RC 25

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The Mulchatna caribou herd ranges from the northern Bristol Bay drainages up into the Kuskokwim River and its eastern tributaries heading in the Alaska Range (ADF&G Mulchatna Management Report, 2007). Over the last 20 years it has experienced extreme fluctuations in populations with the latest survey trends showing a precipitous decline. According the ADF&G's accepted numbers, the herd increased from 90,000 animals is 1991-1992 to a peak population of 200,000 in 1996-1997 and then initiated a long decline with the most recent surveys in 2006-2007 tallying only 45,000 animals within this herd's traditional range. The current population is far below ADF&G's management objective of maintaining 100,000-150,000 total animals with a bull cow:ratio of 35:100. The 2005-2006 bull:cow ratio (most recent herd composition numbers) was a paltry 13.9:100 and only 11.5% of the total bull component was classified as "large bulls" (Table 2 Caribou Management Report) meaning large bulls:cow ratio was only 1.6:100. Analysis reveals that these skewed age:sex ratios may be at the root of the Mulchata herd's decline.

Barren ground caribou (Rangifer tarandus) are polygamous breeders. While males of the population can inseminate many females during the course of breeding season there are indications that there are limits to how many females a single male can service. Furthermore, current studies show that, "younger males may not have the same capacity to inseminate a large number of females as prime age bulls." (Mysterud&Coulson&Stenseth, 910) The negative effects of a skewed sex/age ratio

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extends beyond how many cows a bull can theoretically inseminate. "Detailed studies show a lower proportion of younger females will breed when sex ratios are heavily skewed." (Ginsber&Milner-gulland 1992) Because Caribou are synchronous breeders who live in an extreme, seasonally limited environment; healthy age:sex ratios are especially critical to their ecology.

Birth timing for a wild ungulate is critical and will have life long effects on its dominance, health and reproductive capacity. Dauphine and McClure have this to say about the significance of synchrony during rut and parturition:

> "The evolution and adaptive significance of the mating synchrony characteristic of caribou populations should be considered in the management of the species, particularly in view of the rapidly increasing influence of man on sensitive arctic ecosystems. Presumably, synchronous mating (and births) have evolved through selection as an adaptation to the caribou's environment."

Synchronous mating results in synchronous birthing, and for caribou this is especially important for calves to evade predation (swamping strategy). This "swamping" strategy appears to be the main evolutionary response to high natural predation rates. Social implications of later births are also important to consider. In a study on American Bison (Bison bisonL.) earlier born bison are more socially dominate than later born peers (Green&Rothstein 1993). Delayed calving leads to lower summer survival and lighter fall masses and higher winter mortality (Loison, Langvatn & Solberg 1999). "Light born females may also need and extra year of growth to reach the body mass necessary to reproduce" (Langvatn *et al.* 1996). Caribou have a synchronous reproductive strategy to evade predators, cope with their extreme environment and deviations from the median

have detrimental effects on the individual animal and the population as a whole, management should consider any attempt to mitigate factors that disrupt synchrony within the herd.

Modern human harvest of ungulate populations is extremely male biased with commonly 70-80% of the total harvest being males. Ginsberg and Milner-Gulland specifically addressed the super selective harvest when analyzing sustainable management practices for African ungulates. They argued that in a wild, ungulate population the effects of skewed age:sex ratios could be shown to cause reproductive and population collapse.

> "Potential deleterious effects include disruption of territorial structure, increased mortality of calves born out of season, artificial selection for inferior males, or an inadequate number of males to inseminate all females. Deleterious effects of highly selective hunting are particularly likely to affect species with synchronized breeding seasons in which a short disruption may reduce rates of conception and population growth." (Ginsberg & Milner Gullard 1992)

From 1991-92 to 2003-04, 77.3% percent of the Mulchatna harvest was classified as male. (ADF&G 2007) However, it is important to look at overall harvest levels as well. During the same time period, 1991-92 to 2003-04, human hunters harvested between 3-5% of the Mulchatna herd. (ADF&G 2007) Ginsberg and Milner-Gullard modeled three harvest levels (4%, 8%, 12% of total population) with varying levels of male selectivity (30-90%). All of their examples showed a threshold for population collapse based on a function of overall harvest level and percentage of males harvested (Fig. 1). It was shown that at higher overall harvest levels populations would be more susceptible to skewed

age:sex ratios. The Mulchatna herd's harvest levels and male biased harvest closely mirror Ginsberg and Milner-Gullard's theoretical model. When the Mulchatna herd's population trend is overlaid with bull:cow ratios and calf:cow ratios (Fig. 4) its trend, or visual profile, is nearly identical to Ginsberg and Milner-Gullard's projection of the effects of a highly skewed sex:age ratio.

In a personal interview with Jim Woolington, ADF&G's area biologist for south west Alaska, a variety of alternative explanations for the Mulchatna herd's decline were proposed. It was Woolington's opinion that the herd had exceeded the carrying capacity for its range when it attained its peak population levels in the mid 90s. He was also of the opinion that disease, specifically an outbreak of hoof rot in the late 90s, contributed to initiating the decline. When asked his opinion about the skewed age:sex ratios he proposed that they were a result of low recruitment during the past 8 years as compared to the very high cohort productions of the mid to late 90s. Since bulls have higher natural mortalities they would continue to represent a lower and lower percentage of the herd after years of low recruitment, while cows would be disproportionately represented due to their longer life expectancy. He feels that there are still old cows in the population from those peak production years. It was also his opinion that the low ratio of bulls in the population is conducive to initiating recovery of the herd's population. This, according to him, is due to the fact that the cows will have less range competition during critical winter months, therefore increasing their fecundity. Woolington concluded by emphasizing that the department was taking the necessary steps to conserve the herd and more accurately assess what the ideal, sustainable, population level is for the Mulchatna herd.

But what is the significance of a caribou herd to Alaskan's? One way of quantifying the value of a game population as a renewable resource is by placing a dollar value on the animal and extrapolating what a human, harvested, caribou is worth. Since the range of the Mulchatna caribou herd encompasses a rural region of the Alaska and the residents of this region live in a mixed cash/subsistence economy it is instructive to look at the value of caribou from this subsistence perspective. In a personal interview with Jim Simon the northern region program manager for Alaska's department of subsistence he talked about how his department attempts to evaluate the significance for renewable resources. One way to look at a terrestrial animal, like a caribou, is by how many pounds of meat it provides and how much that meat would cost to replace or buy in rural Alaska. The department uses two numbers $3/lb and $5/lb to assess the dollar value of subsistence harvest. These numbers have not been updated for approx. ten years and are universally viewed as being lower than the true replacement value of meat. By using $5/lb and multiplying it by 120 (the average amount of meat on a caribou) we come up with $600 of meat per caribou. However, subsistence harvest is only one use of the herd. Resident and non-resident sport harvest are also important uses of the state's game resources and caribou is no exception. Simon recommended a more in depth analysis of the value of caribou (in dollars) but thought it was realistic, if not conservative, to use the meat poundage multiplied by its replacement value for a rough figure.

At its peak production the Mulchatna herd was supplying 9,000 caribou per year to the state's economy. That equates to 5.4 million dollars of meat value alone. During the 2005-06 season the harvest was 3,570 caribou for a meat value of 2.14 million dollars. Given current population trends these numbers will continue to decline due to

conservation concerns. It is possible that within 5 years we see will harvest level of approx. 1,000 animals, if not lower. Had the department achieved its management goal of 100,000-150,000 animals, sustained harvest should have been in the 3,500-4,500 animal range. The difference between 1,000 harvested animals and 4,000 in dollars is 1.8 million dollars. From personal experience as an Alaskan hunting guide and life long hunter, depleted ungulate populations will stay at low equilibrium for 20-30 years. Factoring fifteen years of loss of harvest, not correcting for inflation and using 1.8 million as the short fall, it is shown that there will be 27 million dollars of loss to the state. If we use a more realistic $8/lb (personal experience in rural Alaska) and a 4,000 caribou gap in harvestable surplus, over 25 years we come up with a loss of 96 million. With further evaluation and adding the value of the sport hunting allocations and then dividing up the harvest allocation, the real loss to the state, even over 15 yrs, could be in excess of 200 million. For instance a sport hunter wishing to get flow out into the range of the Mulchatna caribou herd will spend, at a minimum, $4,000 dollars. For a non-resident hunter this total is probably well in excess of $8,000 once all the expenditures (transportation, guide) are factored in. Allowing for a conservative loss of allocation for sport hunters of 1000 animals at $5,000 apiece over ten years equates to a loss of 50 million dollars to the economy and residents of Alaska. Caribou are a valuable renewable resource with a statewide economic significance.

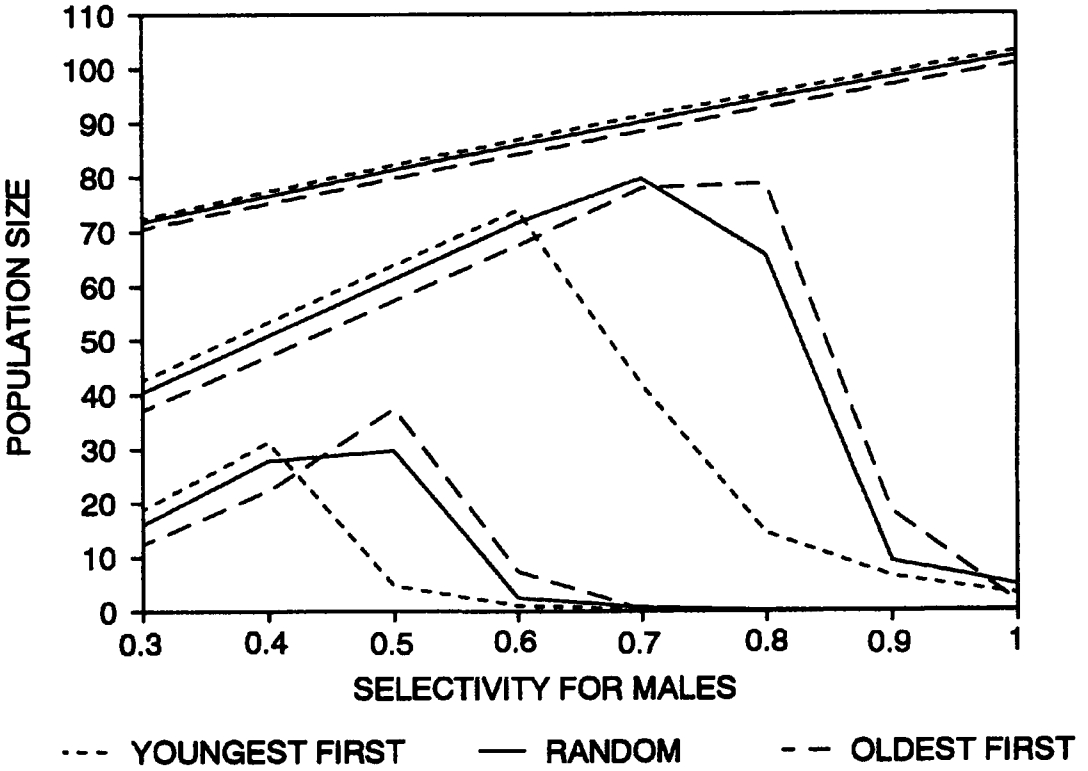

Figure 5. The effects of hunting that selects by both age and sex on the population size. Population size is expressed as a percentage of carrying capacity, selectivity for males by the proportion of the kill that is male. Hunting in proportion to the availability of an age-class ("random") is compared to trophy hunting ("old first") and game ranching ("young first"). The results are shown for three hunting mortality levels, 4%, 8%, and 12%. Although at low selectivities for males and low hunting mortalities, game ranching produces higher population sizes than trophy hunting, the population collapses earlier as the selectivity for males increases. Random hunting by age is intermediate in effect.

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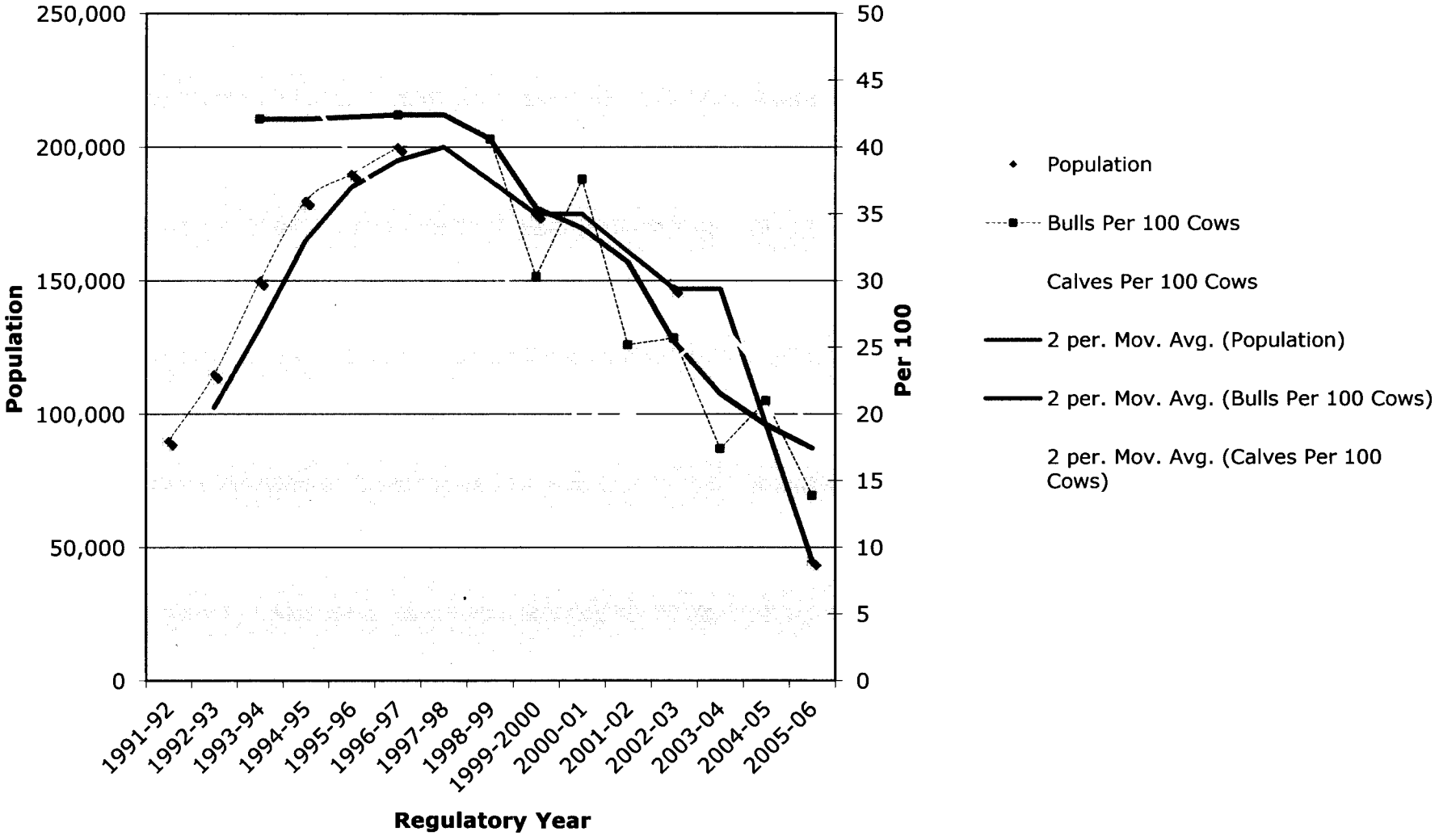

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