

## MOUNTAIN GOAT MANAGEMENT

### IN BRITISH COLUMBIA

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**ABSTRACT:** British Columbia has the largest population of mountain goats (*Oreamnos americanus*) in North America. In the past, management practices allowed several populations to be severely overharvested. With the advent of compulsory inspection, limited entry hunting and improved surveys, most goat populations are being managed with a better understanding of their biological requirements. Although harvest was restricted during the 1970's it is now beginning to increase under a controlled system. The proportion of females in the harvest is relatively constant while average age is increasing slightly. Harvest rates vary from 0.36% to 9% and if distributed homogeneously throughout the population, could probably be increased. Coastal populations are generally regulated by density independent factors while interior populations may be more influenced by density dependent controls.

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British Columbia supports the largest population of mountain goats in North America, approximately 50,000. Mountain goats inhabit a wide diversity of habitats, from coastal forests to alpine tundra. Similarly, their population dynamics range from highly productive, high density populations to less productive, more highly fluctuating coastal populations.

Most mountain goat populations in British Columbia (B.C.) were relatively unmanaged until severe overharvests were identified in the Okanagan (Bone 1978) and especially in the East Kootenay region of southeastern B.C. in the 1960's and 1970's (Phelps et al 1975). Consequently, season and bag limit changes were introduced to reestablish healthy goat populations (Hebert 1978).

Recognition of specific attributes of mountain goat ecology (Hebert and Turnbull 1977, 1978, Rideout 1977, Kuck 1980, Chadwick 1977, Foster and Rahe 1982, Smith 1984) encouraged an improvement in mountain goat management programs. At the same time, Blower (1977), attempted to estimate population size for each management region of the province, using

biophysical estimate methods. Intensification of mountain goat management in B.C. proceeded from the southern portion of the province (Region 1, 2, 3, 4, 5 and 8) which had undergone increased access, demand, and habitat loss, while the northern regions (Regions 6 and 7) of the province which remained relatively untouched. Individual ecotypes (Hebert and Turnbull 1977) were recognized, and differing harvest rates were calculated for each (Hall and Bibaud 1978, Youds et al. 1980). Data was accumulated in order to calculate rates of increase (Youds et al. 1980) and basic population modelling was initiated (Hebert and Langin 1982). Recently, extensive surveys (Hebert and Woods 1984) were undertaken in B.C. and the data summarized to indicate similarities or differences in productivity and density of populations throughout the province.

During the past 7 - 10 years, B.C. has experienced relatively mild winters. As a result, productivity and survival in most mountain goat populations was high. Harvest has begun to increase in the southern portion of the province but has declined slightly over much of the northern portion due to the introduction of the Limited Entry Hunt (L.E.H.) system.

## METHODS

Data were obtained from the Summary Statistics package of the B.C. Wildlife Branch. Statistical information is gathered from a hunter questionnaire and compulsory inspection reporting for age, sex and location. The hunter questionnaire is mailed to all hunters purchasing a goat tag and successful hunters must produce the horns, the lower jaw (to extract I<sub>1</sub> incisor) and the hide to confirm sex of kill.

## RESULTS

The extensive mountain goat population of B.C. is distributed throughout a wide diversity of habitats from coastal forest to alpine tundra (Fig. 1). Mountain goats are absent from the interior plateaus of the Okanagan and Cariboo. Generally, population densities and production are higher for interior populations than for most coastal populations (Hebert and Turnbull 1977, Hebert and Woods 1984). Population estimates (Table 1) were derived from mapped density estimates (Fig. 1) and only recently have portions of the area been verified by actual surveys.

Table I. POPULATION ESTIMATES FOR MARCH 1977  
MOUNTAIN GOAT MAP

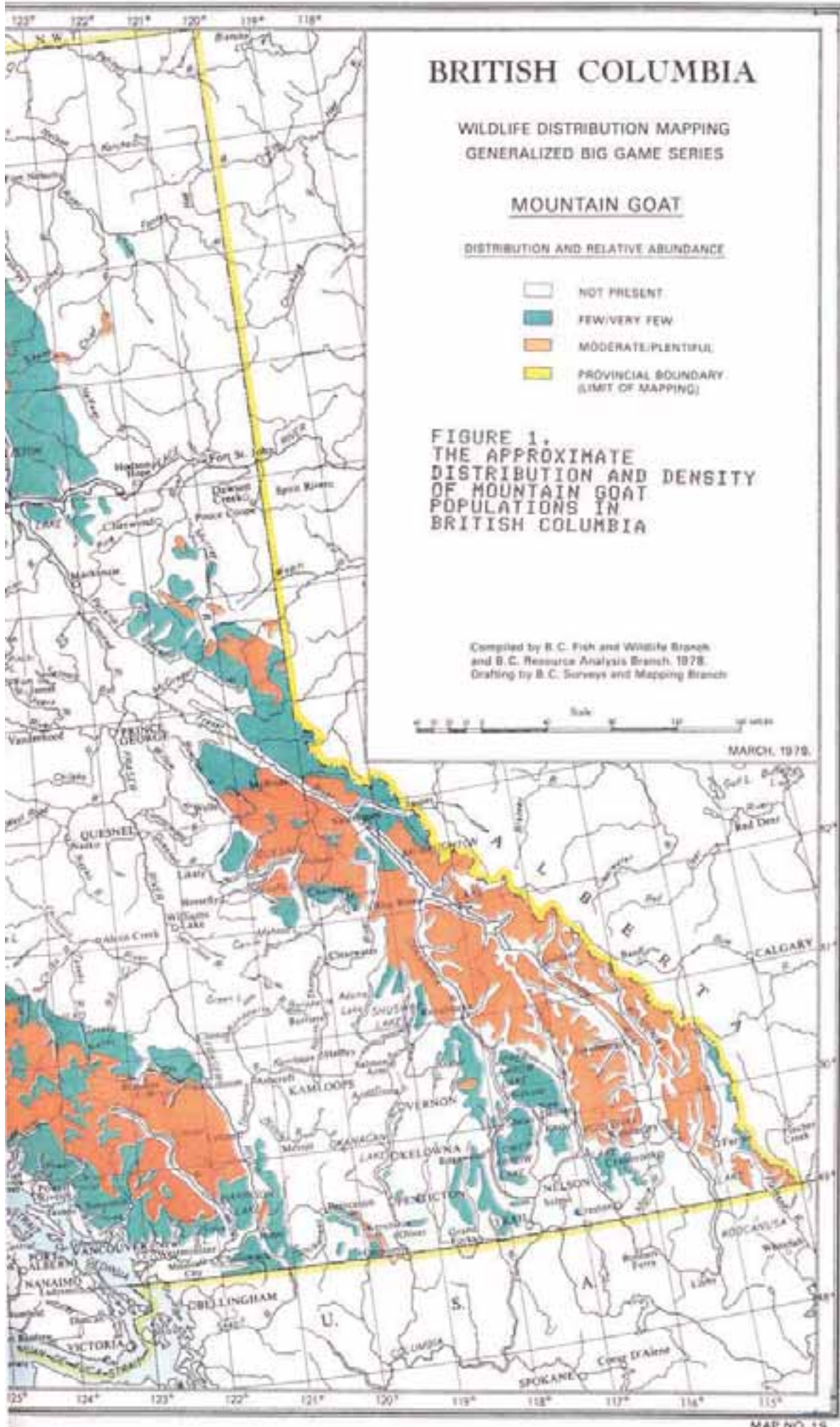
Resource Management Region	Estimated No. of Mountain Goats	Estimated Outside Limits	% of Provincial Total
1. Vancouver Island	1,300 †*	(800 - 1,800)	3%
2. Lower Mainland	2,500*	(1,500 - 4,000)	5%
3. Thompson Okanagan	2,500*	(1,500 - 4,000)	5%
4. Kootenays	5,000*	(3,500 - 6,500)	11%
5. Cariboo	3,000**	(1,500 - 4,500)	6%
6. Skeena	24,000**	(15,000 - 35,000)	52%
7. Omineca - Peace	8,000*	(4,000 - 12,000)	17%
Total ALL Regions	46,500	(30,000 - 65,000)	100%

\* Based partially on projection from abundance categories.

\*\* Based entirely on projection from abundance categories.

† Mainland portion of region only.





Recent surveys in Region 5 (Hebert and Woods 1984) were used to calculate population size by mountain block. This method derived a regional population estimate of 3000, similar to Blower (1977). This does not confirm Blower's estimates in all other areas in the province.

Seasons have been shortened significantly since the 1950's and 60's but have changed little between 1980 and 1984 (Table 2). Where seasons were changed prior to 1980, they have been shortened from September 1 to September 10 in the southern portion of the province and from August 1 to August 15 in the northern portion.

The provincial harvest declined during the 1970's as harvest rates were reduced to coincide with population size, productivity and survival. Areas were closed as increased access resulted in excessive harvest. As populations recovered, L.E.H. authorizations increased, especially in southeastern B.C., Region 4 (Table 3). Other regions have increased L.E.H. numbers but not to the same extent. At this time, it is not possible to calculate the proportion of the land base or goat population under general open seasons or limited entry hunts.

Although goat harvest has become more restrictive in the last few years, hunter effort and harvest have increased (Table 4). Data are not available to determine the L.E.H. harvest vs the open season harvest, however, the largest increase in kill is in the Kootenays (Region 4) where L.E.H. has increased five-fold.

The proportion of males to females in the harvest appears to have remained constant while the average age increased slightly from 1980 to 1984 (Table 5). This occurred on a provincial basis and may mask the harvest on a regional basis. Variability in access, population size, management philosophy and other factors result in differing harvest rates in the province (Table 6). The rates vary from a low of 0.36% on the south coast to a high of 9% in the East Kootenays. Due to the recent mild winters, the present Kootenay goat population is probably higher, thus the harvest is probably only about 7%.

Table 2 GOAT OPEN SEASONS IN B.C.

Region	1980	1985
1	Sept. 6 - Nov. 30	Sept. 7 - Nov. 24
2	Sept. 6 - Sept. 28 Oct. 12 Oct. 26	Sept. 7 - Sept. 22 - Oct. 6 - Oct. 20
3	No Open Season	No Open Season
4	Sept. 15 - Oct. 31	Sept. 10 - Nov. 30
5	Sept. 1 - Oct. 31 Oct. 15	Sept. 1 - Oct. 27 - Sept. 29
6	Aug. 1 - Oct. 15 Aug. 15 - Oct. 19	Aug 1 - Oct. 15 Aug 15 - Oct. 19
7	Aug. 15 - Oct. 15 Sept. 1 - Sept. 30	Aug 15 - Oct. 15 Sept. 1 - Sept. 30
8	Sept. 10 - Oct. 31	No Open Season

Table 3 LIMITED ENTRY HUNTING AUTHORIZATIONS

Region	1981	1985
1	0	0
2	6	6
3	45	64
4	197	977
5	0	20
6	236	810
7	14	54
8	16	31
<b>Total</b>	<b>514</b>	<b>1962</b>

Table 4. NUMBER OF HUNTERS, HUNTER DAYS AND KILL BY REGION.

REGION	YEAR	HUNTERS	HUNTER DAYS	KILL
1	80†	29	82	11
	84	8	23	39
2	80†	57	202	13
	84	39	129	6
3	80†	25	82	11
	84	28	118	16
4	80†	113	391	89
	84	707	3314	446
5	80†	54	234	47
	84	67	218	35
6	80†	490	2354	330
	84	536	2611	270
7	80†	308	1823	264
	84	356	2025	169
8	80†	33	85	18
	84	18	45	10
TOTAL	80†	1165	5487	783
	84	1804	8799	955

† Non Resident not included in number of hunters or hunter days.



## DISCUSSION

Following the restrictive seasons of the 1970's and the mild winters of the 1970's and 80's, most mountain goat populations in the province are stable to increasing and are harvested at less than 5%. However, inventory for most mountain goat populations in B.C. is still lacking, due to the cost of aerial surveys and because impacts from competing resource users are low. Few populations have been inventoried for the first time and even fewer are being monitored on a regular basis. For most populations, weather is usually the most significant factor affecting survival (Smith 1984). Snow density and depth, combined with low temperatures, significantly affect productivity and survival. Hunting probably regulated many goat populations in the 1960's and 70's but unlike weather, it can now be monitored and controlled. In order to monitor and/or modify the effects of hunter harvest and density independent factors such as weather, population monitoring is a necessity. Since each population in the province cannot be monitored, representative populations in each region, management unit or ecotype must be assessed at regular or specific intervals. Seasons or L.E.H. systems can then be altered in response to population change. Due to the lack of inventory, goat management programs rely almost solely on harvest data.

As shown in Table 5, average age has increased since 1980. This may indicate an expanding population but, without systematic plotting of harvest location, it is impossible to verify local overharvests or determine if previously inaccessible herds are being harvested. Although the proportion of females in the harvest is relatively stable, it may be high if the female harvest occurs in a few subpopulations. The sensitivity of the female harvest has been previously demonstrated (Hebert and Langin 1982, Youds et al 1980). In B.C. there are no male only seasons because of the lack of sexual dimorphism in mountain goats. Where possible, hunters are encouraged to select mature males.

Harvest rates appear conservative although harvest is usually clumped rather than distributed homogeneously throughout the range of a particular population. Harvest rates should increase as smaller goat harvest units are developed in conjunction with limited entry hunting and as previously inaccessible herds are accessed.

Table 5. PROVINCIAL GOAT HARVEST BY SEX AND AGE.

	MALE		FEMALE		JUV.	FEMALE IN HARVEST %
	KILL	AGE	KILL	AGE		
1980	508	5.1	273	5.8	2	35 %
1981	481	5.3	253	6.0	-	34 %
1982	487	5.5	243	5.6	2	33 %
1983	583	5.3	340	6.0	3	37%
1984	639	5.6	313	6.0	3	33%

Table 6. A COMPARISON OF HARVEST IN RELATION TO POPULATION SIZE BY REGION

REGION	HARVEST		POPULATION ESTIMATE	PERCENT HARVEST
	1980	1984		
1	11	3	1300	.54
2	13	6	2500	.36
3	11	16	2500	.56
4	89	446	5000	1.78 - 8.92
5	47	35	3000	1.3
6	330	270	24000	1.4 - 1.1
7	264	169	8000	3.3 - 2.1

A preliminary comparison of population characteristics indicates at least two ecotypes: coastal and interior, for the southern portion of the province (Hebert and Turnbull 1977). Ecotypes may also vary from south to north and across the northern portion of the province. Short and long term population change for "natural herds" are postulated in Figure 2. Interior populations appear to have a higher reproductive rate, recruitment rate and potential density than some or all coastal populations. Population fluctuations appear to be reduced, recovery is faster and long term population growth appears to be greater in interior populations. Although density independent factors are operative in interior populations, the role of density dependent factors may play a significant role. By comparison, coastal populations of south central B.C. appear to have lower productivity, recruitment and density. Population fluctuations are more pronounced in coastal populations, however, recovery may be slow (Janz pers comm) in the south central coast of B.C. as compared to more rapid recovery in Alaska (Smith 1984). Density independent factors are highly regulatory in coastal populations while density dependent factors play a reduced role.

#### RECOMMENDATIONS

1. Identification of ecotypes in B.C. Variation along the coast should be determined.
2. Inventory should be improved and expanded. Representative mountain blocks should be identified and monitored at periodic intervals.
3. Small harvest units should be developed to prevent clumped harvests.
4. Female harvests should be monitored and/or reduced where heterogeneous harvest patterns are occurring.
5. The magnitude of population fluctuations should be recognized and significant season changes and harvest rates implemented where necessary.
6. Current provincial policy regarding regulation changes (three year stability in regulations) should not apply to mountain goats.
7. Harvest rates in experimental areas should be modified in order to test density dependent responses and survey techniques.

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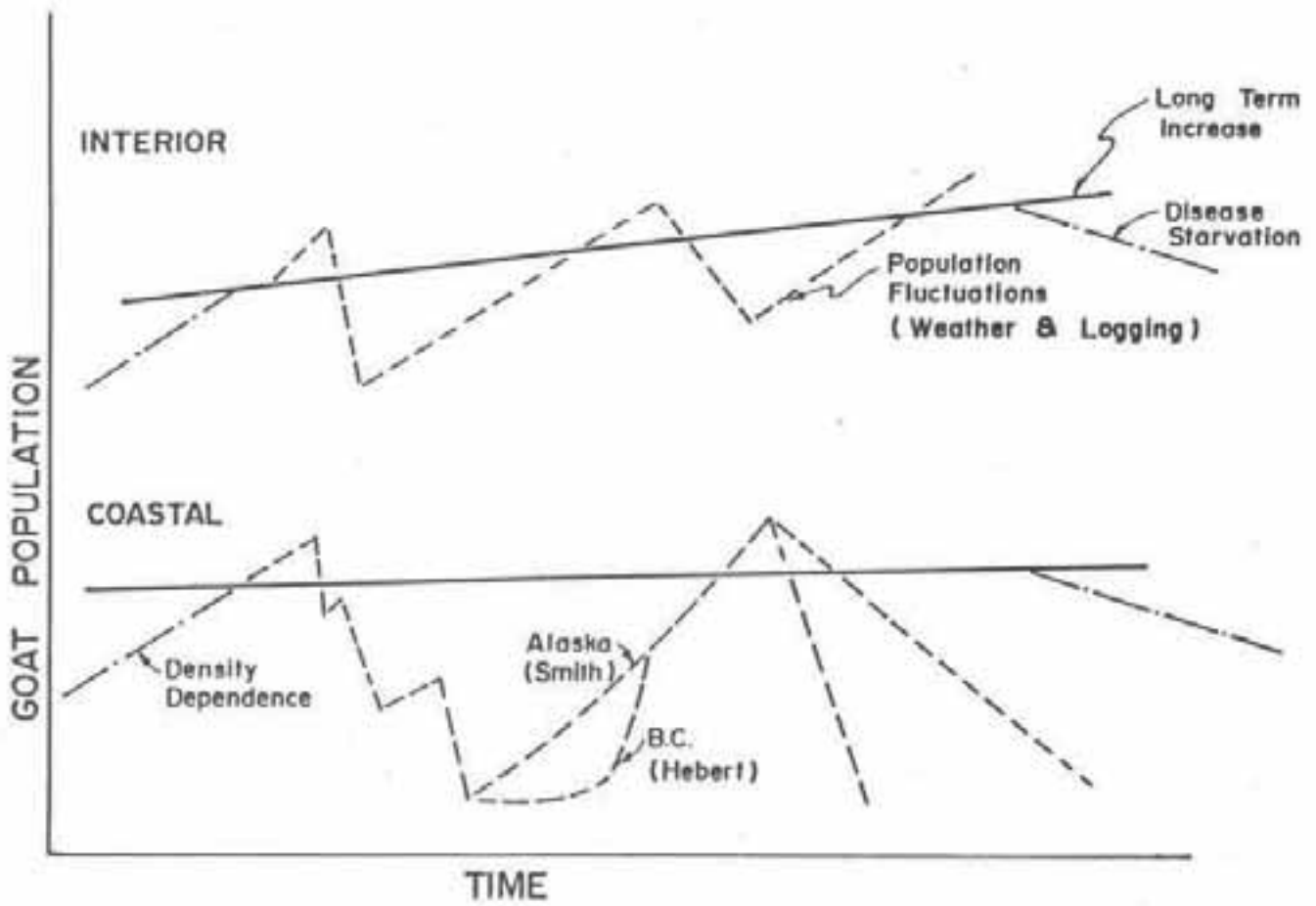


Figure 2. HYPOTHETICAL POPULATION CHANGE IN COASTAL AND INTERIOR ECOTYPES IN BRITISH COLUMBIA.