	42	45	2	161	356	45
RY97	70	168	42	62	143	43	27	52	52	3	162	371	44
RY98	62	159	39	72	185	39	20	47	43	2	156	399	39
RY99	47	129	36	62	155	40	23	62	37	7	139	357	39
RY00	61	156	39	72	178	40	31	72	43	4	168	414	41
RY01	59	156	38	67	194	35	29	71	41	5	160	428	37
RY02	54	163	33	84	179	47	42	73	58	4	184	421	44
RY03	78	184	42	66	159	42	37	78	47	5	186	428	43
RY04	35	148	24	85	185	46	51	124	41	2	173	461	38
RY05	41	115	36	41	57	72	65	153	42	1	148	327	45
RY06	49	153	32	30	65	46	79	215	37	1	159	437	36
RY07	29	101	29	25	55	45	65	148	44	5	124	312	40
RY08	49	135	36	40	54	74	62	192	32	1	152	385	39
RY09	49	148	33	23	47	49	78	200	39	5	155	405	38
RY10	62	161	39	22	39	56	102	257	40	2	188	460	41
RY11	43	139	31	25	43	58	73	204	36	3	144	393	37
RY12	59	176	34	22	48	44	75	262	29	3	156	489	32

Table 5. Sex of moose harvested (harvest and registration report data), RY91 through RY12.

	Sex of moose harvested		
Year	Male	Female	Unknown
RY91	143	33	0
RY92	159	25	0
RY93	118	17	1
RY94	127	6	0
RY95	164	8	1
RY96	145	15	1
RY97	154	8	0
RY98	146	8	2
RY99	127	11	1
RY00	157	11	0
RY01	150	9	1
RY02	172	11	1
RY03	175	11	0
RY04	173	0	0
RY05	137	10	1
RY06	150	7	2
RY07	117	7	0
RY08	145	6	1
RY09	144	10	1
RY10	168	17	3
RY11	133	11	0
RY12	146	10	0

Table 6. Numbers of resident Alaskan moose hunters and harvests in Unit 23 by hunt type and location of residence (harvest and registration report data), RY04 through RY12.

Regulatory Year	General Hunt				RM880			
	Nonlocal AK		Unit 23 Res		Nonlocal AK		Unit 23 Res	
	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort
RY04	31	128	9	15	4	20	42	109
RY05	30	89	13	36	11	26	52	117
RY06	31	115	12	32	18	38	67	183
RY07	15	72	9	35	14	29	56	113
RY08	25	85	4	31	24	50	58	161
RY09	28	107	11	33	21	41	67	167
RY10	34	112	12	28	28	49	90	229
RY11	19	72	7	16	24	67	66	188
RY12	28	106	4	27	31	70	71	235
Total	**241**	**886**	**81**	**253**	**175**	**390**	**569**	**1,502**

Table 7. Percent of moose hunters by transportation type in Unit 23 (harvest and registration report data), RY91 through RY12.

	Airplane	Boat	Snow machine	Horse/Dog	3- or 4-wheeler	Off-road Vehicle	Highway Vehicle	Airboat	Unknown
RY91	67	19	8	1	2	0	1	0	3
RY92	68	17	6	0	2	0	1	0	5
RY93	64	24	6	0	3	1	1	0	2
RY94	64	25	4	1	2	0	1	0	3
RY95	68	22	3	0	5	0	0	0	3
RY96	66	22	6	0	4	0	1	0	2
RY97	67	20	5	1	4	0	1	0	3
RY98	72	19	3	0	3	0	0	0	3
RY99	69	22	5	1	3	0	1	0	0
RY00	63	28	4	1	2	0	0	0	1
RY01	66	27	3	0	2	0	0	0	1
RY02	65	28	3	0	1	0	0	1	1
RY03	59	35	2	1	1	0	0	0	2
RY04	58	36	3	0	2	0	0	0	1
RY05	42	45	5	1	3	0	0	0	2
RY06	36	51	4	1	2	0	0	1	4
RY07	43	46	4	0	2	1	0	0	4
RY08	38	51	4	1	3	0	1	0	3
RY09	37	52	5	0	4	0	0	0	1
RY10	37	50	5	0	4	0	0	0	4
RY11	38	44	6	0	2	0	1	0	9
RY12	35	54	3	1	4	1	0	0	2