Q. You maintained the imprinted lamb at 36 lb. throughout the first winter of his life?

A. Yes. He was weaned at 20 lb. and for about 2 months while the temperature was fairly warm - September and October - he gained weight and then the temperature went down below freezing and he began losing weight for the rest of the winter. They were on maintenance diets. The established maintenance protein diet is about 6-7% and most of the diets I used were 5-6%. The second year he gained about 70 or 80 lb.

Q. Did you have this animal treated for worms or anything else?

A. No, I didn't use any such treatment. I didn't give them any antibiotics and I didn't treat them for any intestinal parasites.

Q. How did you prevent stressing? Did you keep them among people early in life?

A. Right. We kept them in the house for about the first 2 months of their life. He was imprinted so that he would come when he was called. I don't think he underwent too much stress at all. We checked the degree of stress through blood sampling procedures. We stressed some of the other animals and compared their SGOT values to his. There was virtually no change in his blood value, whereas there was a change with some of the other animals.

Q. The older animals - how did you keep them penned?

A. These animals were in metabolism pens at all times. The pens were 6 x 8 ft. in size. I had all the pens connected for purposes of weighing.

POST DIE-OFF RECOVERY OF EAST KOOTENAY BIGHORN SHEEP

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Introduction

Rocky Mountain bighorn sheep suffered severe losses in the East Kootenay of British Columbia during the mid-1960's. Bandy (1966) documented and described the etiology of the die-off which was ascribed to a pneumonia-lungworm-malnutrition complex.

Detailed population composition records have been obtained for most herds of bighorn in the East Kootenay since the early 1960's by the B.C. Fish and Wildlife Branch. The Wildlife Research Section has undertaken a comprehensive analysis of the population data with the objective of describing the dynamics of the area's bighorn population before, during and after the die-off. This paper presents a review of the changes in total numbers as a result of the die-off, a comparison of the post die-off response in two discrete herds and progress in bighorn habitat management and protection.

Methods

Population data was collected by aerial (helicopter) and ground (foot, automobile, snowmobile and horseback) counts by Fish and Wildlife personnel. Population estimates were based on a combination of maximum counts, harvest records and informed estimates.

Acknowledgements

Many people contributed to the organization and collection of the population data between 1960-61 and 1971-72. In some instances the collection of information necessitated physical hardships and personal sacrifices. The list of contributors includes: H. Andrusak, B.E. Clapp, D.A. Demarchi, C.G. Ellis, R.R. Farquharson, T.A. Fraser, B.R. Gates, J.P. Gibault, L.F. Harmsworth, J. Logan, J.V. Mackill, L. Russell, R.A. Seaton, W.G. Smith, C.E. Stenton and J.D. Williams. Helicopter pilot Art Druet piloted all of the aerial surveys, and Daryll Hebert and Frank Phillips contributed classified counts.

Population Estimates

Table 1 shows the estimated numbers of bighorn sheep resident in the East Kootenay herd before and after the die-off and during the 1971-72 winter. Bighorn which summer in B.C. and winter in Alberta are not included.

The total population was estimated at 1,650 in the early 1960's, declined to about 720 at its lowest point and was estimated at 935 during 1971-72 winter. Herds affected by the die-off declined from 1,310 to 380 with a recovery to 595 by 1971-72. This indicates a loss of about 930 bighorn or about 70 per cent of the affected herds and a subsequent recovery by 1971-72 of 215 bighorn or 56 per cent of the survivors.

Losses to individual herds ranged from 95 per cent in the Bull River herd to slightly more than 50 per cent in the Wigwam herd.

Extensive aerial searches were conducted between 1965 and 1971 to locate reported and unknown wintering herds. As shown in Table 1, eight separate herds totalling some 330 bighorn were located. With the possible exception of the McGuire Creek herd which has shown an increase since it was documented in 1967, there is no evidence to suggest that these herds were affected by the die-off. The majority of these herds winter at elevations in excess of 6,500 feet and their apparent numbers and herd structure remained relatively constant since initial discovery.

Recovery

Reproduction and recruitment has occurred annually in all affected herds since the die-off including the Bull River herd which was almost decimated. However, the rate and degree of recovery has varied considerably between herds. As indicated by late winter lamb:ewe ratios, recruitment varied from an average of less than ten lambs per 100 ewes in the Premier Ridge herd to a high of 55 lambs per 100 ewes in the Wigwam herd during the 1966-67 winter. Table 2 compares the lamb:ewe ratios for the Wigwam and Premier herds between the 1962-63 and 1971-72 winters.

TABLE 1. Maximum pre and post die-off and present estimates of separate East Kootenay bighorn herds. (Based on late winter populations).

AREA	HERD	PERIOD OF DIE-OFF	PRE DIE-OFF NUMBERS	POST DIE-OFF NUMBERS	1971-72 NOS.
R.M.T.	Bull River	1964-65	200	10	15
	Columbia Lake	1965-66	100	30	35
	Estella Mtn.	1965-66	130	30	40
	McGuire Cr.*	?	(50)	(30)	50
	Phillips Cr.	N.A.	30	30	30
	Premier Ridge	1965-66	150	50	50
	Radium	1966-67	150	40	60
	Wigwam River	1963-65(?)	300	130	200
	Wildhorse R.	1965-66	(30)	10	(20)
White R. Van Nostrand Range	Coyote Cr. McLean Pk. Whiteswan L. Nine Mile Cr.	1965-66	(200)	(50)	(125)
SUB-TOTALS			1340	410	625
East Elk	Ewin Pass*	N/A	(85)	(85)	85
	Grave Creek*	N/A	(30)	30	30
	Imperial Mtn.	N/A	30	30	30
	Todhunter Cr.*	N/A	(20)	20	20
West Elk	Brule Cr.*	N/A	(15)	15	15
	Crossing Cr.*	N/A	(20)	20	20
	Quarrie Cr.*	N/A	(35)	35	35
Upper Kootenay	Cross R.	N/A	Unknown	(Extinct?)	Unknown
	Simpson R.*	N/A	75	75	75
SUB-TOTALS			310	310	310
GRAND TOTALS			1650	720	935

N/A = Not affected.
Brackets indicate subjective estimates only.
* Herds located since 1965.

TABLE 2. Post die-off late winter juvenile:female ratios in the Wigwam River and Premier Ridge bighorn herds.

	LAMBS : 100 EWES	
WINTER	PREMIER	WIGWAM
1962-63	49(124)	51(238)
1963-64	54(96)	39(112)
1964-65	29(95)	16(112)
1965-66	5(69)	12(110)
1966-67	5(55)	55(164)
1967-68	5(43)	44(148)
1968-69	7(40)	36(193)
1969-70	7(35)	21(147)
1970-71	11(43)	N.S.
1971-72	14(44)	29(161)

Numbers in brackets are total classified including rams.
N/A = not surveyed.

Initial recovery was the most rapid in the Wigwam herd. The high proportions of lambs in 1966-67, 1967-68 and 1968-69 coincided with a marked reduction in the Wigwam River elk herd in 1965 caused by the lifting of a long established elk hunting closure. However, the recruitment rate declined in 1969-70 and the population remained relatively stable between 1969 and 1972.

One explanation for the decline in the lamb component in 1969-70 was the severe winter of 1968-69 which affected most ungulate populations in the East Kootenay.

Recovery in the Premier Ridge herd was negligable over the seven year period following the die-off. The low lamb production and yearling recruitment rates were barely sufficient to maintain the population. A slight improvement was noted in the lamb components in 1970-71 and 1971-72. However, 1971-72 the herd possessed an abnormally old female segment resulting from the low recruitment rates since 1964-65 and unless production improves within the next two or three years, further declines can be expected.

Recovery rates and patterns of the remaining herds fell between the two extremes described for the Wigwam and Premier herds. Generally, all herds increased but, with the possible exception of the McGuire Creek herd, none reached their pre-die-off abundance by 1972.

Management and Protection

Management of the bighorn population has been directed primarily at habitat protection and acquisition and the regulation of the harvest of 3/4 curl males. Efforts have been focused upon protection of the Elk Valley bighorn winter ranges from coal exploration activities. Although no damage has occured to date, most of the ungulate winter ranges on the east side of the valley are under active coal exploration licences and the future of these ranges is uncertain.

In the Rocky Mountain Trench, livestock grazing has been eliminated or reduced on all bighorn winter ranges excepting Phillips Creek.

However, significant numbers of cattle remain on the Bull River and Premier Ridge winter ranges and efforts are being made to improve grazing practices with a view to decreasing the competition with bighorn for winter forage. Two small ranches were purchased to provide land for winter range and to reduce livestock grazing of the adjacent winter range.

No artificial methods of range improvement have been undertaken. Demarchi (1971) documented the rate of forest succession in the Rocky Mountain Trench and concluded that it was a significant cause of range shrinkage for both domestic and wild ungulates. A program of range rehabilitation through controlled burning can only be accommodated by changes in present Forest Service policy.

The regulation of the harvest of rams by the three-quarter curl restriction is presently under active review. A high demand for trophy bighorns and a marked reduction in both population size and the male component of most herds requires further restrictions in the annual harvest of males.

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Ray Demarchi - Question Period

Q. To get a die-off in the alpine, what was the forage like and competition like on that range compared to other ranges?

A. The only area that suffered from the die-off in the alpine situation was the White Swan area. Sheep from this area came into contact with sheep from the Premier area; they appeared to share a common summer range. The White Swan herd winters on high-swept ridges and also utilizes during the spring time a seral shrubland area, which is presently being reinvaded by conifers. Now, we could say that forest succession was a complicating factor and really rationalize this thing, but I would keep my mind open on it and I suspect that once a disease becomes virulent, any population in its path will suffer some loss. Now, this is strictly a hypothesis, but on the other areas there was either a past history of range abuse 15 or 20 years before the die-off, 10 years before the die-off or right at the time of the die-off, or forest succession.

Q. Further to Al's question, do you care to speculate as to why the other alpine herds did not suffer a die-off at the same time. Does that have anything to do with winter nutrition, maybe protein, or is there any livestock use of the alpine ranges?

A. First of all, there is no livestock use of this alpine range and, in fact, there is very little ungulate use of any kind except for

some elk use particularly in the spring and summer. In mid-winter the sheep are up on the high ridges. I am not a nutritionist but one thing that comes to my mind when we are talking about high quality alpine forage (and Daryll Hebert has suggested that it is like a deep-freeze and plants maintain high nutritional levels even on the wind-swept areas), is that snow still gets built up in pockets. Around the edges of drifts you can see where the sheep have been feeding on the wind-swept snow covered vegetation. They are exposed to wind velocities up to and probably in excess of 80 miles per hour and in some situations the wind blows constantly 24 hours a day for the entire winter as Al Luckhurst has found on stone sheep range. The small horn size of the rams to my mind at least points out that they are living under some pretty tough conditions and I would suggest that they require that highly nutritious forage just to make it up there on the alpine. If the bacteria would have reached those sheep, I suspect we would have suffered some losses but it is speculation and I have no evidence to support or deny it.

Q. Could it be that winter weather is acting in a density independent manner to prevent population build-up and that it is maintaining or preventing populations from becoming too abundant?

A. No, I don't think it is working in a density independent fashion. I think maybe the reverse is true and I think that some of these alpine ranges may provide some classic study sites for determining just what is the limiting factor. I find that in the Fording River, for instance, and on Sheep Mountain behind Grave Lake, and north of Quarrie Creek in the strip mining country, there are cases where winter ranges are extremely isolated. You are flying over areas of 3, 4 or 5 feet of snow and all of a sudden you locate a small pasture on the side of the mountain in the shape of a triangle in a basin which is completely free of snow for the whole winter because of the wind action and southern exposure. The sheep are confined as if they were surrounded by a 9, 10 or 11 foot fence in that area, exactly like they were on an island. They are almost insular populations during the winter months. If there was any place where any intra-specific competition for forage was occurring, I would suggest that it be on those sites because no matter what type of winter is occurring down in the valley the winter weather up there is almost the same every year. The sizes of those winter ranges appear to be about the same every year. I think if we did meteorological studies we would find fairly constant weather conditions and the range would stay about the same every year. Therefore, I do not think that winter weather acts in a density independent manner but that again is just my own personal opinion.

Q. You said you had about 50 sheep on Premier now for about 7 years, is that right? How small an area? Have you considered inbreeding on that area with small populations?

A. That is a good question and one I didn't want to discuss for a second because I don't know whether anyone has ever shown it or not, but on the whole, inbreeding is probably something that has been created by man rather than something in the wild. Nature is a pretty harsh culler and anything that is defective goes. There

may be some inbreeding but I don't think it would be significant and the reason I say that is because of the apparent good health of very very small populations of sheep which have existed since white man first came to the Kootenays. Brule Creek supports no more than 15 sheep and when W. C. Hornaday and company hunted in there in 1908, I believe, and killed two rams, they made an estimate of the population which they said was very small. If you go back into the old B. C. Game Commission Reports on the Elk River Game Reserve, you will see that the population has remained fairly constant and yet I saw four Class '4' rams, and the ewes have anywhere from a 40 to 60 per cent lamb crop, so I think that inbreeding in nature is just practically unheard of. If anyone has any information to the contrary I sure would like to hear it.

ABSTRACT OF
NON-TROPHY OR EWE SEASONS IN ALBERTA

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The concept of shooting female sheep in Alberta was first considered seriously in 1956; i.e., the same year that we instigated the protective 3/4 curl law for rams. The inspiration for ewe seasons was primarily due to the die-off in the early 1950's of the protected Tarryall herd in Colorado. I understand at that time the idea of ewe seasons did not go over too well in the United States. Here in Alberta, hunters were in fact ready to hang the man (who still wishes to remain anonymous) for even suggesting the idea of shooting female sheep. Fortunately for us and unfortunately for British Columbia, there was another severe die-off of bighorns closer to home in the mid-sixties. As a result, in 1966 we were able to initiate our first "ewe" season.

Outside of the National Parks we have between 4,000 and 5,000 bighorns. The average legal ram kill is around 150 and the average non-trophy or "ewe" kill is about 110. Thus, the average annual sheep harvest since 1967 has been around 260 animals or about 2% of the available bighorn population. Obviously, the total effect of hunting has been negligible, and our efforts in management will have to be directed to more intensive removal of ewes. At present we have 400-600 applicants for 300-350 non-trophy permits.

In a study area near Nordegg we have a bighorn herd of about 100 head, and at last count there were 33 adult ewes. This particular herd produces between 20-25 lambs per year. This fall we plan to remove about a dozen adult ewes in order to compare the survival of the orphaned