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CHAPTER 3: MUSKOX MANAGEMENT REPORT

From: 1 July 2012
To: 30 June 2014

LOCATION

GAME MANAGEMENT UNITS: 23 (43,000 mi^2) and 26A (56,000 mi^2)

GEOGRAPHIC DESCRIPTION: Kotzebue Sound and North Western Arctic Slope of Alaska

BACKGROUND

Muskoxen are indigenous to Northwest Alaska; however, they disappeared before or during the 19th century for unknown reasons. The North Pacific whaling fleet is often credited with decimating muskoxen in this region. However, muskoxen may have already disappeared from Alaska (but not northwestern Canada) by the time whalers arrived. Although there is ample evidence of several genera of muskoxen in Northwest Alaska from the Pleistocene period (McDonald and Ray 1989), there is little evidence that muskoxen existed south of the Brooks Range during the last several hundred years.

Two muskox populations currently inhabit Unit 23, and both are products of translocations from Nunivak Island. The department released 36 muskoxen on the southwestern portion of the Seward Peninsula near Teller in 1970. In 1981 the department released an additional 35 muskoxen in the same area. Muskoxen inhabiting Unit 23 Southwest, the portion of Unit 23 between the Buckland and Goodhope rivers, are part of the Seward Peninsula population that resulted from these translocations near Teller. The Unit 22 muskox management report covers the Seward Peninsula muskox population and includes information for Units 22 and 23 Southwest.

In 1970 the department released 36 muskoxen near Cape Thompson, and in 1977 the department released an additional 34 muskoxen at the same site. Of the 4 translocations of muskoxen to Alaska, the Cape Thompson population has grown the least. A large portion of the Cape Thompson muskox population inhabits the portion of Units 23 and 26A from the mouth of the Noatak River to Corwin Bluff within 20–35 miles of the Chukchi Sea.

In addition to the relatively discrete Seward Peninsula and Cape Thompson populations that occupy stable, core ranges, muskoxen are also widely scattered throughout the remainder of the unit. Most of these scattered muskoxen occur in small groups of 1–4 individuals, and most are bulls. However, mixed sex-age groups have been observed in the Selawik, middle Noatak, and upper Noatak drainages during recent years, as well as large groups of >20 animals in the southwestern portion of Unit 26A and the headwaters of the Colville River. Muskoxen in the

Noatak drainage and in Unit 26A probably emigrated from the Cape Thompson area while those in the Selawik and Kobuk drainages probably came from the Seward Peninsula.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Allow for growth and expansion of muskoxen into historic ranges.
- Provide for subsistence hunting and eventually for recreational hunting of muskoxen on a sustained yield basis.
- Provide for nonconsumptive uses of muskoxen; e.g., viewing and photography.

MANAGEMENT OBJECTIVES

- Survey the Cape Thompson population at least once every 3 years.
- Assess population level range expansion.
- Monitor the sex and age composition of the Cape Thompson muskoxen population.
- Minimize effects of development (e.g., mines and roads), hunting, and tourism on muskoxen and their habitat.

METHODS

POPULATION STATUS AND TREND

Population Size

The Cape Thompson muskoxen population has been surveyed since 1987 using fixed-wing aircraft. The traditional sample area includes that portion of Unit 23 between the mouth of the Noatak River and Corwin Bluff within approximately 20 miles of the Chukchi Sea coast. It also includes the lower 16 km (10 mi) of the Agashashok River (Aggie River). We used minimum count techniques during 1987–2010. Search efforts focused on known areas of use and prime muskoxen habitat along ridgelines and riparian areas; other areas were searched less intensively. To minimize disturbance, we approach groups of muskoxen at ~305 m (1,000–2,000 ft) above ground level (AGL) and repeatedly count them during a gradual, low power, spiral descent. These surveys had no estimates of sightability or confidence intervals and may have been vulnerable to observer bias.

Since introduction, incidental sightings have increased outside of the traditionally sampled area. In the last 20 years, the number of incidental sightings has increased dramatically, while in the last 5 years, counts within the traditional survey area have decreased (Fig. 1; Westing 2011). In 2011 a population-wide survey was completed that included the traditional area and potential habitat in Units 26A and 23 north of the Kobuk River. In 2012 and 2013 a distance sampling survey was completed in the 10,440 km^2 traditional sample area. Distance sampling surveys are planned for the traditional area in 2014 and 2015. The next population-wide survey that includes the new expanded areas will be in 2016, and thereafter considered on a 4-year rotation.

Distance Sampling. The distance sampling technique gives detections at various distances which can estimate abundance (Buckland et al. 2001, 2004). In 2010, distance sampling methods were successfully used to estimate the size of the Seward Peninsula muskoxen population (Gorn

2011). In 2011, the distance sampling method was adopted to estimate abundance for the Cape Thompson population. The following methods for the 2012 and 2013 survey were modified from the 2011 distance sampling survey (J. H. Schmidt and C. Westing, ADF&G, 2011, unpublished agency report, Kotzebue [W:\muskox\census results\ct2011]) to estimate the Cape Thompson muskox population in the traditional sample area (Schmidt et al. 2012).

All surveys were conducted at ~305 m AGL using tandem fixed-wing aircraft (i.e., Super Cub type aircraft) to reduce potential differences due to aircraft configuration and airspeed. Flight altitudes AGL were allowed to decrease when transects crossed hills to minimize changes in flight angle. If a hill could not be passed over safely without increasing the flight angle, teams were instructed to stop surveying and gain altitude before continuing the transect. In continuous mountainous terrain an altitude that maintained ~305 m AGL over a majority of the transect was selected by the pilot, although this situation was relatively rare (Westing 2013).

The pilot and observer worked together as a team to search all terrain on both sides of the aircraft out to the midpoint between transects. Teams were instructed to concentrate on the area nearest the aircraft first to ensure probability of detection was 1.0 near the centerline. When a group of muskoxen was detected, the team continued surveying until slightly past the group to prevent detections of additional groups after leaving the transect. The team then left the transect, marked the group location with a Global Positioning System (GPS), and recorded the total number of individuals and the number of short yearlings in the group. Digital photographs were used to confirm counts of larger groups when necessary.

Survey Techniques. The Cape Thompson traditional survey area was resampled in 2012 and 2013 to increase the number of area specific group detections, and to decrease the reliance on Seward Peninsula group detections in future surveys (Westing 2013). The parallel transect intervals were changed to 4.8 km (3 mi) spacing for compatibility with Seward Peninsula surveys, and to increase effort to get a better estimate (J. Schmidt, National Park Service [NPS], Fairbanks, personal communication). The 2012 survey was flown during 3–15 March 2012. Snow coverage was adequate (complete or near complete) in each survey area. The 2013 survey was flown during 27 February–2 March. Snow cover was adequate in all locations although ridges and knobs were windswept as is to be expected (Westing 2013; B. Saito, ADF&G, unpublished report, Kotzebue [W:\muskox\census results\ct2013]).

The survey area boundaries were determined using locations of observed muskoxen and exclusionary habitat criteria (e.g., complete snow coverage with no exposed vegetation) for Unit 23 (Westing 2013). Areas at elevations over 700 m were considered nonhabitat and were excluded from the survey. This criterion was set after analyzing the elevation of all muskoxen sightings in the muskoxen database that have been kept at ADF&G since the muskoxen introduction. ArcGIS 10 was used with a Spatial Analyst extension to remove areas higher than 700 m from a raster layer. The raster layer was converted to a coverage so polygons less than 1 mi^2 could be added back for continuity. Finally, the coverage was converted to a shapefile delineating survey boundaries.

Analysis. Perpendicular distances from the flight line to each observed group were calculated using ArcMap 9.3.1. The observed distance data in both surveys were right truncated at 2.23 km (1.4 mi) (J. Schmidt, personal communication), the distance at which adjacent transects

overlapped. The left truncation distance, accounting for the unobserved strip beneath the aircraft, was determined by examining a histogram of the observed data. A sharp increase in the number of detections in subsequent distance categories was used to identify the width of the partially observable strip. Because survey altitude was allowed to decrease while passing over hills, a small number of groups were recorded within the left truncation distance and were discarded prior to analysis. A half normal detection function was used, and the model was fit in a Bayesian framework using R 2.12 (R Development Core Team 2010) and WinBUGS (Spiegelhalter et al. 2004) (J. Schmidt, personal communication). The 2011 survey analysis included group size as a covariate (Westing 2013); however, the group size covariate was not used in the traditional area surveys (J. Schmidt, personal communication).

Population Composition

Composition information was collected by ADF&G and NPS during March–April 2012 and 2013 when sightability was more optimal. Composition information was also collected in August 2012 in partnership with NPS. Fall compositions were not completed in 2013. Muskoxen were classified into the following age and sex classes: mature bull ≥4yr; bull = 3 yr; bull = 2 yr; mature cow ≥4yr; cow = 3yr; cow = 2yr; short yearlings (15 months); and calves. The latter 2 classifications were collected during spring composition.

A Robinson R-44 helicopter was used for transportation to the groups where ground-based observations of muskoxen were performed. We classified as many muskoxen as possible, sometimes using 1 or 2 fixed-wing planes to help search the area between the Noatak River mouth and the Kivalina River. Locations of muskoxen observed during surveys were recorded using GPS coordinates.

Distribution and Movements

Locations of muskoxen observed opportunistically during other work were also recorded using GPS coordinates. In addition, conversations between department staff and local residents, commercial operators, hunters, and nonconsumptive users provided information regarding the distribution of muskoxen in Units 23 and 26A.

MORTALITY

NPS collared and monitored cow muskoxen between March 2009 and May 2013 for a mortality study. Staff from both agencies examined mortality sites when possible to attempt to determine causes of muskoxen mortality and collect samples.

Harvest

Harvest data are summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY12 = 1 July 2012–30 June 2013). Harvest during RY12 and RY13 was monitored through the Tier II hunt report system.

HABITAT

Assessment

The department did not monitor muskoxen range condition in Units 23 and 26A during the reporting period.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

The 2012 Cape Thompson muskox population survey estimated 220 (95% CI: 174–305) muskoxen in the traditional survey area and had 19 group detections.

The 2013 Cape Thompson muskox population census estimated 227 (95% CI: 178–367) muskoxen (Fig. 2) in the traditional survey area and had 20 group detections.

The difference between the 2 point estimates show a slight increase in the population; however, the confidence intervals drastically overlap one another, and analysis indicate there is no statistical change between the 2012 and 2013 Cape Thompson muskox population results. It is important to note that these 2 survey results are less comparable with minimum counts from surveys prior to 2011 since they utilized full coverage rather than transects with 3 mile spacing.

From 1970 to 1998 the Cape Thompson muskoxen population within the sampled area grew approximately 8% annually (Fig. 3). Since 1998 the growth of this population within the sampled area slowed dramatically to 2% annually. Since 2005 the muskoxen population within the traditionally sampled area has shown continuous decline.

Estimates for the traditional survey area should be interpreted with care due to sampling limitations. The fewer group observations in an area, the more reliant the model is on information from other areas and the more likely an estimate may be biased. Two more distance sampling surveys in the traditional survey area will take place in 2014 and 2015. In total these 4 surveys will give us enough specific group detections in the Cape Thompson population to use for the 2016 population-wide survey, and not rely on group detections from the Seward Peninsula population.

Population Composition

Spring composition surveys were conducted in April 2012 and 2013. We observed 8 and 36 short yearlings:100 cows, respectively (Table 1, Fig. 4), 19 and 23 mature bull:cow ratios, respectively (Table 1, Fig. 5), 32 and 36 all bulls:100 cows found, respectively (Table 1, Fig. 6).

Fall composition surveys in 2012 found 39 calves:100 cows (Table 1, Fig. 4), 21 mature bull:100 cows 21 (Table 1, Fig. 5), 33 all bulls:100 (Table 1, Fig. 6). Considering the fall and spring data together, spring surveys found more bulls (Westing 2013). This may demonstrate the difficulties observing bulls in the summer. Mature bulls are often alone or in very small groups that could easily be missed. Fall data suggest that bull:cow ratios are declining (All bulls R^2 = 53%, Mature bulls R^2 = 60% [Figs. 5 and 6]).

In most years, about half of the population estimate is observed during composition surveys. Composition data suggest calf production and yearling survivorship has varied substantially among years. Low calf production (in most years below 15%) combined with observations of mixed sex-age groups emigrating from the core range may suggest this population is beginning to experience density-dependent limitations (Westing 2013).

Distribution and Movements

Muskoxen in the northern portion of their range may be moving along the coast and emigrating into Unit 26A. For example, 48 animals were observed in spring 2009 at Cape Sabine, outside the traditional census area. In 2011, 38 animals were observed in the same area. Additionally, in recent years, there have been groups of >20 muskoxen just outside of the sample boundary and in the Kelly and Kugururok drainages. Collar data from the NPS study has also shown some impressive animal movement. One cow traveled 130 miles from the Igichuk Hills (summer 2009) to Corwin Bluff (February 2010) (L. Adams, U.S. Geological Survey, Anchorage, personal communication). Another cow was observed on the Noatak River near the mouth of the Kaluktavik River wearing a radio collar from capture work in the traditional survey area.

Muskoxen appear to use areas heavily and then nearly abandon them for extended periods (Dau 2005). One recent example of this may be the Wulik River. Summer composition surveys have shown a steady decline from 89 muskoxen in 2004 to 11–14 muskoxen in 2009–2012 (N = 9, R^2 = 0.68). There is no obvious answer to the cause of this decline. There have not been any noticeable increases in other nearby areas. There is no reason to believe a large mortality event occurred on the Wulik River.

MORTALITY

Harvest

Season and Bag Limit. During this reporting period the state administered a Tier II subsistence permit muskoxen hunt in northwest Unit 23 (TX107), the season has been 1 August–15 March, and the bag limit has been 1 bull.

Units and bag limits	Resident/Subsistence hunters	Nonresident hunters
RY11 and RY12		
Unit 23 Southwest, that portion on the Seward Peninsula west of and including the Buckland River drainage.	(see Unit 22 report)	(see Unit 22 report)
Unit 23, that portion north and west of the Noatak River.		
1 bull by Tier II subsistence hunting permit only; up to 15 bulls may be taken.	1 Aug–15 Mar (Subsistence hunt only)	No open season
Remainder of Unit 23	No open season	No open season

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

In addition to the state Tier II hunt (TX107), the Federal Subsistence Board established a federal subsistence muskox hunt on Cape Krusenstern National Monument for residents of the monument that went into effect during RY05. The total annual quota has been 2 bulls with a 1 bull bag limit. The federal season is identical to the Tier II hunt. Three bulls have been harvested on the federal muskox permit during RY05–RY10. There have been no federal permits issued since RY10 (K. Adkisson, NPS, Nome, personal communication). The hunt is almost entirely unutilized because there are virtually no permanent residents living within the monument.

Alaska Board of Game Actions and Emergency Orders. An emergency order was issued 27 June 2013 to close the RY13 TX107 season after it was confirmed 5 cow muskoxen from the Cape Thompson population were illegally shot and left unsalvaged during January–February 2013. The illegal take of the cow muskoxen was additive to the legal harvest of bulls in the TX107 hunt, and filled the available TX107 harvest quota.

Human-Induced Harvest. Few muskoxen have been harvested under TX107 since this hunt was established in RY00 (Table 2). Until the RY04 season, all permits went to residents of Point Hope, Kivalina, or Noatak. However in the years since RY07, all but one of the successful applicants has been from Kotzebue. The shift of permits to Kotzebue hunters has resulted in nearly all recent harvest concentrated in the vicinity of the Noatak Hatchery. Since the RY06 season, all harvest has occurred in the small area west of the Noatak River and east of Cape Krusenstern National Monument.

Permit Hunts. See section above.

Hunter Residency and Success. See *Human-Induced Harvest* section; all hunting is by resident hunters. During RY12 and RY13, 6 and 7 TX107 permits were issued, respectively. Harvest reports for RY12 indicate 83% success rate (n = 5 hunters). The RY13 TX107 season was closed by emergency order and therefore had 0% success rate. During RY00 through RY13 an average annual harvest of 3 muskox per year are harvested by TX107 permit holders.

Harvest Chronology. Since the beginning of this hunt, most harvests have occurred during August–September and December–March.

Transport Methods. Most hunters have accessed the hunting area via snowmachine; however, nearly all hunters that have taken muskoxen in the fall have used boats.

Natural Mortality

The Cape Thompson collaring project monitored 48 adult cow muskoxen. Results found an 83% survival rate (76–90, 95% CI) (L. Adams, personal communication). During the study 37% (n = 18) of the collared cows died; 72% (n = 13) were either killed or scavenged by bears, 22% (n = 4) were killed by wolves, and 6% (n = 1) by unknown cause (L. Adams, personal communication).

Other Mortality

Given the natural tendency for muskoxen to travel along beaches during summer and their increasing numbers in the southern portion of their range, human-muskox conflicts occurring

between Sealing Point and Sisualik (aka Sheshalik) may likely continue. At least 2 bull muskoxen have been shot and left unsalvaged in the vicinity of Sisualik over the past 8 years, and a muskox was taken in defense of life or property in 2008 (Westing 2013).

Illegal harvests may have also reduced muskoxen numbers in the northern portion of this area. Since 2003 the department has found or received reports about at least 16 muskoxen illegally killed and abandoned north of Rabbit Creek. Many residents of Northwest Alaska have long resented the presence of muskoxen in areas they have used to hunt caribou, gather greens, and pick berries for generations (Westing 2013). Agency staff spend little time in the northern portion of this muskoxen range so we do not know the magnitude of illegal harvests.

HABITAT

Assessment

There were no muskox habitat assessment activities in Unit 23 or 26A during the reporting period.

Enhancement

There were no muskox habitat enhancement activities in Unit 23 or 26A during the reporting period.

NONREGULATORY MANAGEMENT PROBLEMS/NEEDS

Conflicts among Muskoxen, Caribou, and Reindeer

For many years, local residents have expressed concern about muskox competing and displacing *Rangifer* from traditional hunting areas (Dau 2005). However, studies on caribou and muskoxen interactions in the Northwest Territories of Canada have shown that, at least when densities of both species were low in relation to relative abundance of food, there was no competition between the 2 species (Thomas et. al 1999). Studies on the Seward Peninsula have found that although muskoxen and reindeer may occupy the same feeding areas, they select different forage plants (Ihl and Klein 2001). Although most published information indicates that competition is not a serious issue, traditional knowledge in many areas of the state suggest that indirect and direct competition may be an issue between *Rangifer* and muskox.

CONCLUSIONS AND RECOMMENDATIONS

1. Two distinct populations of muskoxen inhabit Unit 23. One population ranges primarily within 20–35 miles of the coast between the mouth of the Noatak River and Corwin Bluff. The other population inhabits the southwestern portion of Unit 23 as part of the Seward Peninsula population. Both populations stem from translocations initiated by the department in 1970. Small groups are scattered throughout much of the remainder of northern Unit 23 and some large groups exist in parts of Unit 26A. Additionally, mixed-sex age groups are becoming established within Unit 23 in the Selawik and upper Noatak drainages, and in Unit 26A and in the upper Noatak drainage.

2. As incidental observations outside of the traditionally sampled core have increased over the last 10 years, it has become increasingly important to try to evaluate the population size, distribution, and changes occurring for the Cape Thompson population with reference to the

majority of its range. A distance sampling survey in the traditional area was completed in 2012 and 2013. Two more distance sampling surveys will be completed in 2014 and 2015 that will increase the sample size of group detections to develop a specific detection function for future Cape Thompson population-wide surveys. The next population-wide survey will be completed in 2016.

3. A 2–3% harvest rate on a stable or slowly declining population allows subsistence opportunity without posing significant risk to the population. Therefore, the harvest strategy for TX107 should remain conservative with a 6 bull quota for Unit 23.

4. As an increasing number of mixed-sex age groups are observed in new areas, the department is considering ways to determine if natural range extensions of existing populations are occurring, or if discrete populations are becoming established. This will affect how harvest quotas are determined in the future and if new hunts should be established.

5. Harvests of muskoxen in the northwest portion of Unit 23 should be cooperatively managed by the department and NPS, similar to state-federal management occurring on the Seward Peninsula. That would better allow state and federal quotas to be based on the relative abundance of muskoxen on these lands.

6. Muskoxen use riparian areas during summer, and exposed, sparsely vegetated domes and ridges where snow cover is minimal during winter. Muskoxen use body-fat reserves and extremely conservative behavior to survive through winter. Disturbance to muskoxen during winter should be minimized.

REFERENCES CITED

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas. 2001. Introduction to distance sampling: Estimating abundance of biological populations. Oxford University Press, New York.

Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers, and L. Thomas, editors. 2004. Advanced distance sampling. Oxford University Press, New York.

Dau, J. 2005. Unit 23 muskox. Pages 38–48 [*In*] C. Brown, editor. Muskox management report of survey-inventory activities 1 July 2002–30 June 2004. Alaska Department Fish and Game, Division of Wildlife Conservation, Federal Aid Wildlife Restoration Project 16.0, Juneau.

Gorn, T. 2011. Unit 22 muskox. Pages 16–47 [*In*] P. Harper, editor. Muskox management report of survey-inventory activities 1 July 2008–30 June 2010. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 16.0, Juneau.

Ihl, C., and D. R. Klein. 2001. Habitat and diet selection by muskoxen and reindeer in western Alaska. Journal of Wildlife Management 65:954–972.

McDonald, J. N., and C. E. Ray. 1989. The autochthonous North American musk oxen *Bootherium*, *Symbos*, and *Gidleya* (Mammalia: Artiodactyla: Bovidae). Smithsonian Contributions to Paleobiology, No. 66. Smithsonian Institution Press, Washington, D.C.

R Development Core Team. 2010. Version 2.12. R Foundation for Statistical Computing, Vienna, Austria. http://www.R-project.org/ (Accessed 31 October 2016).

Schmidt, J. H., K. L. Rattenbury, J. P. Lawler, and M. C. MacCluskie. 2012. Using distance sampling and hierarchical models to improve estimates of Dall's sheep abundance. Journal of Wildlife Management 76:317–327. doi:10.1002/jwmg.216

Spiegelhalter, D. J., A. Thomas, N. G. Best, and D. Lunn. 2004. WinBUGS Version 1.4.1. User manual. MRC (Medical Research Council) Biostatistics Unit, Cambridge, United Kingdom.

Thomas, D. C., E. J. Edmonds, and H. J. Armbruster. 1999. Range types and their relative use by Peary caribou and muskoxen on Melville Island, NWT. Canadian Wildlife Service, Prairie & Northern Region, Technical Report Series No. 343, Edmonton, Alberta.

Westing, C. 2011. Unit 23 muskox. Pages 48–62 [*In*] P. Harper, editor. Muskox management report of survey-inventory activities 1 July 2008–30 June 2010. Alaska Department of Fish and Game, Division of Wildlife Conservation, Federal Aid in Wildlife Restoration Project 16.0, Juneau.

Westing, C. 2013. Unit 23 muskox. Pages 52–74 [*In*] P. Harper, editor. Muskox management report of survey-inventory activities 1 July 2010–30 June 2012. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2013-2, Juneau.

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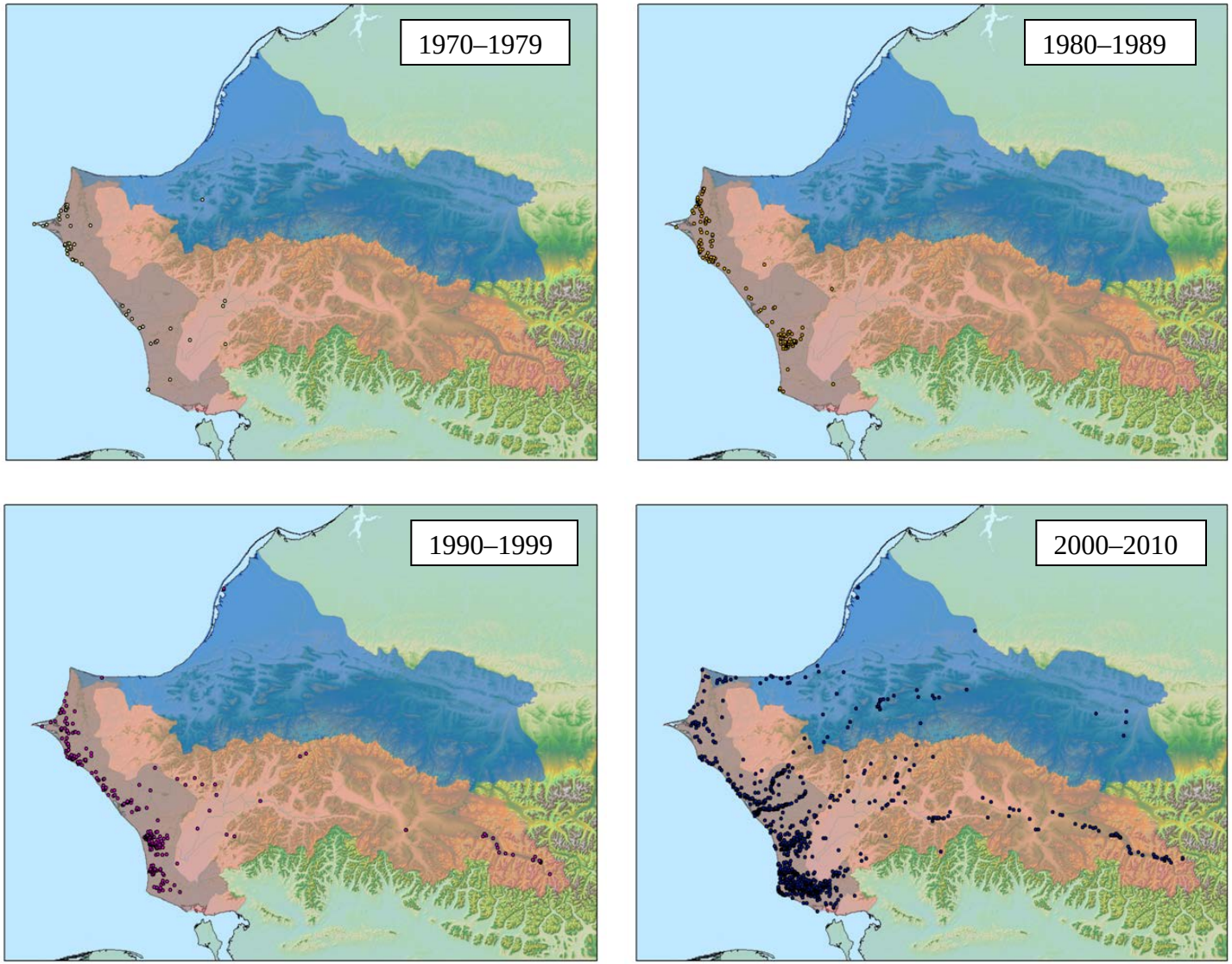

Figure 1. Locations of muskoxen observations by decade, Northwest Alaska, 1970–2010. (Includes incidental, census, and composition efforts occurring in the traditional survey area only; Unit 23 in pink; Unit 26A is shown in blue; traditional survey area in gray.)

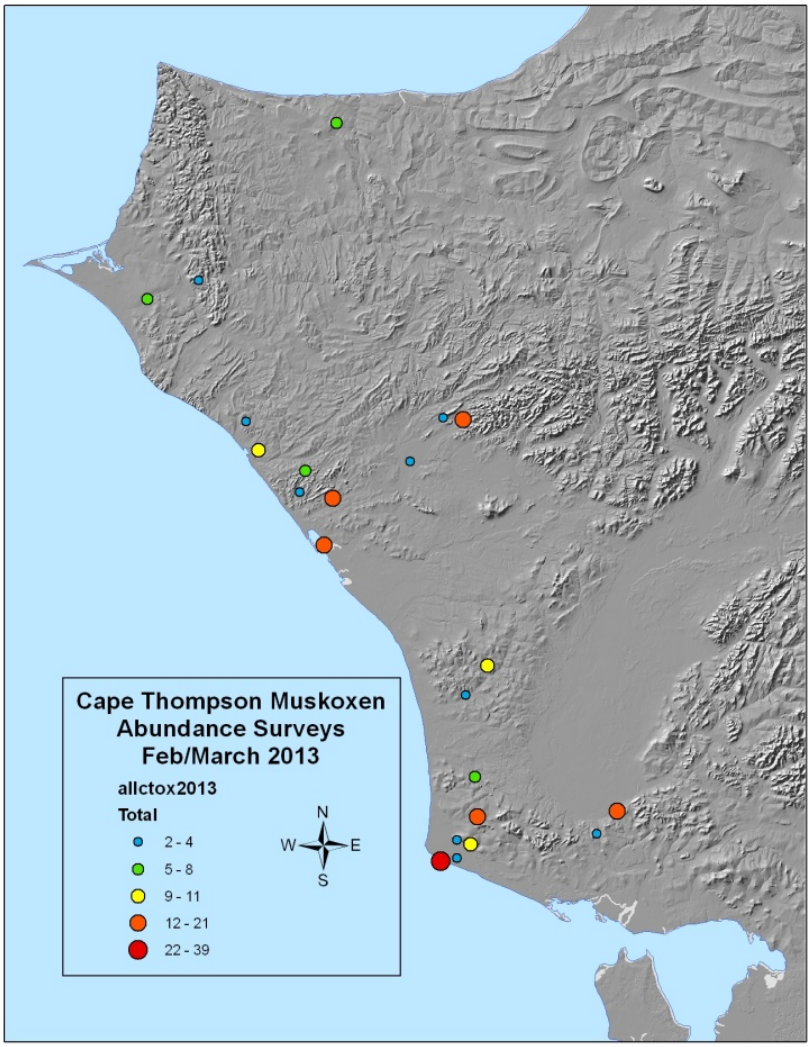

Figure 2. Cape Thompson 2013 distance sampling survey in traditional area, Northwest Alaska (Westing 2013; B. Saito, ADF&G, unpublished report, Kotzebue [W:\muskox\census results\ct2013]).

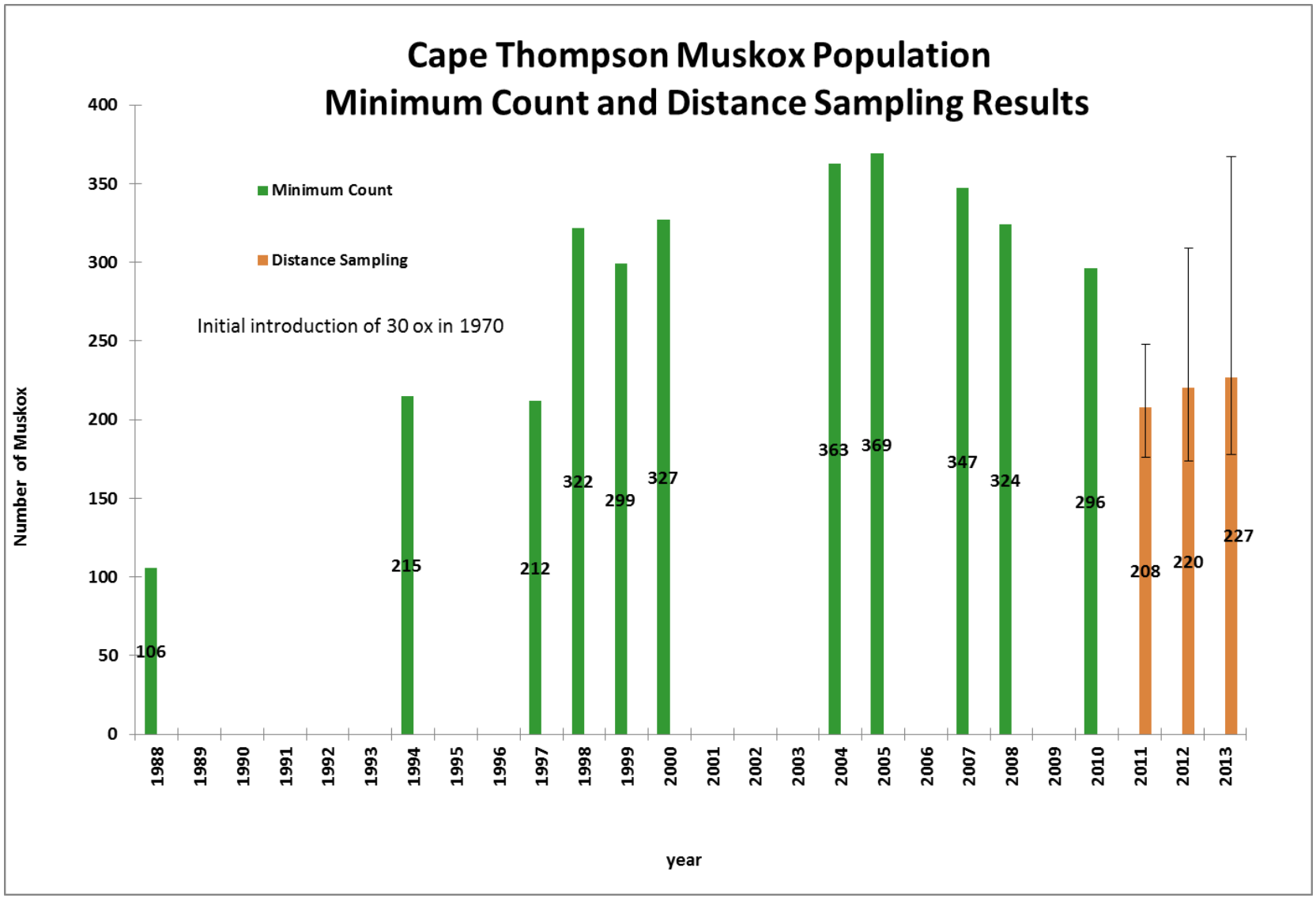

Figure 3. Cape Thompson muskoxen abundance estimate with minimum counts and distance sampling surveys, Northwest Alaska, 1988–2013.

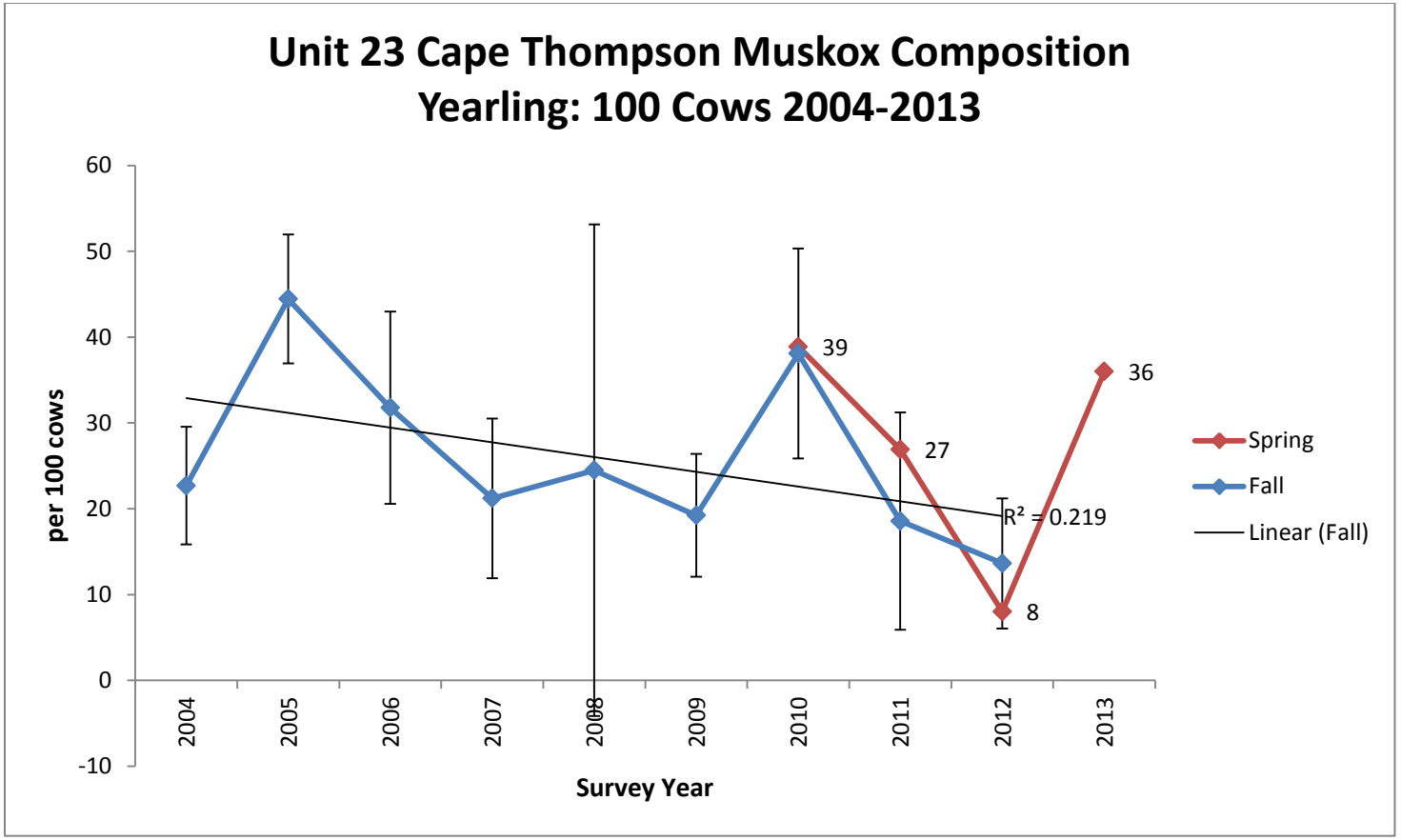

Figure 4. Muskox composition data for yearlings:100 cows, Cape Thompson population, Northwest Alaska, 2004–2013.

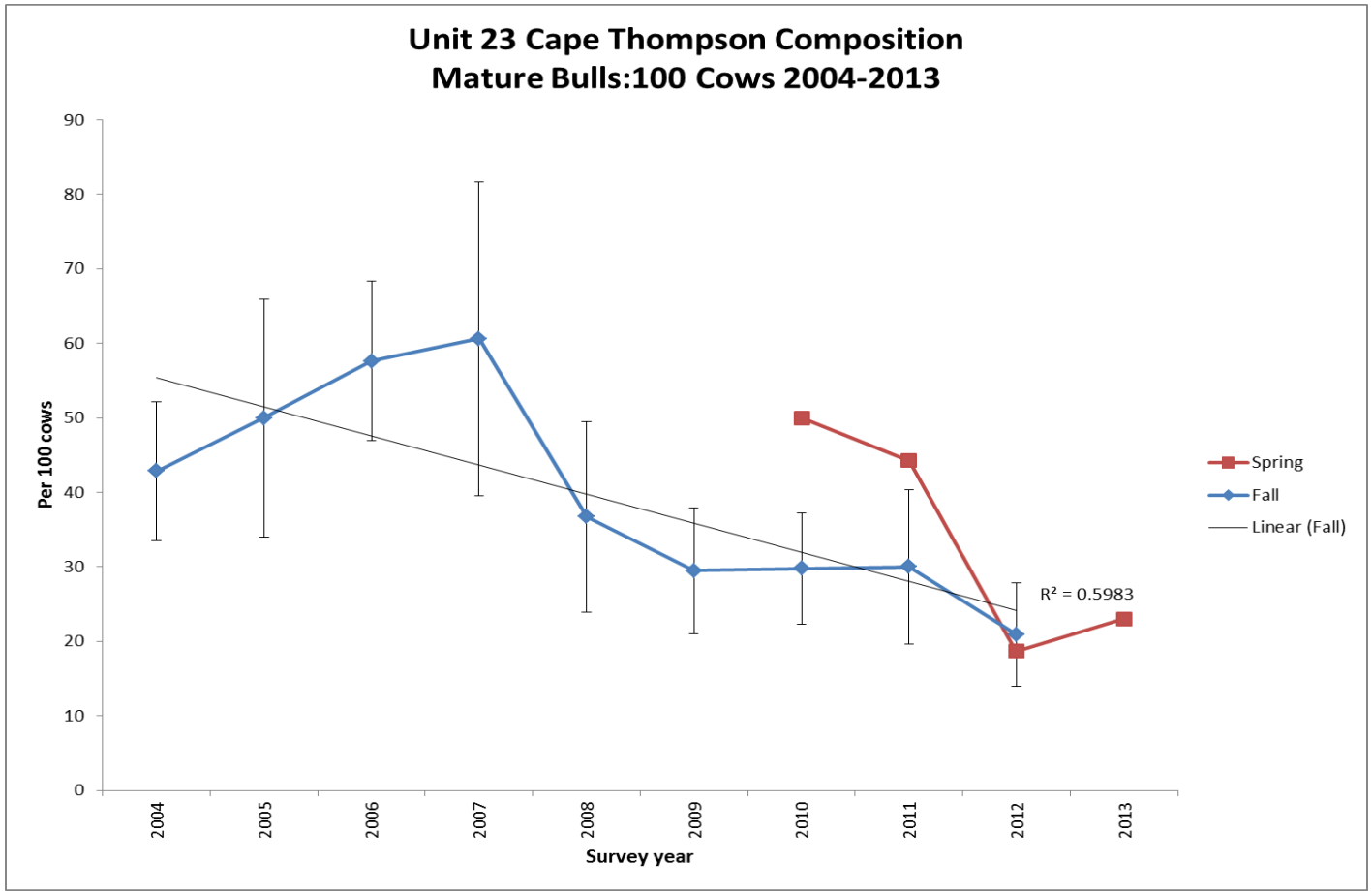

Figure 5. Muskox composition data for mature bulls:100 cows, Cape Thompson population, Northwest Alaska, 2004–2013.

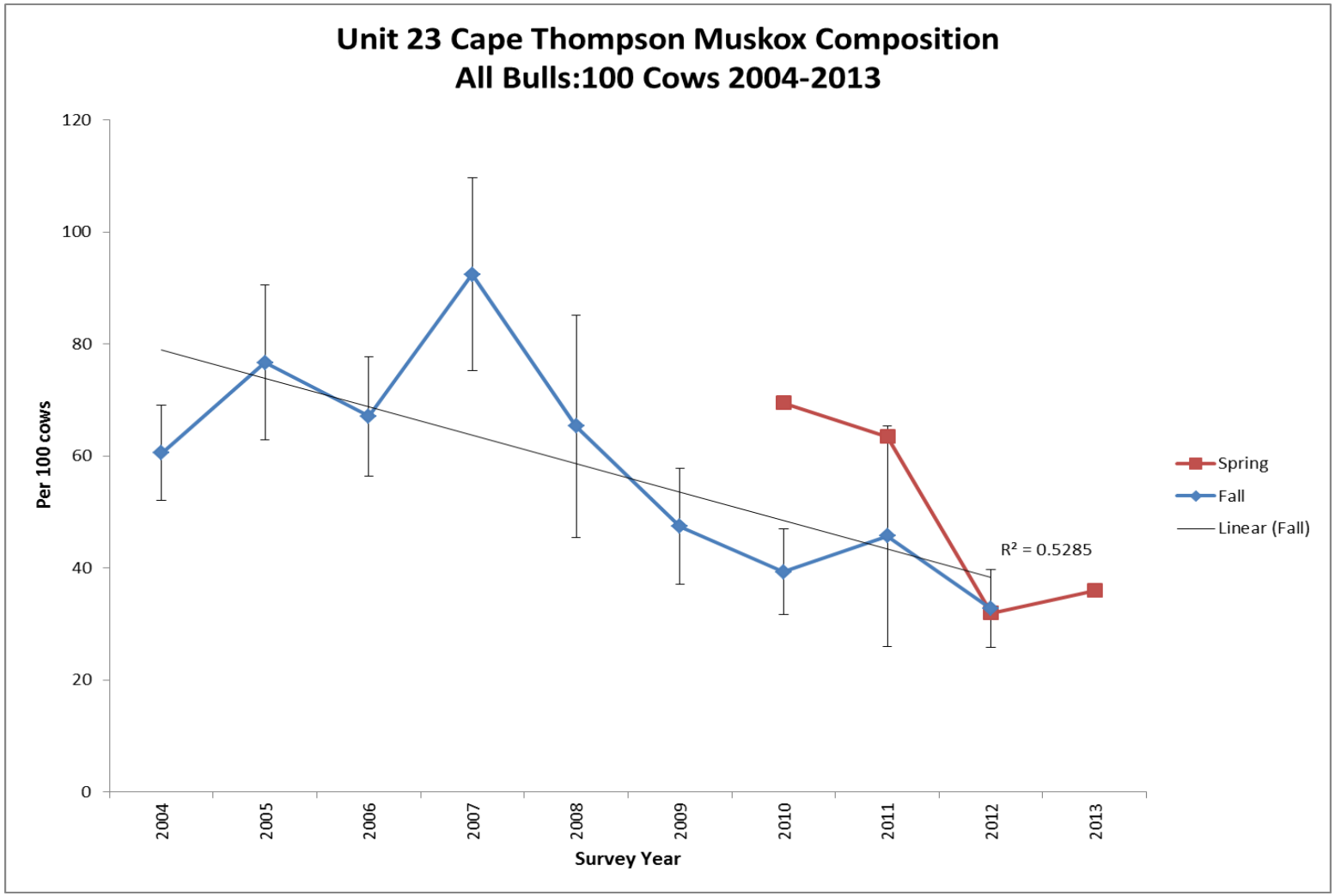

Figure 6. Muskox composition data for bulls: 100 cows, Cape Thompson population, Northwest Alaska, 2004–2013.

Table 1. Age and sex composition of Cape Thompson muskoxen groups, Northwest Alaska, 2004–2013.

Season/		%	Males ≥4 yr old		Females ≥4 yr old		Males 3 yr old		Females 3 yr old		Males 2 yr old		Females 2 yr old		Yearlings		Calves		Unk				
Year	*N*	Obs	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	Nr	%	B:C[a]	MB:C[b]	Y:C[c]
Fall																							
2004	269	74	51	19	98	36	4	1	10	4	17	6	11	4	27	10	48	18	3	1	61	43	40
2005	228	62	45	20	70	31	11	5	16	7	13	6	4	2	40	18	26	11	3	1	77	50	29
2006	190		49	26	69	36	4	2	15	8	4	2	1	1	27	14	21	11	0	0	67	58	25
2007	162	47	40	25	51	31	9	6	8	5	12	7	7	4	14	9	21	13	0	0	92	61	32
2008	97	30	18	19	39	40	10	10	4	4	4	4	6	6	12	12	4	4	0	0	65	37	8
2009	152		23	15	60	39	5	3	14	9	9	6	4	3	15	10	22	14	0	0	47	29	28
2010	173	58	25	14	65	38	6	3	12	7	2	1	7	4	32	18	23	13	1	1	39	30	27
2011	128	62	21	16	50	39	4	3	14	11	7	5	6	5	13	10	13	10	0	0	46	30	19
2012	211	96	23	11	71	34	5	2	22	10	8	4	17	8	15	7	43	20	7	3	33	21	39
Spring																							
2010	152	51	36	24	47	31	10	7	21	14	4	3	4	3	28	18	0	0	2	1	69	50	39
2011	101	49	23	23	35	35	2	2	7	7	8	8	10	10	14	14	0	0	2	2	63	44	27
2012	106	69	14	13	47	44	5	5	14	13	5	5	14	13	6	6	0	0	1	1	32	19	8
2013	182	80	24	13	78	43	8	4	18	10	6	3	10	5	38	21	0	0	0	0	36	23	36

[a] B:C denotes all bulls ≥2 years old per 100 cows ≥2 years old.
[b] MB:C denotes mature bulls per 100 cows ≥2 years old.
[c] Y:C denotes yearlings per 100 cows ≥2 years old.

Table 2. Harvest data for the Tier II muskoxen hunt, TX107, and the federal muskoxen hunt in Unit 23, Northwest Alaska, regulatory years[a] 2000–2013.

Regulatory year	No. of permits TX107[b]	Harvest		Total harvest	Hunter residency				
		No. of bulls	No. of cows		Point Hope	Kivalina	Noatak	Kotzebue	Other
2000	6	1	0	1	4	2	0	0	0
2001	6	0	0	0	2	0	4	0	0
2002	6	4	1	5	1	2	3	0	0
2003	6	0	0	0	0	0	6	0	0
2004	6	2	1	3	0	0	3	3	0
2005[c]	6 (1)	(1)	0	1	0	1	3	2	(1)
2006	6 (1)	4	0	4	1	1	1	3	(1)
2007	6 (2)	6 (1)	0	7	0	0	0	6	(2)
2008	6	5	0	5	0	0	1	5	0
2009	6	4	0	4	0	0	0	6	0
2010	6 (1)	4	0	4	0	0	0	6 (1)	0
2011	7	4	1	5	0	0	0	6	1
2012	6	5	0	5	0	0	0	6	0
2013[c]	7	0	5	5	0	0	2	5	0

[a] Regulatory year begins 1 July and ends 30 June, e.g., regulatory year 2000 = 1 July 2000–30 June 2001.
[b] Numbers in parentheses are from the federal hunt.
[c] Season closed by emergency order; quota taken with illegal cow harvest.