Bighorns and Little Horns Revisited

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Abstract: During the 1960s a series of horn measurements of bighorn rams (*Ovis canadensis*) from the eastern slopes of Alberta was recorded. The horn base circumferences of rams from the chinook belt south of the Bow River were significantly larger than ram horns to the north. A subsequent series of horn base measurements up to forty years later had the same results. However, there were some notable exceptions in central and northern Alberta. Ram horn bases increased significantly following a controlled ewe removal program in central Alberta on Ram Mountain and decreased to former levels after cessation of ewe removals. Ram horns at northern coal mine reclamation sites had larger horn bases than ram horn measurements prior to reclamation.

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In light of the discussions in recent years regarding the potential impact of trophy hunting on the size of ram horns (Coltman et al. 2003), I compared the size of horns on rams harvested under trophy seasons 40 years ago with those on rams harvested under trophy seasons today. Since the 1960s approximately 7000 trophy rams have been registered from an Alberta population of about 6000 bighorns. During the investigation of horn registrations, other information came to light and is presented here as well.

In 1969 I presented a paper titled *Bighorns and Littlehorns* at a meeting of the Northwest Section of The Wildlife Society in Victoria, B.C. (later published as Wishart 1969). At that time and again in 1982 (Wishart and Brochu 1982) I reported that horn base circumferences of bighorn sheep (*Ovis canadensis*) rams from the chinook belt of southern Alberta were significantly larger than ram horn bases to the north. The chinook belt refers to an area where warm winter winds have created montane ecoregions which have the warmest winter temperatures of any forested ecoregion in Alberta. Since the 1960s, other river valleys with montane climate and vegetation north of the Bow River were described. These valleys also provide extensive and extended grazing periods for ungulates during the winter months (Strong and Leggat 1992).

In addition to climatic factors, a controlled herd reduction experiment of the bighorn sheep herd on Ram Mountain in central Alberta 52°N, 115°W provided an opportunity to examine gross effects of nutrition on bighorn basal circumference (Jorgenson et al. 1998). Similarly, coal mine reclamation near Cadomin (53°N,

117°W) and Smoky River (54°N, 119°W) created bighorn habitat featuring pit walls adjoining heavily-fertilized forage areas seeded with grasses and legumes on two northern bighorn ranges which allowed additional evaluation of nutritional effects on bighorn horn growth. Results of these influences on ram horn growths are described herein.

Methods

From 1961 to 1967 ram horn sizes were determined from information recorded in over 500 sheep hunter questionnaires. Results were confirmed from approximately 600 measurements of annular horn segments of rams at taxidermy shops from both north and south of the Bow River in southwest Alberta. During those years the legal minimum for a harvestable ram was an animal whose horns completed a 3/4 curl. The 4/5 curl regulation began in 1968 and registration of ram heads began in 1971 where similar information from the 1960s was obtained, that is, age, location, horn length, and horn basal circumference. All measurements were recorded in inches in the 1960s and all the metric measurements from registrations were converted to inches for this analysis. Horn bases in the 1960s were compared to this century (2001-2005) from a selection of four wildlife management units (WMUs) south of the Bow River and four WMUs north of the Bow. Three northern WMUs were analysed separately due to significant events affecting the horn growth of rams. The non-parametric Mann-Whitney U and Kruskal-Wallis tests were utilized for all comparisons used in this study (α=0.05).

Results

With two notable exceptions involving coal reclamation sites (discussed below) there were no significant differences in horn base circumferences from the 1960s and this century (U=10144.0, P=0.6) Rams south of the Bow River had significantly larger horn bases than rams north of the Bow River (1960s: U= 2984.5, P<0.001; 2000s: U= 16307.0, P<0.001) with no apparent change in circumference after 40 years (Table 1).

In the 1960s the difference in base circumference between north and south held true right into the record classes. For example, horn basal circumference from southern Alberta bighorn sheep recorded in *Records of North American Big Game* (Boone and Crockett Club 1964) averaged 15.5 in while basal circumference from northern bighorn sheep averaged 15 in. This difference was highly significant (P<.001) (Wishart 1969). Horn basal circumference reached the maximum at 5 yr of age in southern Alberta and at 6 yr in northern Alberta (Wishart 1969).

Table 1. Average ram horn base circumferences (in inches) south and north of the Bow River in southwest Alberta during the 1960s and during this century.

	1960s (n)	2000s (n)
North of Bow River	14.8 ± 0.1 (337)	14.5 ± 0.1 (165)
South of Bow River	15.6 ± 0.1 (165)	15.9 ± 0.2 (129)

Ram Mountain (WMU 429)

The results of ewe removals and the significant effect on increased incremental

horn development in bighorn rams on Ram Mountain have been reported (Jorgenson et al. 1998). Registrations of ram horn lengths and basal circumferences from Ram Mountain provide similar results (Table 2).

During the ewe removal the registered horn measurements are from rams that were produced during the period when yearling ewes were breeding and the herd was young and highly productive. The ram horns produced at that time are some of the largest ever recorded for Ram Mountain. Horn basal circumference increased even as age decreased (U=141.5, *P*=0.04) during the period of ewe removal, perhaps associated with reduced competition for food resources (Jorgenson et al. 1998). When the ewe removals ceased, the population more than doubled, the yearling ewes stopped breeding, and horn growth among rams diminished significantly in basal circumference from the period of ewe removal (U=112.5, *P*=0.01).

Cadomin reclamation site (WMU 438)

Ram horn sizes in the Cadomin area were typical of northern rams until the 1980s. As reclamation efforts featuring fertilized grasses and legumes on mined-over lands increased, horn size of rams responded with increased growth from 1991 to 2004 (U=1723.0, *P*=0.02) (Table 3). Along with increased horn growth there was a rapid increase in population growth from 320 bighorns prior to 1980 to over 800 on the mine sites during the 1990s (MacCallum 2000). A new world record bighorn ram was harvested from the Cadomin area on 28 November, 2000 (Boone and Crockett Club 2005). Although over 200 ewes and lambs were removed (translocated) from the Cadomin area during the 1990s to maintain herd productivity (MacCallum 2000), the mine population appeared to stabilize after 2000. Horn basal circumferences have subsequently declined significantly in recent years (U=3556.5, *P*=0.002) (Table 3).

Smoky River reclamation site (WMU 446)

The Smoky River herd in WMU 446 appears to be a founder population since it has the least heterozygosity of all the bighorns in Alberta (Patterson et al. 2007). The herd occurs in the most northern montane zone of the province, yet the rams show exceptional horn growth (Table 4). These rams enjoy effects of both warm chinook winds during the winter and local coal mine reclamation efforts designed to promote ungulate use similar to those at the Cadomin site. The herd is very accessible by road and harvest management features ewe permits. In addition, harvest of bighorn sheep of either

Table 2. Horn measurements (in inches) of rams registered from Ram Mountain in west central Alberta before, during, and after ewe removal (1976 to 1999).

		Average ± Standard error		
	n	Age	Horn base	Horn length
Before ewe removal	15	7.4 ± 0.5	14.7 ± 0.1	32.5 ± 0.6
Ewe removal	30	6.3 ± 0.3	15.0 ± 0.1	31.5 ± 0.5
After ewe removal	18	7.2 ± 0.4	14.4 ± 0.2	31.7 ± 0.5

Table 3. Average horn measurements (in inches) of rams taken near the protected coal lease reclamation sites in the Cadomin area in western Alberta (WMU 438).

Year	n	Age	Base	Length

1976-1981	96	7.6 ± 0.2	14.6 ± 0.1	32.3 ± 0.3
1982-1991	236	7.7 ± 0.1	15.4 ± 0.1	33.6 ± 0.2
1992-2001	261	8.8 ± 0.1	15.4 ± 0.1	36.3 ± 0.3
2002-2004	40	8.8 ± 0.3	15.0 ± 0.1	36.8 ± 0.6

Table 4. Average horn sizes (in inches) of the rams from Smoky River in western Alberta (WMU 446) at a mine reclamation site in a montane ecoregion.

Year	n	Age	Base	Length
1991-1995	24	5.4 ± 0.3	15.7 ± 0.1	32.3 ± 0.6
1996-2000	42	4.9 ± 0.2	15.6 ± 0.1	30.9 ± 0.4
2001-2005	48	5.3 ± 0.2	15.6 ± 0.1	32.6 ± 0.9

sex and any age by First Nations is allowed. Most rams removed are harvested by special permit and are killed as soon as they reach legal age. Some rams produce legal-sized horns as young as 3 yr old. In spite of the very northerly location, local conditions result in these rams having the fastest and largest growing horns in Alberta (Table 4).

Rams harvested at Smoky River feature larger basal circumferences than rams on Ram Mountain despite the fact that they reach legal size at an earlier age than those from Ram Mountain. Age at harvest is the consequence of the 4/5 curl regulation which states “a line drawn from the most anterior point of the horn base must pass in front of the anterior margin of the eye to the tip of the horn when viewed in profile”. In other words, the leading edges of horns with large bases extend well in front of the eye, whereas, smaller horn bases do not.

Conclusion

After forty years of trophy hunting, no detrimental effect on the horn size of bighorn rams could be determined based on horn base circumferences. However, some beneficial effects on horn growth were detected. All such effects occurred in improved forage-related situations where bighorn rams produced horns with large bases. During the 1960s in Alberta, bighorns with the largest horn bases occurred in the chinook belt of southern Alberta where winter ranges often are cleared of snow by warm winter winds. Following an experimental population reduction featuring removal of ewes on Ram Mountain, horn measurements in rams increased significantly as population size was reduced to a level where there was decreased intraspecific competition for food resources. Similarly, increased forage on coal mine reclamation sites in the Cadomin area resulted in significant increases in ram horn basal circumferences. Finally, exceptional horn bases developed in rams exposed to all three forage enhancement situations, that is, coal mining reclamation sites, ewe seasons, and living in the chinook zone of the Smoky River. Generally, bighorn rams in Alberta with access to the most plentiful and palatable forage for a variety of reasons produce the largest horns.

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