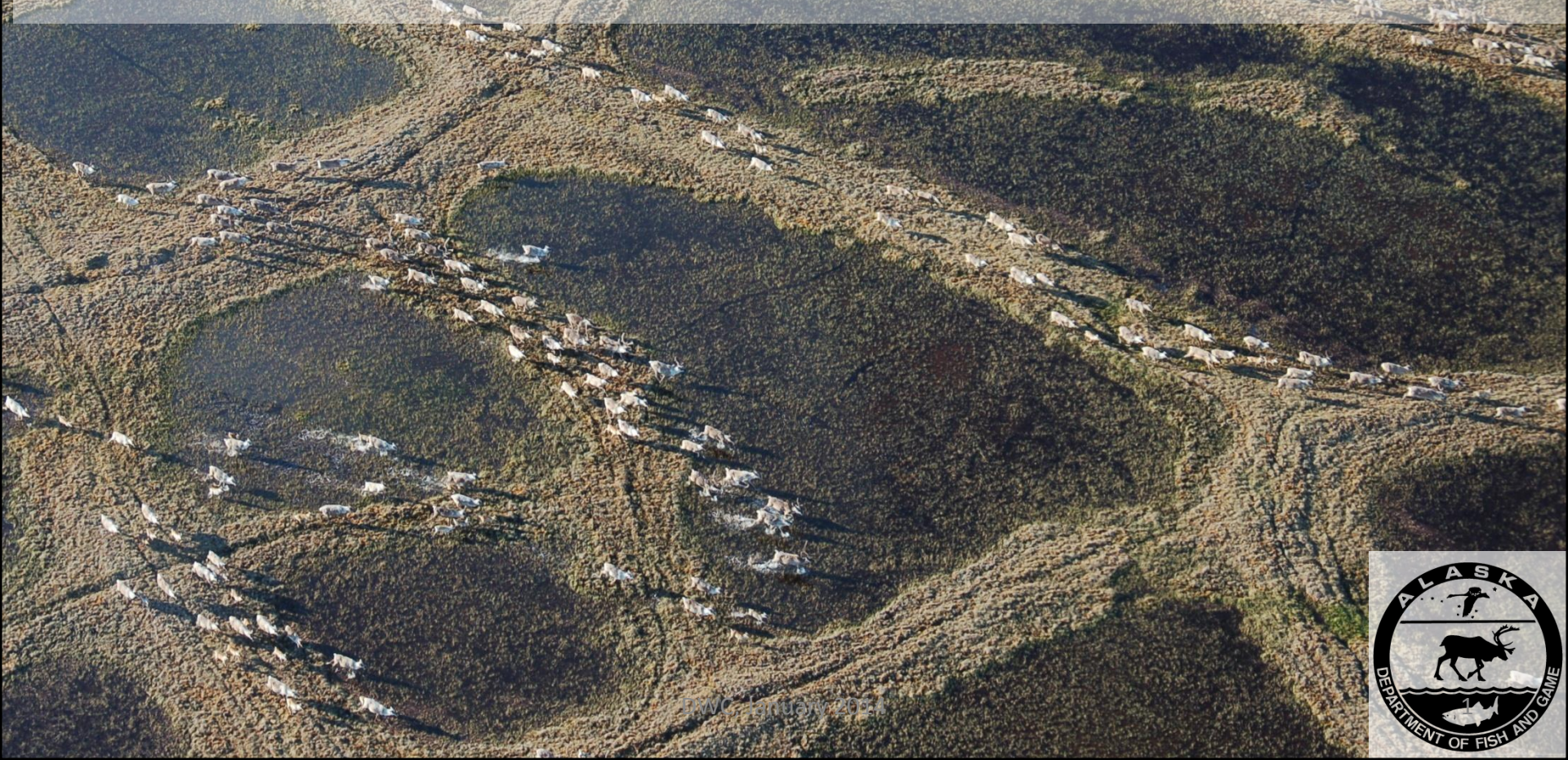# Teshekpuk Caribou Herd Overview
Board of Game, Kotzebue, AK
January 2014

Lincoln Parrett–Caribou Management/research Biologist
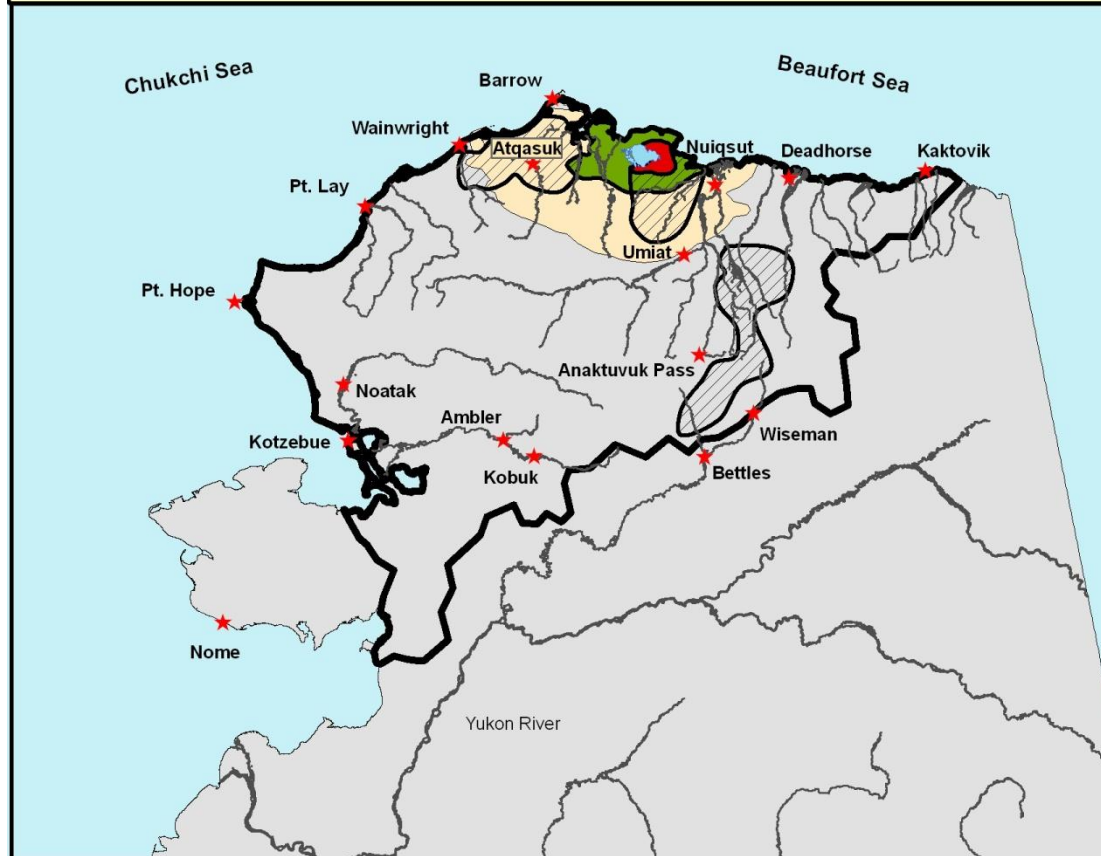## ADF&G – Wildlife Conservation

Outline

- **Seasonal Ranges**
- **Abundance and Demographics**
- **Calf Survival**
- **Regulations and Harvest**
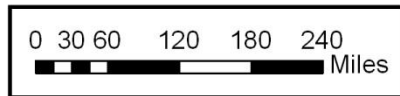- **Health and Productivity**

Seasonal Ranges

Teshekpuk Caribou Herd Seasonal Ranges

Teshekpuk Caribou Herd Cumulative Calving Distribution 1994-2009

Legend

Kernel Density

	0 - 0.0025
	0.0026 - 0.005
	0.005 - 0.0075
	0.0075 - 0.011

50% contour

★ villages

Chukchi Sea

Beaufort Sea

Barrow

Wainwright

Smith Bay

Harrison Bay

Teshekpuk

Atqasuk

Kuk River

Meade River

Ikpikpuk River

Fish Creek

Judy Creek

Nuiqsut

Itkillik River

Deadhorse

Umiat

0   65   130 Kilometers

N
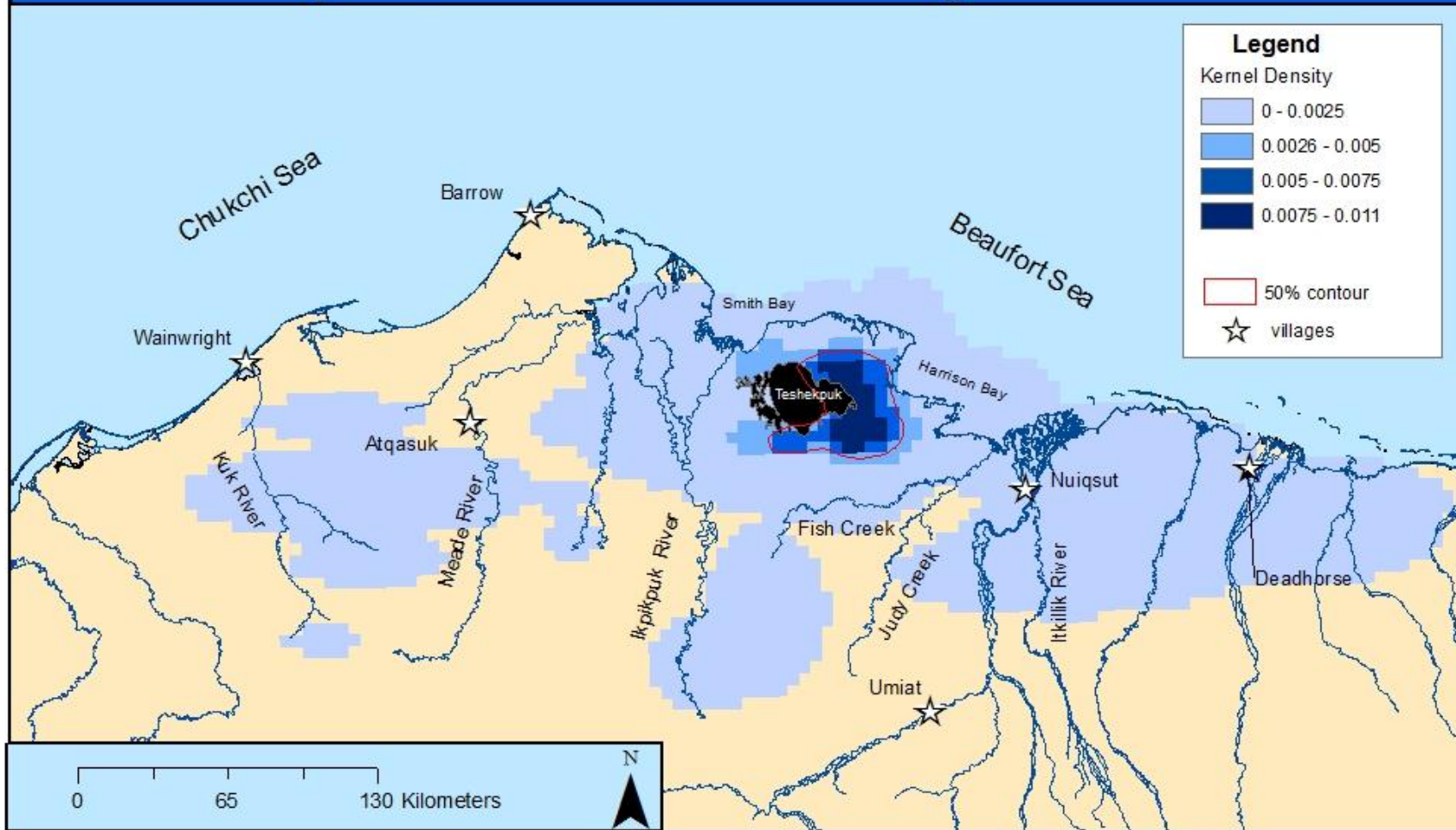
Brownian Bridge 1990-2012

Female population-level fall migration
- High use
- Moderate-high use
- Moderate-low use
- Low-use

Teshekpuk Lake
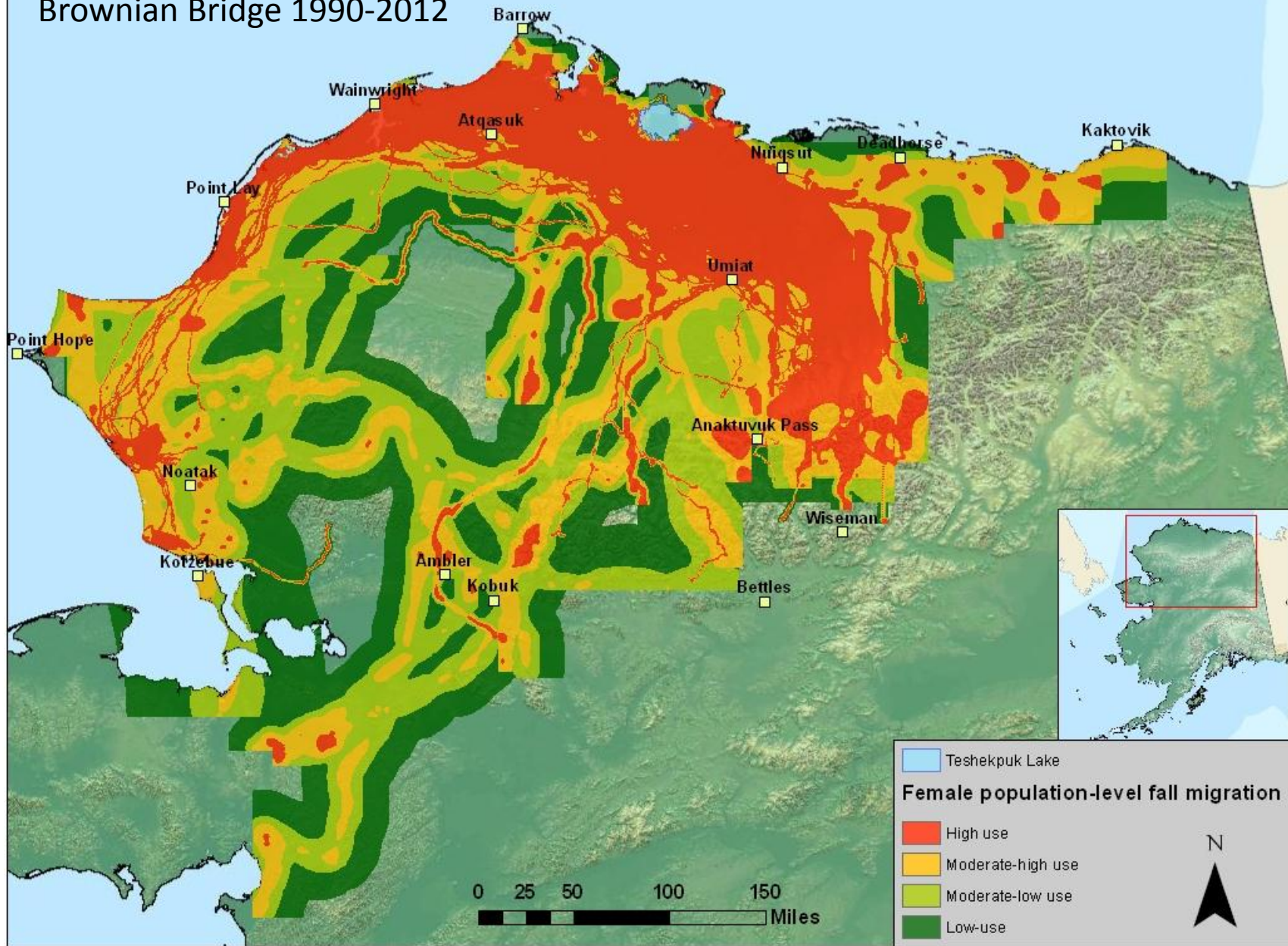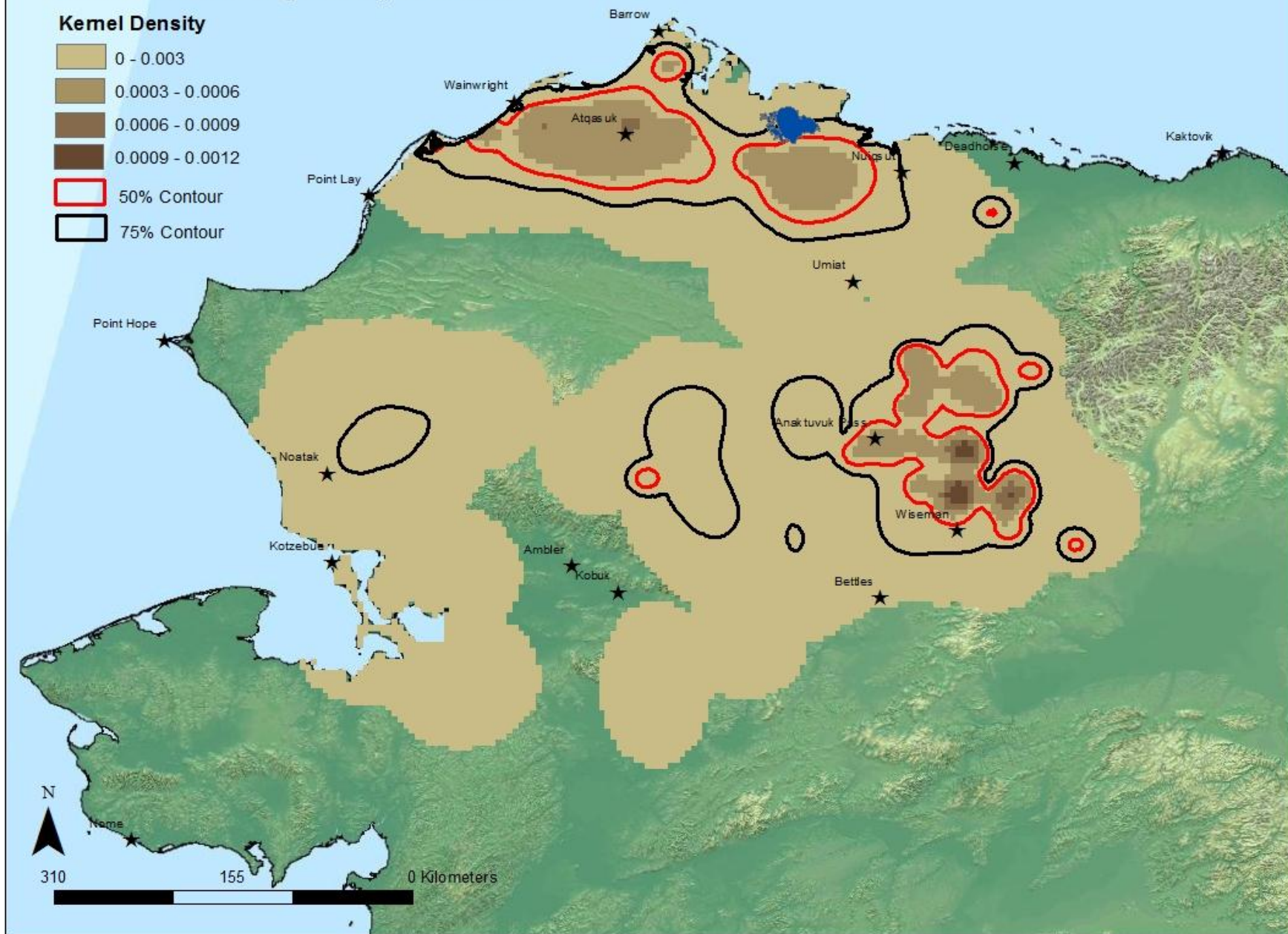
Abundance and Demographics

TCH Population and Harvest Objectives

Population Size
        55,000 ……………… **2011 census**
        38,000 ……………… **2013 predicted size from population model**

Available Harvest (based on 1.5% female, 15% male)
        2,910 ……………… **if population is 55,000**
        2,020 ……………… **if population is 38,000 predicted size**

Amount Necessary for Subsistence (ANS)
        TCH …………………………….. **no herd finding;**
                                      arguably part of Unit 26 ANS for WAH

        Units 21, 22, 23, 26 ………. **WAH**   **positive (8,000 – 12,000)**

        Unit 26(B) ……………………. **CAH**   **positive**   **(250 – 450)**

Intensive Management

        Population Objective: ….. **15,000 – 28,000**

        Harvest Objective: ………..   **900 – 2,800**

TCH Abundance Estimates
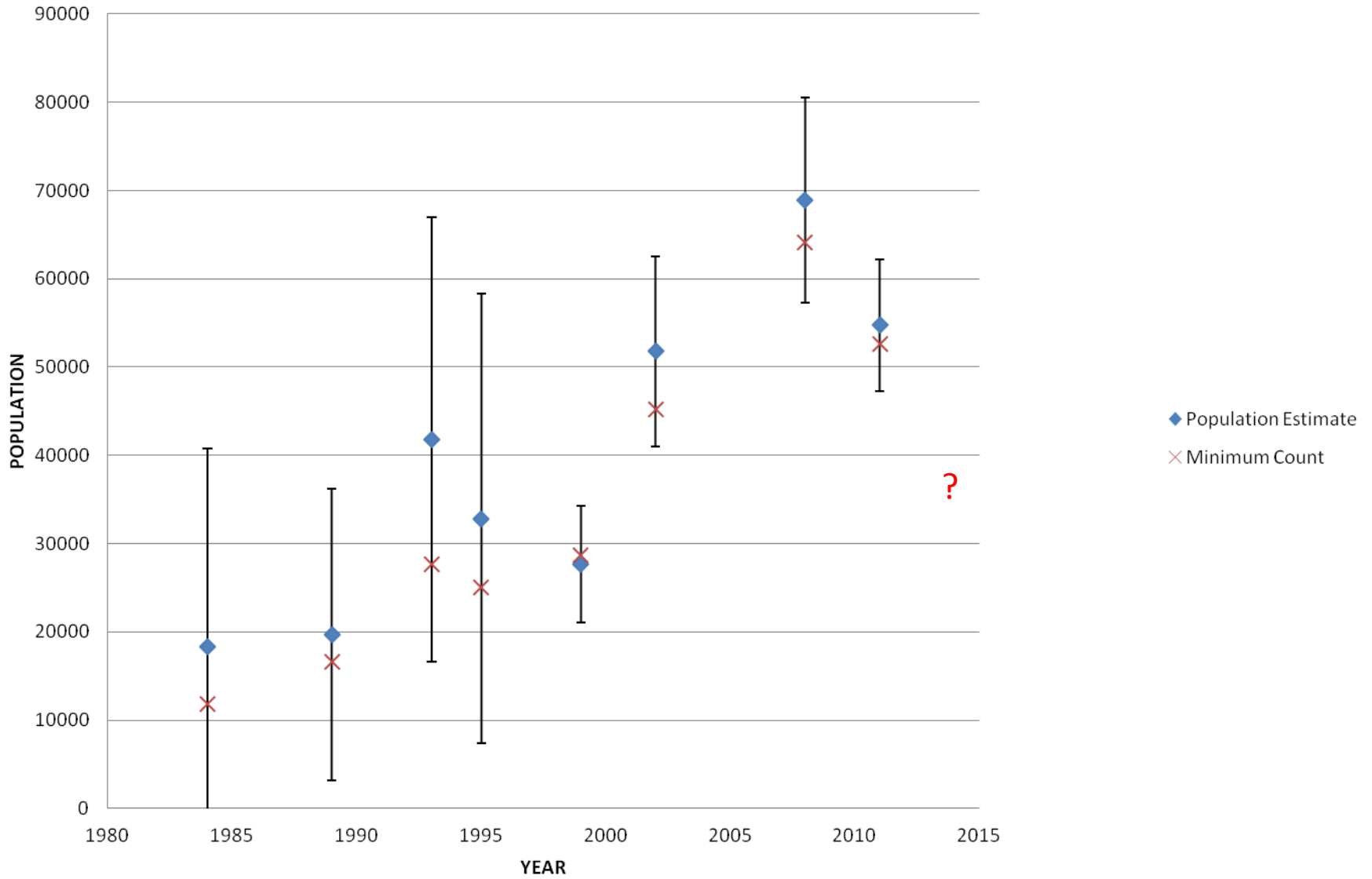
Stochastic Population Model 2008-2011
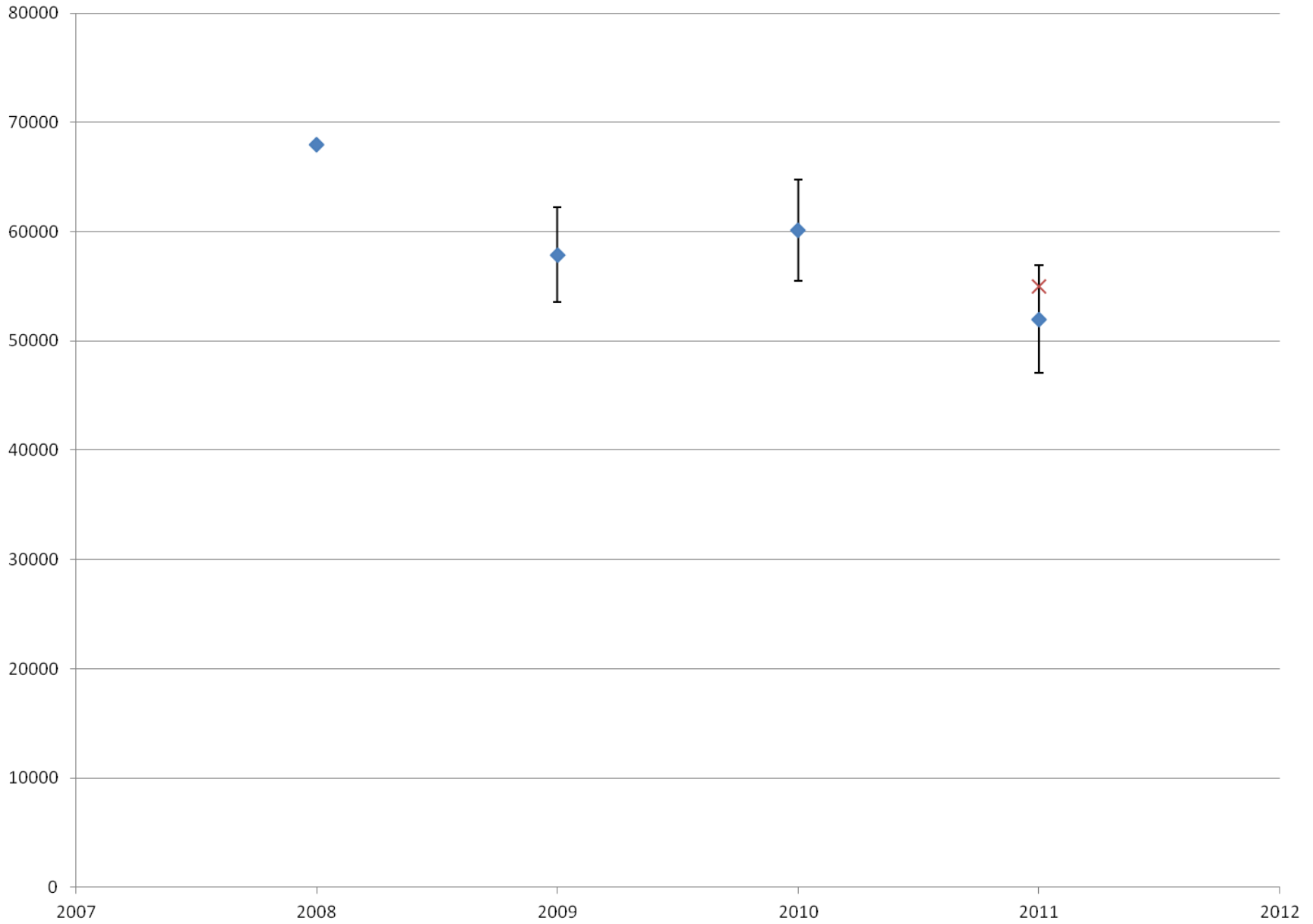
Stochastic Population Model 2008 -2013
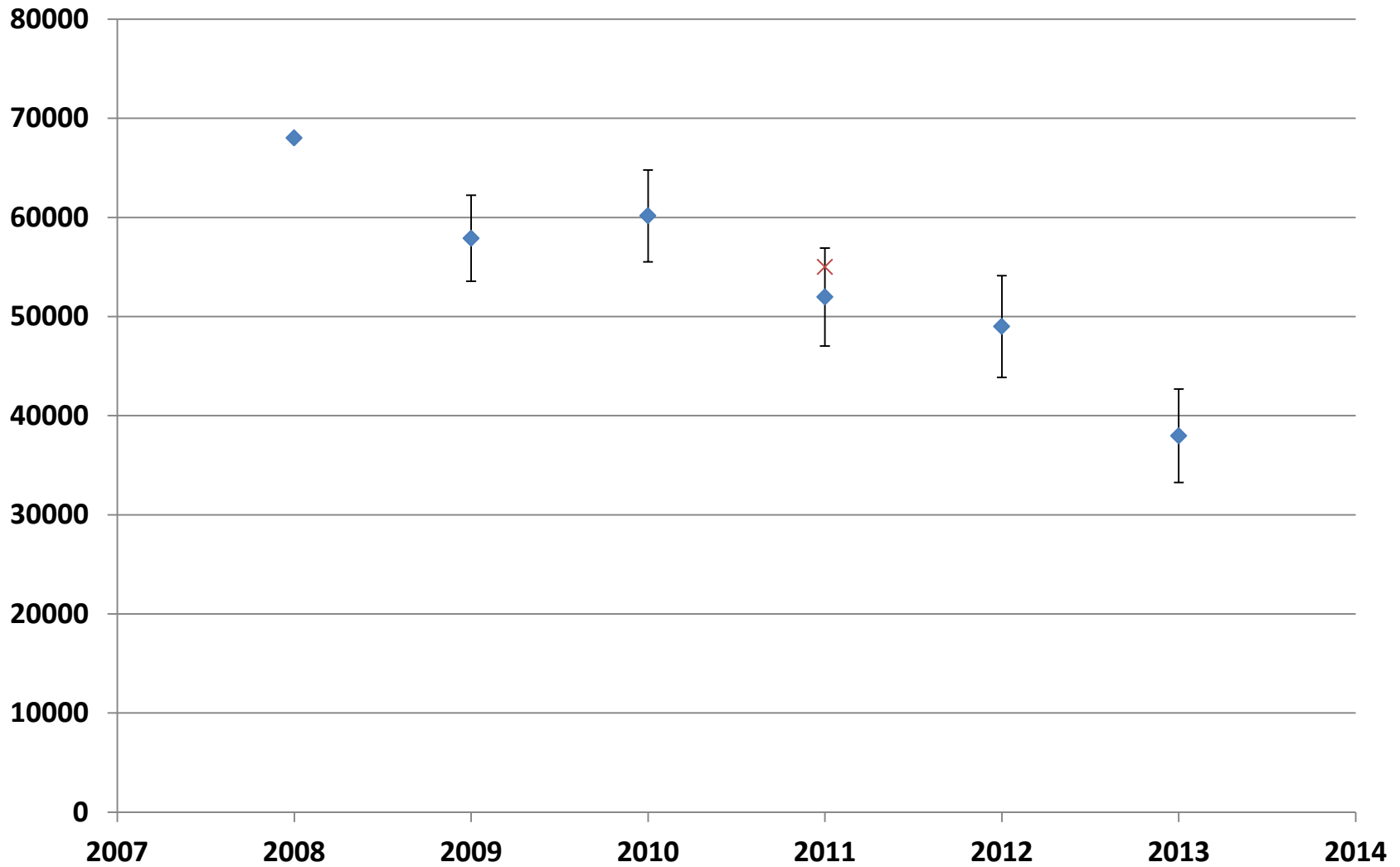
Adult Female Mortality Rate 1991-2011
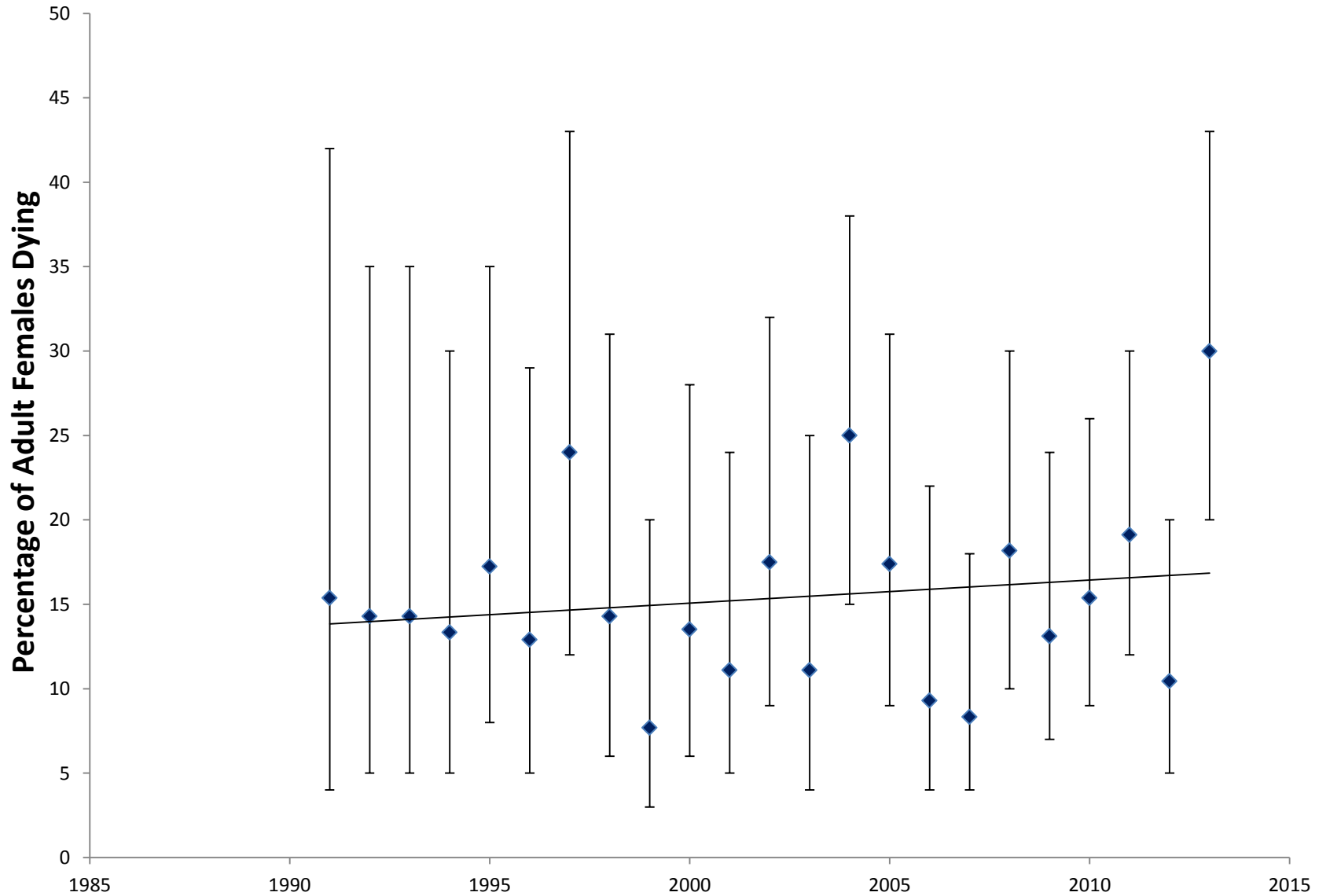
TCH Female Mortality by Season
1990-2013
(all causes)
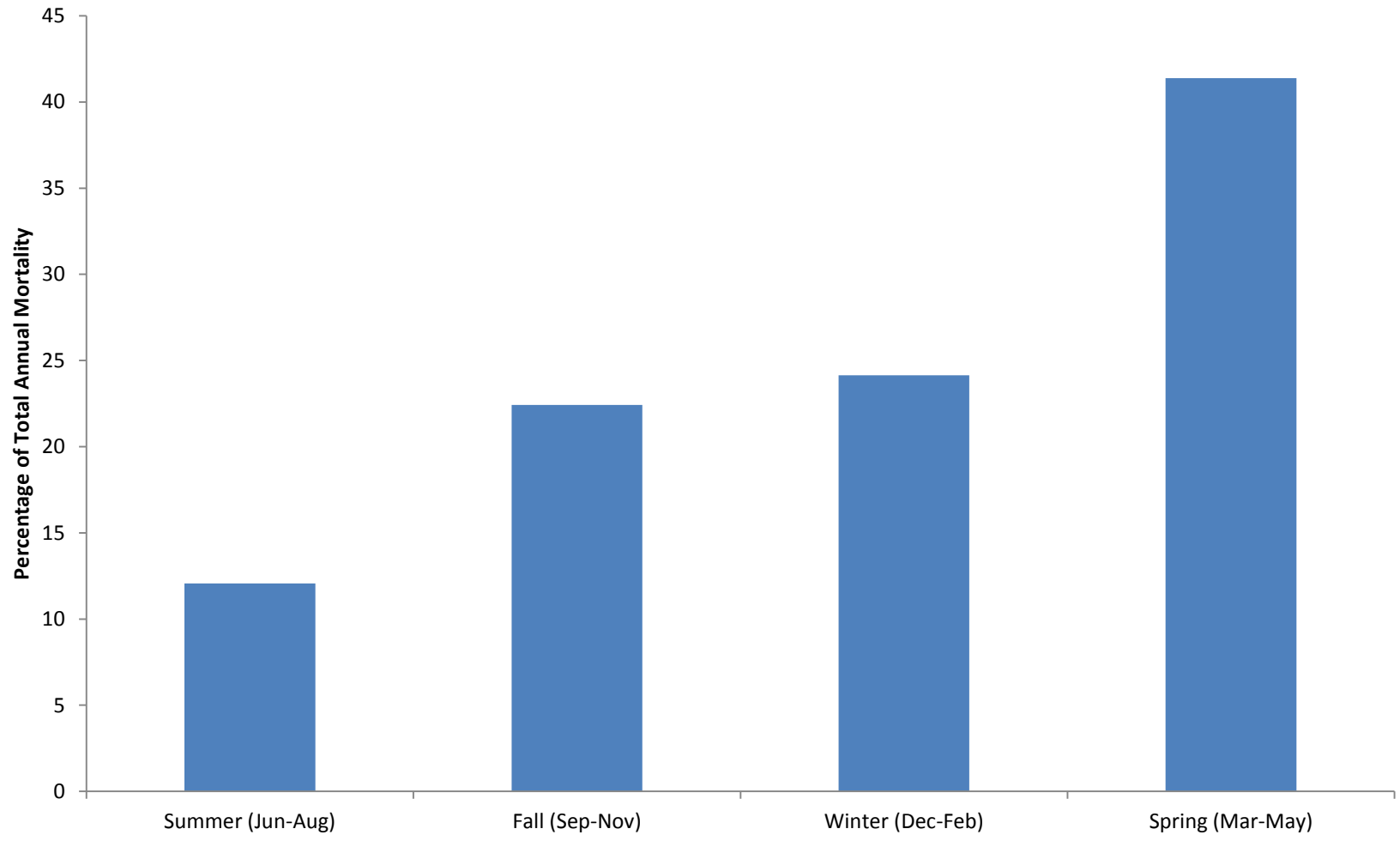
Calf Production

Teshekpuk Caribou Herd
PROPORTION OF ADULT (>2 YR) FEMALES WITH CALVES (95%CI)

YEAR
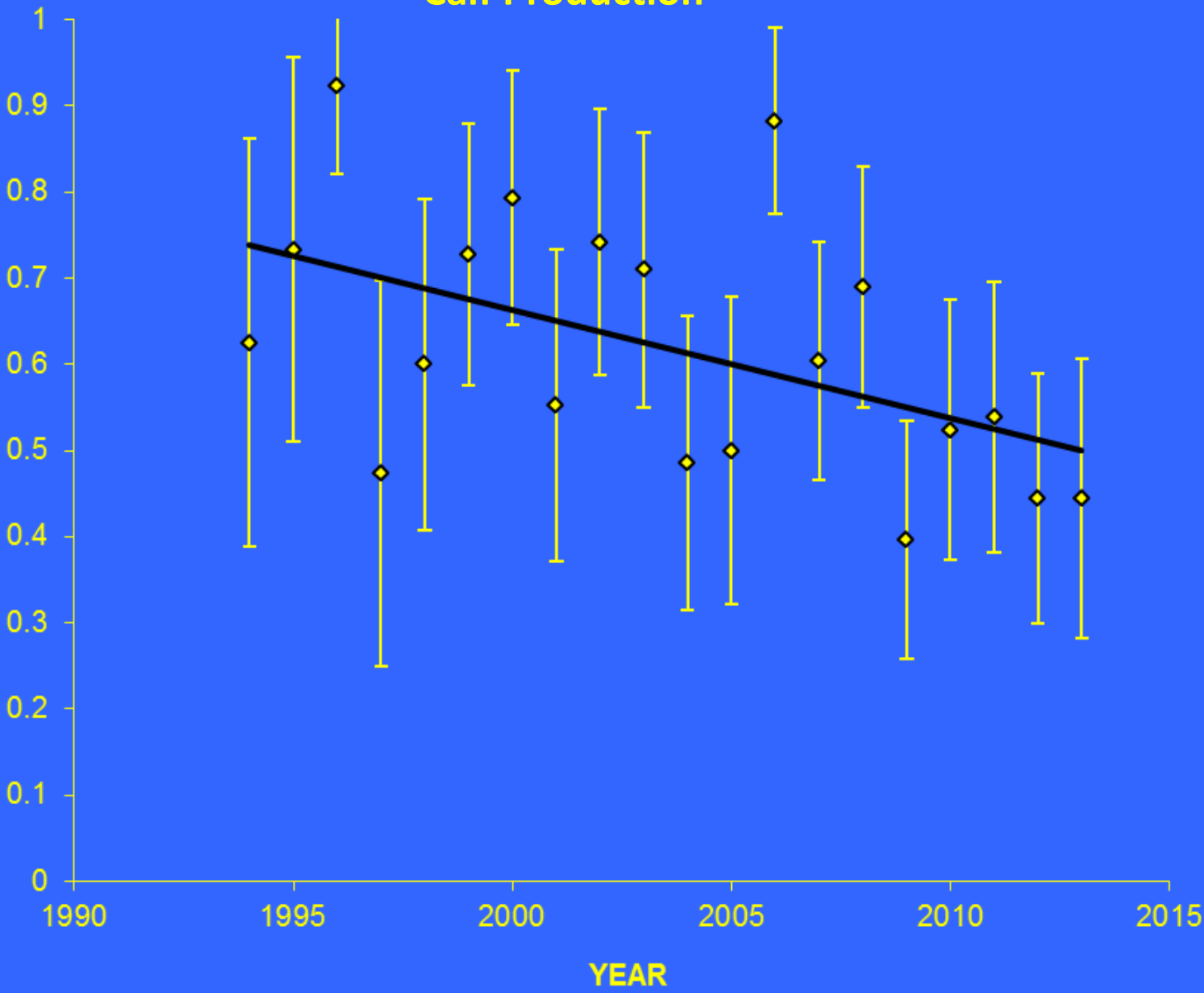
Index of Recruitment 1990-2013
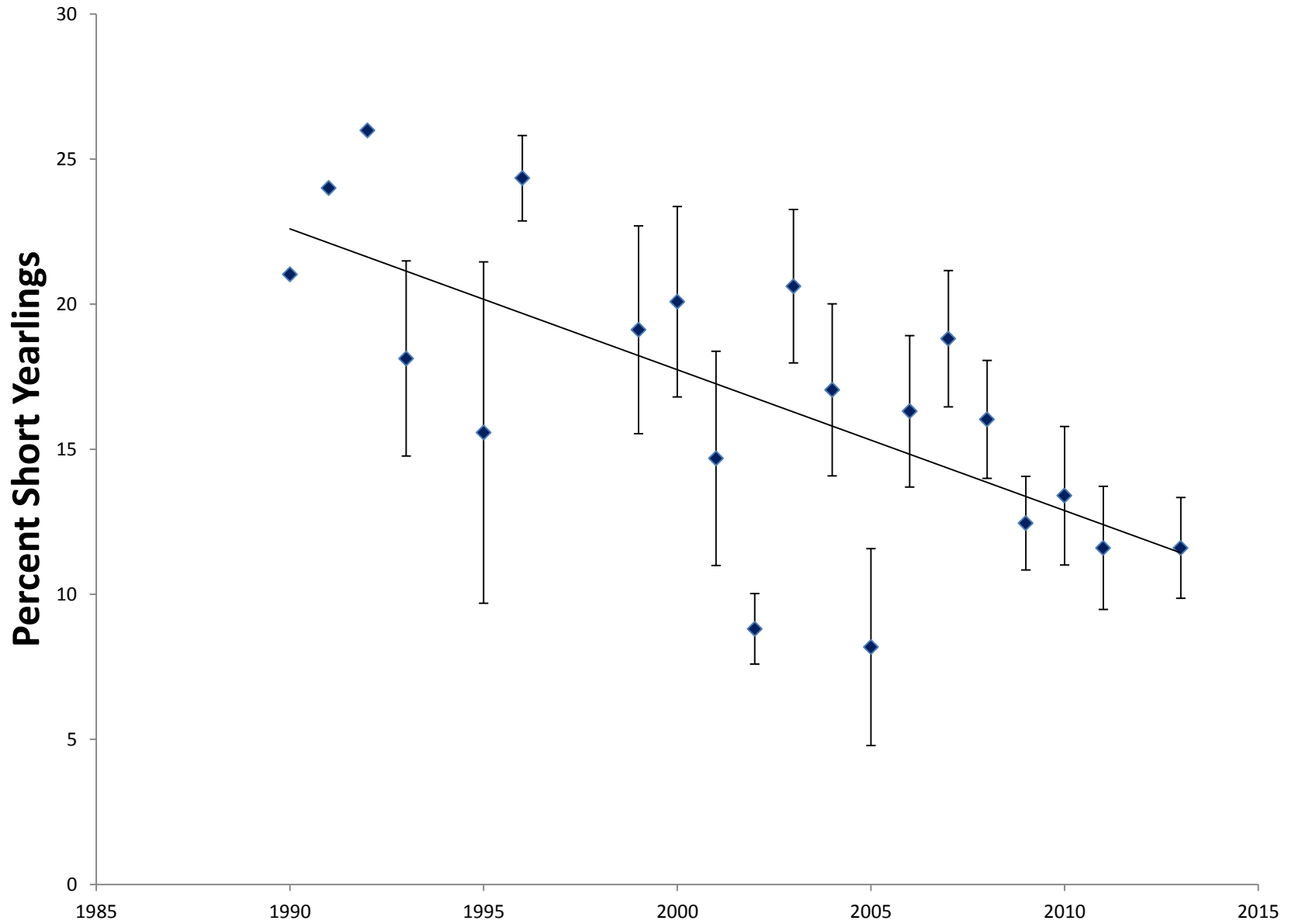
TCH Calf Survival Project

TCH Calf Fates Through October, 2011 (n=70)

- CAPTURE MORTALITY
- WOLF
- BEAR
- STARVATION/ACCIDENT
- UNKNOWN (INCLUDING UNK. PRED.)
- MISSING
- SURVIVED

3%
4%
3%
4%
4%
4%
77%
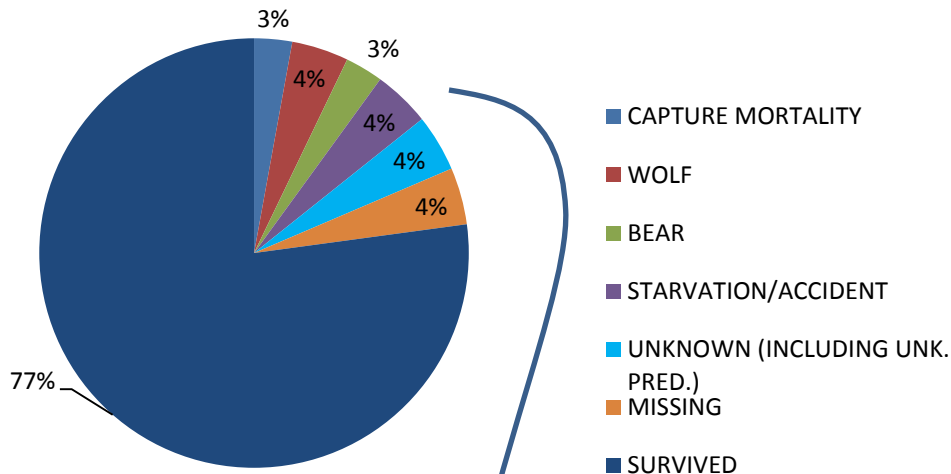
Causes of Mortality through October, 2011 (n=13)

- CAPTURE
- WOLF
- BEAR
- STARVATION/ACCIDENT
- UNKNOWN (INCLUDING UNK. PRED.)

15%
23%
15%
23%
23%
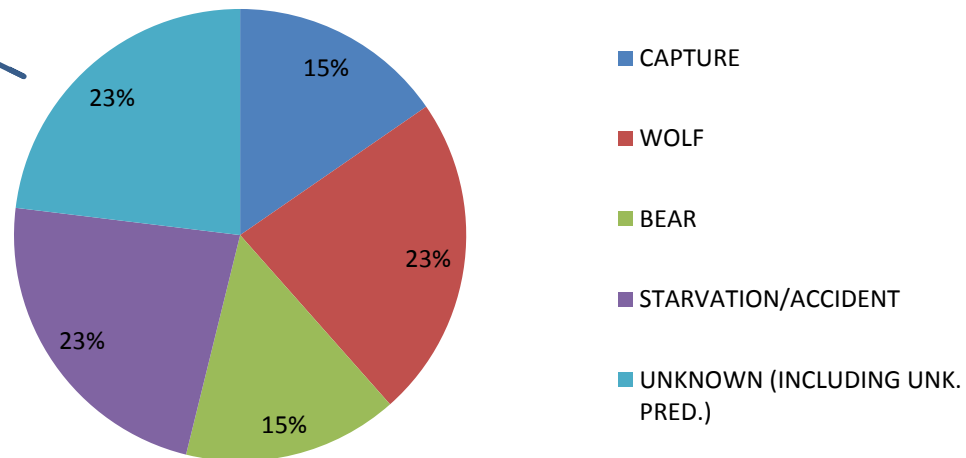
Causes of Calf Mortality, Late Winter 2013
n=14

STARVATION

UNK PREDATOR (WOLF/WOLVERINE)

WOLF

WOLVERINE

UNKNOWN
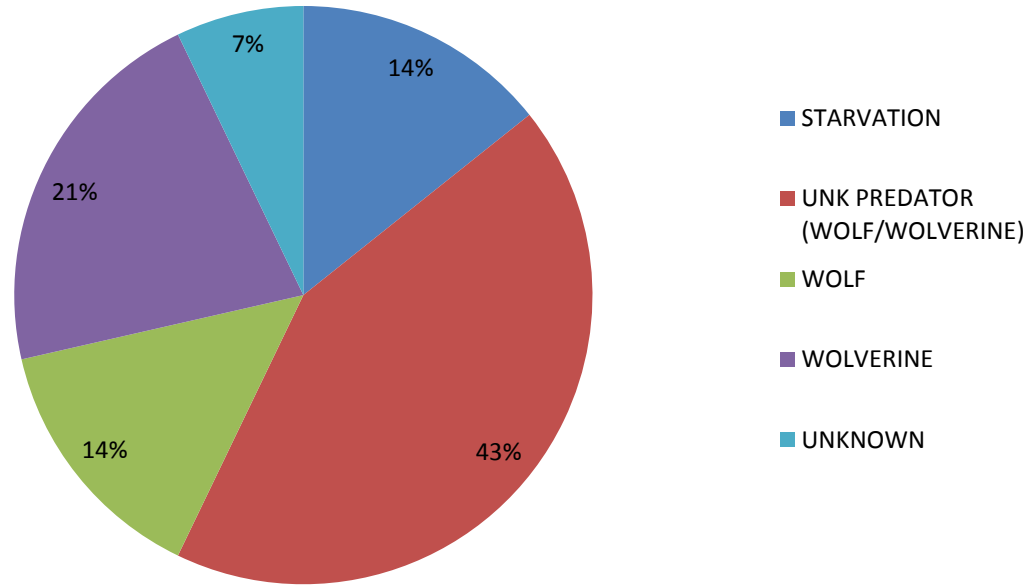
DWC, January 2014

Unit 26A State Regulations:

- Residents: 5 caribou per day, 'no closed season' for bulls, July 1-May15 for cows
    Registration requirement for residents north of Yukon River; or statewide harvest ticket

- Nonresidents: 5 caribou total, no closed season for bulls, July 1-May15 for cows

Unit 26A Harvest:

- Community Harvest Data: ~4500 total caribou per year
    - Typically ~80:20 ratio of bulls:cow in harvest
    - ~70% from the TCH, the remainder from WAH and CAH→ more on this later...

- Harvest Ticket Data (Residents): 49 per year (RY2002-RY2012 averages 90% WAH)

- Nonresidents: 40 per year (RY2002-RY2012 averages 90% WAH)

- Total annual harvest is high; estimated at 3-6% of the population, depending upon Barrow harvest level, and the ratio of WAH:TCH in the harvest

- Bulls harvested at 11-15% and cows harvested at 1-2% in recent years, based on a ratio of 80:20 in the harvest.

BARROW - September Harvest and Caribou Distribution
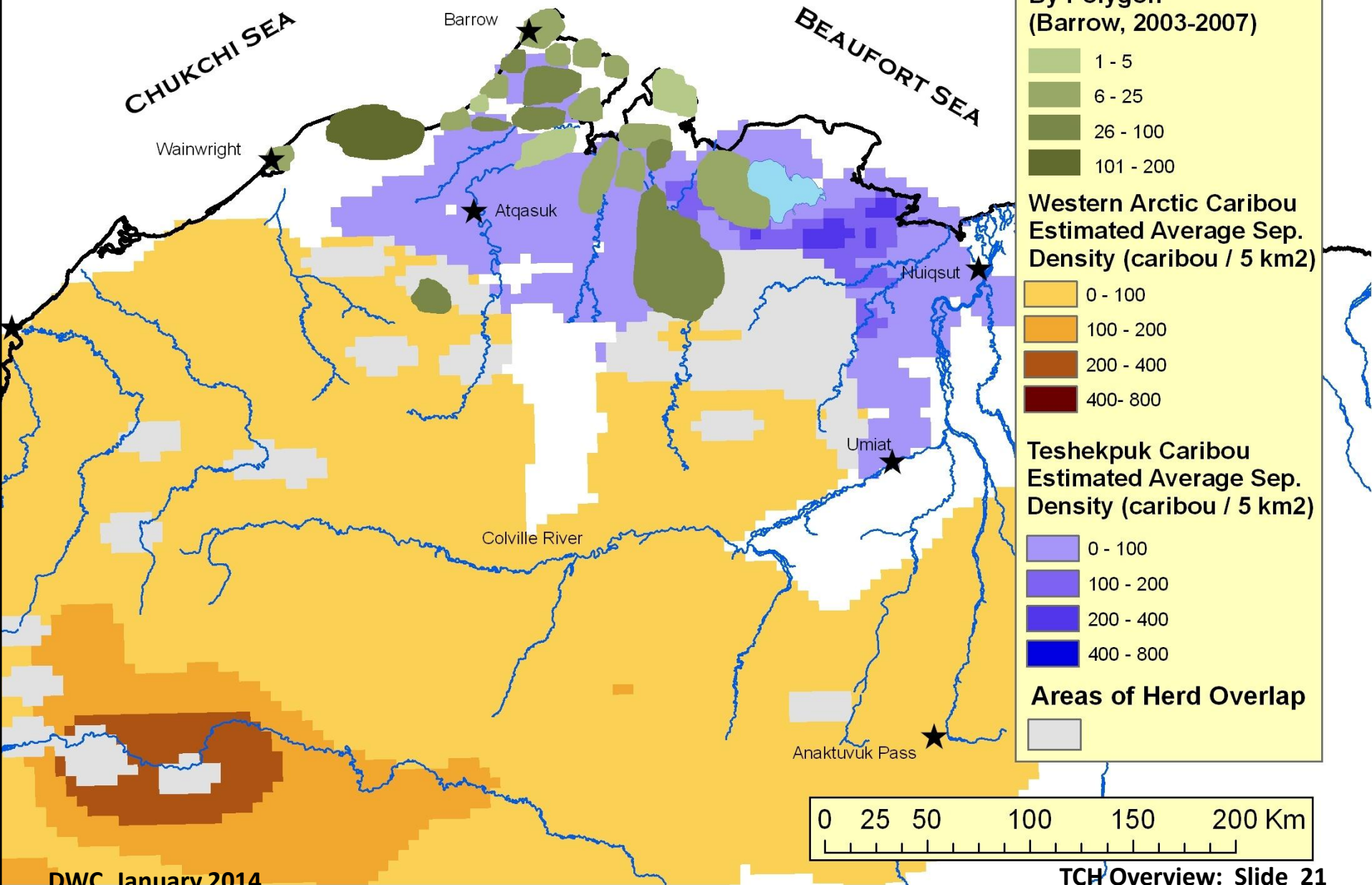
Health and Productivity

- Parturition rates

- Disease monitoring

- Yearling weights

- Neonate weights

Calf Weights - TCH and selected caribou herds in North America

HERD[1]	TCH	TCH	TCH	TCH	CAH	PCH	GRH	FMH
YEARS	2013	2012	2011	2006-2009	2001-2005	1992-1994	1978-2003	1994-1997
SAMPLE SIZE	31	30	31	77	266	176	270	207
MEAN MASS (kg)	5.5	5.5	5.7	6.0	6.6	6.2	6.0	7.8
ANNUAL MEAN RANGE (kg)	N/A	N/A	N/A	5.9-6.3	6.2-6.8	6.1-6.2	5.1-6.8[2]	7.5-8.1

CONCLUSIONS

- Herd is declining

- Decline is a due to a combination of:
    - Low and declining productivity
    - Poor recruitment
    - High adult mortality rates (especially recently)

- Underlying mechanisms are not totally clear, but are likely related to:
    - Poor summer and winter nutrition
    - High levels of predation on calves in winter
    - Nutritionally mediated risk of predation

- Harvest will play an increasing role in herd dynamics if the decline continues

- Population dynamics are suggestive of a crash-susceptible age structure

Questions?

TESHEKPUK CARIBOU HERD
GAME MANAGEMENT UNITS 26, 23, 24, 25 and 22

Management/Research Biologist: Lincoln Parrett

Arctic and Western Region, Board of Game Meeting, Barrow, Alaska, Jan. 2014

INTRODUCTION [Slide 1: Title Slide]

1. In Region V, we have divided duties such that caribou receive the dedicated attention of a biologist tasked with both research and management duties of the herd.
2. I manage the Teshekpuk Caribou Herd (TCH), although overlapping ranges require much cross-herd cooperation and communication with the managers of the adjacent herds, the Western Arctic Herd (WAH) and Central Arctic Herd (CAH).
3. The survey and inventory program for the TCH is a collective effort on the part of ADF&G, the North Slope Borough Department of Wildlife Management, and the Bureau of Land Management. Conoco Phillips and their contractor ABR Inc. have played a substantial role in the purchase of satellite collars and satellite telemetry data management in some years.
4. **[Slide 2: Presentation Outline]** This presentation will include 6 sections:
    o Seasonal Ranges
    o Abundance and Demographics
    o Calf Survival
    o Regulations and Harvest
    o Health and Productivity

SEASONAL RANGES [Slide 3]

1. **[Slide 4: Seasonal Range Summary]** The TCH distribution covers a large portion of northwestern Alaska, but in most years, the concentrated areas of use are focused on the north slope between Wainwright and the Colville River in the summer, and that same area, as well as the Brooks Range between the Sagavanirktok and the drainages of the upper Colville in winter. I will focus on seasonal distributions for a few minutes, as they relate to proposal 23, the C&T and ANS for the TCH.
2. **[Slide 5: Cumulative Fixed Kernel Calving distribution 1994-2009]** Caribou herds are identified on the basis on fidelity to calving grounds. I used a kernel density estimator to sum the annual calving distributions from 1994-2009. From 1994-2009, the high density calving area was on the east side of Teshekpuk Lake. This distribution is estimated by combining 16 years of annual calving distributions, and averaging that sum to create an 'average' distribution.

Since 2009, calving has been widespread, and concentrated farther to the west than we had previously observed. Although the wide ranging nature of this herd has led to shared calving distribution with both the WAH and CAH in the past, the concentrated calving areas remain distinct. We have been looking closely at calf survival since 2011, trying to see if this change in distribution has an effect on survival rates.

3. **[Slide 6: Brownian Bridge - Fall Migration 1990-2012]** This distribution is another type of averaged distribution, in this case the average fall movements of adult females since 1990. Individual movement paths are created by estimating the possible distribution of movements possible between known locations (i.e. GPS relocations), based on reasonable estimates of location accuracy, and movement rates. Generally speaking, there are three types of migratory movements in this herd: 1) movement from one place on the coastal plain to another, 2) movements off the coastal plain to the central Brooks Range, where overlap with the Central Arctic Herd is common, and 3) movements off the slope to Units 22 and 23, where the WAH winters.

4. **[Slide 7: Fixed Kernel Winter Distribution 2008-2012]** Similar to the process described regarding calving distributions, this is a cumulative winter distribution for the winters of 2008 through 2012, based on fixed kernel estimates of annual herd distribution. I used locations from satellite collars and VHF relocations from late winter to generate this estimate of winter distribution. Core areas for wintering are near Atqasuk and Wainwright, southwest of Nuiqsut, and the central Brooks range west of the Dalton Highway.

5. Understanding distribution of this herd is important for understanding ecological drivers, interactions with other herds, and development of regulations.

ABUNDANCE AND DEMOGRAPHICS [Slide 9]
[Slide 9:TCH Population and Harvest Objectives]
1. Population size was 55,000 in 2011.
2. Stochastic model predicts 38,000 in 2013.
3. Based on a harvest rate of 1.5% on females, and a harvest rate of 15% on males, the harvestable surplus would be 2,910 based on the population of 55,000, and 2,020 based on the predicted population of 38.000.
4. There is no Amount Necessary for Subsistence established for this herd.
5. Based on the administrative record, the ANS for this herd may be part of the current WAH ANS. This is unclear, but the WAH ANS is 8,000-12,000, and the adjacent CAH is 250-450.
6. Intensive Management Objectives for this herd are a population of 15,000-28,000 and a harvest of 900-2,800.

HISTORICAL ABUNDANCE **[Slide 10: TCH population growth chart]**
1. After 24 years of growth at an exponential rate of 7%, we saw a decline in 2011.
2. We estimated approximately 55,000 caribou in 2011. The current population estimate, has not been finalized.
3. During the photocensus, we found 2 CAH collars in photography groups; the number of caribou these are thought to represent have been accounted for using the population estimator. At the time of the TCH photocensus, there was 1 collared adult associated with the CAH, and 5 collared adults associated with the WAH. Mixture has become an inevitable part of photocensus estimates in the last 4-5 years.
4. The predicted average rate of decline from 2011 to 2013 is 17% per year.

POPULATION MODEL **[Slide 11: Modeled Population Growth 2008-2011]**
1. This population model was developed by ABR Inc. at the behest of BLM, using ADFG data. This model uses real estimates of productivity and survival where possible, and incorporates the individual estimates of variance in projecting possible outcomes; this process is called stochasticity and is meant to produce a more realistic range of population outcomes.
2. Assuming the point estimate from 2008 was correct, and the age distribution I have assumed is reasonable, the projection for 2011 was 52,000, based on survival, productivity, recruitment and harvest since 2008. The actual estimated population in 2011 was about 55,000, and within the confidence interval of the model
3. **[Slide 12: Modeled Population Growth 2008-2013]** Projecting recent demographic estimates (2008-2013) in mortality, productivity and recruitment, we would have expected this herd decline from 55,000 to approximately 38,000 in 2013, with declines of 11% and 23% in the two recent years.
4. I did not project this model further into the future, primarily because of the uncertainty in future demographic rates. If productivity stays low, calf survival stays modest, and female mortality rates are no better than they have averaged over the long term, the decline will certainly continue, and that is just using long-term averages, not more recent trends. Projecting just the average rate of decline over the past two years would leave the population at approximately 26,000 by 2015.

ADULT MORTALITY **[Slide 13: TCH Adult Female Mortality Rates]**
- Long-term adult mortality rate of 15 %
- Last year was the highest we have observed (30%), but long-term since 1991, there is no significant trend. Last year was a record high for the CAH as well.
- **[Slide 14 Seasonality of Female Mortality]** Female mortality climbs throughout the year, peaking in late winter.

PRODUCTIVITY **[Slide 15: TCH Calf Production]**
1. Over the long-term (1994-2013) we have seen an average of 62% of adult cows (>2 years old) with calves during calving ground surveys. Note that this long-term index is a product of both parturition and some neonatal mortality. The shorter term average estimated parturition rate, which is less sensitive to early mortality, averaged 70% for collared females at least 3 years of age was (2001-2013).
2. Recent years have shown very low parturition rates (range of 44-54%, 2009-2013).
3. We tend to see high inter-annual variation and a large amount of uncertainty in the estimates, but the TCH is generally unproductive compared to many other caribou herds, and is showing a significant (P=0.03) 1.25% per year declining trend in productivity, a potential indicator of density dependence in this herd.

RECRUITMENT **[Slide 16: TCH Short Yearlings:100 Adults]**
1. This index of recruitment shows a slow but significant long-term decline of 0.5% percent per year.
2. This index is difficult to relate to actual recruitment because the denominator of the ratio is of unknown composition, and in particular is effected by the bull:cow ratio, and sexual segregation in any given year.
3. If the denominator is in fact relatively stable, then the trend indicates a long-term decline in recruitment, potentially leading to an unstable, top-heavy age-structure. The crash of the Mulchatna herd may have been precipitated in part by such an age structure, so we have watched this index carefully.

CALF SURVIVAL **[Slide 17: Calf Survival Project]**
1. A calf survival project was initiated in June 2011.
2. Starting in 2010, the TCH distribution during calving became relatively unpredictable. There were no weather or other environmental reasons that we were aware of that precipitated the change. The change in calving distribution has provided a natural experiment.
3. This is a cooperative study with the BLM to look at survival in relation to calving ground use, and get some baseline numbers on mortality rates and causes. Some preliminary results are presented.
4. [**Slide 18: Calf Mortality Through October, 2011 Example**] Overall, we have averaged 70% survival through October. Like many summer caribou calf mortality studies, there is a burst of mortality following birth that slows down dramatically through the course of the summer. In this study however, the overall rates of mortality were fairly low. For comparison, instead of 65-75% survival, 40% survival is more common in other calf mortality studies. Using 2011 as an example, mortality rates were low through October, and we saw a diversity in the sources of mortality.

5. **[Slide 19: Late Winter Sources of Calf Mortality]** We had suspected that much of the calf mortality for this herd takes place in winter based on differences between fall and spring calf:adult ratios, and this has been borne out by the results of this calf mortality study. This is essentially the inverse of other calf mortality studies, where mortality is high through the summer, then relatively low through the winter. Because of slipped collars and missing animals, it is difficult to estimate survival to 12 months of age, but we know that at least 15% survived in 2011-2012, and 17% survived in 2012-2013. We made a good effort to visit as many over-winter mortalities as possible to attempt to determine the cause. Predation was dominant source of mortality, but a few did starve, and I would speculate that the high number of mortalities that were attributed to wolverines in 2013 may be a product of nutritional stress.

HARVEST **[Slide 20: Seasons and Harvest Estimates]**
1. Overall harvest levels are somewhat complicated to determine for this herd, but may range from 1500-3000 per year. The subsistence division will go over this in detail in their presentation on proposal 23.
2. For many years the harvestable surplus was largely irrelevant; the herd was growing, and bull:cow ratios were relatively high. Actual harvest rates were probably in the vicinity of 3-6%. Cow harvest rates on this herd have probably been fairly low for many years (1-2%), but bull harvest rates are relatively high, and will become an issue if bull:cow ratios continue to decline.
3. Because harvest, no matter the reporting system, is not herd-specific, we have done a lot of work to try to estimate the ratio of TCH:WAH and CAH in the harvest. Slide 21 **[Spatially Explicit Harvest Patterns by Barrow]** gives an example of how we estimate caribou distribution using satellite collars, and attempt to apportion harvest by herd, by using spatially explicit harvest estimates, with concomitantly estimated caribou herd distributions. An important point to make here is that it is essential for us to understand more than just how many were harvested; we need to know when, and where, or else we are making a lot of assumptions.
4. Since we are going to focus extensively on harvest patterns when we provide background for proposal 23, I will refrain from further discussion at this point.

HEALTH and PRODUCTIVITY [Slide 22]
1. We look at 4 primary indicators of herd health for the TCH, productivity, disease monitoring, yearling weights, and neonate weights. I mentioned parturition rates previously; they are low and decreasing in this herd.

2. Another index to body condition that the recently retired Rod Boertje was emphasizing was the parturition rates of 3-year-olds. We have recently begun to capture more young animals in an effort to boost our sample of 3-year olds. Although based on small sample sizes, the 3-year-olds seem to mirror the older cows in this herd, but as we saw earlier, all of them are relatively low.
3. We monitor a few diseases and parasites in this herd, and have conducted 2 health assessments that include extensive necropsy work. Thus far, we have not noted any issues that are indicative of widespread disease or parasite issues, at least in comparison to other herds.
4. **[Slide 23: Neonatal calf weights]** An additional index to body condition is neonate calf weights, which are thought to be indicative of the body condition of cows coming out of winter. Caribou calf development peaks in the third trimester, and captive research has shown that caribou are somewhat dependent on protein intake in late winter to build that calf. We have observed that the TCH has the lowest calf weights I am aware of in North America, and those have decreased in comparison to weights we observed from 2006-2009.

CONCLUSIONS [Slide 24]
1. Herd is declining
2. Productivity, recruitment and adult mortality are all implicated
3. Poor summer and winter nutrition, high predation rates, and their interaction seem to play a role in the driving factors behind the decline.
4. Harvest, which previously had a minimal role in herd dynamics, is likely to in the near future.
5. Population dynamics are suggestive of a crash-susceptible age structure; we have not verified this.