

EVOLUTION OF MOUNTAIN SHEEP HORN CURL REGULATIONS
IN BRITISH COLUMBIA

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INTRODUCTION

MOUNTAIN SHEEP IN B.C.

Two species including four subspecies of mountain sheep are native to British Columbia: thinhorn (*Ovis dalli*) in the north including Dall sheep (*O.d. dalli* Nelson) and Stone sheep (*O.d. stonei* Allen); and bighorn (*Ovis canadensis*) in the south including Rocky Mountain bighorn (*O.c. canadensis* Shaw) and California bighorn (*O.c. californiana* Douglas). (Cowan and Guiguet, 1965). All four subspecies occur as viable populations and all are hunted annually.

RESULTS AND DISCUSSION

MANAGEMENT OBJECTIVES

British Columbia's Mountain Sheep Management Plan (Draft) developed the basic objectives: to protect and manage mountain sheep for consumptive uses through recreational hunting and non-consumptive uses for the general public (Demarchi, *et al.*, 1977). The policy statement reads, "The Fish and Wildlife Branch will maintain the mountain sheep resources (the animals and their habitat) on the principle that their perpetuation is compatible with the management of related wildlife and is of benefit to the people of British Columbia." Management for non-consumptive uses is recognized as an important objective. However, as the purpose here is to examine the various alternatives employed by the B.C. Fish and Wildlife Branch to improve recreational hunting management, this objective will not be discussed.

OBJECTIVES OF MOUNTAIN SHEEP REGULATIONS

Mountain sheep have been managed as basically three distinct groups in B. C.: 1) northern thinhorns (comprising Dalls, Stones and a small native population of Rocky Mountain bighorns in the northern Fockies); 2) southern and central Interior California bighorns (comprising several native populations of California bighorns and two small introduced herds of Rocky Mountain bighorns) and 3) Rocky Mountain bighorns in south eastern B. C.

Beginning with any age rams and an annual bag limit of five, in the early 1900's, mountain sheep regulations have gradually become more restrictive particularly from 1966 to 1976. Basically the regulations take into account: 1) the trophy status afforded mountain sheep by the majority of hunters; 2) the limited supply of mountain sheep in relation to the demand; 3) the biological attributes including: the relatively low rate of recruitment to yearling age and poorer compensating mechan-

isms (compared to whitetailed deer for example) and the apparent importance of maintaining a relatively normal age-class distribution among males (Geist 1971 and 1975); and 4) the importance that the public places upon the maintenance of viable mountain sheep populations.

MOUNTAIN SHEEP REGULATIONS IN NORTH AMERICA

A generalized summary of mountain sheep regulations in North America is shown in Table 1 (from Trefethern, 1975).

Several management options are available to meet the four conditions listed above as follows:

a) Closed Seasons:

Season closures were imposed on most Rocky Mountain, California and Desert bighorn populations in southern British Columbia and the western American states in the late 1800's or early 1900's. Some attempts were made to restore populations which were depleted by overhunting and/or habitat deterioration but active conservation programs were minimal until at least the mid-1950's. Reopening seasons increased public awareness of the significant problems affecting bighorns and added a consumptive value factor to the hunted populations. Protection from hunting may be necessary or desirable in special instances but is not a viable alternative in most situations because of the loss of interest among the primary conservation agencies and organizations which often follows such closures.

b) Shortened Seasons:

Shortening seasons at either the beginning or the end is a useful method for reducing harvests and has been employed in most southern British Columbia California bighorn and Rocky Mountain bighorn populations. However, while some reduction of hunter effort usually occurs, shortening seasons beyond a certain point tends to concentrate hunters. The adverse effects include: 1) increase competition between hunters which tends to reduce the value of the recreational experience, 2) increased harassment of mountain sheep (Geist, 1975) and 3) a reduction in non-resident revenues to both the guide-outfitter industry and the government.

c) Increased Tag-Licence Fees:

Current big game species tag-licence fees for residents in British Columbia reflect approximately the amount that hunters expressed as their willingness-to-pay for a day's hunting for each species in 1970-71 (see Pearse-Bowden, 1972) while non-resident hunters are charged ten times the resident fee (for mountain sheep the tag licence fees are \$25.00 for residents and \$250.00 for non-residents). Using licence fees to limit resident hunters does not appear to be a viable alternative given the traditional common property ethic of most North Americans. However, pricing non-residents is another matter which should be given more consideration. Mountain Sheep hunting, including fees and guiding costs for non-residents in countries such as Mexico and Mongolia vary from about \$5,000* to \$16,000** for example. In British Columbia, the mandatory

* one desert sheep

** one Argali sheep and one ibex,

TABLE 1. Summary of the historical and present mountain sheep regulations in North America to 1973 from: Trefethen (1975)

A. Thinhorn and Rocky Mountain Bighorns

SPECIES & LOCALE	SEASON CLOSED	MALES ONLY	LIMITED ENTRY	1/2 CURL	3/4 CURL	4/5 CURL	7/8 CURL	B. & C. POINTS
<u>THINHORN</u>								
Alaska	-	1900±	No	-	1950±	-	-	-
B. C.	-	1900±	No*	-	1969	-	1973& 1974a.	-
N.W.T.	-	1900±	No	-	1966	-	-	-
Yukon	-	1900±	No	-	1960s?	-	-	-
<u>ROCKY MOUNTAIN BIGHORN</u>								
Alberta	-	1922	Some	-	1956	1968	-	-
B. C.	-	1900±	No	-	1966	-	1972a.	-
Colorado	1890±	-	Yes	1953	1971	-	1970	-
Idaho	1900±	-	Yes	-	1953	-	-	-
Montana	1912	-	Some	-	1953	-	-	-
New Mex.	1900±	-	Yes	-	1959b.	-	-	-
Oregon	1900±	-	-	-	-	-	-	-
Utah	1899	-	-	-	-	-	-	-
Wash.	1900±	-	-	-	-	-	-	-
Wyoming	-	-	Yes	1965	1930 1969	-	-	-
S. Dakota	No information							

a. 7/8 curl or 8 years plus

b. 3/4 curl or 144 Boone and Crockett points

* Two thinhorn sheep herds placed under limited entry hunting in 1977

TABLE 1. (continued)

B. California and desert bighorns

SPECIES & SEASON	MALES	LIMITED	1/2	3/4	4/5	7/8	B.&C.
LOCALE	CLOSED ONLY	ENTRY	CURL	CURL	CURL	CURL	POINTS
<u>CALIFORNIA BIGHORNS</u>							
B. C.	1909	-	Some	-	1954	-	1975a.
Calif.	1873	-	-	-	-	-	-
Idaho	1900 [±]	-	-	-	-	-	-
Nevada	1900 [±]	-	-	-	-	-	-
N.Dakota	1905	-	*	*	-	-	-
Oregon	1900 [±]	-	Yes	1974	1965	-	-
Wash.	1900 [±]	-	Yes	-	1966	-	-
<u>DESERT BIGHORN</u>							
Arizona	1900 [±]	-	Yes	-	1953b.	-	-
Calif.	1873	-	-	-	-	-	-
New Mex.	1900 [±]	-	Yes	-	1954c.	-	-
Mexico	?	-	Yes	-	1963?	-	1974
Nevada	1917	-	Yes	-	1952	-	1965d.
Texas	1903	-	-	-	-	-	-
Utah	1900 [±]	-	Yes	-	-	-	1967d.

a. 7/8 curl or 8 years plus

b. 3/4 curl and a minimum horn length of 26 inches in 1965 and 28 inches in 1972

c. 3/4 curl or 144 Boone and Crockett points

d. 144 Boone and Crockett points or 7 years plus

* Limited entry season introduced for 1/2 curl rams in 1975

guide requirement is more of a limiting factor to non-residents than is the sheep tag licence fee (most guide outfitters in B. C. charge between \$250-\$500 per hunter per day for sheep hunting).

d) Limited Entry Hunting:

Limited entry hunting has been imposed on almost all hunted sheep populations in the contiguous U. S. and Mexico, on three California bighorn herds in British Columbia, on two herds of Stone Sheep in northern B.C., and on non-trophy sheep for residents and trophy sheep for non-residents in Alberta (Table 1). Limiting licences to a predetermined number provides for both an increased measure of control over the harvest and the reduction or elimination of over-crowded hunting conditions. However, limited entry significantly reduces recreational hunting opportunities. For most but not all of B. C.'s sheep herds, the extraction of rams by hunters can still be effectively controlled by other means such as shortened seasons, non-resident quotas, and more definitive horn-curl regulations.

e) Non-resident Quotas:

Most provinces and states provide non-resident sheep hunting. Nevada and Wyoming set aside 25 and 10 per cent, respectively, of bighorn permits for non-residents for example, while the Yukon, Alaska, and Northwest Territories have unlimited non-resident hunting, like B.C., impose a compulsory guiding restriction.

Competition between resident hunters while increasing in B.C. is apparently not a significant problem as yet because of the ruggedness and/or relative inaccessibility of most late summer-early fall bighorn habitats. (Exceptions to this occur primarily in the less rugged and/or more accessible sheep ranges of the interior of B.C. and accessible areas in northern B.C.) Competition between residents and non-residents, however, is a problem which has increased in significance in recent years. In addition, some guide-outfitters tend to over-exploit the mature ram component. Concern among resident hunters is expressed in a variety of ways but the most commonly suggested solution made by resident hunters is to eliminate or severely limit non-resident hunting. Considering the international interest in mountain sheep, the opportunities of British Columbians to hunt in other countries, including the U.S., the international exchange of research and management information (which flows mostly from the U.S. to Canada), the revenue from non-resident hunters which benefits all British Columbians and the dependence of the guiding industry on non-resident sheep hunters, total exclusion on non-residents is not a desirable alternative. In 1976 guide-outfitter quotas were established in the East Kootenay on Rocky Mountain bighorn. Individual area quotas were based on the population estimates of mountain sheep in each guide-outfitter territory and the degree of use by resident hunters. In this manner, resident-non-resident competition was reduced and overexploitation of sheep by a minority of opportunistic guide-outfitters was eliminated while maintaining non-resident hunting. The institution of non-resident quotas has been expanded to other regions and now includes grizzly bear and mountain goat as well as mountain sheep in the Kootenay Region.

Reduced numbers of non-resident big game hunters need not result in a concomitant reduction in revenues to either the government or the guide-outfitter, providing that the licence fees and guiding fees are increased to more closely reflect market values. To date, only the guide-outfitter sector has attempted to capitalize on the increased demand and decreased supply in British Columbia as licence fees for non-residents have remained unchanged since 1974, while guiding fees have more than doubled since 1975.

f) Horn Curl/Age Restrictions:

According to Cowan (1940) and Clark (1964) male mountain sheep possess three basic horn forms - convergent (tight curl); parallel (medium or average curl); and divergent (open or flaring curl). The three basic horn curl forms are shown in Figure 1.

Although the various subspecies may possess uniform horn shapes, considerable variability often exists both between and within herds of the same subspecies. Furthermore, horn size, if not shape, is often influenced by habitat influences such as fire, overgrazing, overpopulation, etc. (Shackleton, 1973). The difficulty encountered in attempting to standardize horn characteristics for purposes of defining a legal ram is compounded in British Columbia by the presence of four subspecies covering a greater physiographic range than any other area in North America.

Mountain Sheep have been managed under a variety of horn curl restrictions throughout North America (Table 1). As an historical note, the first horn curl restriction appears to have been instituted as a three-quarter curl law in Wyoming in the early 1930's (Trefethen, 1975). Since then, many attempts have been made to devise systems of enabling hunters to identify specific age/horn class rams in the field by employing horn curl, varying from one-half to full curl, establishing minimum horn lengths, setting minimum ages of rams, and establishing minimum total points according to the Boone and Crockett horn scoring system. Within reasonable limits, horn curl restrictions have proven to be a valuable tool in Mountain sheep management.

HORN CURL/AGE RESTRICTIONS IN BRITISH COLUMBIA: 1956 - 1975.

In the early 1900's, B.C.'s mountain sheep were managed under an Any Age Ram Regulation with a bag limit of five. The bag limit was gradually reduced to one, and beginning in 1954 several California bighorn herds which were closed to hunting were reopened under a three-quarter horn curl regulation. Rocky Mountain bighorn herds were placed under the three-quarter curl restriction in 1966 and the thinhorn herds were added in 1969. Figure 2 depicts the diagram used between 1954 and 1971 in B.C. The definition in the hunting regulations read as follows:

3/4 - CURL HORN means the horn of a mature mountain sheep, the tip of which has grown through 270 degrees of the circle described by the outer surface of the horn, as seen from the side.

With increasing demands for more stringent sheep hunting regulations from resident sheep hunters and guide-outfitters, the Fish and Wildlife

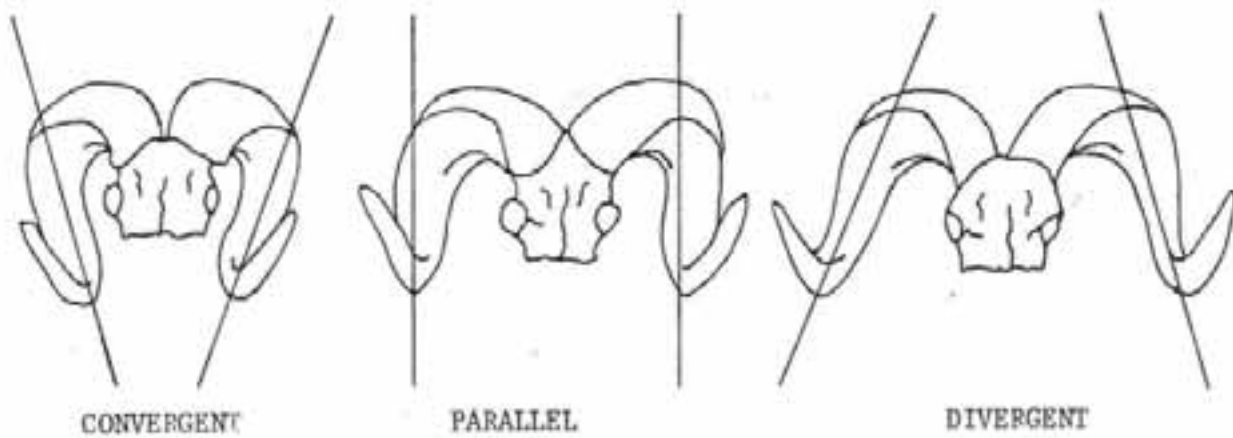


FIGURE 1. The basic forms of mountain sheep horns after Clark (1964).

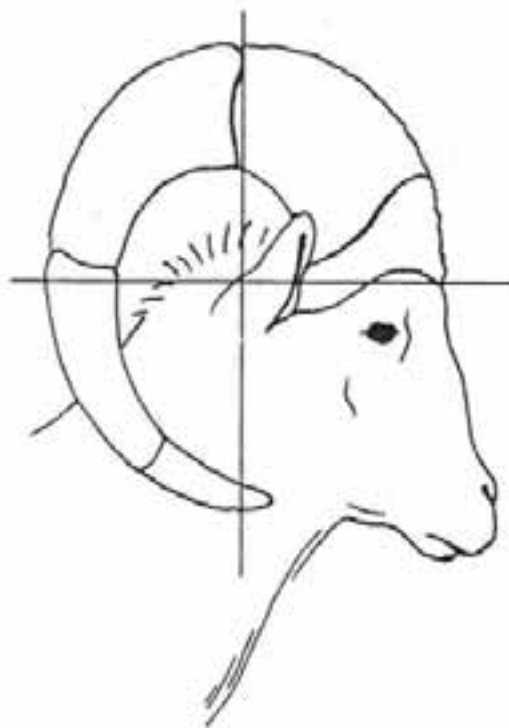


FIGURE 2. Diagram used in B.C. Hunting Regulations Synopses to depict a legal three-quarter curl ram from 1954 to 1971.

Branch attempted to increase the minimum legal horn curl by devising a seven-eighths curl for Rocky Mountain bighorns in 1972 (Figure 3). The definition involved three separate lines plus a circle, but did not accurately define a focal point. A minimum age was added to the definition for the first time in the province:

MATURE RAM is a male mountain sheep which has attained the age of eight years as determined by the horn growth (annuli): Or whose longest horn has grown through a minimum of 7/8 of a circle (315 degrees) described by the outer surface of the horn as seen from the side and including any broomed portion.

The province's remaining mountain sheep populations were progressively placed under the new regulation until 1975, when all mountain sheep, including California bighorns, came under the seven-eighths curl restriction. Although the diagram was improved somewhat (Figure 4), the complex definition was retained. In 1975, with the initiation of compulsory reporting of hunter-killed rams and after four hunting seasons under seven-eighths curl restrictions, 11 charges were laid for undersized rams in the East Kootenays out of a total of 23 Rocky Mountain bighorn rams inspected.

The B.C. Provincial Court decided the regulation was ambiguous in that it did not define a focal point (B.C. Provincial Court Judge H. Swayze in: Regina Vs. Ray Larson, 1975). The issue was sensationalized in the local press and resulted in considerable public controversy.

REDEFINING THE MATURE RAM REGULATION

Following the Provincial Court's criticism of the seven-eighths curl regulation, the Fish and Wildlife Branch established a committee to develop and test an improved mature ram regulation comprised of:

Odd W. AASLAND, Taxidermist
Dennis A. DEMARCHI, Wildlife Biologist
Raymond A. DEMARCHI, Wildlife Biologist
Cecil G. ELLIS, Animal Control Officer
Ross R. FARQUHARSON, Conservation Officer
David J. LUNN, District Judge
William J. WARKENTIN, Wildlife Technician

Diagrams and/or written descriptions were developed for the following: three-quarter, four-fifths, seven-eighths, and full curl rams. A series of scale line diagrams of male sheep heads were prepared by Dr. Val Geist. The diagrams and definitions thus developed were tested on mountain sheep museum specimens, color transparencies, and in the field. In addition, numerous sheep hunters were questioned as to their understanding of the various descriptions of ram horns in common use (i.e., half curl, three-quarter curl, four-fifths and full curl).

Ideally, the regulation would be one which could be easily understood, was readily applicable in the field, was enforceable, and which restricted the kill to the mature ram component. No regulation then in effect in North America adequately covered the wide range of horn forms

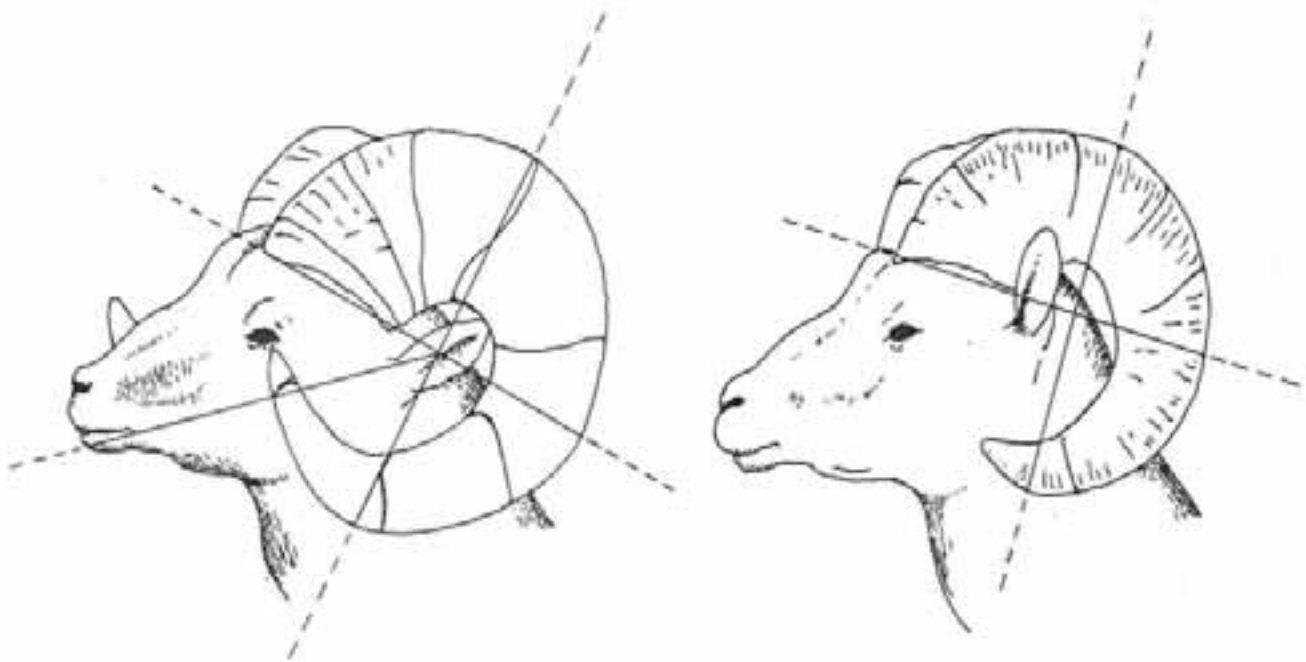


FIGURE 3. Diagram used in B.C. Hunting Regulations Synopses to depict a legal seven-eighths curl ram from 1972 to 1974.

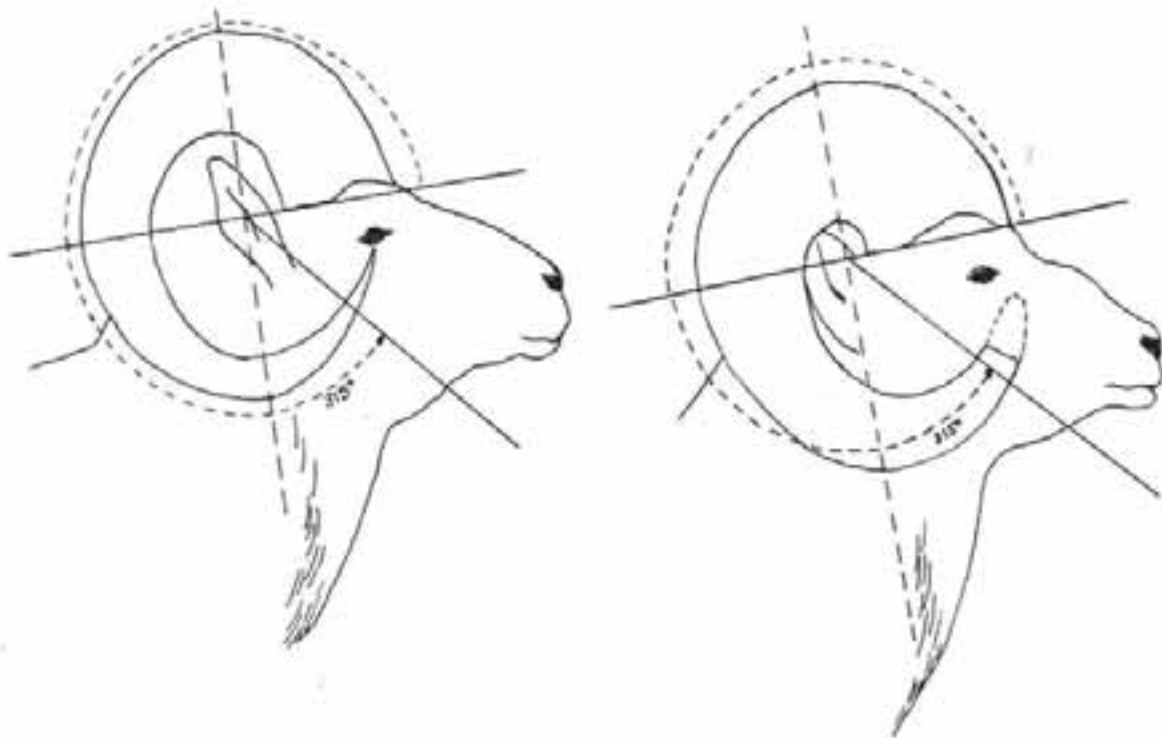


FIGURE 4. Diagram used in B.C. Hunting Regulations Synopses in 1975 to depict a legal seven-eighths curl ram.

found in the province with the possible exception of the Boone and Crockett trophy point system. However, the regulation requires considerable hunter education and training and is perhaps best applied in strictly controlled limited entry hunts.

A relatively simple system, involving a base line between two relatively distant discernible points, the nostril and the lowest hindmost portion of the horn, can be applied in the field to describe a "full curl" horn.* As the ventral posteriormost portion of the horn base, the eye socket and the nostril can be dissected by a straight line and, as the nostril is often removed from a hunter-killed ram, the legal definition need only refer to a straight line drawn through the eye socket and ventral posteriormost portion of the horn base. By describing a line drawn through the ventral anteriormost portion of the eye socket remaining with the skull, and the ventral posteriormost portion of the horn base, the legal definition is slightly less stringent than the field definition, thus allowing the hunter a margin of error.

CONCLUSIONS

The improved 3/4 curl regulation was applied to most California bighorn herds while all Rocky Mountain bighorn, Stone, and Dall sheep herds were managed under the new Full Curl Regulation beginning in 1976.

The field definitions read as follows:

3/4 CURL RAM is any male Mountain Sheep which has attained the age of six years as determined by the horn annuli or whose horn tip, when viewed from the side, extends beyond a straight line drawn through the center of the eye and at right angles through a line drawn between the center of the nostril and the lowest hindmost portion of the base of the horn.

FULL CURL RAM is any male Mountain Sheep which has attained the age of six years as determined by the horn annuli or whose horn tip extends upwards beyond a straight line drawn between the center of the nostril and the lowest hindmost portion of the base of the horn.

LEGAL RAMS cannot be identified unless viewed from the side. These field definitions adequately conform to legal definitions, copies of which are available at Fish & Wildlife Branch and Government offices.

The legal definitions read:

FULL CURL RAM means any ram (male) Mountain Sheep which has attained the age of six (6) years as determined by horn annuli, or whose horn tip, when viewed from the side parallel to the horizontal plane

* The addition of a right angle extending below the baseline and passing through the eye provides a definition of a 3/4 curl horn.

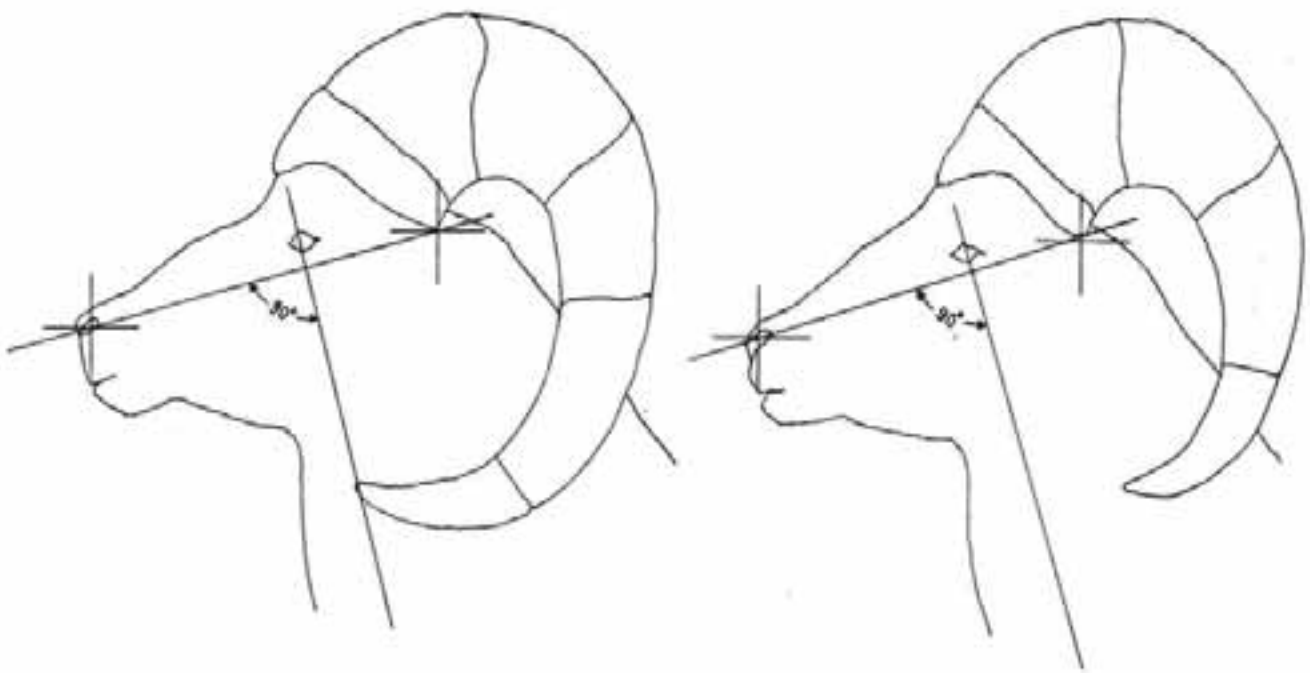
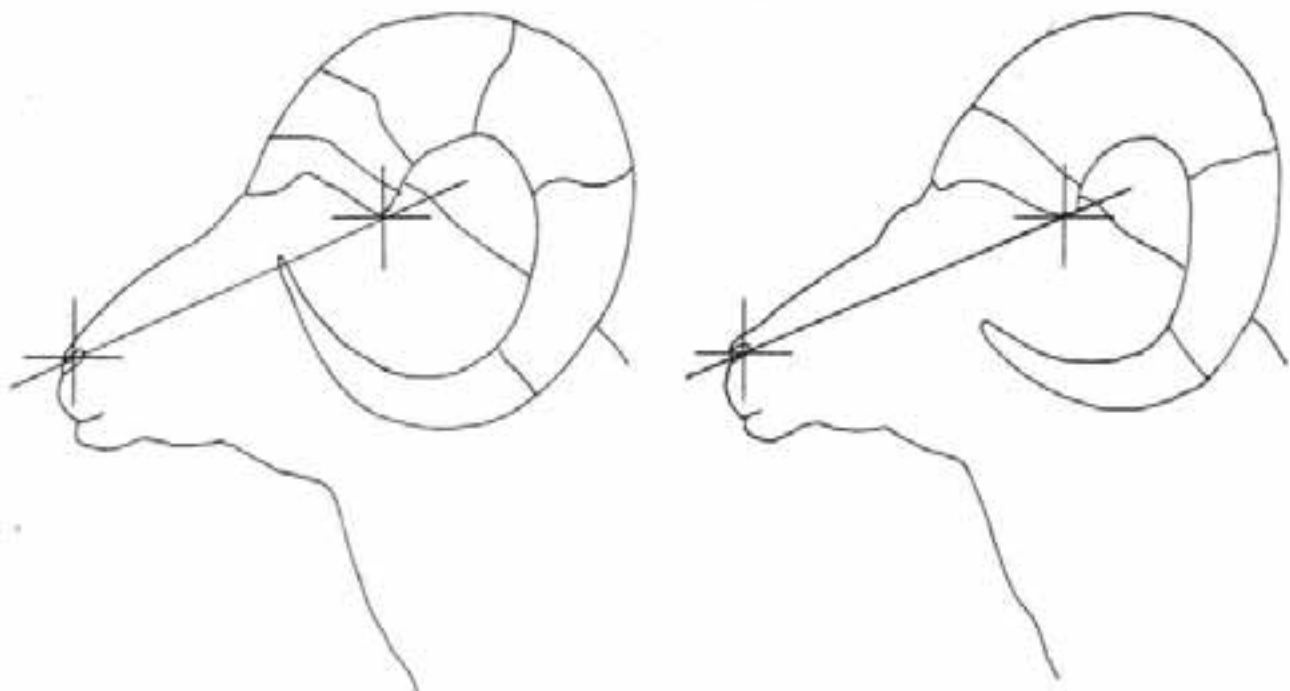


Figure 5. Diagram used in B.C. Hunting Regulations Synopses in 1976 and 1977 to depict three-quarter curl and full curl mountain sheep.



and at right angles to the sagittal plane of the skull, extends upwards beyond a straight line drawn between the ventralmost portion of the eye-socket retained with the skull and the ventral posterior-most portion of the base of the horn.

THREE QUARTER (3/4) CURL RAM means any ram (male) Mountain Sheep which has attained the age of six (6) years as determined by horn annuli, or whose horn tip, when viewed from the side parallel to the horizontal plane, and at right angles to the sagittal plane of the skull, extends beyond a straight line drawn vertically from the ventral anteriormost portion of the eye-socket remaining with the skull and which is at right angles to a line drawn between the ventral anteriormost portion of the eye-socket remaining with the skull and the ventral posteriormost portion of the base of the horn.

- (a) The SAGITTAL PLANE is the surface by which the skull is divided equally into left and right sides;
- (b) The HORIZONTAL PLANE is the surface intersecting the ventral posteriormost portion of the base of the left and right horns, the ventral portion of the left and right eye-sockets retained with the skull and which is at right angles to the sagittal plane;
- (c) PLANE is a surface such that the straight line that joins any two if its points lies wholly in that surface.

The "improved" 3/4 curl regulation and the "new" full curl regulation have proven to be considerably more applicable in the field and enforceable in the courtroom than other previous regulations employed in British Columbia. The number of undersized Rocky Mountain bighorn rams taken in 1976 and 1977 was significantly reduced over previous years, particularly 1975, and convictions were readily obtained for the two rams which did not meet the minimum curl/age restriction. Because thinhorn sheep horns usually form a circle when viewed broadside at a younger age than bighorn sheep, and because the change in the age class distribution of the thinhorn ram kill did not meet expectations after the institution of the full curl regulation in 1976, the minimum age for a full curl thinhorn ram was raised from six to eight years in 1977.

The improved (1976) horn curl regulations have received general acceptance from sheep hunters, guide-outfitters, enforcement officers, and staff of the provincial courts. Although it is too soon to determine the effect on the sheep populations and the harvest, it appears, from the results of the 1976 and 1977 seasons, that an improvement is to be expected in both the sheep populations (viz. improved ram age class distributions and sex ratios) and the kill (viz. increased horn quality without a significant decline in the number of mature rams harvested) without sacrificing recreational hunting and commercial guiding opportunities.

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