

HORN DEFORMITIES IN DALL RAMS

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ABSTRACT

A number of Dall rams with deformed horns have been observed, shot by hunters, or collected by the Yukon Wildlife Branch over the past few years. This horn abnormality appears to be restricted to a population of about 1,300 sheep inhabiting a range of about 1870 square km on the northeast side of Kluane Lake in the Ruby Range of the Yukon Territory, Canada. To date 12 such rams have been inspected and an estimated 6 more are still alive in the area. This would translate into an incidence rate of about 1%. However, it appears that only mature rams, older than 7 years, are affected, in which case the incidence rate would be around 10% of mature rams and would approach 15% in the most heavily affected area. One or both of the following problems affect the horns: 1) part of the horn sheath, usually the first 3 annual increments, are lost; 2) the remaining horn changes its direction of growth, growing in a very tight angle back toward the skull and reaching it in the general area of the orbit. The affected horns are retarded in growth rates, usually tightly curled and deformed in cross-section.

Work on this problem will continue in 1980, and hopefully we will be able to identify the cause.

INTRODUCTION

Observations of rams with deformed horns in the Kluane Lake area of S.W. Yukon have been received by the Yukon Wildlife Branch since the early 1960's. Originally these were isolated cases, more of a curiosity than a reason for concern. As hunting pressure in the area built up these observations became more numerous. By the mid 1970's outfitters in the area began to be concerned about the numbers of affected rams observed and asked the Wildlife Branch to look into this problem. In 1977 ten different affected rams were reported by guides and hunters from one or two outfitting districts in the area. Government reaction to the request was slow. Budget restraints to this date did not allow a thorough investigation of this problem. This report outlines the present state of our knowledge and plans for 1980.

METHODS AND MATERIALS

Most information available on the distribution, prevalence, and history of this abnormality is anecdotal in nature. It is based on reports by hunters, outfitters, and guides that are familiar with the area and have hunted it for many years. Only in the last few years has the Yukon Wildlife Branch taken a more

active role in this investigation and has made some surveys and collections to verify claims made by informants.

The first extensive big game inventory was carried out in the area in 1974 (Hoefs 1975) and was meant to determine the distribution and abundance of sheep, goat, and mountain caribou in the area. This inventory was based on one flight only in July, and, while an attempt was made to classify sheep into legal and young rams, ewes, and lambs; no attempt was made to look for sheep with deformed horns.

More frequent complaints about this problem by outfitters and hunters in 1977 persuaded the government to do a reconnaissance of part of the affected area and inspect some of these sheep. One three-hour helicopter survey accompanied by Dr. Eric Broughton, veterinarian with Canadian Wildlife Service, was done on September 20, 1977 during which 2 rams with deformed horns were collected.

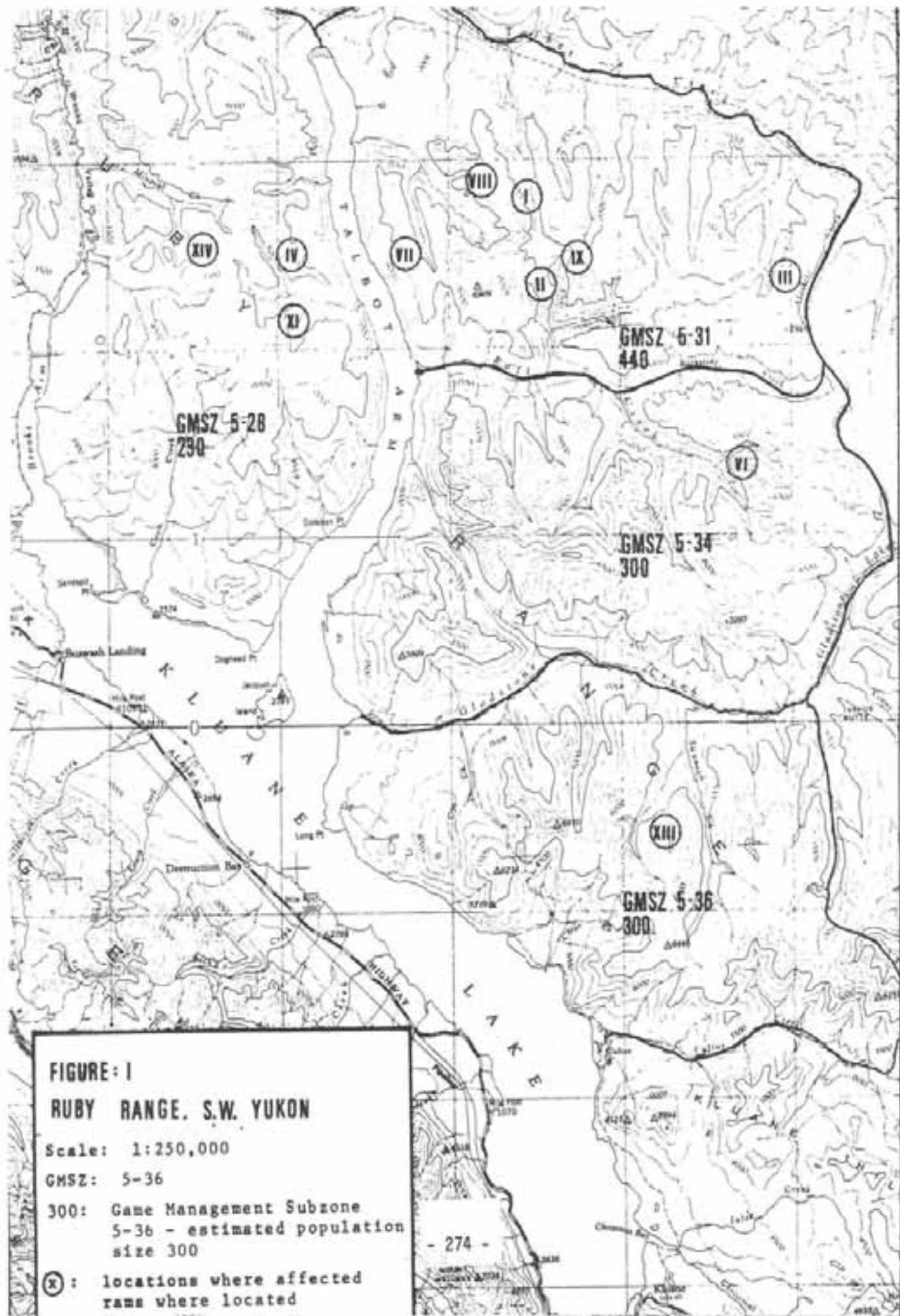
A more detailed helicopter reconnaissance was carried out in July, 1979, when 3 Game Management Subzones (5-31, 5-34 and 5-36) were inspected and 4 additional rams were collected. This survey, which covered about 50% of the affected area, was done in great detail and over 1,000 sheep were looked at from close range (Hoefs 1979).

Standard anatomical measurements, particularly of horns, were taken from collected sheep. An additional 6 skulls of sheep taken by hunters in the area were measured and photographed before being exported from the Yukon.

We have, therefore, information on 12 rams with deformed horns, while at least another 6 rams are still alive which have been observed by hunters subsequent to our surveys.

RESULTS AND DISCUSSION

Study area: Eleven of the 12 rams inspected by the Wildlife Branch came from a relatively small area of about 700 square miles located along the northeast side of Kluane Lake. This area includes 4 Game Management Subzones (G.M.s.Z. 5-28, 5-31, 5-34, and 5-36) and portions of 2 outfitting areas (#11 and #12). Figure 1 shows the location of the subzones, estimated sheep populations, and specific areas where affected rams were harvested or collected. The highest concentration of affected rams was found in the northern subzones of this survey area; 6 in G.M.s.Z. 5-31 and 3 in G.M.s.Z. 5-28. Hunters have observed additional rams in these areas. Even though most information came from the study area shown in Figure 1, individual reports are on file from as far east as Pilot Mountain,



as far west as Tincup Lake and Dogpack Lake, and from the Kluane Park area to the south near the Duke River and near St. Elias Lake. It is not known at this time whether these rams observed with deformed horns in various areas have all the same pathologic or genetic problem.

Population size and prevalence of deformities:

The Ruby Range, of which the study area is a part, consists of excellent Dall sheep habitat, and sheep densities observed here are only surpassed by those of Kluane National Park. Detailed helicopter surveys carried out in 3 G.M.s.Z.'s in 1979 provided sheep population estimates of 300, 300, and 440 in subzones 5-36, 5-34, and 5-31 respectively (Table 1). The remaining subzone, 5-28, was superficially covered in 1974, at which time its population size was estimated at 230 (Table 1).

The total sheep population in the study area outlined in Figure 1 is, therefore, around 1,300. If this total population size is compared to 11 affected rams that came from this area plus a few more rams known to be alive, we are dealing with a prevalence of this abnormality of only 1%. This would be insignificant and no reason for concern; however, detailed surveys of part of the area lead us to assume

Table 1. Summary of sheep surveys and estimates of population sizes on ranges where rams with deformed horns have been observed.

G.M.S.Z. (1)	$\phi > 270^\circ$	$\phi < 270^\circ$	Nursery Sheep (2)	Lamba	Total number Observed	Estimate	Survey Date
5-28	11	14	104	30	159	230	July 1974
5-31	52	96	194	58	400	440	July 1979
5-34	50	26	141	60	277	300	July 1979
5-36	52	14	171	41	278	300	July 1979
Total	165	150	610	189	1114	1270	

- (1) G.M.S.Z. = Game Management Sub Zone
 (2) Nursery sheep are all adult members in nursery bands, and include ewes, yearlings and some young rams (usually less than 3 years of age)

that of the ram component of these populations only mature rams (horn curls equal or larger than 270° or at least 6 to 7 years of age) are affected. We do not have any positive evidence so far that ewes are affected.

If we assume that these observations turn out to be factual, the frequency of this abnormality reaches significant proportions. The total number of mature rams in the study area is estimated to be 165 (Table 1). Eleven affected rams have been taken and 6 more are assumed to be alive. The overall frequency of this condition among mature rams would, therefore, be around 10%; and it would be up to 15% in G.M.s.Z. 5-31, where most affected rams have been located.

Description of abnormality: As already indicated, observations so far indicate that this abnormality affects, or becomes apparent, only in rams of 7 years of age and older. Of the 12 skulls inspected 3 were in their 7th growing season, the others were older. During our detailed surveys no ewes with deformed horns were located, but we have unconfirmed reports of ewes also being affected. The abnormality affects 1 or both horns and appears to manifest itself in 2 stages. Of the 12 skulls inspected 6 (50%) had 2 affected horns. If only 1 horn was affected,

it was the left horn in 5 of 6 skulls. The first stage involves the sloughing off of part of the horn sheath, usually the first 3 annual growth increments; sometimes more is lost. Of 12 deformed horns measured, 6 had lost the first 3 increments. This phenomenon is different from brooming in that the breakage occurs at an annual growth check and it leaves behind a very clean, smooth cone-shaped protuberance which is part of the following year's growth. In 7 of 17 affected horns this was the only problem. The second stage of this disease affected the other 10 horns. It resulted in the remaining stumps of these horns changing their direction and curvature of growth. Horn growth in a normal sheep proceeds in a dorsal-posterior direction from the base; affected horns grow laterally, almost at a right angle, away from the skulls and form a very tight curl. Because of this tight curl the end of the horn grows back toward the skull, reaching it in a few years, and penetrates the orbit, maxilla, or nasal bones anterior and ventral to the orbit. Three affected rams were blind on 1 side, 2 had severe infections below the eye, and in 1 ram the horn had grown into his muzzle, severely affecting mastication. Figure 2 shows a representative sample of affected skulls and Table 2 summarizes information about all 12 skulls inspected.

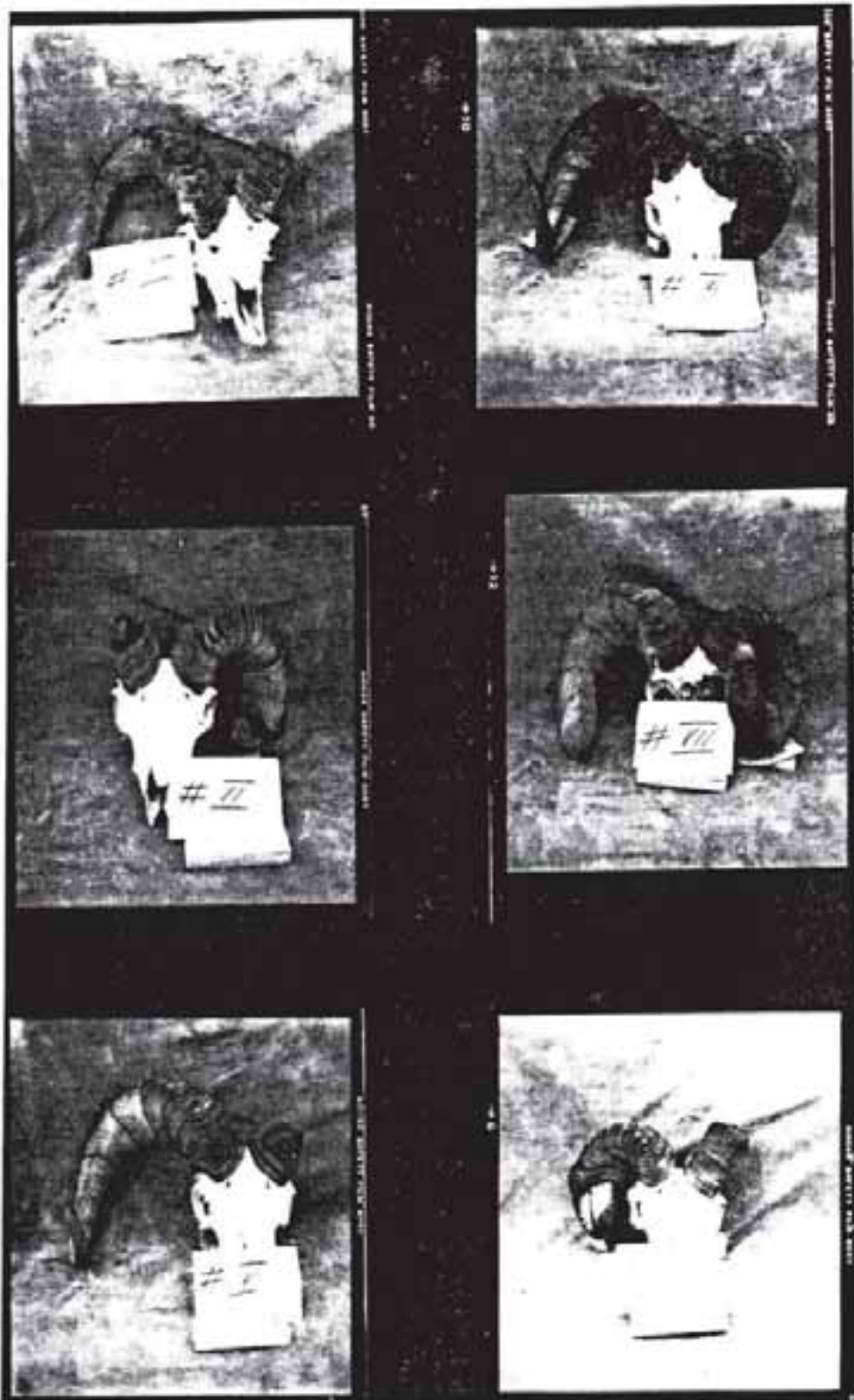


FIGURE 2.
EXAMPLES OF SKULLS WITH DEFORMED HORNS

TABLE 2. Summary of information on rams with deformed horns

Specimen #	Age ⁽¹⁾	Location of kill ⁽²⁾	Date of kill	Horn(s) affected	Description of abnormality
I	8	GMaZ 5-31	July, 1979	Left horn	♂ normal ⁽³⁾ , angle ⁽⁴⁾ normal, first four increments ⁽⁵⁾ lost.
II	7	GMaZ 5-31	Sept. 1977	Right horn Left horn	♂ normal, angle normal, first seven increments lost. ♂ normal, horn grew in sharp angle back toward skull and would have touched skull below orbit in one more year's growth, first three increments lost.
III	10	GMaZ 5-31	July, 1979	Right horn Left horn	♂ partly squashed, very heavy; horn grew in sharp angle toward skull, meeting it below orbit, first three increments lost. ♂ partly squashed, very heavy; horn grew in a ventral direction (downward) parallel to skull, but did not touch skull, first three increments lost.
IV	9	GMaZ 5-28	Sept. 1978	Left horn	♂ squashed heavily, oval-shaped, elongated in cross-section, horn grew in sharp angle back toward skull into orbit, first five increments lost.
V	11	GMaZ 5-46	July, 1979	Left horn	♂ normal; angle normal; first eight increments lost.
VI	10	GMaZ 5-34	July, 1979	Left horn	♂ squashed, oval-shaped in cross-section; horn grew in sharp angle back toward skull meeting it below orbit, first four increments lost.
VII	11	GMaZ 5-31	Aug., 1974	Left horn	♂ normal; horn grew in a very tight curl close to skull but did not touch it; first two increments lost.
VIII	7	GMaZ 5-31	July, 1979	Right horn Left horn	♂ normal, angle normal; first three increments lost. ♂ normal, angle normal; first five increments lost.
IX	10	GMaZ 5-31	Sept. 1977	Right horn Left horn	♂ normal; horn grew in sharp angle back toward skull into orbit, first three increments lost. ♂ normal; angle normal; first six increments lost.
XI	7	GMaZ 5-28	Sept. 1978	Right horn Left horn	♂ small for ram horn, almost eye-like in size; normal in shape; horn grew in a wide angle back toward skull into the ram muzzle. ♂ squashed during last four increments, spreading over orbit in a "pancake-like" manner; angle of horn was that of a eye and not that characteristic for ram horns. Note: This animal was in very poor physical shape when shot, eye-like in weight, perhaps because the right horn interfered with mastication. Besides the horn problem this ram missed one front leg.
XIII	14	GMaZ 5-36	Aug., 1979	Left horn	♂ normal; horn grew in a tight angle back toward skull, would have reached skull in two to three years' growth; first four increments lost.
XIV	10	GMaZ 5-28	Sept. 1979	Right horn	♂ normal; angle normal; first three increments lost.

(1) Ages given refer to "growing season".

For instance, a ram shot in September of its 8th growing season, is only 7 years and 4 months old in chronological age.

(2) Location of kill refers to Game Management Subzone (GMaZ) (see map for details).

(3) ♂ refers to cross-section of horn.

(4) Angle refers to normal angle by a horn in relation to skull of ram.

(5) Increment refers to annual additions to horn lengths.

Measurements on annual horn growth rates reveal that deformed horns grew slower than "normal" horns of affected rams. Unexpected was the observation that the "normal" horn of rams whose second horn was deformed had a slower growth rate than the horns of healthy rams from the same population. Table 3 presents annual increments in growth of affected rams and Figure 3 shows the differences in growth rates between normal horns of healthy rams, normal horns of affected rams, and deformed horns. Relevant statistics are given in the appendix. Deformed horns were not only retarded in their growth rates and subject to very tight curling, their cross-sections were also deformed, usually compressed into oval or elongated shapes with no apparent difference between outer and inner surfaces and no distinct "horn keel" present.

DISCUSSION AND CONCLUSION

It is not known what causes this abnormality.

Three hypotheses have been proposed:

- a) For some unknown reason the sheep in this area are more prone to accidents. Horn sheaths are lost and horns become deformed when young rams have accidents. This is the position of a number of hunters from the area and it is shared by

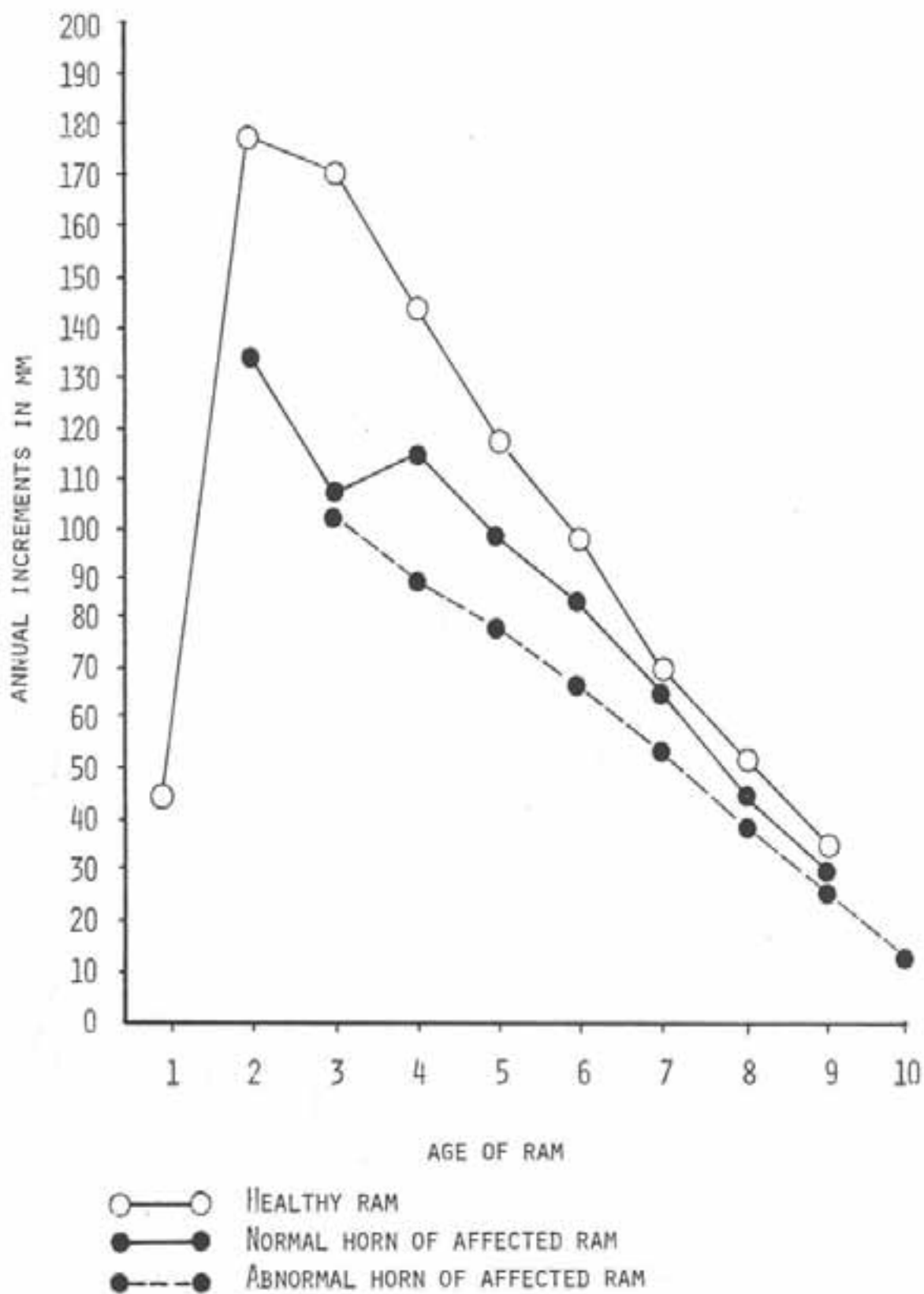
Table 3. Annual growth increments in mm of affected horns

Horn	1	2	3	4	5	6	7	8	9	10	11	12	13	14
I Left		(1)		46		42	30	15						
II Left				140	85	87	60							
III Left				59	94	45	37	35	25	11				
III Right				95	82	57	50	45	32	16				
IV Left						62	72	67	45					
V Left								18	17	12				
VI Left					74	112	115	55	34	21				
VII Left			80	148	120	90	100	46	25	8	10			
VIII Left						95	46							
VIII Right				70	120	95	41							
IX Left							70	41	39	10				
IX Right			82	76	70	55	46	20	22	11				
XI Right		50	217	129	74	40	72	3						
XI Left		46	189	121	16	17	8							
XIII Left					120	100	65	34	38	20	18	17	15	12
XIV Right														
		N/A	N/A	103	91	79	69	40	31	14	N/A	N/A	N/A	N/A
					(2)									

(1) These portions of the horn sheath had been lost.
 (2) No data available since hunter left the Territory
 (only a picture had been taken of this skull).

FIGURE 3.

Horn growth rates of normal and affected rams



Dr. Eric Broughton, Veterinarian with the Canadian Wildlife Service, who was present when 2 of the affected rams were collected.

- b) The deformities are caused by a disease.

Dr. Thomas Bunch, Pathologist with Utah State University, who has done considerable research on "frontal sinusitis", a disease affecting the skulls and horns of desert bighorns, favours this hypothesis. Dr. Bunch will come to the Yukon this summer and look at this problem.

- c) Lastly we may be dealing with a genetic defect.

Some observations favour this hypothesis. Rams with deformed horns have been observed in this area since the mid 1930's. They have become more numerous in the last few years as hunting pressure built up. More and more of the healthy rams were removed by hunting, leaving more of the affected rams to reproduce.

If we were dealing with a contagious disease, this would have spread into neighbouring populations by now, whose summer ranges overlap with the affected population under study and whose densities are just as high.

We are grateful to the Foundation for North American Wild Sheep for providing funding to continue this investigation. Hopefully, we will know more about the nature and seriousness of this problem by the end of this year.

LITERATURE CITED

- Hoefs, M. 1975. Sheep surveys and evaluation of present harvests in southwestern Yukon. Unpubl. Report, Yukon Wildlife Branch. 40pp.
- Hoefs, M. 1979. Sheep surveys in outfitting area 12 (V. Hassard) to determine distribution and frequency of rams with deformed horns. Unpubl. Report, Yukon Wildlife Branch. 9pp.

APPENDIX

Annual Increments of Horn Growth of Unaffected Rams⁽¹⁾

#	G.M.S.	1	2	3	4	5	6	7	8	9	10
265	5-36	80	245	445	565	645	720	775	840	905	
300	5-36	50	270	452	600	730	775	831	885	930	960
17	5-36	41	271	475	607	695	772	846	900	931	
80	5-36	30	252	457	592	705	785	840	872	905	
77	5-34	30	120	252	423	557	670	751	810	243	
36	5-31	65	260	433	541	644	774	860	915		
37	5-34	37	204	352	509	635	721	782	832	890	916
75	5-31	46	228	395	535	651	754	845	910		
88	5-31	40	180	330	500	630	785	860	880		
86	5-31	35	190	340	490	635	745	830	890	940	970
x ⁽²⁾		45	222	392	536	653	751	822	873	907	949
x ⁽³⁾		45	177	170	144	117	98	71	51	34	42

Annual Increments in Growth of "Normal" Horns of Affected Rams

#	Horn	1	2	3	4	5	6	7	8	9	10	11
I	Right	97	285	432	510	560	630					
IV	Right	-	195	342	446	551	618	678	727	762		
V	Right	-	234	440	560	659	730	780	824	841	859	871
VI	Right	51	182	341	470	579	672	750	801	839		
VII	Right	-	140	273	409	530	625	716	767	794	806	819
VIII	Right	-	-	196	331	425	525	604	635	666	685	699
XIV	Left	-	-	180	300	422	500	566	615	645	661	
x ⁽²⁾		N/A	207	315	432	532	614	682	728	758	753	796
x ⁽³⁾		N/A	133	108	117	100	84	68	46	30	N/A	N/A

(1) Data are based on 10 randomly selected rams, that were shot in the fall of 1979 by hunters.

(2) These are total horn length data to the age class in question.

(3) These are average annual increments for the age class in question.

QUESTIONS - RESPONSES

Tom Thorne: I think that's real interesting, Manfred. I think I tend to side with you. It looks suggestive of something genetic to me. It would be fun to breed one of those rams with a normal ewe from some place else and re-do it and see if you could reproduce it; I think that would be very interesting. It doesn't look like a disease to me.