Status of Bighorn Sheep in North Dakota

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Abstract: Bighorn sheep (*Ovis canadensis*) were extirpated from North Dakota by 1905 and reintroduced in 1956. A total of 45 transplant projects, involving 357 animals, have occurred. In 2008, a minimum of 335 bighorn sheep, distributed among 15 sub-populations, inhabited the Little Missouri National Grassland of southwestern North Dakota. A catastrophic die-off occurred in 1997 within the southern metapopulation due to contact with domestic goats. Consequently, in 1999, a management partnership commenced with the Minnesota-Wisconsin Chapter of the Foundation for North American Wild Sheep in an effort to expedite the population's recovery. The first modern day hunting season occurred in 1975. A total of 203 licenses have been issued with 198 rams harvested through 2008. The ¾-curl restriction was abandoned in favor of an Any-Ram designation in 1990. One license is auctioned annually with the remainder issued via a lottery system, no more than one of which may be issued to a non-resident. Supplemental data has been gathered from radio-marked bighorn since 2000, including cause-specific mortality, home range size, and population demographics. Implications of introducing Rocky Mountain bighorn sheep (*Ovis canadensis canadensis*) to North Dakota are discussed.

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The first recorded observation of bighorn sheep (*Ovis canadensis)* in North Dakota was made by a member of the Lewis and Clark Expedition in 1805. However, bighorn were extirpated from the state by 1905 when the last known ram was killed in Magpie Creek. Disease from domestic sheep and unregulated hunting were the likely causes of the population's demise (Knue 1991). Although Cowan (1940) originally classified the state's native bighorn population as a distinct subspecies, *Ovis canadensis auduboni,* Wehausen and Ramey (2000) concluded that Audubon's bighorn was merely a population of Rocky Mountain bighorn sheep (*Ovis canadensis canadensis)* inhabiting low elevations east of the Rocky Mountains.

During the 1950s, the Pittman-Robertson Act afforded the North Dakota Game and Fish Department (NDGF) with the opportunity to reintroduce bighorn sheep to North Dakota. In 1956, 18 California-type bighorn were translocated from Williams Lake, British Columbia to a 160 acre enclosure in Magpie Creek, North Dakota. The purpose of the captive herd was to act as a source from which to establish additional populations throughout the badlands (Knue 1991). Eventually there were 3 captive herds utilized as source-stock; however, the captive management program was abandoned during the 1990s in favor of translocating free-ranging sources of bighorn from in-state and out-of-state populations, including British Columbia, Idaho, Oregon and Montana.

Bighorn inhabit rugged escape terrain that is ubiquitous throughout much of the Little Missouri National Grassland, with

elevations ranging between 637 to 785 m above sea level. Substrates consist of highly erodible silts and clays and harder materials such as sandstone and scoria (Bluemle 1980). The climate in southwestern North Dakota is semi-arid, continental and windy, with very warm summers and very cold winters (Jensen 1974). Plant communities are comprised primarily of short-grass prairie, sedges, sagebrush, grama, saltbrush, juniper and green ash (Nelson 1961, Wali 1980, Jensen 1988 and Fox 1989). Land ownership throughout North Dakota's bighorn range is 87% public and 13% private (per comm.-Arden Warm, USFS)

Following 6 out-of-state and 29 in-state translocations subsequent to the initial transplant in 1956, the state's population grew to approximately 300 by the mid-1990s. However, following a catastrophic all-age-class die-off in 1997 attributed to contact with domestic goats, the southern metapopulation was decimated to only 20 surviving individuals, with the state-wide population being only 140 (Stillings 1999).

The late-1990s epizootic precipitated a management partnership between NDGF and the Minnesota-Wisconsin Chapter of the Foundation for North American Wild Sheep (MN-WI FNAWS). Under the agreement, MN-WI FNAWS would provide funding for projects that were deemed critical for the recovery of the state's population by NDGF. Consequently, NDGF was able to radio-collar 30 bighorns within the remaining 7 sub-populations and successfully complete 3 out-of-state and 5 in-state transplants to reestablish herds decimated by disease and establish new populations in areas containing suitable habitat (Sweanor 1994).

Wiedmann (2008) reported that by 2008 North Dakota's bighorn population had reached a minimum of 335 animals distributed among 15 sub-populations (Figures 1 - 4), likely the highest population total since the 1800s. Ram:ewe ratios from 1999 to 2008 have averaged 64:100 (Figure 5). Lamb recruitment rates from 1999 to 2008 have averaged 30.3% (12-37%) (Figure 6).
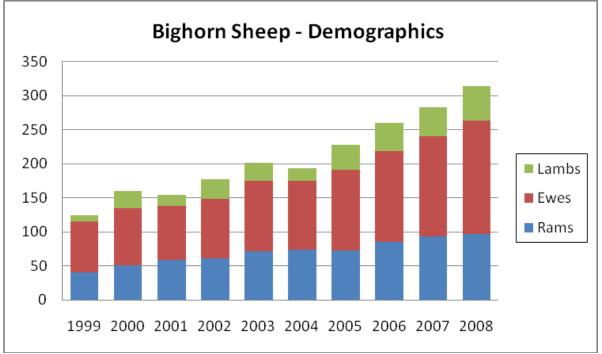

Figure 1. Bighorn sheep population demographics, 1999-2008.
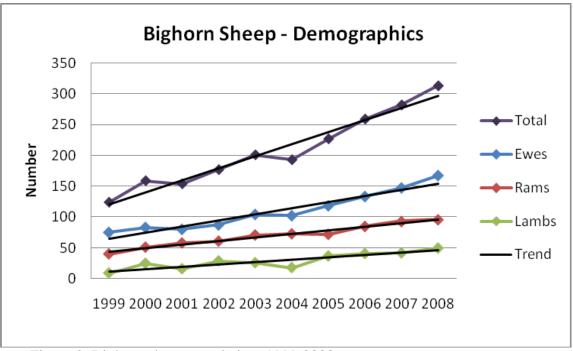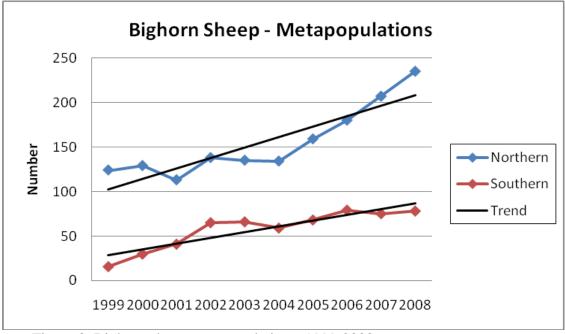
Figure 2. Bighorn sheep population, 1999-2008.

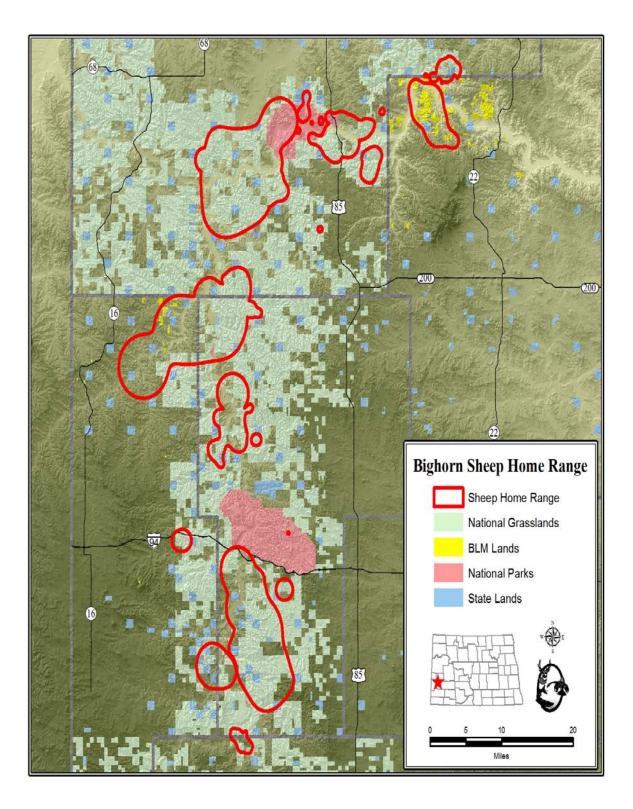Figure 3. Bighorn sheep metapopulations, 1999-2008.
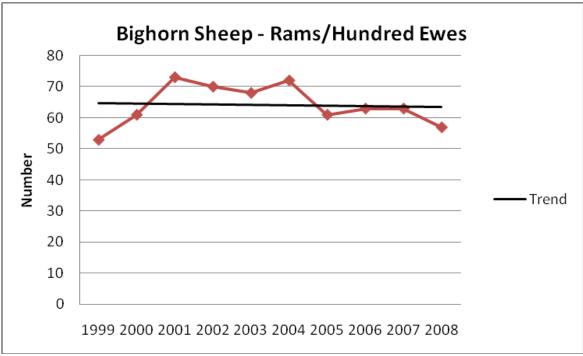
Figure 4. Bighorn sheep distribution.

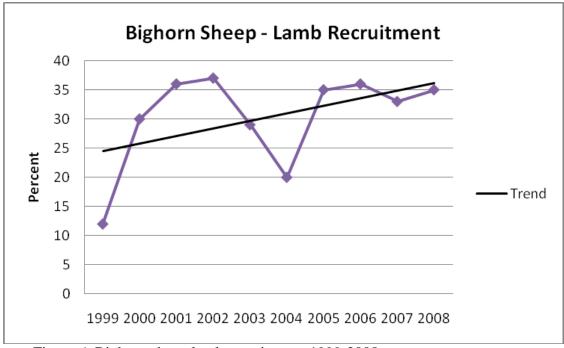Figure 5. Bighorn sheep ram:ewe ration, 1999-2008.

Figure 6. Bighorn sheep lamb recruitment, 1999-2008.

Bighorn were radio-marked in January 2000 primarily to collect population distribution, demographic and survey data. Therefore, VHF radio-collars were preferred in order to mark a greater number of individuals rather than collect significantly more locations from fewer animals using Global Positioning System technology (Girard 2007). Consequently, supplemental analysis was also calculated, including adult survivability, cause-specific mortality and home range size.

Adult survivability (Heisey and Fuller 1985) from 2000 to 2008 averaged 84.1% (71-92%) and 86.1 % (74-97%) for rams and ewes, respectively (Figure 7).

Mountain lion predation accounted for 25.6% of total mortality, including 15.4 and 30.8% for rams and ewes, respectively. The primary cause of ram mortality was hunting (53.8%); and, although a majority of ewe cause-specific mortality was undetermined/non-predation (46.5%), lion predation was the most significant cause of known mortalities. Age and winter stress were likely co-factors in a majority of undetermined/non-predation mortalities for rams and ewes. Other known sources of mortality included disease, poaching, vehicle collisions, fence entanglements, falls, coyote predation and rut injuries.
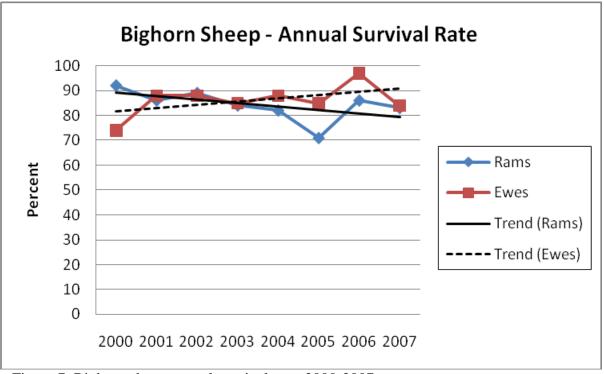

Figure 7. Bighorn sheep annual survival rate, 2000-2007.

NDGF presumed for decades that the state's bighorn herds occupied small home ranges, even less than 2 km^2. However, a preliminary Adaptive Kernel home range analysis (Rogers 2007) has revealed that home ranges are much larger than previously thought. Average home range size was approximately 81.3 km^2 for all herds. Home ranges within the northern and southern metapopulations averaged 85.2 and 77.4 km^2, respectively. Due to their migratory behavior, ram home ranges are typically twice that of ewes. The Ice Box Canyon (333.6 km^2) and Theodore

Roosevelt National Park (14.2 km^2) herds had the largest and smallest home ranges, respectively. Lambing areas were also indentified for each of the 15 sub-populations, allowing NDGF to more effectively coordinate with federal agencies to protect these critical areas from disturbance and improve habitat. A more precise home range analysis of North Dakota's bighorn herds will be completed in 2009.

The first modern day hunting season was held in 1975 when 12 licenses were issued for rams having a minimum ¾-curl. However, the ¾-curl requirement was abandoned in 1990 in favor of an Any-Ram designation. From 1975 to 2008, 203 licenses have been issued with 198 rams being harvested (97.5% success). Licenses are allocated via a lottery system with no preference points being offered. In 2008, a record 10,425 individuals applied for 5 lottery licenses (Figure 8). In 1999, non-residents were allowed to apply for no more than one of the available lottery licenses. One license was authorized to be auctioned to the highest bidder beginning in 1986, resulting in $815,000 being raised for bighorn management through 2009. The average age of harvested rams since 1975 is 6.3 yr old, with no significant difference since the change from the ¾-curl regulation (6.2 yr old). No ewe seasons have been sanctioned in North Dakota.
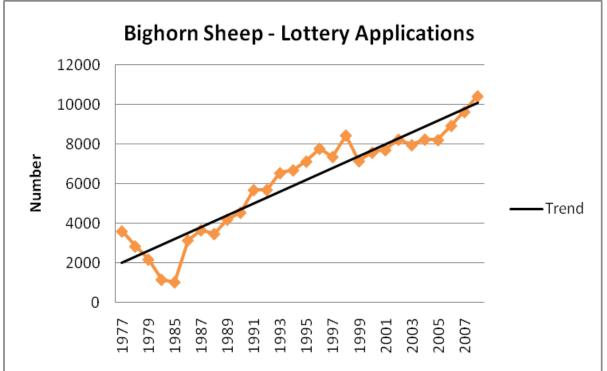

Figure 8. Bighorn sheep lottery applications, 1977-2007.

A paradigm shift occurred in North Dakota's bighorn management program in 2006 based upon revisions of Cowan's (1940) mountain sheep taxonomy by Wehausen, Ramey and Bleich (2000 and 2005). Because NDGF's initial transplant stock originated from an *O. c. californiana* source in British Columbia, the Department felt obligated to maintain this subspecies designation when conducting future translocations, even though it was believed low-elevation *O. c. canadensis* populations

would much more readily acclimated to North Dakota's very similar habitat type. However, with Wehausen and Ramey's re-classification of *O. c. californiana* as synonymous with *O. c. canadensis*, NDGF translocated Rocky Mountain bighorn (*O. c. canadensis*) from Montana's Missouri River Breaks in 2006 and 2007. The Missouri River Breaks bighorn have surpassed expectations thus far, as annual lamb recruitment has averaged 70.9% the first 3 lambing seasons, far exceeding the 32.4% lamb recruitment achieved by the state's resident California-type populations during the same period. Furthermore, the incongruity in lambing success was also evident in an area where both resident California-type and translocated Montana Missouri River Breaks bighorn interact and occupy the same range. Future assessment and comparisons between these populations will continue so as to lend credence to the importance of translocating bighorn between similar habitat types when feasible.

Challenges facing North Dakota's bighorn population include contact with domestic sheep and goats due to interspersed private land ownership throughout the Little Missouri National Grassland (domestic sheep and goat grazing is prohibited within 16 km of known bighorn range on all federal and state lands), an increasing mountain lion population, increased mineral development (Sayre 1996, Feist 1997), disturbance from recreational trails constructed near critical lambing areas (Sayre 2002) , habitat degradation due primarily to juniper encroachment, and persistence concerns due to a fragmentation and connectivity between sub-populations.

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