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A N A L Y S I S   O F   E A S T   K O O T E N A Y

R O C K Y   M O U N T A I N   B I G H O R N   R A M

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## I. INTRODUCTION:

Rocky mountain bighorn sheep have been hunted in the East Kootenay for over 7000 years. Following the withdraw of the Pleistocene glacier, Neolithic hunters roamed the alpine tundra in search of game. A large chert quarry, countless worked pieces and rows of rock cairns in Top of the World Provincial Park, indicate that early men were skilled hunters of bighorn sheep and goats. Whitemen began hunting bighorn sheep in 1805 when one of David Thompson's guides killed a ram near the present site of Banff, Alberta.

Sport hunting of bighorn rams became popular in the East Kootenay in the late 1800's following a report in 1885 that Scotty McDougall had shot a huge ram near Fort Steele. Ernest Thompson Seton based his story "Crag The Kootenay Ram" upon the hunt as related to him by Scotty McDougall's partner. Sheard's Taxidermy Shop of Tacoma, Washington purchased this head and challenged any hunter in North America to find one larger. This publicity and that generated by Hornaday(1) when he published his book "Campfires in the Canadian Rockies" in 1906, focused worldwide attention on the East Kootenays as a hinterland where trophy animals could be collected. The extension of the Burlington Northern Railroad from northern Idaho to Elko in 1898 and of the Canadian Pacific Railroad from Crowsnest Pass to Kootenay Lake in the same year made access to this hinterland simple.

Bag limits for bighorn sheep were very liberal during this era. Hornaday was allowed to collect three bighorn sheep of any age or sex, five goats and any number of bear. The bag limit for bighorn sheep was reduced to one male of any age in 1923. A size limit of 3/4 curl ram or better was established in 1966. Since then, horn curl regulations have become progressively more restrictive in order to maintain trophy bighorns and maximize recreational opportunities for viewing and hunting bighorns. Following is a list of horn curl regulations which have been in force in the East Kootenay since 1923.

1. Prior to 1966 - any ram over 1 year of age.
2. 1966 to 1971 - 3/4 curl rams or larger.
3. 1972 to 1975 - 7/8 curl rams or larger.
4. 1976 to 1978 - full curl or 6+ years of age.
5. 1979 to 1987 - full curl or 8+ years of age.
6. 1985 to 1987 - mature full curl or 8+ years of age in W.M.U. 4-23 (Elk Valley).

Season dates for ram hunting in the East Kootenay since 1975 are listed in Table 1, Appendix II.

Twenty-two herds (Figure 1, Appendix I), numbering 2200 bighorns presently live in the Rocky Mountains between Golden and the American border 150 miles (240 km) to the south. Numbers of bighorns have fluctuated widely during the past 70 years due to epidemic die-offs at 18 to 24 year intervals.

This paper evaluates the effect of: herd density, herd number, Wildlife management Unit (W.M.U.) of harvest, hunter effort, type of regulation and age of ram harvested upon number of rams harvested. Compulsory inspection data, guide-outfitter returns and random hunter sample data collected between 1975 and 1987 were used for the analysis.

## II. METHOD:

Compulsory inspection data was analyzed to determine:

1. Average annual ram harvest;
2. Average ram harvest per Wildlife management Unit (W.M.U.);
3. Average number of ram hunters and hunter effort per W.M.U.;
4. Average number of resident and non-resident ram hunters per year;
5. Average annual hunter effort for rams;
6. Average annual success of resident and non-resident ram hunters;
7. Average success rate of ram hunters per W.M.U.;
8. Average number of rams harvested per week of hunting season;
9. Size of horns of harvested rams by W.M.U.;
10. Size of ram horns by age of ram harvested;
11. Size, age and hunter effort by type of regulation under which the ram was harvested.

Numbers of hunters and hunter effort were compared to population density and population number of bighorn sheep in order to determine whether there might be a relationship. Densities were determined by using population estimates based upon aerial and ground surveys and relating these estimates to size of the W.M.U.

## III. OBSERVATIONS:

### A. LAND BASE AND POPULATION DENSITY

Eight W.M.U.s support bighorn sheep in the Rocky Mountains of East Kootenay (Table II).

Table 2: Population Estimates and Densities of Bighorn Sheep by Wildlife Management Unit in the East Kootenay in 1987.

W.M.U.	EST. POP.	PERCENT TOTAL	AREA (SQ.KM.)	PERCENT TOT. AREA	POP. DEN. /SQ.KM.
4-01	40	1.87	1,573	8.96	.03
4-02	280	13.08	1,087	6.18	.26
4-21	395	18.46	1,348	7.66	.29
4-22	210	9.81	2,357	13.39	.09
4-23	600	28.04	3,583	20.36	.17
4-24	120	5.61	1,782	10.13	.06
4-25	540	25.23	3,187	18.11	.17
4-35	50	2.34	2,681	15.2	.02
TOTAL	2,235		17,598		.12

Wildlife Management Unit 4-21 which includes the Premier Ridge, Estella, Wildhorse, Marmalade and Van Nostrand herds support the highest density of Rocky Mountain sheep. Wildlife Management Unit 4-02 which includes the Wigwam Flats, China Wall and Galton Range has the highest potential for supporting bighorn sheep, however densities are down 250 head below normal due to the loss of 350 head in an epizootic die-off in 1981 and 1982. The largest W.M.U. (4-23) is located in the Elk Valley. It contains high densities of bighorns on the East side of the Elk River (0.11/sq.km.). Lowest densities of bighorns are found north of Radium Hot Springs in W.M.U. 4-35 where a combination of forest encroachment, land alienation and climatic shift toward greater snowfall severely limit bighorn sheep winter range.

#### B. HARVEST LEVELS

It is estimated that 5% of the population of bighorn sheep are full curl rams or bigger. This proportion is lower in post-die-off herds and greater in herds which have had a history of light harvest or in herds which are intensively managed. The East Kootenay presently contain slightly more than 100 legal rams of which not more than 50% should be harvested annually in order to maintain a healthy breeding ram component. The average annual harvest of 37 rams is 32% below the number which should be harvested but does not include cripple loss and poaching.

Total ram harvest has remained fairly constant since implementation of the full curl or 8+ year regulation in 1979 varying from a low of 26 in 1983 to a high of 44 in 1986 (Table 6, Appendix II).

Annual ram harvest in the East Kootenay is not closely related with the density of bighorns found in each Wildlife Management Unit (Figure 2, Appendix I). Extensive areas of Wildlife Management Units 4-01, 4-02 and 4-21 are difficult to hunt due to closed forest canopy over spring, summer and fall range.

A comparison of total annual ram harvest with total population of bighorn sheep in each Wildlife Management Unit, reveals that W.M.U.s 4-21 and 4-25 have significantly lower harvest and W.M.U.s 4-02 and 4-23 have significantly higher harvest level than expected (Table 3).

Harvest levels of bighorn sheep living in W.M.U. 4-02 have remained at pre-die-off levels even though 74% of the estimated population of 580 bighorns died in the spring and summer of 1982. With very poor lamb survival (less than 10%) between 1982 and 1987, ram harvest opportunities will be drastically reduced in the near future. Harvest rates of bighorn sheep in W.M.U. 4-23 (Elk Valley), have declined by 40% from an average of 15 per year between 1981 and 1984 to 9 per year, since a mature full curl harvest regulation was implemented in 1985.

Table 3: harvest rates of rams as related to estimated bighorn sheep populations of Wildlife Management Units in the East Kootenay 1981 to 1987.

W.M.U.	EST. POP.	PERCENT TOTAL	AVERAGE HARVEST	PERCENT TOTAL	SIGNIFICANCE Chi Square
4-01	40	1.87	.57	1.65	N.S.
4-02	280	13.08	6.54	18.92	.001
4-21	395	18.46	3.85	11.14	.001
4-22	115	9.81	2.71	7.84	N.S.
4-23	600	28.04	11.86	34.32	.001
4-24	120	5.61	2	5.79	N.S.
4-25	540	25.23	7	20.25	.05
4-35	50	2.34	.71	2.05	N.S.
TOTAL	2140		35.24		

\*Excludes 2.75 rams/year where W.M.U. was not recorded.

### C. HUNTING EFFORT

The number of hunters seeking rams doubled between 1976 and 1982 but ram harvest levels did not increase proportionally (Figure 3, Appendix I). The average number of ram hunters is closely related to the population of sheep hunted, with the exception of W.M.U. 4-02 where number of hunters is significantly higher than expected (Table 4, Appendix II), and W.M.U. 4-25 where numbers of hunters are significantly lower.

A 25% decline in number of hunters was observed in 1983 closely following a 25% reduction in total bighorn sheep population of the East Kootenay due to a pneumonia epidemic in 1982 and 1983. The number of resident hunters averaged 316+-111 between 1976 and 1987 and 387+-51 between 1979 and 1987 since implementation of the full curl regulation. The number of non-resident sheep hunters averaged 25.5 between 1981 and 1987 or 6.2% of the total number of hunters (Figure 3, Appendix I).

Resident hunters required an average of 94.9+-22.5 days to harvest a ram in the East Kootenay while non-residents required 30.9+-26.1 days\* (Figure 4, Appendix I). The East Kootenay bighorn sheep die-off of 1982/1983 greatly increased the effort needed for non-resident hunters to harvest a ram, but not the effort of resident hunters. (Compare Figures 4 and 5, Appendix I). If the average number of days required by non-residents to harvest a ram in 1983 is excluded from the average then the average number of non-resident days required to harvest a ram is only 21.1+-2.24 days.

Hunter effort was correlated with the number of bighorn sheep in each Wildlife Management Unit except for W.M.U. 4-25 where effort was significantly lower than expected (Table 5, Appendix I). Limited entry hunting on the Simpson River herd located on the northeastern boundary of W.M.U. 4-25 reduced ram hunter effort following implementation in 1982. Nearly 50% of all bighorns in this W.M.U. spend summer and fall seasons in Kootenay and Banff National Parks which is likely the main reason that hunter effort and harvest levels have been less than expected.



Nearly 28% of the total annual hunter effort for rams is spent in the Elk Valley (W.M.U. 4-23). Since 1981 an average of 101 hunters and 940 hunter days were spent annually pursuing bighorns in this valley.

\* The accuracy of Compulsory Inspection data recording days hunted may not be good. Telephone surveys of grizzly bear hunters indicated that many hunters did not record total number of days hunting on Compulsory Inspection Forms.

#### D. HUNTER SUCCESS

Hunter success rates vary widely between years, between Wildlife Management Units and between resident and non-resident hunters. Average annual hunter success rates varied from a low of 7.6% in 1983 to a high of 11.25 in 1985 (Figure 6, Appendix I).

The range of success in different W.M.U.'s for resident hunters varies from a low of 0.8% in W.M.U. 4-01 to a high of 13.3% in W.M.U. 4-25 while success for non-resident hunters varies from a low of 0% in W.M.U. 4-35, 8.5% in W.M.U. 4-25 to a high of 44.7% in W.M.U. 4-23 (Figure 7, Appendix I). Hunter success is greatest in W.M.U. 4-23 as expected due to high densities of bighorn sheep and large land base. However, extensive open pit coal mines in which hunting is not allowed and the proximity of Kananaskis Park in Alberta will probably reduce hunter success in the future.

The average resident hunter success for rams between 1981 and 1987 was 7.5% while 37.8% of non-resident hunters were successful (Figure 8, Appendix I). Guided non-resident hunters consistently had a better success rate than resident hunters. Nearly 91% of rams harvested by residents were taken by East Kootenay residents (Figure 9, Appendix I). The average annual resident ram harvest between 1981 and 1987 was 29.1 rams while non-residents have harvested an average of 8.7 (Figure 10, Appendix I).

Compulsory inspection sheets indicate that successful hunters required an average of 6.4 days to harvest a ram between 1976 and 1987. The average number of days successful hunters took to harvest a ram varied from a low of 3.5 days in 1976 to a high of 9.0 days in 1986 (Figure 11, Appendix I or Table 7, Appendix II). The hunter sample taken between 1981 and 1985 indicates that residents hunted an average of 7.1 days and non-residents 8.4 days each year. With an average resident hunter success for rams being 7.5% per year, the average number of days required to harvest a ram is 90.4 while non-residents require 26.4 days.

The number of days which successful hunters needed to harvest a ram varied widely between Wildlife Management Units as well as between year of harvest (Figure 12, Appendix I). Successful hunters required an average of less than 5 days to harvest a ram in W.M.U.s 4-01, 4-22 and 4-24 and between 6 and 8 days in W.M.U.s 4-02, 4-21, 4-23 and 4-25 and over 16 days to harvest a ram in W.M.U. 4-35.

#### E. TIME AND AGE OF RAM HARVEST

About 20% of the total annual harvest of rams occurs during the first week of the regular hunting season (Figure 13, Appendix I). The harvest rate declined during the last two weeks of September. On the average the first hunters took 41% of the annual ram harvest during the first three weeks of October. The significant increase in hunter success during this period of time may be related to snow accumulations in alpine and sub-alpine summer ranges which cause rams to move down to fall pre-rut range. The dramatic increase in hunter success during the first three weeks of October 1986 is correlated with a heavy snowfall which fell in late September.

Counterintuitively, the youngest age class of rams harvested required the greatest hunter effort while the oldest age class required the least hunter effort. Successful hunters required an average of 9.2 days to harvest 4.5 year old rams and an average of 2.5 days to harvest 13.5 year old rams (Table 7, Appendix II). Most hunters seek large trophy rams but almost 20% of the annual ram harvest (18.6%) is composed of rapidly growing young rams under 6 years of age (Table 7, Appendix II). This level of harvest compared to hunter effort suggests that relatively few young rams reached full curl and those with rapidly growing large horns were harvested. Although 9+ year old rams are most desirable as trophy animals, these age classes constitute less than 20% of the average annual harvest (Table 7, Appendix II). The low level of harvest of 9+ year old rams probably reflects the scarcity of these age classes in hunted populations. Nearly 63% of rams harvested were between 6.5 and 8.5 years of age (Figure 14, Appendix I or Table 7, Appendix II). Only 6.5% of all rams harvested have been 10 years of age or older.

Average age of rams harvested between 1975 and 1987 was 7.4 years with a low average age of 6.7 years occurring in 1985 (Table 6, Appendix II).

#### F. HORN SIZE VERSUS YEAR OF HARVEST, TYPE REGULATION, AGE OF RAM HARVESTED AND LOCATION OF HARVEST

Compulsory inspection data indicated that horn size of harvested rams was influenced by the type of regulation, the Wildlife Management Unit and age of ram harvested. The average basal circumference of rams harvested did not change significantly between 1975 and 1987 but horn lengths increased significantly between 1978 and 1979 when the minimum age requirement was changed to eight years of age (Table 8, Appendix II). There was no significant difference in age or size of rams harvested under the 7/8ths curl regulation of 1975 and the full curl and/or 6 years of age regulation of 1976 to 1978 (Table 8, Appendix II). Although the mean age of rams harvested under the 8 years or full curl regulation were 0.5 years older and the horns were 26mm longer than those harvested under the 6 year or full curl regulation, the difference is not statistically significant. Rams harvested under the mature full curl regulation of 1985 to 1987 in W.M.U. 4-23 (Elk Valley) have both a significantly greater (95% C.L.) age and longer horn curl than those

harvested under previous regulations. The mean age of rams harvested in W.M.U. 4-23 under the mature full curl regulation was 9.0 years or 1.5 years greater than those harvested under the full curl regulation and mean horn length was 897mm or 20mm longer. When age and size of ram horns harvested under the mature full curl regulation in W.M.U. 4-23 were compared to age and size of those harvested under the full curl regulation from the remainder of the East Kootenay during the same time period, differences in age and size were not statistically significant (Table 8, Appendix II).

Horn size of rams harvested from intensely managed herds such as in W.M.U. 4-25 was greater than in all other W.M.U.s including 4-23 which had a mature full curl regulation since 1985. Bases of rams harvested in W.M.U. 4-25 averaged 1cm greater and horns over 2cm longer than rams harvested during the same time period in W.M.U. 4-23 (The Elk Valley, Table 9, Appendix II). Average age of rams harvested in the Elk Valley under the mature full curl regulation was 9 years or 1.5 years older than rams harvested in W.M.U. 4-25 during the same time period. During the three year period over which the mature full curl regulation was in force, successful hunters required 10.2 days to harvest a ram in the Elk Valley compared to 6.9 days in W.M.U. 4-25.

Basal circumference and lengths of horns did not differ significantly between years of harvest, unless a major change in horn curl regulation was made (Figure 15, Appendix I). The size of horn bases of rams harvested between 1975 and 1987 did not change and averaged 387mm. Average horn lengths have increased from 870mm in 1979 to 898mm in 1987. Horn bases of all age classes of rams harvested between 1975 and 1987 were similar, but horn lengths increased with age until 7.5 years of age when brooming probably occurred (Figure 16, Appendix I, Table 7, Appendix II). Horns of 6 year old rams were significantly longer than younger age rams while horns of 6, 7 and 8 year old rams were similar in length (Table 7, Appendix II). This suggests that 6+ year old rams have an active role in the rut causing annual brooming. Horn lengths of 9+ year old rams were significantly longer than those of younger rams because horns continue to grow throughout the ram's life but the degree of brooming diminishes with age (Table 7, Appendix II).

#### G. VALUE OF RAM HUNTING

An average of 2841 resident hunter days were spent pursuing rams in the East Kootenays annually between 1981 and 1987. At a value of \$70.00/day (Reid, 1984), the average net annual value to the Province of British Columbia was \$198,847 or \$6,824 for each of the 29.1 rams harvested annually by residents. Between 1984 and 1987 an average of 24.6 guided ram hunts occurred annually in the East Kootenays. At an average of \$10,000 per hunt, the annual gross value of non-resident hunting was \$246,000 or \$28,000 per 8.7 rams harvested annually. The value of non-resident ram hunting is high because the East Kootenay is one of the few places in North America where there is an opportunity to harvest "Boone and Crocket" quality ram. With the record of 6 of 37 rams harvested in 1987 being of sufficient size to be placed in the Boone and Crocket record book and the largest ram harvested anywhere in North America since 1920, the East Kootenay will remain a preferred trophy ram area.

#### IV. CONCLUSIONS:

1. Population densities of Rocky Mountain bighorns vary widely between Wildlife Management Units in the East Kootenays.
2. Ram harvest was not correlated with the population or density of bighorns found in Wildlife Management Units but was correlated with the number of hunters and hunting pressure.
3. Ram hunter success varied with the year hunted, the Wildlife Management Unit of harvest, and whether the hunter was guided or non-guided (resident). Differences in harvest between years was believed to be weather related.
4. Non-resident hunters had a significantly higher success rate than local hunters (37.8% vs 7.5%). An average of 25.5 non-resident hunters spend an average of 8.4 days to harvest an average of 8.7 rams annually. This translates into an average of 25.5 non-resident hunter days per ram harvested.
5. Slightly over 75% of the annual ram harvest is by residents and 91% of these reside in the East Kootenays. Non-residents take nearly 25% of the annual ram harvest but exert only 7% of the total hunting pressure.
6. Successful hunters required a greater number of days to harvest rams under 6 years of age than those greater than 6 years of age, suggesting either that there are few legal rams of this age or assessment of legal status is difficult in the field. Since nearly 20% of the annual harvest is under 6 years of age, the latter explanation is more probable.
7. Regulation changes concerning length of curl or age can have a significant effect upon size of ram harvested.
8. Most full curl rams harvested were between 6.5 and 8.5 years of age. These age classes required the least hunter effort for success probably due to better availability and less uncertainty of legal status.
9. Conclusion #9 is reinforced by the observation that mature ram horn length is reached by 6.5 years or 7.5 years of age depending upon W.M.U. of harvest. Brooming occurs between 7.5 and 8.5 years of age. Horn length increases with older age but availability of rams is reduced after 9.5 years of age probably due to natural mortality.
10. Horn size of rams harvested is also influenced by Wildlife Management Unit hunted and type of horn curl regulation. A significant increase in horn length of rams harvested occurred with a change from a full curl or 6 year regulation to a full curl or 8 year regulation in 1979. However a significant increase in horn size did not occur when the latter regulation was changed to mature full curl in W.M.U. 4-23.

## V. DISCUSSION:

Horn curl regulations have become progressively more restrictive since 1975 to protect rams from over-harvest while maintaining unlimited hunting and viewing opportunities. Harvest levels in W.M.U. 4-23 (Elk Valley), were not affected by regulation changes until 1985 with implementation of the Mature Full Curl regulation. The minor gain in horn lengths of rams harvested in the Elk Valley was offset by a 40% reduction in average annual harvest. About 63% of the Elk Valley bighorns live east of the Elk River and are typical of dispersal populations (Shackelton 1973)(2). These populations are characterized by high recruitment, large body size, large horn growth of rams in younger age classes and relatively short life span. Few rams would be expected to live past 10 years of age. The mature full curl regulation would be more appropriate for rams which winter in the middle section of the Rocky Mountains at mid to high elevations. These static populations are characterized by low recruitment, relatively low horn growth of rams during early years, smaller body size and longer life span of rams which survive the first two years of life (Ibid.1973). Herds wintering at Brule Creek, Crossing Creek, Quarrie Creek, the Van Nostrand Range and Marmalade Basin could be effectively harvested with a mature full curl regulation however there is no indication that this regulation is required at present.

Ideally, younger age classes of rams should be protected from harvest through a 6 year and full curl regulation because the best potential breeding rams are most likely to be harvested at a young age. This regulation would require a judgement call on all rams harvested. Enforcement of this regulation would be difficult in cases where hunters have harvested an underaged ram. A full curl or 7 year age regulation is recommended as an alternative. Because horn size of 7 and 8 year old rams harvested was virtually identical, a minimum age requirement of 7 years instead of 8 years could reduce the incidence of illegal underage ram harvest under the present regulation.

Aging bighorn sheep accurately from horn annuli in a field setting is virtually impossible. Therefore, the best horn curl regulation would be one having a set horn length without an age requirement. It is argued that existing regulation permits harvest of rams which would not otherwise be legal due to horn configuration or heavy brooming. Unfortunately, compulsory inspection sheets do not record whether rams were legal by age and/or length consequently the number of rams legally harvested on the basis of age alone cannot be ascertained.

Compulsory inspection information for the East Kootenays does not include distance between annuli or circumference of annuli, thus the growth characteristics of herds from which the ram was taken cannot be ascertained. This information would be useful in improving bighorn sheep regulations in the East Kootenays.

The best horn growth of trophy rams occurred in herds which were actively managed such as those in W.M.U. 4-25. Management includes the following:

1. Habitat enhancement through slashing, spacing, prescribed fire and seeding;
2. Maintaining the herd below the carrying capacity of winter range during a normal winter. This was done through translocations and/or herd reduction by ewe/lamb limited entry hunting seasons;
3. Parasite reduction through bait site treatment;
4. Alleviation of trace mineral, vitamin and energy deficiencies through bait site treatment;
5. Reduction of grazing competition through extensive harvest of elk by Limited Entry Hunting of cows and calves and Coordinated Resource Management Planning on winter ranges which are also grazed by cattle;
6. Reduction of harassment especially on winter and spring ranges through vehicular access management;
7. Maintenance of the required land base through coordinated land-use planning, land-use referrals and land acquisition.

Managed herds have a 15% higher recruitment rate and excellent growth of horns. Translocations from the Columbia Lake and Stoddard Creek herds in W.M.U. 4-25 have removed about 13% of the estimated populations annually and the herd numbers have remained stable. The cost of maintaining an active management program must be weighed against the opportunities for hunting and viewing bighorns and the economic and social benefits to British Columbia.

#### VI. RECOMMENDATIONS:

1. General open seasons for rams should be maintained to provide unlimited hunting and viewing opportunities as long as herd quality is not compromised.
2. Ideally, the hunting regulation should read "no ram younger than 6 years of age and full curl may be harvested" in order to protect immature high-quality potentially dominant rams. However, this age may not be feasible due to the difficulty in determining age of rams by horn annuli.
3. Consideration should be given to reducing the minimum age requirement to 7 years throughout the East Kootenays because there are no observable differences in horn size between 7 and 8 year old rams.
4. Compulsory inspection data should be expanded to include circumferences and lengths of horn annuli and whether the ram was legal by age and/or curl.

5. Intensive management of bighorns is more effective in producing an abundance of large horned harvestable rams than horn curl regulations which severely restrict the age classes, quality and quantity of rams which can be harvested. Ram harvest was reduced by 25% following the 1981-1983 die-off and has returned to pre-die-off levels as the population level recovered supporting the contention that habitat and herd management are more important in maintaining viable bighorn sheep populations than horn curl regulations.
6. The rapid recovery of bighorn sheep populations and the high quality of rams harvested are evidence that the East Kootenay Sheep Enhancement project has been a success and should be continued (Figure 16, Appendix I).

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A P P E N D I X I

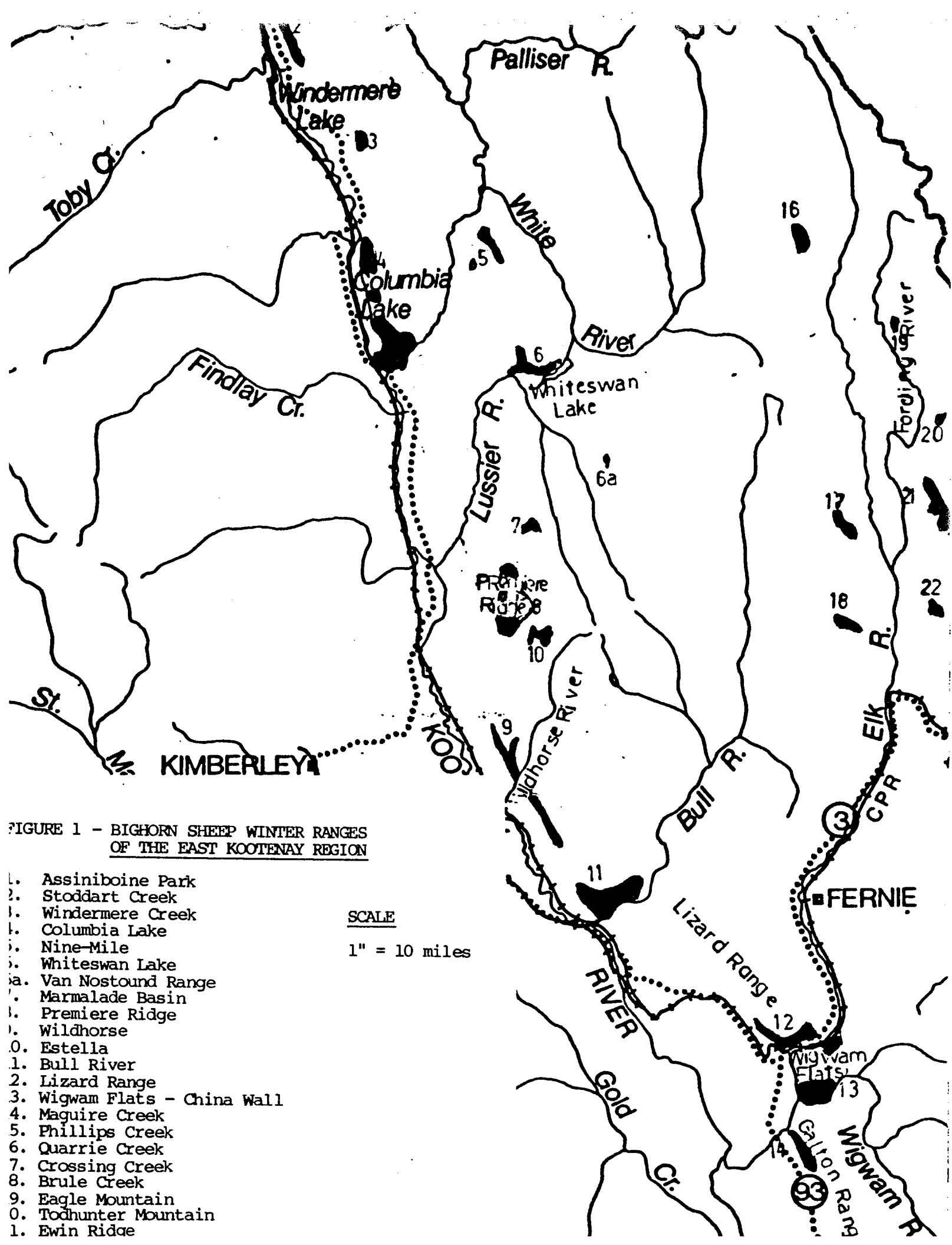
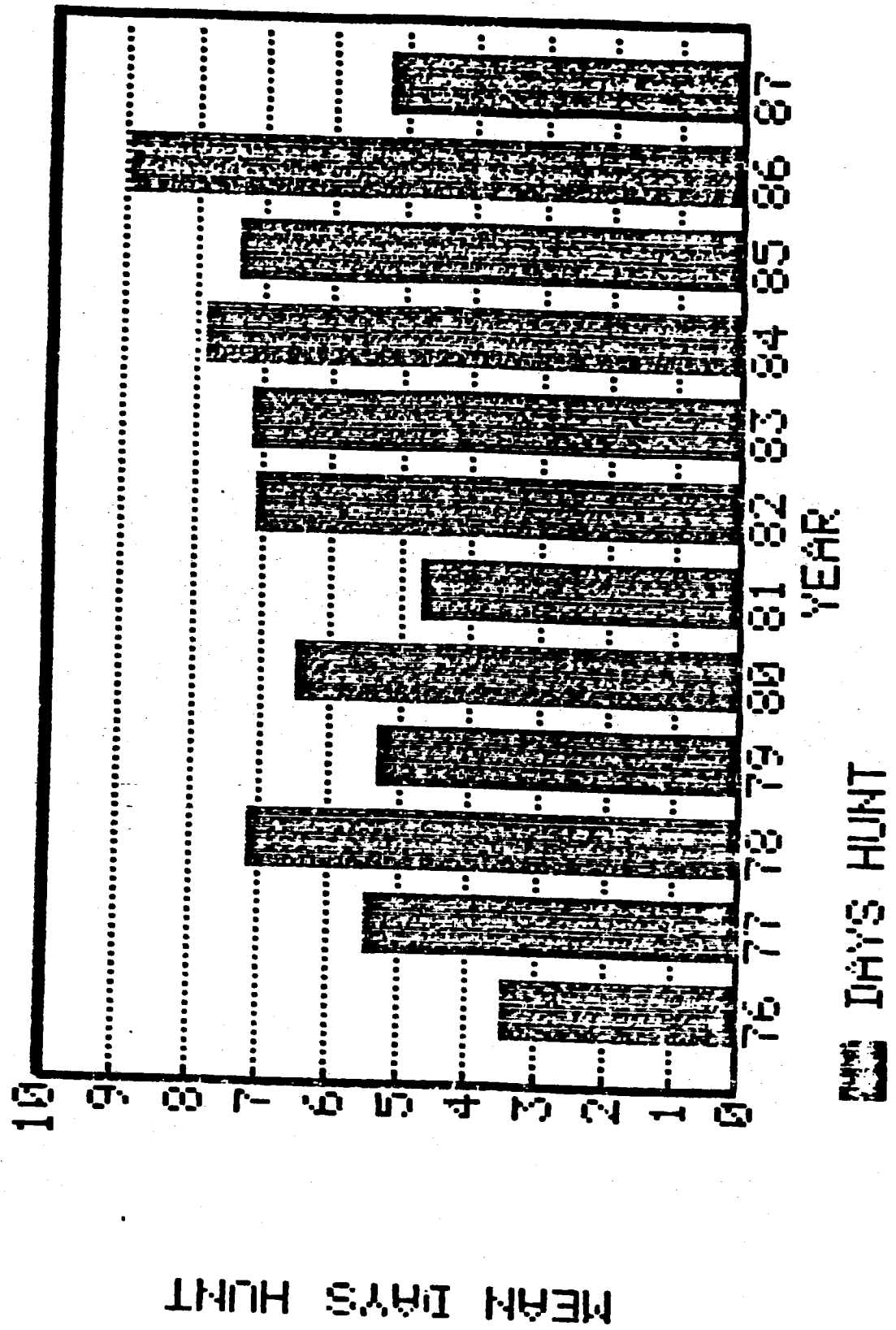


FIGURE 1 - BIGHORN SHEEP WINTER RANGES OF THE EAST KOOTENAY REGION

- 1. Assiniboine Park
- 2. Stoddart Creek
- 3. Windermere Creek
- 4. Columbia Lake
- 5. Nine-Mile
- 6. Whiteswan Lake
- 7a. Van Nostound Range
- 7. Marmalade Basin
- 8. Premiere Ridge
- 9. Wildhorse
- 10. Estella
- 11. Bull River
- 12. Lizard Range
- 13. Wigwam Flats - China Wall
- 14. Maquire Creek
- 15. Phillips Creek
- 16. Quarrie Creek
- 17. Crossing Creek
- 18. Brule Creek
- 19. Eagle Mountain
- 20. Todhunter Mountain
- 21. Ewin Ridge

SCALE  
1" = 10 miles

**FIGURE 11 - NUMBER OF DAYS SUCCESSFUL HUNTERS TOOK TO HARVEST A RAM IN THE EAST KOOTENAY BETWEEN 1976 AND 1987**



**FIGURE 12 - AVERAGE NUMBER OF DAYS SUCCESSFUL HUNTERS TOOK TO HARVEST A RAM BY WILDLIFE MANAGEMENT UNIT IN THE EAST KOOTENAY 1976 TO 1987**

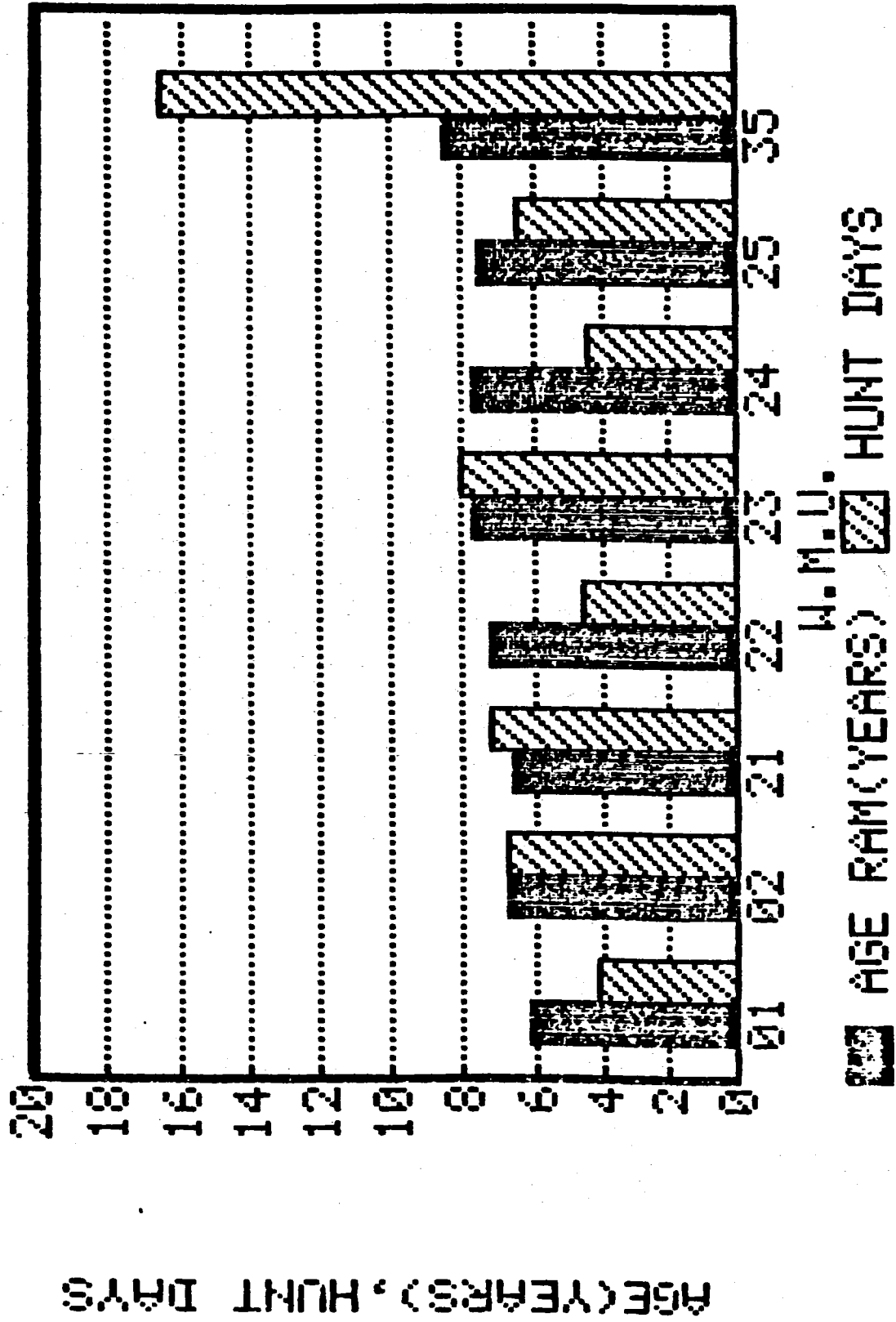
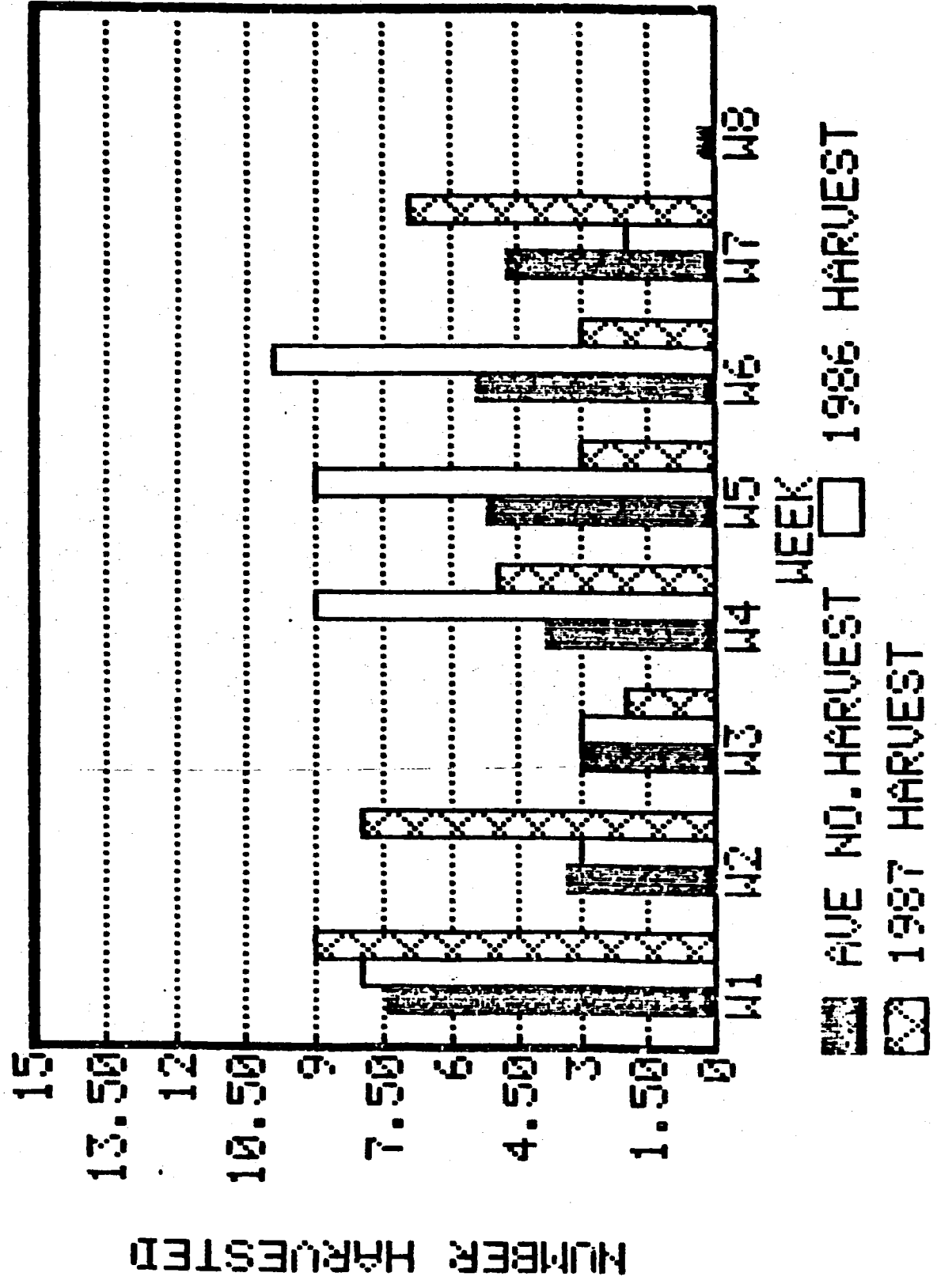


FIGURE 13 - AVERAGE NUMBER OF RAMS HARVESTED BY WEEK OF HUNTING SEASON IN THE EAST KOOTENAY BETWEEN 1976 AND 1987



**FIGURE 14 - PERCENT OF TOTAL RAM HARVEST IN THE EAST KOOTENAY BY AGE CLASS OF THE RAM HARVESTED 1976 TO 1987**

