MACKENZIE MOUNTAIN
NON-RESIDENT AND NON-RESIDENT ALIEN
HUNTER HARVEST SUMMARY
2000

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ABSTRACT

Data on harvest of big game in the Mackenzie Mountains of the Northwest Territories (NWT) by non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded for the 2000 hunting season by each of the eight licenced outfitters that operate in the area and by Renewable Resource Officers with the Department of Resources, Wildlife & Economic Development of the Government of the NWT.

Non-resident licences were bought by 332 hunters in 2000. Hunters from outside Canada (non-resident aliens) – primarily from the United States of America - comprised 77% of the outfitted hunters in the Mackenzie Mountains. Canadians from outside the NWT (non-residents) comprised 17%; the country of origin for 6% of hunters is unknown. Of the 332 non-resident licence holders, 320 came to the NWT and most spent at least some time hunting.

Tags to hunt Dall's sheep were purchased by 231 non-resident hunters and 189 rams were harvested. The average age of harvested rams was 10.0 $\pm$ 1.7 years, which represents the 4th consecutive year with an average age $\geq$ 10.0 years for the Mackenzie Mountains. Hunters' observations gave estimates of 47 lambs and 90 rams per 100 ewes, respectively. Hunters reported seeing an average of 8.9 legal rams (horns at least ¾ curl) during their hunts. Tags to hunt woodland caribou were purchased by 206 non-resident hunters and they harvested 127 animals. Hunters' observations gave estimates of 41 caribou calves and 39 bulls per 100 cows, respectively. Non-resident hunters purchased 69 moose tags and harvested 44 bulls. We calculated estimates of 26 moose calves and 89 bulls per 100 cows, respectively, from hunters' reported observations. There was 1 mountain goat harvested by the 12 non-residents that purchased tags, 14 wolves by 155 tag-holders, and no wolverines were taken by 85 tag-holders. Six tags were purchased for black bears, but no animals were harvested. There has not been an open season for non-residents to hunt grizzly bears since 1982.

Hunter satisfaction remains high, with 93% rating their experience as either excellent (76%) or very good (17%). Over 90% of hunters indicated that they would like to return to the Mackenzie Mountains in future years and 26% of this year's hunters were repeat clients who were returning for their 2nd to 17th hunts in the region.

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INTRODUCTION

The 140,000 km^2 (54,000 mi^2; 34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NWT) were first opened to non-subsistence hunters in 1965 (Simmons 1968). Since then, the Mackenzies have become world-renowned for providing a high quality wilderness hunting experience, particularly for Dall's sheep (Veitch and Simmons 1999). In return, non-resident hunters and outfitters in the Mackenzie Mountains provide an estimated $1,800,000 annually to individuals, businesses, and governments in the NWT (EXCELeration corp. 2000). The outfitted hunting industry in the Mackenzie Mountains also provides employment for 100 to 120 outfitters, guides, pilots, camp cooks, camp helpers, and horse wranglers (Kelly Hougen, President, Association of Mackenzie Mountain Outfitters, personal communication).

Eight outfitters are currently licenced by the Government of the NWT (GNWT) to provide big game outfitting services within the Mackenzie Mountains, NWT (Figure 1; Appendix 1). No hunting - except for subsistence harvest by NWT General Hunting Licence holders - is permitted within the boundaries of Nahanni National Park Reserve in the southern half of the range (Figure 1). Each licenced outfitter has the exclusive privilege to provide services within their zone, which enhances the outfitters' ability to practice sustainable harvest through annual allocation of the harvest effort.

The hunting licence year in the NWT runs from 01 July to 30 June. Those who desire to hunt big game within the NWT must annually obtain a big game hunting licence and must be at least 16-years-old (Department of Resources, Wildlife & Economic Development 2000). There are four classes of licenced big game hunters in the NWT:

1) *General* – Subsistence harvesters, primarily aboriginal people.
2) *Resident* - Canadian citizens or landed immigrants who have lived in the NWT for at least two consecutive years prior to application for the licence;
3) *Non-resident* - Canadian citizens or landed immigrants who live outside the NWT, or have not lived within the NWT for two consecutive years prior to application for the licence; and
4) *Non-resident Alien* - Non-Canadian citizens or landed immigrants.

Both non-residents and non-resident alien hunters must use the services of an outfitter and must be accompanied by a licenced guide at all times while hunting. For simplification in this report, we call both non-resident and non-resident alien hunting licence holders 'non-residents' and combine their harvest statistics.

Individual non-resident hunters are annually restricted to one each of the following big game species (Appendix 2): Dall's sheep (male with at least ¾ curl horns), woodland caribou (either sex), moose (either sex), mountain goat (either sex), wolf (either sex), wolverine (either sex), and black bear (adult not accompanied by a cub or cubs). Non-resident hunting for grizzly bears was closed in 1982 as a result of concerns about over-harvest (Miller et al. 1982; Latour and MacLean 1994). There are currently no restrictions on the total number of each big game species that an outfitter can take within the zone for which they are licenced.

Wildlife management within the Mackenzie Mountains is the responsibility of a variety of government agencies and boards set up as a result of comprehensive land claim agreements. The Nahanni National Park Reserve (4,766 km^2) in the south Mackenzie Mountains is managed by Parks Canada – an agency of the Canadian federal government. Under the terms of the Sahtu Dene and Metis Comprehensive Land Claim Agreement (signed in 1993) and the Gwich'in Comprehensive Land Claim Agreement (signed in 1992), primary responsibility for wildlife management within the two settlement areas lies with the Sahtu Renewable Resources Board (SRRB) and the Gwich'in Renewable Resources Board (GRRB), respectively. Approximately 68,000 km^2 of the central and northern Mackenzie Mountains are within the Sahtu Settlement Area and 8,300 km^2 are within the Gwich'in Settlement Area, which encompasses the extreme north end of the range. However, the GNWT maintains ultimate jurisdiction for management of wildlife and wildlife habitat within each of the claim areas. The Department of Resources, Wildlife & Economic Development (RWED) of the GNWT is responsible for licencing outfitters, guides, and hunters and for annually monitoring non-resident big game harvest in the Mackenzie Mountains. RWED also has primary responsibility for wildlife management within the Deh Cho region (approximately 59,000 km^2) of the southern half of the Mackenzie Mountains where there is currently no settled land claim agreement.

Each year RWED, under provisions in the GNWT's *Wildlife Business Regulations*, requires that outfitters submit an Outfitter Return on Client Hunter Success form for each

person that purchased a NWT non-resident big game hunting licence (Figure 2). These are known as outfitter return forms and they must be submitted whether or not a client actually hunted, and whether or not any game was harvested. The outfitter return forms allow us to quantify harvest by non-resident hunters to help biologists with the GRRB, SRRB, and RWED to ensure that the harvest of each species is within sustainable limits. In addition to the outfitter return forms, we request all non-resident hunters to voluntarily provide reports of the wildlife they saw during their hunts. This data is recorded on a separate form - the Hunter Wildlife Observation Report (Figure 3). These are referred to as hunter observation forms.

This is the sixth consecutive year that a summary of the data collected by RWED on non-resident hunters in the Mackenzie Mountains has been made. In the text of this document, data for 1995 are found in Veitch and Popko (1996), for 1996 in Veitch and Popko (1997), for 1997 in Veitch and Simmons (1998), for 1998 in Veitch et al. 2000b, and for 1999 in Veitch and Simmons (2000). In addition, Latour and MacLean (1994) summarized data for 1979 to 1990. We hope that the information presented is of interest and use to members and staff of wildlife co-management boards, community Renewable Resource Committees, outfitters and their staff, hunters, people involved in promotion of tourism in the NWT, other biologists, and to anyone else with an interest in the Mackenzie Mountains.

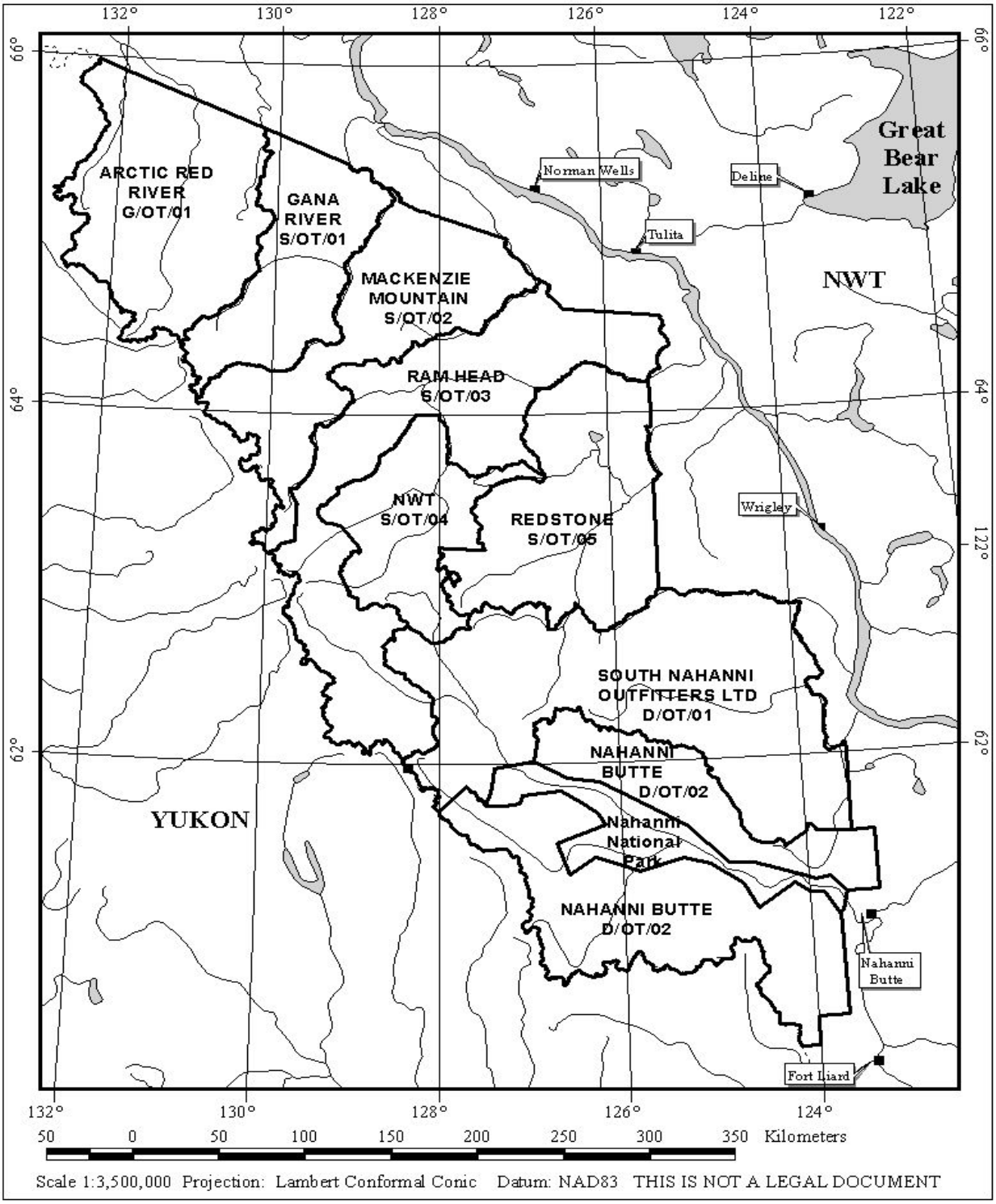

Figure 1. Outfitting zones in the Mackenzie Mountains, NWT – 2000.

METHODS

Prior to the start of the 2000 hunting season, each outfitter in the Mackenzie Mountains received sufficient copies of the outfitter return and hunter observation forms for all their clients for the year. The *Wildlife Business Regulations* require outfitter returns to be returned by the tenth day of the month following the month of the hunt – e.g., for a hunter that was in the field in July, a form must be submitted by the 10th of August. Those forms were submitted to the senior author whether or not a client actually hunted and whether or not harvest occurred. In co-operation with Renewable Resource Officers with RWED and the outfitters, persistent attempts were made to obtain outfitter return forms for every non-resident that held a big game hunting licence through a Mackenzie Mountain outfitter in 2000.

Where an hunter observation form was received, we recorded wildlife observations directly from the form. When no hunter observation form was received, but observation data was recorded on the outfitter return form, we entered the data from that form.

Once received, data from the outfitter return forms were cross-checked with the GNWT wildlife *Export Permit* forms, and with records of sequentially numbered, unique identifier plugs inserted in the horns of legally harvested rams maintained by RWED offices across the western NWT. After verification, all data were entered onto an *Excel 5.0* (Microsoft Corporation, Seattle, WA) spreadsheet for analyses.

INSERT SCANNED FORM HERE

Figure 3. 2000 Mackenzie Mountain *Outfitter Report* form.

MACKENZIE MOUNTAINS, N.W.T.

HUNTER OBSERVATION REPORT - 2000

The following information is requested in order to assist management of Mackenzie Mountain big game populations. The requested information is voluntary and your providing it to us is most appreciated.

HUNTER INFORMATION

Last Name	First Name and Initials	
Address - number and street, box number	Town, City	Province, State, Country

Hunting Licence# _____ Outfitting Zone: _____ Company: _____

Start Date of Hunt _____ 2000 End Date of Hunt _____ 2000 Observations Made Over __ Days

ESTIMATED NUMBER OF DALL'S SHEEP SEEN			
¾ and Full Curl Rams	Less than ¾ Curl Rams	Ewes	Lambs

ESTIMATED NUMBER OF WOODLAND CARIBOU SEEN		
Bulls	Cows	Calves

ESTIMATED NUMBER OF MOOSE SEEN		
Bulls	Cows	Calves

ESTIMATED NUMBER OF MOUNTAIN GOATS SEEN			
Billys	Nannys	Kids	Unknown Age

OTHER SPECIES

	Wolf	Wolverine	Black Bear		Grizzly Bear	
			Adult	Cub	Adult	Cub
Number Seen						

How would you rate your overall hunting experience in the Mackenzie Mountains?

Excellent _____ Very Good _____ Good _____ Fair _____ Poor _____

Was this your first time hunting the Mackenzie Mountains? _____ Yes _____ No

If no, how many times have you hunted in the Mackenzie Mountains before 2000? _____

If yes, will you return to hunt the Mackenzie Mountains again? Yes _____ No _____

Of the following hunting organizations, check all for which you are a current member

Foundation for North American Wild Sheep _____ (FNAWS Chapter _____)

Grand Slam Club _____ Fraternity of the Desert Bighorn _____ Boone and Crockett Club _____

Safari Club International _____ Wild Sheep Society of BC _____ Nevada Bighorns Unlimited _____

Rocky Mtn Elk Foundation ____ Arizona Desert Bighorn Society ____ Texas Bighorn Society _____

Other(s) _____

Comments: (continue on reverse if necessary)

Figure 4. 2000 Mackenzie Mountain *Hunter Observation Report* form.

RESULTS and DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains, NWT were bought by 332 non-resident hunters in 2000 (Table 1). Of those, at least 320 (96%) came to the NWT and spent some time hunting; 12 either cancelled their hunts or decided not to hunt after arriving in the NWT. The proportion of licence sales to Canadian citizens (i.e., non-residents) at 17% was below the 1979-1990 average of 22% and mirrors the 17% recorded in both 1997 and 1998. In 1999, only 13% of licences were sold to Canadians. The reduced proportion of Canadians over the last 4 years is most likely due to the low value of the Canadian dollar relative to the US dollar (^{CAN}\$1.00 is worth approximately ^{US}\$0.65-\$0.67), since outfitters charge in US funds.

We received mandatory Outfitter Return forms for 318 (96%) of the 332 people that purchased non-resident licences and voluntary Hunter Observation Report forms from only 53% of the 320 that did at least some hunting in 2000 (Table 2). The continued low return rate of hunter observation forms was discussed with the Association of Mackenzie Mountain Outfitters at their annual general meeting in February 2001 where it was suggested that the rate would increase if hunters submitted completed forms to the outfitter, who would then submit all forms received at the end of the hunting season. This procedure will be implemented in 2001.

It is obvious that non-residents immensely enjoy their hunting experience in the Mackenzie Mountains (Table 3) – in 2000, 93% of hunters rated their experience as either excellent (76%) or very good (17%). It was the first time hunting the Mackenzie Mountains for 117 of 158 (74%) hunters; the 41 repeat hunters (26%) had hunted from 2 to 17 times previously. Of 131 hunters that answered our question about their plans to return to the Mackenzies to hunt in the future, 91% indicated they would like to return.

As in previous years, hunters' comments reflected a general dissatisfaction at the inability to hunt for grizzly bears and about problems encountered with bears, such as losing meat, capes, or both, to bears in and around camps. However, the proportion that commented on grizzly bears was down somewhat from 1995-1999. In 2000, 12% of hunters that provided comments mentioned high numbers of wolves; comments about wolves had not been received previously during 1995-1999. All comments received are provided in Appendix 1.

Table 1. Province or country of origin for 332 non-resident hunters in the Mackenzie Mountains, 2000.

Canada		United States		Europe		Other	
NWT/Yukon	0	Eastern States[1]	111	Germany	2	Australia	5
British Columbia	16			Switzerland	1	Mexico	6
Alberta	36	Western States[2]	127			Nepal	1
Saskatchewan	3					South Africa	1
Manitoba	1						
Ontario	1					Unknown	21
Quebec	0						
Atlantic Provinces	0						
Total	57		238		3		34

[1] AL, AR, CT, DE, DC, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, OH, PA, PR, RI, SC, TN, VT, VA, VI, WV, WI

[2] AK, AZ, CA, CO, HI, ID, KS, MT, NB, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY

Table 2. Mackenzie Mountain outfitter and non-resident hunter forms submission compliance rate, 1996-2000.

Form Type	2000	1999	1998	1997	1996
Outfitter Return (mandatory)	96%	96%	97%	98%	100%
Hunter Observation (voluntary)	53%	51%	60%	50%	71%

Table 3. Satisfaction ratings for non-resident hunters in the Mackenzie Mountains, 1996-2000.

Rating	2000	1999	1998	1997	1996
Number of Hunters Reporting	158	157	202	144	227
Excellent	76%	73%	80%	78%	77%
Very Good	17%	20%	17%	17%	17%
Good	6%	5%	2%	3%	2%
Fair	0%	1%	1%	1%	3%
Poor	1%	1%	0%	1%	1%

Table 4. Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1996-2000.

Species	2000 (332 hunters)		1999 (321 hunters)		1998 (345 hunters)		1997 (352 hunters)		1996 (387 hunters)	
	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	231	70	227	71	246	71	252	72	252	65
Woodland Caribou	206	62	181	56	223	65	260	74	274	71
Moose	69	21	63	20	69	20	73	21	74	18
Mountain Goat	12	4	6	2	23	7	30	8	14	4
Wolf	155	47	89	28	165	48	209	59	193	50
Wolverine	85	26	65	20	99	29	135	38	114	30
Black Bear	6	2	2	<1	2	<1	8	2	0	0

Dall's Sheep (*Ovis dalli dalli)*

Dall's sheep are the most desired species sought by non-resident hunters in the Mackenzie Mountains - tags to hunt Dall's sheep were purchased by 70% of non-resident hunters in 2000, which is essentially unchanged from 1997-1999 (Table 4). At least 90% of sheep tag holders pursued Dall's sheep and they harvested 189 rams. The average length of a sheep hunt was 4.5 $\pm$ 2.8 days - similar to 1997 (4.3 days), 1998 (4.4 days), and 1999 (4.7 days), but a drop from the 5.3 day average for 1979-1990 (Latour and MacLean 1994). Outfitted hunts in the Mackenzie Mountains are generally booked for 10 days; when hunters fill their sheep tag, any remaining time on the hunt is typically spent in pursuit of other big game species for which tags are held, or in hunting small game.

Harvest by non-residents comprises at least 90% of the total annual harvest of Dall's sheep in the Mackenzie Mountains and takes only 0.8 to 1.5% of the estimated 14,000 to 26,000 Dall's sheep in the Mackenzie Mountains (Veitch et al. 2000a). Therefore, the current non-resident harvest level appears well within sustainable limits, provided that hunting pressure is geographically distributed across each of the zones. In the Yukon Territory - where harvest is managed by a full curl rule - thinhorn sheep managers have set the sustainable harvest at 4% of the non-lamb population (Yukon Renewable Resources 1996). In those areas of the Yukon where the management objective is to increase population size, harvest is limited to 2% of the total population.

Table 5. Horn measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 2000.

	Left Horn Contour Length		Right Horn Contour Length		Left Horn Base Circumference		Right Horn Base Circumference		Tip to Tip Spread	
	cm	in	cm	in	cm	in	cm	in	cm	in
Mean	88.9	35.0	89.5	35.2	33.5	13.2	33.5	13.2	59.2	23.3
Standard Deviation	7.7	3.0	7.1	2.8	1.9	0.7	1.9	0.7	7.9	3.1
Maximum	109.5	43.1	108.5	42.7	39.0	15.4	39.0	15.4	85.5	33.7
Minimum	62.0	24.4	63.3	24.9	27.5	10.8	27.8	10.9	36.0	14.2

There has been remarkable consistency from 1979 to 2000 in the mean outside contour length of the right horns from rams harvested by non-residents (Appendix 3), which is surprising given the increase in average age during that same period. We expect to see more broomed, or broken, horn tips on older animals, since horn breakage generally occurs as a result of fights between rival males (Geist 1993). In 2000, brooming was noted on 30% of left and 31% of right horns.

Ninety (48%) of 189 aged rams taken by non-residents were at least 10-years-old (Table 6). The average age of rams taken by non-residents in 2000 was 10.0 $\pm$ 1.7 years (range 6.5 to 15.5 years). This is the fourth consecutive year for which the average age of rams harvested by non-residents has been $\geq$10.0 years (Appendix 3).

Table 6. Age-structure of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1996-2000.

	2000		1999		1998		1997		1996	
Age	No.	%	No.	%	No.	%	No.	%	No.	%
3	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5
4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5
6	3	1.6	1	0.5	4	2.0	1	0.5	5	2.5
7	16	8.5	13	7.1	9	4.3	12	5.8	21	10.5
8	39	20.8	23	12.6	39	18.8	39	18.8	47	23.5
9	40	21.2	49	26.8	45	21.7	52	25.1	56	28.0
10	41	21.8	47	25.7	63	30.4	58	28.0	36	18.0
11	28	14.9	29	15.8	30	14.5	24	11.6	26	13.0
12	14	7.5	15	8.2	12	5.8	15	7.2	6	3.0
13	3	1.6	6	3.3	2	1.0	4	1.9	1	0.5
14	3	1.6	0	0	1	0.5	2	1.0	0	0.0
15	1	0.5	0	0	1	0.5	0	0.0	0	0.0
>10-yrs	90		109		102		69		68	
%>10-yrs	47.9		52.6		49.5		34.5		36.0	
>12-yrs	21		16		21		7		20	
%>12-yrs	11.2		7.7		10.1		3.5		10.6	

Table 7. Dall's sheep observations reported by non-resident hunting licence holders in the Mackenzie Mountains, 2000.

	Number of Hunters Reporting	Number Observed	Mean Number Observed	Percent of Sheep Classified
Rams	153	3096	20.2	38.1
Ewes[1]	150	3431	22.9	42.2
Lambs	143	1597	11.2	19.7

[1] includes females >1-yr-old, yearlings, and younger rams. Also called 'nursery sheep'.

From hunters' classifications of sheep observed during their hunts (Table 7), we calculated an estimate of 47 lambs per 100 ewes, down from 57-60 lambs per 100 for 1997-1999 and the second lowest ratio recorded since 1995 (Appendix 5). For the Richardson Mountains of the northern Yukon and NWT, Nagy and Carey (1991) suggest an August ratio of 43 lambs per 100 ewes would have allowed for their observed 10.5% average annual rate of increase from 1986 to 1991. Jorgenson (1992) summarized 17 years of lamb: ewe classification data for a herd of bighorn sheep in westcentral Alberta and found a mean of 43 lambs per 100 ewes in September (range 25 to 54).

Differences in adult sex ratios among populations may result from differences in hunting pressure, differences in survival of males and females from birth to adulthood, or both (Nichols and Bunnell 1999). However, since the ratio of rams to ewes is almost never equal in wild populations of mountain sheep, even where they are unhunted, it is clear that there is a different natural mortality rate for the two sexes. Geist (1971) suggested that this difference is a result of injuries and stress accumulated by males during the breeding season. The 90 ram to 100 ewe ratio calculated from hunters' observations in 2000 was identical to 1999 and follows the 1995-1999 trend of generally high ram to ewe ratios (Appendix 6). In the Yukon, mid to late June annual aerial surveys to count and classify sheep from 1973 to 1998 produced an average of 48 rams (range 28 to 74) per 100 'nursery sheep' (Jean Carey, Sheep and Goat Biologist, Yukon Dept. of Renewable Resources, unpublished data). In Alaska, ram to ewe ratios for two unhunted herds in Denali and Gates of the Arctic national parks typically averaged 60-67 rams

per 100 ewes (Nichols and Bunnell 1999). In more heavily hunted Alaskan herds, ram to ewe ratios range from 33: 100 (heavily hunted) to 87: 100 (lightly hunted). Therefore, the mean ram to ewe ratio of 80 per 100 calculated from hunters' observations since 1995 (Appendix 5) suggests that the harvest of rams in the Mackenzie Mountains is sustainable at current levels.

Table 8. Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1996 to 2000.

Ram Class	1996		1997		1998		1999		2000	
	Horns >¾ curl	Horns <¾ curl	Horns >¾ curl	Horns <¾ curl	Horns >¾ curl	Horns <¾ curl	Horns >¾ curl	Horns <¾ curl	Horns >¾ curl	Horns <¾ curl
No. of Hunters Reporting	172	174	205	205	177	177	144	138	151	147
No. of Rams Classified	1713	1699	1538	1586	1848	1924	1579	1756	1351	1717
Percent of Rams Classified	50.2	49.8	49.2	50.8	49.0	51.0	47.3	52.7	44.0	56.0
Mean no. Observed	10.0	9.8	7.5	7.7	10.4	11.3	11.0	12.7	8.9	11.7

The mean number of legal rams ($\geq$ ¾ curl horns) observed per reporting hunter in 2000 was down from 1999, but was still well within the range reported over the past 5 years (Table 8). These data indicate that hunters who do not fill their tag generally pass up the opportunity to take at least one legal ram, and most pass on several. Many of those hunters that have hunted the Mackenzie Mountains for more than one year have specific requirements for the type of ram they wish to harvest and will pass on legal rams that do not meet those requirements (Kelly Hougen, President, Association of Mackenzie Mountain Outfitters, personal communication).

Sixteen Dall's sheep taken from the Mackenzie Mountains are recorded in the 11th edition of the Boone and Crockett Club record book for big game in North America (Byers and Bettas 1999). The top ranking sheep from the NWT currently holds 48th place – it was harvested in 1973 and had a right horn length of 112.8 cm (44.4 in) and a left horn of 115.6 cm (45.5 in).

Woodland (Mountain) Caribou (*Rangifer tarandus caribou)*

Woodland caribou tags were purchased by 62% of non-resident hunters (Table 4). At least 70% of tag holders hunted caribou and harvested 127 bulls, up slightly from 117 in 1999, but still lower than the annual mean of 164 taken 1991-1999 (Veitch and Simmons 2000). The average length of a woodland caribou hunt was 3.7 $\pm$ 2.8 days and ranged from 1 to 12 days.

Table 9. Antler measurements of woodland caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2000.

	Contour Length	
	Left Antler	Right Antler
Number Measured	81	82
Mean (cm)	120.1	120.3
Mean (in)	47.3	47.4
Standard Deviation (cm)	11.0	10.5
Standard Deviation (in)	4.3	4.3
Maximum (cm)	144.0	139.0
Maximum (in)	56.7	54.7
Minimum (cm)	90.2	95.0
Minimum (in)	35.5	37.4

Thirteen of the top 50 mountain caribou recorded by the 11th edition of the Boone and Crockett Club record book are from the Mackenzie Mountains, with the highest scoring antlers holding 6th place (Byers and Bettas 1999). The maximum antler length recorded by Boone and Crockett for mountain caribou in North America is 158.5 cm (62.4 in) for a caribou taken from the Mackenzie Mountains in 1978 (Byers and Bettas 1999).

Table 10. Woodland caribou observations reported by non-resident hunters in the Mackenzie Mountains, 2000.

Age/Sex class	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Total Classified
Bulls	142	2496	17.6	21.8
Cows	134	6358	47.4	55.5
Calves	121	2604	21.5	22.7

From hunters' observations, we calculated ratios of 41 calves and 39 bulls per 100 cows; bulls comprised 22% of all caribou classified – up from 20% in 1999 and from the low of 13% in 1997. Bergerud (1978) summarized data for eight North American caribou populations that were either non-hunted or hunted non-selectively (i.e., both males and females included in the harvest) and documented a cumulative average bull component of 39%. Veitch et al. (2000c) classified 2659 of an estimated 5000 caribou in the central Mackenzie Mountains in August 1999 - only 25% of those animals were classified as males $\geq$1-year-old.

Appendix 5 shows that bull: cow ratios have been quite low for Mackenzie Mountain caribou for at least the past six years. Therefore, further investigation is warranted to determine the reason for continued poor bull: cow ratios in the Mackenzie Mountains with an estimated 12,400 to 17,400 caribou in at least 4 separate herds shared between the Yukon and NWT (Yukon Renewable Resources 1996) – Bonnet Plume (est. 5000), Redstone (est. 5-10,000), South Nahanni (est. 2000), and La Biche (est. 400) - and a bull-selective non-resident harvest of only 160 animals per year. Resident harvest of woodland caribou in the Mackenzie Mountains also tends to be bull-selective (but not restricted to bulls) and is generally light (i.e., <25 animals/year); subsistence harvest includes both males and females, with the proportion of each dependent on the time of year that animals are harvested (Jody Snortland, Executive Director and Sahtu Settlement Harvest Study Co-ordinator, Sahtu Renewable Resources Board, unpublished data). In 2000, staff with the Sahtu Renewable Resources Board began a study of woodland caribou in the central and northcentral Mackenzie Mountains that will continue through 2001 (Olsen 2000, 2001).

Alaska-Yukon Moose (*Alces alces gigas)*

Moose in the Mackenzie Mountains belong to the Alaska-Yukon subspecies of moose (also known as tundra moose) that occur across Alaska, the Yukon, extreme northern British Columbia, and the Mackenzie Mountains - the Mackenzies represent the eastern limit of the subspecies' range. This is the largest of the four subspecies that occur in North America (Bubenik 1997). Tags to hunt moose were purchased by 21% of non-resident hunters in 2000, which is similar to previous years (Table 4). At least 71% of tag holders hunted moose and harvested 44 bulls. Moose hunts averaged 4.2 $\pm$ 2.8 days and ranged from 1 to 12 days.

The mean tip-to-tip spread of 34 measured antlers was 147.0 $\pm$ 12.8 cm (57.9 $\pm$ 5.0 in) from bull moose harvested by non-residents in 2000. This was an increase from 144 cm (56.7 in) recorded in 1999 and from 142 cm (56.1in) in 1998. The maximum recorded moose antler spread in 2000 was 178.5 cm (70.5 in) – still below the maximum recorded antler spread for an Alaska-Yukon moose in the NWT since 1995 of 188 cm (74.0in); the maximum antler spread recorded from across the subspecies' range is 210 cm (82.7 in; Bubenik 1997). Two moose taken from the Mackenzie Mountains are in the top 20 Alaska-Yukon moose recorded in the record book of the Boone and Crockett Club and hold places 11 and 15 (Byers and Bettas 1999); the rest of the top 20 were all taken in Alaska.

Table 11. Moose observations reported by non-resident hunters in the Mackenzie Mountains, 2000.

Age/Sex class	Number of Hunters Reporting	Number Observed	Mean Number Observed/Hunter	Percent of Total Classified
Bulls	125	343	2.7	41.3
Cows	130	386	3.0	46.5
Calves	114	102	0.9	12.3

From hunters' observations (Table 11) we calculated ratios of 26 calves and 89 bulls per 100 cows. This is the sixth consecutive year (Appendix 5) in which moose calf: cow ratios

have been considerably lower than the 40 to 60 calves per 100 cows that are generally documented during early to mid-winter aerial surveys for northwestern moose (*Alces alces andersoni*) along the Mackenzie River in the vicinity of the communities of Fort Good Hope (MacLean 1994a), Norman Wells (Veitch et al. 1996), and Tulita (MacLean 1994b). No research has been done on moose in the Mackenzie Mountains; therefore, we have no explanation for the apparent discrepancy in calf production, survival, or both between the mountains and the river valley. A survey of moose in the Norman Wells study area in January 2001 estimated 18 calves per 100 cows (RWED, Norman Wells, unpublished data), which indicates that low calf to cow ratios may no longer be restricted to the Mackenzie Mountains and that study is required to determine the cause(s).

Mountain Goat (*Oreamnos americanus*)

Tags to hunt mountain goats were purchased by only 4% of non-resident hunters in 2000 (Table 4). There is more annual fluctuation in sales of tags for mountain goats than for any ungulate species available to non-resident hunters in the Mackenzie Mountains – in the past 5 years annual tag sales have ranged from 6 to 30 (Table 4) while harvest during that period ranged from 1 to 5 animals (Appendix 4). In 2000, at least 1 tag holder hunted mountain goat and one billy was harvested.

Mountain goats are known to occur in 5 of the 8 outfitting zones in the Mackenzie Mountains and occur almost exclusively below 63^{o} 00’ N (RWED, Norman Wells, unpublished data); however, since 1995 we have only received hunter observations or harvest reports of goats from 4 zones - D/OT/01, D/OT/02, S/OT/03, and S/OT/04. Goats are most numerous in high relief terrain along the Yukon-NWT border between 61^{o} 00’ and 62^{o} 00’ N. In 2000, observations of mountain goats by hunters came only from zones D/OT/01, D/OT/02, and S/OT/04.

No mountain goats from the NWT are listed in the 11th edition of the Boone and Crockett Club record book (Byers and Bettas 1999).

Carnivores

Wolf (*Canis lupus)*

Wolf tags were purchased by 47% of non-resident hunters in 2000 (Table 4) and 14 wolves were harvested (Appendix 4). The average number of wolves observed by hunters that reported their wolf sightings to us again increased in 2000 and the total number observed was the highest recorded since 1996 (Table 12).

Table 12. Wolf observations reported by non-resident hunters in the Mackenzie Mountains, 1996-2000.

	1996	1997	1998	1999	2000
No. Hunters Reporting	76	141	148	103	116
No. Observed	186	200	148	142	228
Mean No. Observed	2.4	0.8	1.0	1.4	2.0
No. Hunters That Saw at Least 1	62	76	57	40	61

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 26% of non-resident hunters (Table 4). At least 47% of tag holders hunted wolverines; however, no wolverines were taken in 2000. This was the third year since 1991 that no wolverines were harvested by non-residents (Appendix 4).

Wolverines occur throughout the Mackenzie Mountains, but sightings are rare – the 97 hunters that reported their observations saw only 11 wolverines; only 9% of those hunters saw at least one wolverine. The 11 sightings of wolverines in 2000 were received from hunters in zones D/OT/02, S/OT/03, S/OT/05, and G/OT/01.

Black Bear (*Ursus americanus)*

Non-resident hunters purchased 6 black bear tags in 2000, but again no bears were harvested; no black bears have been harvested by non-residents in the Mackenzie Mountains in the last 5 years. Black bears are relatively rarely seen in the Mackenzie Mountains and in most years are reported only from below 63^{o} 00 N. In 2000, a total of 17 black bears were reported from zones D/OT/02, S/OT/03, and S/OT/05.

Table 13. Black bear observations reported by non-resident hunters in the Mackenzie Mountains, 1996 – 2000.

	2000		1999		1998		1997		1996	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total Number Observed	2	15	4	7	0	15	2	3	1	10
Percent of Total Observed	49	51	36	64	0	100	40	60	9	91
No. Hunters Reporting	88	93	87	89	121	124	96	96	6	14
Number of Hunters That Saw at Least 1	1	10	2	6	0	8	2	3	1	9
Maximum Number Observed	2	3	2	2	0	3	1	1	1	2

Grizzly Bear (Ursus arctos)

The Mackenzie Mountains have been closed to non-residents for hunting grizzly bears since 1982 and resident hunters have been restricted to one bear per lifetime since the same year (Veitch 1999). It is clear from Appendix 7 that, despite the lack of any hunting opportunities, grizzly bears remain a subject of considerable interest for non-resident hunters and their guides in the Mackenzie Mountains. Hunters reported loss of meat, capes, food, and equipment to grizzly bears in 2000 and several implicated grizzlies as the principal reason for low numbers of moose and caribou calves. It was also frequently suggested that the bears have lost their fear of humans and that someone will be attacked by a bear; however, since the

closure of the non-resident season there have been no documented injuries from grizzly bears in the Mackenzie Mountains (Veitch 1999). At least 30 grizzly bears have been killed in defence of life and property in the Mackenzie Mountains since 1993-1994 (RWED, Norman Wells, unpublished data).

Table 14. Grizzly bear observations reported by non-resident hunters in the Mackenzie Mountains, 1996 – 2000.

	2000		1999		1998		1997		1996	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total Number Observed	113	281	52	225	68	343	70	306	96	377
Percent of Total Observed	29	71	19	81	17	83	19	81	20	80
No. Hunters Reporting	108	131	98	117	139	177	110	170	49	132
Number of Hunters That Saw at Least 1	51	97	28	81	31	105	32	129	46	129
Mean Number Observed	1.1	2.1	0.5	1.9	0.5	1.9	0.6	1.8	2.0	2.9
Maximum Number Observed	8	12	4	12	6	16	12	17	5	15

While the mean number of adult grizzly bears observed per hunter has remained relatively stable from 1996 to 2000, there was a considerable increase in 2000 from the period 1996-1999 in the cub to adult ratio calculated from hunters' observations, with cubs comprising 29% of all bears (Table 14). Since cub grizzlies in the Mackenzies tend to stay with their mothers for 3 years (Miller et al. 1982), 'cub' refers to cubs-of-the-year, yearlings, and 2-year-olds. In comparison to other northern grizzly bear populations, there is generally a lower proportion of cubs in the Mackenzie Mountain grizzly population. Miller et al. (1982) documented a low reproductive rate for female Mackenzie Mountain grizzly bears, with cubs not produced by any sows less than 8-years-old, a mean litter size of 1.8, and an average inter-litter interval of 3.8 years.

ACKNOWLEDGMENTS

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We also greatly appreciate the efforts, interest, and co-operation shown by our visiting hunters and the more than 80 guides that completed the forms, reported observations of animals seen, and did the various antler and horn measurements. In addition we would like to particularly thank those hunters that took the time to write comments.

Lana Robinson (Sahtu GIS Project, Norman Wells) prepared the map of outfitting zones and Lynda Yonge (RWED, Yellowknife) co-ordinated the final preparation of this manuscript. We appreciate both their efforts.

PERSONAL COMMUNICATIONS

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REFERENCES

Bergerud. A. T. 1978. Caribou. pp. 83-102 *in* J. L. Schmidt and D. L. Gilbert (eds.) Big game of North America: ecology and management. Stackpole Books, Harrisburg, PA. 494 pp.

Bubenik, A. B. 1997. Evolution, taxonomy, and morphophysiology. pp. 77-123 *in* A. W. Franzmann and C. C. Schwartz (eds.) Ecology and management of the North American moose. Smithsonian Institution Press, Washington, DC. 733 pp.

Byers, C. R. and G. A. Bettas. 1999. Records of North American Big Game. 11th Edition. Boone and Crockett Club, Missoula, MT. 712 pp.

Department of Resources, Wildlife & Economic Development 2000. Northwest Territories summary of hunting regulations 2000-2001. Department of Resources, Wildlife & Economic Development, Yellowknife, NT. 24 pp.

EXCELeration corp. 2000. Benefits of outfitted hunting in the NWT Mackenzie Mountains. Final report prepared for the Association of Mackenzie Mountain Outfitters in co-operation with the town of Norman Wells and the Department of Resources, Wildlife & Economic Development. Calgary, AB. 45 pp.

Geist, V. 1971. Mountain sheep: a study in behaviour and evolution. University of Chicago Press, Chicago, IL. 383 pp.

Geist, V. 1993. Wild sheep country. NorthWord Press, Minocqua, WI. 173 pp.

Jorgenson, J. T. 1992. Seasonal changes in lamb:ewe ratios. Northern Wild Sheep and Goat Council 8: 219-226.

Latour, P. and N. MacLean. 1994. An analysis of data returned by outfitted hunters from the Mackenzie Mountains, NWT, 1979-1990. File Rep. No 110, Dept. of Renewable Resources, Norman Wells, NT. 41 pp.

MacLean, N. 1994*a*. Population size and composition of moose in the Tulita area, NWT, November 1993. Manuscript Rep. No. 78, Dept. of Renewable Resources, Yellowknife, NT. 18 pp.

MacLean, N. 1994*b*. Population size and composition of moose in the Fort Norman area, NWT, November 1993. Manuscript Rep. No. 80, Dept. of Renewable Resources, Yellowknife, NT. 17 pp.

Miller, S. J., Barichello, N, and D. Tait. 1982. The grizzly bears of the Mackenzie Mountains, Northwest Territories. N.W.T. Wildl. Serv. Compl. Rep. No. 3, Yellowknife, NT. 118 pp.

Nagy, J. and J. Carey. 1991. Dall sheep survey in the Richardson Mountains, 1991. Unpublished survey report manuscript, Dept. of Resources, Wildlife, and Economic Development, Inuvik, NT. 8 pp.

Nichols, L. and F. Bunnell. 1999. Natural history of thinhorn sheep. pp. 23-77 *in* R. Valdez and P. R. Krausman (eds.). Mountain sheep of North America. University of Arizona Press, Tucson, AZ. 353 pp.

Olsen, B. 2000. Fall distribution and population composition of woodland caribou in the central Mackenzie Mountains, October 2000. Manuscript Report No. 1 (draft), Sahtu Renewable Resources Board, Tulita, NT. 15 pp.

Olsen, B. 2001. Caribou studies in the Redstone River watershed: research proposal 2001. Unpublished research proposal submitted to Sahtu Renewable Resources Board, Tulita, NT. 5 pp.

Simmons, N. M. 1968. Big game in the Mackenzie Mountains, Northwest Territories. Proceedings of the Federal-Provincial Wildlife Conference. 32: 35-42.

Veitch, A. M. and R. A. Popko. 1996. 1995 Mackenzie Mountain non-resident hunter harvest summary. Manuscript Rep. No. 90, Dept. of Renewable Resources, Norman Wells, NT. 22 pp.

Veitch, A. M. and R. A. Popko. 1997. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1996. Manuscript Report No. 97, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 37 pp.

Veitch, A. M., Popko, R.A., and N. McDonald. 1996. Size, composition, and harvest of the Norman Wells area moose population, November 1995. Manuscript Rep. No. 93, Dept. of Renewable Resources, Norman Wells, NT. 32 pp.

Veitch, A. M. and E. N. Simmons. 1998. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1997. Manuscript Report No. 106, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 28 pp.

Veitch, A. M. and N. Simmons. 1999. Dall's sheep – Northwest Territories. pp. 54-58 *in* D. E. Toweill and V. Geist (eds.) Return of royalty: wild sheep of North America. Boone and Crockett Club and Foundation for North American Wild Sheep, Missoula, MT. 214 pp.

Veitch, A. M. 1999. Status of grizzly bears in the Mackenzie Mountains, NWT. Unpublished report, Department of Resources, Wildlife & Economic Development, Norman Wells, NT. 28 pp.

Veitch, A. and E. Simmons. 2000. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1999. Manuscript Report No. 121, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 29 pp.

Veitch, A. M., Simmons, E., Adamczewski, J., and R. Popko. 2000a. Status, harvest, and co-management of Dall's sheep in the Mackenzie Mountains, NWT. Northern Wild Sheep and Goat Council 11: 134-153.

Veitch, A., Simmons E., and N. Whiteman. 2000b. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1998. Manuscript Report No. 120, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 31 pp.

Veitch, A., R. Popko, and N. Whiteman. 2000c. Classification of woodland caribou in the central Mackenzie Mountains, Northwest Territories, August 1999. Dept. of Resources, Wildlife & Economic Development Manuscript Rep. No. 122, Norman Wells, NT. 13 pp.

Yukon Renewable Resources. 1996. Sheep management guidelines. Dept. of Renewable Resources, Yukon Territorial Government, Whitehorse, YT. 10 pp.

Appendix 1. Outfitters licenced to provide services to non-resident hunters in the Mackenzie Mountains, NWT - 2000

G/OT/01 – *ARCTIC RED RIVER OUTFITTERS*
Kelly and Heather Hougen
P.O. Box 5988
Whitehorse, YT Y1A 5L7
Ph: 867-633-4934
Fx: 867-633-4934

S/OT/01 – *GANA RIVER OUTFITTERS*
Bill and Carol McKenzie
P.O. Box 4659
Quesnel, BC V2J 3J8
Ph: 1-800-661-0702
Fx: 250-992-8639

S/OT/02 - *MACKENZIE MOUNTAIN OUTFITTERS*
Stan and Helen Stevens
P.O. Box 5
Tomslake, BC V0C 2L0
Ph: 250-786-5118
Fx: 250-786-5118

S/OT/03 – *RAM HEAD OUTFITTERS*
Stan and Debra Simpson
P.O. Box 89
Warburg, AB T0C 2T0
Ph: 403-848-7578
Fx: 403-848-7550

S/OT/04 - *NWT OUTFITTERS*
Eric Mikkelson
3018 Kensington Cres.
Courtenay, BC V9N 8Z8
Ph: 250-897-0057
Fx: 250-897-0054

S/OT/05 - *REDSTONE TROPHY HUNTS LTD.*
P.O. Box 621
Cochrane, AB T0L 0W0
Ph: 250-261-9992
Fx: 250-932-2624

D/OT/01 – *SOUTH NAHANNI OUTFITTERS*
Kevin Mattice
358 Golf Course Rd.
Huntsville, ON P1H 1N8
Ph: 705-789-5754
Fx: 705-789-9514

D/OT/02 – *NAHANNI BUTTE OUTFITTERS*
Cam, Clay, and Jim Lancaster
3 Athabaska Way
Lethbridge, AB T1K 7A6
Ph: 403-380-2789
Fx: 403-380-6126

Association of Mackenzie Mountain Outfitters
c/o Kelly Hougen, President
P.O. Box 5988
Whitehorse, YT Y1A 5L7
Ph: 867-633-4934
Fx: 867-633-4934

Appendix 2. Summary of fees, bag limits, and seasons for big game species available to non-resident and non-resident alien hunters in the Mackenzie Mountains, NWT – 2000. [Note: all prices are in Canadian funds.]

Species	Status	Tag Fee	Trophy Fee	Bag Limit	Season
Black Bear	Non-resident	$20.00	$100.00	1 adult bear not accompanied by a cub	15 Aug - 31 Oct
	Non-resident alien	$50.00	$100.00		
Woodland Caribou	Non-resident	$20.00	$200.00	1	25 Jul - 31 Oct
	Non-resident alien	$50.00	$200.00		
Mountain Goat	Non-resident	$20.00	$200.00	1	15 Jul - 31 Oct
	Non-resident alien	$50.00	$200.00		
Moose	Non-resident	$20.00	$200.00	1	1 Sep - 31 Oct
	Non-resident alien	$50.00	$200.00		
Dall's Sheep	Non-resident	$20.00	$200.00	1 adult male with min. ¾ curl	15 Jul - 31 Oct
	Non-resident alien	$50.00	$200.00		
Wolf	Non-resident	$20.00	$100.00	1	15 Aug - 31 May
	Non-resident alien	$50.00	$100.00		25 Jul - 10 Oct
Wolverine	Non-resident	$20.00	$100.00	1	15 Aug - 31 Oct
	Non-resident alien	$50.00	$100.00		25 July - 31 Oct

Source: Department of Resources, Wildlife & Economic Development. 2000. Northwest Territories Summary of Hunting Regulations. Department of Resources, Wildlife & Economic Development, Yellowknife, NT. 24 pp.

Appendix 3. Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2000.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean (cm)	Sample Size
1967-1968	223	8.4	Unknown	86.4	168
1969	110	-	-	-	-
1970	94	-	-	-	-
1971	88	-	-	-	-
1972	110	8.5	96	86.2	90
1973	89	8.9	86	84.4	88
1974	93	9.2	85	88.6	91
1975	129	7.6	67	84.6	127
1976	144	7.8	46	88.0	144
1977	132	5.7	69	86.8	132
1978	187	8.5	115	88.9	165
1979	200	8.7	108	90.7	154
1980	180	-	-	89.9	127
1981	187	8.1	101	93.7	157
1982	126	8.7	98	89.7	124
1983	100	9.0	80	90.9	94
1984	102	8.4	98	91.2	99
1985	123	8.1	115	89.7	112
1986	154	8.8	132	88.4	153
1987	148	8.9	148	89.4	148
1988	177	9.8	166	91.7	161
1989	207	9.9	199	90.4	203
1990	219	9.8	200	90.2	218
1991	170	9.7	161	89.1	170
1992	203	9.7	199	88.0	202

Appendix 3 (continued). Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2000.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean	Sample Size
1993	191	9.7	181	87.6	190
1994	199	9.5	191	89.8	196
1995	190	9.7	189	89.3	189
1996	201	9.5	200	88.7	201
1997	210	10.0	206	89.9	203
1998	215	10.0	207	90.0	209
1999	204	10.2	183	88.8	184
2000	189	10.0	189	89.5	189

Appendix 4. Outfitted non-resident hunter harvests in the Mackenzie Mountains, 1991-2000.

Year	Number of Licences Sold	Number of Animals Harvested					
		Dall's Sheep	Woodland Caribou	Moose	Mountain Goat	Wolf	Wolverine
1991	354	170	179	40	6	14	3
1992	364	203	142	32	4	7	0
1993	382	191	191	56	9	7	3
1994	356	199	164	46	5	15	2
1995	344	190	180	49	6	14	1
1996	387	201	175	46	4	11	4
1997	352	210	168	44	2	17	1
1998	345	215	160	52	5	9	0
1999	321	204	117	36	1	11	3
2000	332	189	127	44	1	14	0
Mean 1991-2000	354	198	160	45	4	12	2

Appendix 5. Summary of age and sex ratios calculated from non-resident hunter observation reports in the Mackenzie Mountains, 1995-2000.

Year	Dall's Sheep		Woodland Caribou		Moose	
	Lambs: 100 Ewes	Rams: 100 Ewes	Calves: 100 Cows	Bulls: 100 Cows	Calves: 100 Cows	Bulls: 100 Cows
1995	67	82	36	34	30	95
1996	44	82	45	40	26	76
1997	57	55	36	21	30	107
1998	60	84	36	34	30	95
1999	58	90	43	25	20	100
2000	47	90	41	39	26	89
1995-2000 Mean	56	80	39	32	27	94

Appendix 6. Hunting and related organizations to which non-resident hunters in the Mackenzie Mountains in 2000 belong.

Organization	Number of hunters
Arizona Desert Bighorn Society	3
Australian Deer Association	3
BC Elk Foundation	1
BC Wildlife Federation	2
Boone and Crockett Club	18
Ducks Unlimited	4
Fish First	1
Foundation for North American Wild Sheep*	48
Fraternity of the Desert Bighorn	2
German Hunting Organisation	2
Grand Slam Club	19
Mule Deer Foundation (Nevada)	2
Mzuri Foundation	1
National Rifle Association	5
Nevada Bighorns Unlimited	7
Nevada Wildlife Record Book Committee	1
North American Hunting Club	2
NTA Life	1
Oregon Hunting Association	3
Pheasants Forever	1
Pheasants Unlimited	1
Pope and Young Club	4
Quail Unlimited	1
Rocky Mountain Elk Foundation	33
Safari Club International	22
Shikar Foundation (Int'l)	1
Texas Bighorn Society	5
Wild Sheep Society of BC	3
Wisconsin Bowhunters	1
WVTA	1

* Includes FNAWS Chapters: Utah, Idaho, Montana, Eastern, Minnesota, Wisconsin, Phoenix, Alaska, Alberta, Milwaukee, Washington, Oregon, Wyoming, Nevada, Reno

Appendix 7. Comments from non-resident hunters in the Mackenzie Mountains, NWT on voluntary Hunter Wildlife Observation Report forms, 2000.

- I saw a lot of wolf sign. The bears showed very little fear of humans. They are a problem.
- Great hunt – beautiful country.
- I think wolf is a problem.
- Missed 5 days of hunt due to bad weather. Had 4 grizzly bears come within 100 yards of tent after meat. Had to chase them off.
- Overall an outstanding hunt with an excellent guide and outfitting company. I would highly recommend both XX outfitters and the Northwest Territories to anyone.
- Hunting was great. Great outfitter/guide.
- We had a close encounter with a sow grizzly and two yearling cubs, as they came within 10 yards of our tent while we were sleeping.
- Snowed in for 2.5 days. Otherwise it was a great experience. Do not change a thing.
- Sow and 2 cub grizzlies came right into camp - showed no fear of humans - saw another grizzly very close to camp following others.
- Maybe more wolf control to increase sheep populations?
- Good sheep numbers. Good age dispersal. Excellent number of lambs.
- Excellent experience, please don't change anything. We were snowed in the tent for two days and two long nights. Thank you.
- I had a very enjoyable hunt and I can't wait to come and hunt here again. I also saw a lot of wolf sign on this trip.
- Wolf in camp and area. Sheep nervous.
- Viewed numerous piles of bear scat. Grizzly tracks.
- Snowed in 2.5 days.
- Had a wonderful time, beautiful country, top notch outfitters.
- Wolf problem evident.
- Grizzly bears seen by others of our party moving toward camp. A lot of grizzly sign seen.
- Everything went well. Weather was great. No problems.
- Ram was very old with some difficult time moving around.
- This hunt was the hardest, physically that I have ever been on, but the most beautiful scenery. I will definitely return to the great "Mackenzie Mountains." I harvested a 40" Dall sheep and a 61" moose.
- One of the greatest hunts I have ever been on.
- Second hunt with XX. Both hunts were excellent. Great outfitter, area, crew and guides. Only problem is there is no hunting quota for grizzlies.
- The outfitter, guides and operation with XX were all excellent. We had several serious encounters with grizzly bears. One that entered our camp and destroyed equipment and food and clothing and one on a hike back to camp with meat where a bear we watched lay in ambush for one of our packers. We had to wait and watch long before he would move off. A grizzly hunt might help give bears fear of man.
- Why is there no possibility to hunt grizzly bear in the NWT? As there is in the Yukon Territory.
- What an awesome place. Thanks for managing the resource for future generations. I hope to bring my 5-year-old son to hunt Dall Sheep, caribou and grizzly in 10 years!!! XX is an awesome outfitter that leaves no trace of man and obeys all the laws.

- Outstanding operation with excellent equipment, staff, and organization. Exhibits respect for animals and habitat.
- Lots of bear sign seen. Bears that were seen were a small distance away but there was signs of them around our camps at night and when we were not around. I think there is a over population of bears in that area!
- There is no doubt I will be back! Unfortunately I could only hunt 1 day and must return home for business. I hunted with XX and could have killed a ram (full curl) but elected not to take one.
- The hunting was great. I do feel that there are too many grizzly bears in area and need to be hunted. We had camp equipment, food and clothing destroyed by grizzly. It is only a matter of time before someone is killed by one of these bears.
- Excellent experience.
- Need to kill far more predators. Way too many bears and wolves – hunting moose herds and sheep.
- Lots of bears, very few moose calves and caribou calves. Bears need to be reduced for more survival.
- Hunted in foothills at xx lake. No large bull moose were seen. There are lots of marten and a family of otters at the lake. Very little sign of bears or wolves. The moose habitat seems to be the restricted to mainly the lake shores. The surrounding country is mainly tundra complete with scrub spruce and tamarack - very little willow.
- Good hunt, good outfitter.
- XX is a first class outfitter.
- Great country - great experience, hasn't changed in 20 years.
- Bears are unafraid of men and aggressive.
- Mackenzies are beautiful. XX 1st class outfitters.
- Excellent hunt - I have had the opportunity to hunt animals for more than 25 years and this was one of my best hunts. Good facilities, very professional and the best guide I have ever hunted with.
- Saw very few calf moose. What is happening to the calf crop?
- Good hospitality - great people, nice country - too much rain.
- Open a grizzly season on a draw basis to non-residents! Far too many grizzlies. Even if you gave 2 permits to each outfitter it would educate these bears.
- Great hunt.
- We saw 21 mountain caribou - I harvested 1 bull.
- Had a great time.
- I thought I would see more rams $\geq$ ¾ curl.
- Tough hunt! Lots of walking, shot the best ram we saw.
- Excellent hunt - great camp, wonderful people.
- Lots of grizzly bears and sign very few caribou and moose calves. Reduce the bears by hunting.
- My first big game hunt couldn't have been better!
- Great outfitter, great hunt! XX really works hard for their clients. I will be back.
- Excellent outfitter and number of animals.
- Outstanding number of sheep, as we only hunting 2 days for sheep.

- Enjoyed every minute of my stay and plan to return in the future. I would appreciate a copy of your survey results when they are completed. Thank you.
- Thought it would have been good to have wolf season open with all hunts. Was surprised not to have seen more lambs and ewes. Seen a lot of bear sign.
- Mackenzie Mountains are the most immense, remote, rugged, wild and beautiful mountains I've ever seen. An incredible wilderness experience I will always treasure.
- Wolf season should open same as earliest sheep date. Should see more lambs and ewes. Lots of grizzly sign.
- This experience at this facility is superb and well-maintained and excellent guide and wranglers.
- Bears were a major concern with many bears coming into camp. Very obvious problem due to their numbers and their behavior around hunters.
- Consider opening grizzly season. Hunters in our last camp saw a lot of grizzly bears. My guide and I were charged by a grizzly while on horseback hunt and grizzly was coming into main camp at night.
- Fantastic experience. One of the unique destinations in the world of hunting. Need to open grizzly hunting due to harassments of myself and my trophies.
- I hunted NWT in 1980 with XX. I observed a lot more sheep and caribou then. On this hunt we saw less game and more grizzly, and more wolf sign. Had trouble with one large grizzly in our camp daily.
- Excellent outfitter - only problem - lack of game. Lots of bear sign everywhere we walked. Also lots of wolf sign. Not as much as bear. I question the number of predators in area are part of the reason we saw so few caribou. This is my 5th trip to the NWT.
- I was hunting caribou. Most of the animals seen were 2 to 5 miles away. The animals I saw were up high in the snow. Good moose population.
- Great hunt wonderful country.
- My first time hunting with XX outfitters. Mr. XX, as you know, is the outfitter. The camp, and all the staff who work there are to be highly praised. Everybody, including XX always put in 100% effort to make all "us hunters happy."
- Lung worm lesions.
- Ram was in very poor condition, lungs were hard and tissues were grown together to rib cage. Nasal/sinus were full of clear mucus when skull was cut.
- Outfitter is the worst I 've hunted with ever.
- Bears have destroyed the camp and ruined the sheep hunt.
- Too many bears. Bears destroyed hunting camp.
- Grizzly bear took all of my caribou from the meat pole in camp.
- Too old to come back. Bears were in all of our camps and took two animals off the meat pole.
- Would be more sheep without the grizzly bears.
- The Mackenzie Mountains are the greatest mountains I have ever been in.
- Excellent hunt with XX. Very professional.
- We're tired of the bears.
- Had 2 encounters with grizzlies that caused us to prepare for a charge. Probably should be a season to thin the bear and possibly instill a little fear of man in the beast.

- A grizzly claimed my sheep before we could retrieve it.
- Fellow hunter had his sheep wrecked by a grizzly, able to save hide but not meat really. They are not afraid of anything.
- Caribou were not here yet.
- The grizzly bears seem overly aggressive.
- My hunting trip was excellent. The outfitter and all guides were very professional and good friends. The country was clean, trash free, great water, abundant game and great scenery
- Extensive camp damage and visible sign of grizzlies. Sheep (ewes) observations made at long distances. It appears that the number of larger, older rams is dwindling - I hope this changes - it is a beautiful area.
- Grizzly damaged camp and was very brazen on the trail. Showed no fear of humans and chased us off the trail 3 times. A real problem.
- There should be a season on grizzlies because we got ran off of two kills.
- Never will hunt [again] with XX. The bear took the caribou before we got the meat. XX don't care about the hunter. He take you on short horse rides sometime you see caribou and sometime you don't. I don't have experienced guide with each - just somebody to ride along.
- Grizzlies are getting to become less afraid of people, camps are always torn up and meat is getting stole and carcasses claimed more often. A lot more grizzly sign in the past 6 seasons.
- Should be allowed to hunt male grizzly. XX run a very professional and excellent operation. A great ambassador for the Northwest Territories!