MACKENZIE MOUNTAIN NON-RESIDENT AND NON-RESIDENT ALIEN HUNTER HARVEST SUMMARY 1999

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2000

Manuscript Report No. 121

ABSTRACT

Data on harvest of big game in the Mackenzie Mountains by non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded for the 1999 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, and Economic Development. The data recorded included: date(s) of harvest; tags held for each species; horn/antler measurements for Dall's sheep, woodland (mountain) caribou, moose, and mountain goats; age of Dall's sheep; location of kill sites; hunter effort; sex of mountain goats, wolves, wolverines, and black bears harvested; numbers of animals observed for each species (including grizzly bears); and a subjective rating of the overall hunting experience by each hunter.

Non-resident licences were bought by 321 hunters in 1999. Hunters from outside Canada (non-resident aliens) comprised 87% of all outfitted hunters in the Mackenzie Mountains and Canadians from outside the NWT, or NWT residents with less than 2 years residency (non-residents) comprised 13%. Of the 321 non-resident licence holders, 310 came to the N.W.T. and most spent at least some time hunting. *Outfitter Return on Client Hunter Success* forms were submitted for 297 (93%) non-resident licence holders in 1999. *Hunter Wildlife Observation Report* forms were voluntarily submitted by 163 non-resident hunters.

Tags to hunt Dall's sheep were purchased by 227 non-resident hunters and they harvested 204 rams. The average age of rams harvested was 10.2 $\pm$ 1.5 years. Hunters' observations gave estimates of 58 lambs and 90 rams per 100 ewes, respectively. Hunters reported seeing an average of 11.0 legal rams (horns at least ¾ curl) during their hunts. Tags to hunt woodland caribou were purchased by 181 non-resident hunters and they harvested 117 animals. Hunters' observations gave estimates of 43 caribou calves and 25 bulls per 100 cows, respectively. Non-resident hunters purchased 63 moose tags and harvested 36 bulls. We calculated estimates of 20 moose calves and 101 bulls per 100 cows, respectively, from hunters' reported observations. There was one mountain goat harvested by the 6 non-residents that purchased tags, 11 wolves by 89 tag-holders, and 3 wolverines were taken by 65 tag-holders. Two tags were purchased for black bears, but no animals were harvested.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The 140,000 km^2 (34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NWT) was opened for sport hunting in 1965 (Simmons 1968) and over the last three decades the Mackenzies have become known to big game hunters around the world for the high quality wilderness experience they offer (Veitch and Simmons 1999). In return, non-resident hunters in the Mackenzie Mountains contribute $1,800,000 annually to individuals, businesses, and governments in the NWT (Crapo 1997). The non-resident hunting industry in the Mackenzie Mountains also provides annual employment for 100 to 120 outfitters, guides, pilots, camp cooks, camp helpers, and horse wranglers (Kelly Hougen, Association of Mackenzie Mountain Outfitters, personal communication).

Eight outfitters are currently licenced to provide big game outfitting services within the Mackenzie Mountains, NWT (Figure 1; Appendix 2); however, no hunting is permitted within the boundaries of Nahanni National Park in the southern portion of the range. 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.

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;

2) *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

3) *non-resident alien* - non-Canadian citizens or landed immigrants.

All holders of big game hunting licences must be at least 16-years-old. 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.

The Department of Resources, Wildlife, and Economic Development (DRWED) in Norman Wells (Sahtu Region) annually monitors non-resident big game harvest in the Mackenzie Mountains. Seasons for each big game species vary slightly and the total non-resident hunting season lasts from 15 July to 31 October. There are currently no restrictions on the numbers of Dall's sheep, woodland caribou, mountain goats, moose, wolves, wolverine, and black bears that each outfitter can take within their zone.

Individual non-resident hunters are annually restricted to one each of the following big game species: 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).

Each year the DRWED, under provisions laid out in the Northwest Territories *Wildlife Act*, requires that outfitters submit an *Outfitter Return on Client Hunter Success* for each person that purchased a NWT non-resident big game hunting licence (Figure 2). These forms (known as *Outfitter Returns)* must be submitted whether or not a client actually hunted, and whether or not any game was harvested.

The *Outfitter Returns* annually monitor the activities of non-resident hunters in the Mackenzie Mountains and help ensure that the harvest of each species is within sustainable limits (Latour and MacLean 1994; Veitch and Popko 1996; Veitch and Popko 1997; Veitch and Simmons 1998; Veitch et al. 2000). In addition to the *Outfitter Returns*, we request all non-resident hunters to voluntarily provide reports of the wildlife they saw during their hunts. These data are recorded on a separate form, the *Hunter Wildlife Observation Report* (Figure 3).

This is the fifth consecutive year that a summary of the data collected by DRWED on non-resident hunters in the Mackenzie Mountains has been made. In the text of this document, data for 1995 is found in Veitch and Popko (1996), for 1996 in Veitch and Popko (1997), for 1997 in Veitch and Simmons (1998), and for 1998 in Veitch et al. 2000. We hope that the information is of interest and use to outfitters and their staff, communities, land claim settlement area wildlife co-management boards, hunters, people involved in promotion of tourism in the NWT, other biologists, and to anyone else with an interest in the Mackenzie Mountains.

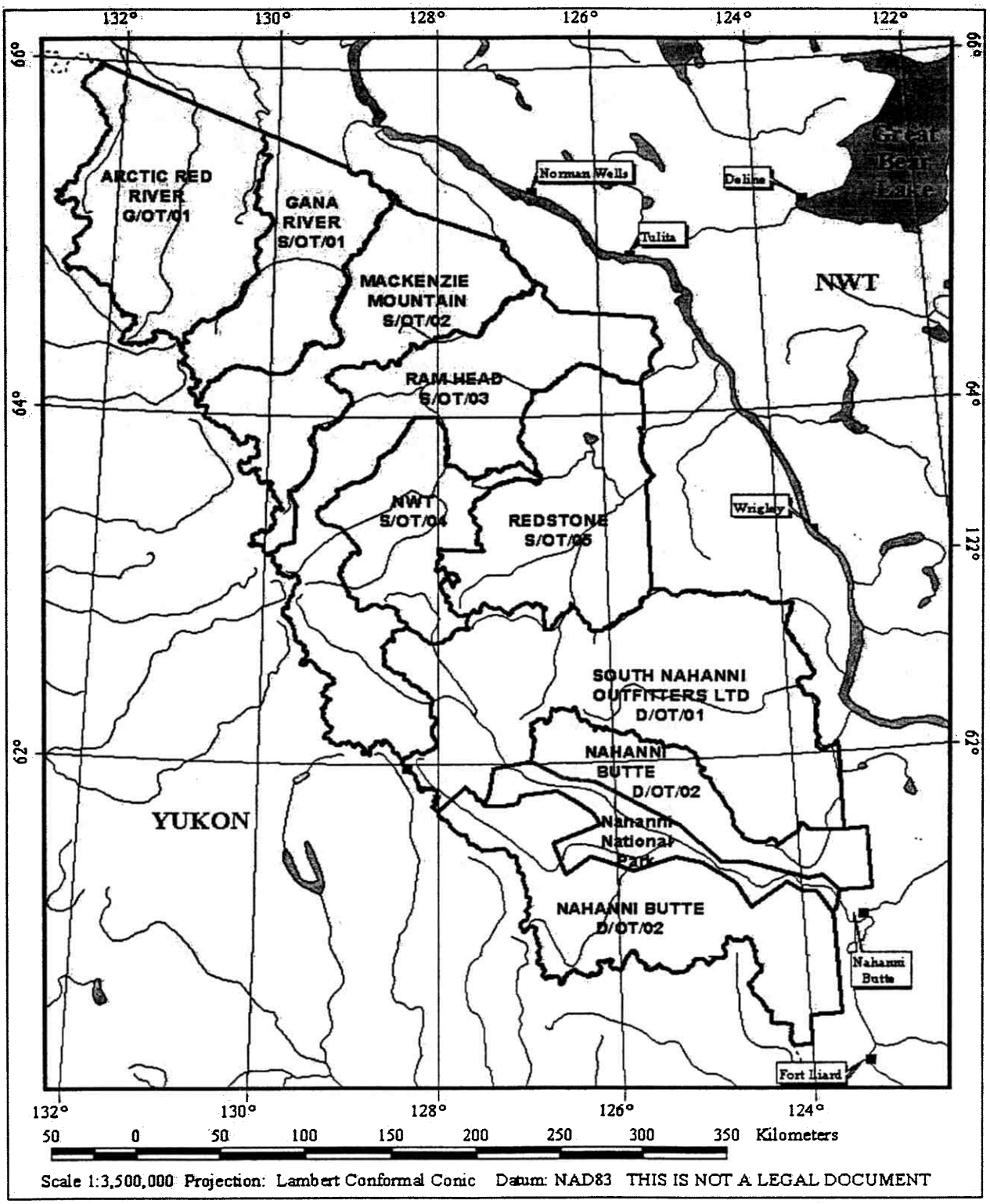


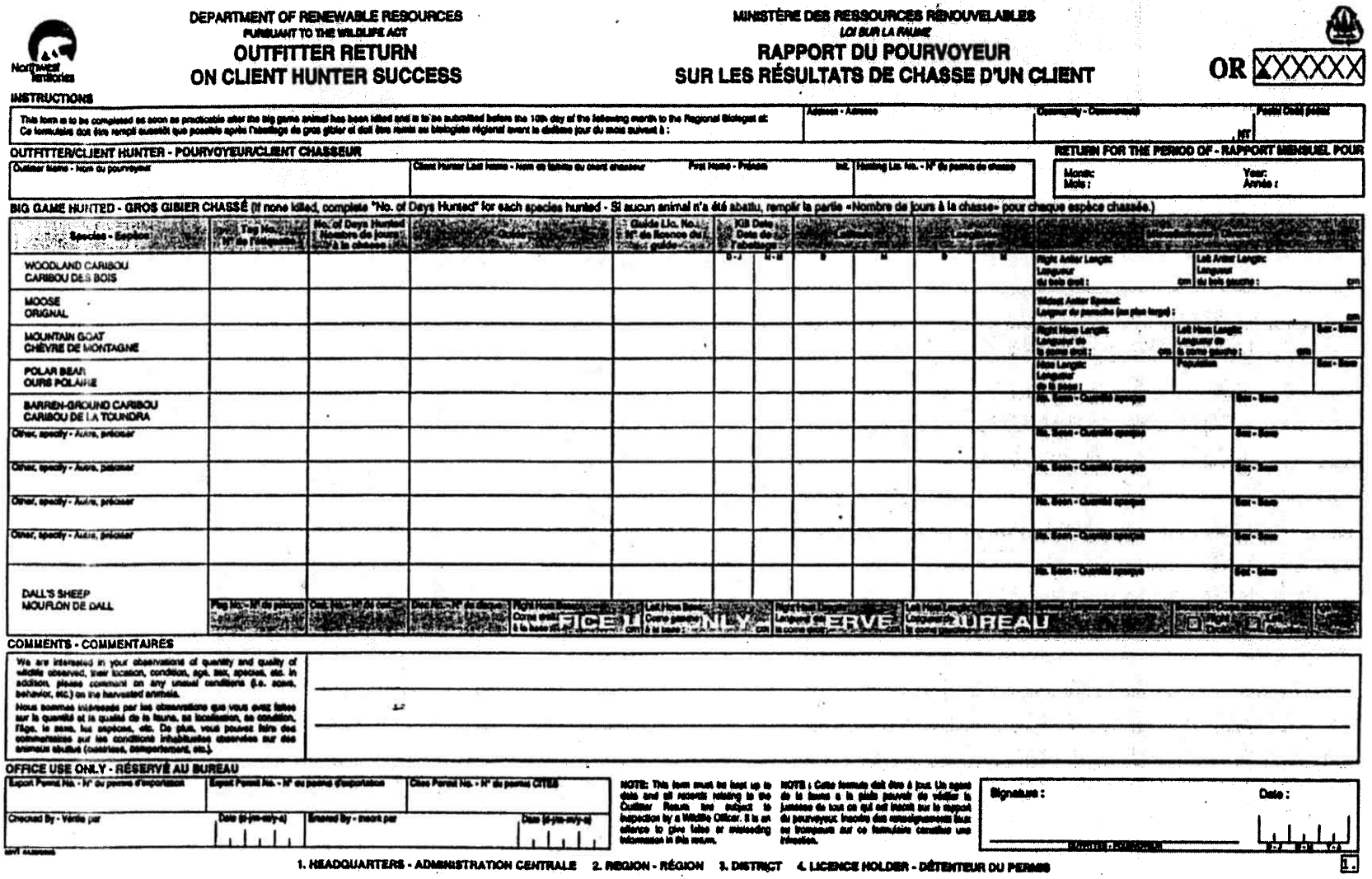
Figure 1. Outfitting zones in the Mackenzie Mountains, NWT – 1999.

METHODS

Prior to the start of the 1999 hunting season, each outfitter in the Mackenzie Mountains received sufficient copies of the *Outfitter Return* and *1999 Hunter Wildlife Observation Report* (*Observation Report*) 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, and the voluntary *Observation Reports*, 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 DRWED and the outfitters, persistent attempts were made to obtain *Outfitter Returns* for every non-resident that held a big game hunting licence through a Mackenzie Mountain outfitter in 1999.

Where an *Observation Report* form was received, we recorded wildlife observations directly from the form. When no *Observation Report* was received, but observation data were recorded on the *Outfitter Return*, we entered the data from the *Outfitter Return*.

Once received, data from the outfitter returns were cross-checked with the DRWED *Game Licencing* central database maintained in Yellowknife, 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 DRWED offices across the western NWT. After verification, all data were entered onto an *Excel 5.0* (Microsoft Corporation, Seattle, WA) spreadsheet for analyses.



DEPARTMENT OF RENEWABLE RESOURCES
PURSUANT TO THE WILDLIFE ACT
OUTFITTER RETURN
ON CLIENT HUNTER SUCCESS

MINISTÈRE DES RESSOURCES RENOUVELABLES
LOI SUR LA FAUNE
RAPPORT DU POURVOYEUR
SUR LES RÉSULTATS DE CHASSE D'UN CLIENT

OR XXXXXX

INSTRUCTIONS

This form is to be completed as soon as practicable after the big game animal has been killed and is to be submitted before the 10th day of the following month to the Regional Biologist at:
Ce formulaire doit être rempli aussitôt que possible après l'abattage de gros gibier et doit être remis au biologiste régional avant le dixième jour du mois suivant à :

Address - Adresse | Community - Communauté | Postal Code/ postal

NT

OUTFITTER/CLIENT HUNTER - POURVOYEUR/CLIENT CHASSEUR

Outfitter Name - Nom du pourvoyeur | Client Hunter Last Name - Nom de famille du client chasseur | First Name - Prénom | Init. | Hunting Lic. No. - N° de permis de chasse

RETURN FOR THE PERIOD OF - RAPPORT MENSUEL POUR

Month: Mois : | Year: Année :

BIG GAME HUNTED - GROS GIBIER CHASSÉ (If none killed, complete "No. of Days Hunted" for each species hunted - Si aucun animal n'a été abattu, remplir la partie «Nombre de jours à la chasse» pour chaque espèce chassée.)

Species - Espèce	Tag No. - N° de l'étiquette	No. of Days Hunted - Nombre de jours à la chasse	Outfitter	Guide Lic. No. - N° de licence du guide	Kill Date - Date de l'abattage D-J	Kill Date - Date de l'abattage M-M	Left - Gauche		Right - Droite		Measurements - Dimensions
WOODLAND CARIBOU CARIBOU DES BOIS											Right Antler Length: Longueur du bois droit : cm; Left Antler Length: Longueur du bois gauche : cm
MOOSE ORIGNAL											Widest Antler Spread: Largeur du panache (au plus large) : cm
MOUNTAIN GOAT CHÈVRE DE MONTAGNE											Right Horn Length: Longueur de la corne droit : cm; Left Horn Length: Longueur de la corne gauche : cm; Ear - Tête
POLAR BEAR OURS POLAIRE											Hide Length: Longueur de la peau : Population; Ear - Tête
BARREN-GROUND CARIBOU CARIBOU DE LA TOUNDRA											No. Seen - Quantité aperçue; Ear - Tête
Other, specify - Autre, préciser											No. Seen - Quantité aperçue; Ear - Tête
Other, specify - Autre, préciser											No. Seen - Quantité aperçue; Ear - Tête
Other, specify - Autre, préciser											No. Seen - Quantité aperçue; Ear - Tête
Other, specify - Autre, préciser											No. Seen - Quantité aperçue; Ear - Tête
DALL'S SHEEP MOUFLON DE DALL											No. Seen - Quantité aperçue; Ear - Tête
	Plug No. - N° de poinçon	Ont. No. - N° de l'ont.	Disc No. - N° du disque	Right Horn Sheath: Corne droite à la base	Left Horn Sheath: Corne gauche à la base		Right Horn Length: Longueur de la corne droite		Left Horn Length: Longueur de la corne gauche		Horn Curl: Courbure de la corne; Right - Droite; Left - Gauche

OFFICE USE ONLY - RÉSERVÉ AU BUREAU

COMMENTS - COMMENTAIRES

We are interested in your observations of quantity and quality of wildlife observed, their location, condition, age, sex, species, etc. In addition, please comment on any unusual conditions (i.e. scars, behavior, etc.) on the harvested animals.

Nous sommes intéressés par les observations que vous avez faites sur la quantité et la qualité de la faune, sa localisation, sa condition, l'âge, le sexe, les espèces, etc. De plus, vous pouvez faire des commentaires sur les conditions inhabituelles observées sur des animaux abattus (cicatrices, comportement, etc.).

Export Permit No. - N° du permis d'importation | Export Permit No. - N° du permis d'exportation | Cites Permit No. - N° du permis CITES

Checked by - Vérifié par | Date (d-j/m-m/y-a) | Entered by - Inscrit par | Date (d-j/m-m/y-a)

NOTE: This form must be kept up to date and all records relating to the Outfitter Return are subject to inspection by a Wildlife Officer. It is an offence to give false or misleading information in this return.

NOTE : Cette formule doit être à jour. Un agent de la faune a le droit pouvoir de vérifier la justesse de tout ce qui est inscrit sur le rapport du pourvoyeur. Inscrire des renseignements faux ou trompeurs sur ce formulaire constitue une infraction.

Signature : | Date :

1. HEADQUARTERS - ADMINISTRATION CENTRALE 2. REGION - RÉGION 3. DISTRICT 4. LICENCE HOLDER - DÉTENTEUR DU PERMIS

Figure 2. 1999 Mackenzie Mountain *Outfitter Report* form

MACKENZIE MOUNTAINS, N.W.T.

HUNTER OBSERVATION REPORT - 1999

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 _____ 1999 End Date of Hunt _____ 1999 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 1999? _____

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

Check each of the following areas in which you have previously hunted for Dall's sheep.

Alaska _____ Yukon _____ BC _____

Comments: (continue on reverse if necessary)

Figure 3. 1999 Mackenzie Mountain *Hunter Observation Report* form.

RESULTS and DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains, NWT were bought by 321 non-resident hunters in 1999. Of those, at least 310 (97%) came to the NWT and spent some time hunting; 11 either cancelled their hunts or decided not to hunt after arriving in the NWT. Licence sales in 1999 were down 7% from 1998. As in 1998, there was an overall decline in non-resident licence sales to Canadian citizens (i.e., non-residents) compared to previous years (Table 1). Thirteen percent of all licences sold in 1999 were to non-residents. Seventeen percent of all licences sold in both 1997 and 1998 were to non-residents, whereas from 1979 to 1990 the annual average was 22% (Latour and MacLean 1994); in 1996 non-resident sales accounted for 24% of all licences. The decline over the last three years is possibly a result of a sharp decrease in the value of the Canadian dollar versus its US counterpart after 1996, since outfitters charge clients in $US.

We received mandatory *Outfitter Returns* for 297 (96%) of non-resident hunters. Voluntary *Hunter Observation Reports* were received from 51% of the 310 hunters who spent some time hunting in the Mackenzie Mountains in 1999. On the *Hunter Wildlife Observation Report* each hunter was asked to rank his or her experience in the Mackenzie Mountains from poor to excellent (Figure 3; Table 2). Responses were received from 157 hunters (96% of hunters that submitted *Observation Reports*) and 93% expressed a high degree of satisfaction with their outfitter and their Mackenzie Mountain hunting experience (Table 2). It was the first time in the Mackenzie Mountains for 121 of 157 (77%) hunters that indicated the number of times they have hunted the region; the 34 repeat hunters (22%) had hunted from 2 to 10 times previously. Of the 123 hunters that answered our question about their plans to return to the Mackenzies to hunt in the future, 116 (94%) indicated they would like to return.

As in previous years, hunters expressed 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 appeared to be down from 1996-1998. All comments received are provided in Appendix 1.

Table 1. Province or country of origin for 321 non-resident hunters in the Mackenzie Mountains, 1999.

Canada		United States		Europe		Other	
NWT/Yukon	0	Eastern States[1]	150	Germany	2	Australia	1
British Columbia	18			Slovakia	1	Mexico	3
Alberta	17	Western States[2]	121			New Zealand	1
Saskatchewan	1					Unknown	1
Manitoba	1						
Ontario	2						
Quebec	1						
Atlantic Provinces	0						
Unknown	1						
Total	41		271		3		6

[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. Satisfaction ratings for non-resident hunters in the Mackenzie Mountains, 1999.

Ranking	Number of Responses	Percent of All Responses
Excellent	115	73.3
Very Good	31	19.7
Good	8	5.1
Fair	1	0.6
Poor	2	1.3

Dall's Sheep (*Ovis dalli dalli)*

Tags to hunt Dall's sheep were purchased by 71% (N = 227) of non-resident hunters. This compares to 71-72% in 1997 and 1998 and is up from 64-65% in the 1995 and 1996 seasons. At least 96% of sheep tag holders pursued Dall's sheep and they harvested 204 rams. The average length of a sheep hunt was 4.7 $\pm$ 3.1 days, similar to 4.4 $\pm$ 2.8 in 1998 and 4.3 $\pm$ 2.6 in 1997, but a slight decrease from 5.0 $\pm$ 3.0 days in 1996, 5.1 $\pm$ 2.9 days in 1995, and the 5.3-day average reported for the period 1979 to 1990 (Latour and MacLean 1994).

The non-resident sheep harvest comprises at least 90% of the total annual harvest of Dall's sheep in the Mackenzie Mountains and removes only 0.8 to 1.5% of the estimated 14,000 to 26,000 Dall's sheep in the Mackenzie Mountains (Veitch et al. *in press*). It appears the current harvest level is sustainable provided that hunting pressure is distributed evenly 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.

The average age of rams taken by non-residents in 1999 was 10.2 $\pm$ 1.5 years (range 6.5 to 13.5 years), which is the highest average since 1967-68 (Appendix 3). Ninety-seven (53%) of 183 aged rams were 10 or more years-old (Table 6). This is the second consecutive year in which the majority of animals taken were at least 10-yrs-old.

There has been remarkable consistency from 1979 to 1999 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 1999, brooming was noted on 28% (51 of 183) of left and 30% (55 of 183) of right horns.

Table 3. Horn measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1999.

	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	89.6	35.3	88.8	35.0	33.4	13.1	33.6	13.2	59.9	23.6
Standard deviation	8.8	3.5	11.2	4.4	1.9	0.7	1.9	0.7	10.6	4.2
Maximum	109.0	42.9	108.0	42.5	38.0	15.0	38.5	15.2	88.5	34.8
Minimum	37.0	14.6	9.0	3.5	28.0	11.0	29.0	11.4	39.0	15.4

Each year we ask hunters to report their observations of numbers and age/sex classes of sheep to assist in assessing population dynamics of Dall's sheep in the Mackenzie Mountains. From hunters' observations of 2197 lambs and 3781 ewes, we calculated an estimate of 58 lambs per 100 ewes, which is essentially unchanged from 60 per 100 reported in 1998 (Appendix 6). For the Richardson Mountains of the northern Yukon and NWT, Nagy and Carey (1991) suggest an August lamb: ewe ratio of 43 per 100 would allow 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 per 100). Veitch and Popko (1998) summarized ground-based classification and census data from four study areas in the north and northcentral Mackenzie Mountains (total area 1409 km^2); they estimated an average of 82 lambs per 100 ewes for mid-June surveys in 1998.

The ram to ewe ratio calculated from hunters' observations in 1999 was 90 per 100 - a slight increase from 84 per 100 in 1998 (Appendix 6). Veitch and Popko (1998) documented ram to ewe ratios from 60 to 76 rams per 100 ewes for their four study areas, with a cumulative ratio of 65 rams per 100 ewes. In the Yukon, 26 years of aerial surveys (1973-1998) to count and classify sheep have given an average of 48 rams per 100 'nursery sheep' (i.e., yearlings and

ewes combined), with a range of 28 to 74 rams per 100 nursery sheep (Jean Carey, unpublished data, Yukon Dept. of Renewable Resources). The Yukon's ratio in 1998 was 37 rams per 100 nursery sheep. In Alaska, ram to ewe ratios for two unhunted herds in Denali and Gates of the Arctic national parks typically average 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).

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 never equal, even in unhunted populations, 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.

Table 4. Dall's sheep observations reported by non-resident hunting licence holders in the Mackenzie Mountains, 1999.

	Number of hunters reporting	Number observed	Mean number observed	Percent of sheep classified
Rams	145	3386	23.4	36.2
Ewes[1]	148	3781	25.5	40.4
Lambs	144	2197	15.3	23.5

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

In 1999, hunters reported seeing a mean of 11.0 legally harvestable rams each (144 hunters reporting) and 47% of all rams observed by hunters were legal (Table 5). In 1998, hunters reported seeing a mean of 10.4 legally harvestable rams each (177 hunters reporting) and 49% of all rams observed were $\geq$ ¾ curl. In their four study areas, Veitch and Popko (1998) reported that 46% of rams classified were legally harvestable.

Table 5. Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1999.

Ram class	Number of hunters reporting	Number classified	Mean number observed/hunter	Percent of rams classified
Horns ≥ ¾ curl	144	1579	11.0	47.3
Horns < ¾ curl	138	1756	12.7	52.7

Table 6. Age-structure of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1995-1999.

	1999		1998		1997		1996		1995	
Age	No.	%	No.	%	No.	%	No.	%	No.	%
3	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0
4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5	0	0.5	1	0.5	0	0.0	1	0.5	1	0.5
6	1	7.1	4	2.0	1	0.5	5	2.5	4	2.1
7	13	12.6	9	4.3	12	5.8	21	10.5	16	8.5
8	23	26.8	39	18.8	39	18.8	47	23.5	49	25.9
9	49	25.7	45	21.7	52	25.1	56	28.0	51	27.0
10	47	15.8	63	30.4	58	28.0	36	18.0	34	18.0
11	29	8.2	30	14.5	24	11.6	26	13.0	14	7.4
12	15	3.3	12	5.8	15	7.2	6	3.0	14	7.4
13	6	0	2	1.0	4	1.9	1	0.5	5	2.6
14	0	0	1	0.5	2	1.0	0	0.0	1	0.5
15	0	0	1	0.5	0	0.0	0	0.0	0	0.0
>10-yrs	97		109		102		69		68	
%>10-yrs	53.0		52.6		49.5		34.5		36.0	
>12-yrs	21		16		21		7		20	
%>12-yrs	11.4		7.7		10.1		3.5		10.6	

Woodland Caribou (*Rangifer tarandus caribou)*

Tags to hunt woodland caribou were purchased by 56% (N = 181) of non-resident hunters. At least 75% of tag holders hunted caribou and they harvested 117 animals, down substantially from the 160 taken in 1998, 168 in 1997, and 172 in 1996. The average length of a woodland caribou hunt was 3.7 $\pm$ 3.5 days and ranged from 1 to 15 days.

Table 7. Antler measurements of woodland caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 1999.

	Contour length (cm)		Antler spread (cm) (tip to tip)
	Left antler	Right antler	
Number measured	76	76	2
Mean (average)	116.4	116.2	134.1
Standard deviation	10.4	10.6	22.5
Maximum	139.7	141.0	150.0
Minimum	74.0	75.0	118.1

The overall mean right antler length of caribou harvested by non-residents (Table 7) was up slightly from the 113.9 cm (44.8") recorded in 1998. The maximum length and spreads recorded in 1999 (141.0 (55.5") and 150 cm (59.1"), respectively) were also down from 142.5 cm (56.1") and 95.3 cm (37.5") in 1998.

Table 8. Woodland caribou observations reported by non-resident hunters in the Mackenzie Mountains, 1999.

Age/sex class	Number of hunters reporting	Number observed	Mean number observed/hunter	Percent of total classified
Bulls	133	2604	19.6	14.8
Cows	129	10,535	81.7	59.7
Calves	116	4500	38.8	25.5

From hunters' observations of 17 639 woodland caribou, we calculated ratios of 43 calves and 25 bulls per 100 cows. In 1998 there were 36 calves and 34 bulls per 100 cows. This compares to 36 calves and 21 bulls per 100 cows in 1997. Bulls comprised 20% of all caribou classified – up from a 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%. Therefore, the apparent continuation of poor bull: cow ratios in the Mackenzie Mountains needs to be more fully investigated and a proposal to initiate a study of woodland caribou in the central and northcentral Mackenzie Mountains (MacDonald and Veitch 1999) was approved by the Sahtu Renewable Resources Board in March 1999.

Moose (*Alces alces)*

Tags to hunt moose were purchased by 20% (N = 63) of non-resident hunters, which is similar to previous years. At least 70% of tag holders hunted moose and they harvested 36 bulls – down considerably from the 52 harvested in 1998 (Appendix 5). Moose hunts averaged 3.9 ± 3.1 days and ranged from 1 to 13 days.

The mean tip-to-tip spread of 26 measured antlers from bull moose harvested by non-residents was 144.2 ± 13.8 cm (56.7 ± 5.4") in 1999, up slightly from the 142.4 cm (56.1") recorded in 1998, and down from the 147.2 cm (58.0") recorded in 1997. The maximum recorded moose antler spread in 1999 was 166.0 cm (65.4").

Table 9. Moose observations reported by non-resident hunters in the Mackenzie Mountains, 1999.

Age/sex class	Number of hunters reporting	Number observed	Mean number observed/hunter	Percent of total classified
Bulls	104	128	1.2	45.7
Cows	102	127	1.2	45.4
Calves	92	25	0.3	8.9

From hunters' observations (Table 9) we calculated ratios of 20 calves and 101 bulls per 100 cows. This is the fifth consecutive year (Appendix 6) in which moose calf: cow ratios have been considerably lower than the 40 to 60 calves per 100 cows documented in early winter aerial surveys 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 biological surveys of moose have ever been done in the Mackenzie Mountains and we have no explanation for the apparent discrepancy in calf production/survival between the mountains and the river valley.

Mountain Goat (*Oreamnos americanus*)

Mountain goat tags were purchased by 2% (N = 6) of non-residents. At least 4 tag holders hunted mountain goats and they harvested one male. The harvested animal was from outfitting zone D/OT/01. Goat hunts ranged from 1 to 3 days and averaged 0.8 $\pm$ 1.5 days. Mountain goat observations were made in only zone D/OT/02 in 1999. No goats were observed in 1998. In previous years the only three zones that have had reports of mountain goats have been G/OT/01, G/OT/02, and S/OT/04.

The right and left horn lengths of the harvested goat in 1999 were 20.0 cm (7.9") and 19.5 cm (7.7"), respectively.

Carnivores

Wolf (Canis lupus)

Wolf tags were purchased by 28% (N = 89) of non-resident licence holders. At least 55% of tag holders hunted and they harvested 11 wolves. Wolf hunts averaged 5.7$\pm$ 4.8 days.

In comparison with 1996, 1997, and 1998, observations of wolves in 1999 were down considerably. One hundred and three non-resident hunters recorded whether or not they had seen wolves - of those, 41 (40%) observed at least one wolf and a total of 145 wolves was recorded. Wolves were reported from six zones - no wolves were reported from D/OT/O1 and

S/OT/03. In 1998, a total of 148 wolves was reported by 148 hunters, of whom, 57 (38%) saw at least one wolf. In 1997, a total of 203 wolves was reported by 141 hunters, of whom 77 (55%) saw at least one. However, even that was a reduction from 1996 when 82% of hunters saw at least one. As shown in Appendix 5, harvest of wolves in 1999 was up slightly from 1998.

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 20% (N = 65) of non-resident hunters. At least 58% of tag holders hunted wolverines and they harvested 3 animals. The average length of a wolverine hunt was 6.8 $\pm$ 4.4 days.

The ninety-eight hunters that reported their observations saw thirty wolverines; 21.4% of those hunters saw at least one wolverine. Wolverines were reported from zones D/OT/02, S/OT/02, S/OT/04, S/OT/05, and G/OT/01.

Black Bear (*Ursus americanus*) *and Grizzly Bear (U. arctos)*

Non-residents purchased two black bear tags for the Mackenzie Mountains in 1999, but no bears were harvested. Black bears are relatively rarely sighted in the Mackenzie Mountains and in most years are more commonly reported from the southern outfitting zones. In 1999, we received 11 sightings of black bears, down from the 15 that were reported in 1998. However, all 11 black bears seen by hunters and reported to us were from two zones - D/OT/01 in the south and S/OT/05 in the central Mackenzies.

The Mackenzie Mountains are not open to non-resident hunting of grizzly bears; however, as is clear from Appendix 1, grizzly bears compete with Dall's sheep and woodland caribou as the most discussed species of large mammals among our non-resident hunters and their guides. In 1999, 69.2% of those hunters that reported numbers of grizzly bears observed saw at least one bear (Table 10), which is up from the 59.3% in 1998, down from 75.8% in 1997, 97.7% in 1996, and 89.1% in 1995. The 277 grizzly bears reported in 1999 was down considerably from 411 in 1998, 376 in 1997, and 473 in 1996.

Again in 1999 we had a low cub to adult ratio from hunters' observations, with cubs comprising only 18.8% (Table 10). 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, the proportion of the Mackenzie Mountain grizzly population that are cubs is very low (cf. Nagy et al. 1983, 1983). Miller et al. (1982) found that Mackenzie Mountain grizzlies have a very low reproductive rate, with cubs not produced by any females less than 8-years-old, a mean litter size of 1.8, and an average inter-litter interval of 3.8 years. It is not known if the persistent low proportion of cubs observed by non-resident hunters is a result of this low reproductive rate, mortality of cubs as a result of predation by mature males (Bunnell and McCann 1993), or some combination of these two factors.

Table 10. Black bear and grizzly bear observations reported by non-resident hunters in the Mackenzie Mountains, 1999.

	Black bear		Grizzly bear	
	Cub	Adult	Cub	Adult
Total number seen	4	7	52	225
Number of hunters reporting	87	89	98	117
Number of hunters that saw at least one	2	6	28	81
Mean number seen	0.0	0.1	0.5	1.9
Standard deviation	0.3	0.3	0.9	2.2
Maximum number seen	2	2	4	12
Percent of the total number seen	36.4	63.6	18.8	81.2

ACKNOWLEDGMENTS

Co-operation from the outfitters operating in the Mackenzie Mountains in 1999 was again very good and we thank them for the extra effort they gave in completing, signing, and sending us their harvest report forms. We thank Renewable Resources Officers and clerks with DRWED in Norman Wells, Fort Simpson, and Fort Liard for collecting and organising data from non-resident hunters in their respective offices. Special thanks are extended to officers Jamie Chambers and Wayne McCowan in Norman Wells for their assistance in obtaining and extracting additional information from the outfitters and the DRWED hunting licence database.

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 (DRWED, Yellowknife) co-ordinated the final preparation of this manuscript. We appreciate both their efforts.

PERSONAL COMMUNICATIONS

Kelly Hougen, President, Association of Mackenzie Mountain Outfitters, Whitehorse, YT.

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Appendix 1. Comments from non-resident hunters in the Mackenzie Mountains, NWT on voluntary *Hunter Wildlife Observation Report* forms, 1999.

Can't believe the NWT has a barren ground griz hunt and none for the mountain grizzly.
Sign of grizzly.
Great country; beautiful scenery; terrible weather; super outfitter!
Bear was unafraid of people. Seen wolf sign as well.
Lots of tracks and 1 bear in camp.
We had a grizzly come into camp and had to chase it off.
Grizzly bear sign were around us in my hunt area. However, we didn't see any bears. Although another camp had a young bear charge into camp twice. Had a very good experience XX outfitters did a great job. Well maintained.
This was the best of seven sheep hunts I have been on - great guides, beautiful area.
I would like to return and hunt in future.
Hunting was with archery tackle.
Wolverine took all meat – this is a well run outfitter providing a good hunt and mountain experience for their clients. All parts of our trip through NWT has been pleasant and we were welcomed by the people.
Seen a lot of grizzly bear sign. Through out the hunt. Sign in every drainage.
No comment.
Great hunt lots of fun!
Saw quite a few bears, never had a problem though.
Excellent outfitter.
Grizzly raided camp - could have been serious problem.
The Mackenzie mountains are rugged and beautiful. They are game rich and just awesome. My outfitters all first class in every way. I do believe you are not too far away from serious grizzly problems. They are more aggressive than in any other parts of Canada, including BC.
I had an excellent time. XX is a high quality organization with excellent guides and staff. Seen lots of bear sign in most drainages.
Need to establish a grizzly season.
My dad hurt his back the first day of the hunt. He had to be helicoptered out, so I went with him. I wish we could have stayed longer. Excellent job XX!
I injured my back one day before the hunt, had to be helicoptered to Norman Wells. Excellent help by the guides and outfitters.
Thank you.
Great Outfitter.
The lack of grizzly hunting has taken any fear of man from them. I feel that there would be less bear-guide-hunters encounters if a season was initiated. Thanks.
Need a grizzly season. Problem with bears. Great guide. Food drop was excellent. Good food for backpack hunt. Camp was kept immaculate!
As a biologist for Utah Div. Of Wildlife Resources in charge of making black bear hunt recommendations – it appears that grizzly bear densities and sex and age structure of the population indicates that some sort of harvest would not affect grizzly populations. In 9 days of hunting covering a very small portion of X Creek drainage, 3 single adults (assumed males), one female with yearling, and one female with 3 cubs (this year) was observed. Encounters with the female and yearling resulted in warning shots fired to frighten away. The end result was the bears eating the sheep meat from a harvested ram. One other incident involving a warning shot occurred when we accidentally walked in on a bear on a caribou kill, which bluff charged to within 5 feet of two of the hunting party. These bears along with an enormous amount of bear sign was observed between X Pass (below the confluence with X Creek and Y Creek) and the drainage coming out of the lakes on X Mountain.
This was an exceptional hunt for me. My first guided hunt and one that makes me want to come back

for more. The territory is beautiful and game plentiful. The outfitter has a first rate operation and top notch people.
Fantastic hunt! XX was a great guide and this is some of the most beautiful country I've seen. Plenty of wildlife. I never could've gotten a chance to see. Especially the bears, although that was a little closer than I would've like to see them. Base camp is great. Everyone is very friendly and the food is first class.
Great hunt with great outfitter and guide
Had an excellent hunt, saw lots of sheep. My guide and his famous pack dog XX were the best. My ram had lumpy jaw and was blind – 12.5 years old. The sheep herds look very healthy.
This is by far the best area for Dall's sheep. Saw lots of bear sign, but no wolves. Very few berries this season. Real healthy sheep population.
Great time had by all.
The Mackenzies were a great experience for sheep and caribou. There are tremendous numbers of grizzlies in the area. We had numbers of encounters.
I had a excellent time the XXX outfitters were very good to me I will be coming back
Beautiful country great outfitter.
Great hunt. Non-residents should be allowed to hunt grizzlies. Lots of bears - lots of bear sign.
Good hunt hood outfitter. Good guide.
XX does NWT proud - great hunt and great family atmosphere - Thanks to everyone.
Great time - a well managed herd.
I can't believe there isn't a grizzly season. The sign and sightings by myself and others shows there is a very healthy population. Hunting grizzlies will give the outfitters more income and perhaps the bears won't be as aggressive. They seem to have no fear of man. XX is an excellent outfit in all aspects and I am looking forward to returning to the Mackenzie Mountains.
Excellent hunt - XX whole organization is great. Well managed.
Great place, keep anti-hunters in place.
Well run operation. Good guides. Good horses. Would book with XX again.
Excellent hunt. I do recommend XX outfitters, one word to describe this trip. Just great. PS the scenery is breath taking, wonderful.
Excellent hunting, beautiful scenery
Outstanding hunt with a great outfitter and guide. A first class experience.
Outstanding hunt with a great outfitter and guide. A first class experience.
Beautiful country - excellent outfitter and a great adventure.
XX outfitters ran a class, professional operation. All equipment, food, and facilities top quality. Guides more knowledgeable than any other outfitter experience. Impressed by the distribution and quality of game seen and outfitter appears to have a sound game management program.
Was surprised to have snow in July! Beautiful country, lots of sheep in hunting area.
Need to have a grizzly bear season.
Saw lots of grizzly sign; no bears - but rubs and scrapes were abundant.
We had a great hunt, we saw lots of game and probably would have seen lots more if we hadn't harvested our sheep on the evening of opening day. Overall it was a great experience in a beautiful setting.
Beautiful country, had great time. I will be back.
Excellent hunting experience, plentiful game, awesome country; will be back in September 2001 for moose and caribou.
Great hunt, tough country, great guide (X) and great outfitter (XX). One of my best hunting experiences ever.
My guide and outfitter were very professional, well organized and productive. The area was rich with game and beautiful. All the people were extremely helpful everywhere and it was the hunt of a lifetime. Would highly recommend it.
The outfitter and the area were excellent. Game was plentiful. The scenery was absolutely beautiful. Difficult hunt with over 6 days of rain.

Got 1 bull moose and 1 bull caribou. Officers in Norman Wells very polite. Prettiest place I've ever been.
Great time and hunt. XX runs a great camp and works hard for his clients
One of my most wonderful experiences. I will definitely encourage my hunting friends to consider the Mackenzie Mountains.
I came from east in the states and loved it here. Great hunting, great guides. Beautiful country. I would definitely come back soon. Thank you for having us.
Lots of large rams. Great area. XX outfitters is first class.
I love this place.
Excellent area with good ram:ewe ratio and good age ratios among rams.
Very good hunt, excellent guides, thanks for the opportunity. You should consider a non-resident grizzly hunt.
I saw well over 100 Dall's sheep during my hunt. The unaccounted numbers were yearling and 2 year olds.
Outstanding experience. Number of grizzly bear were a concern to me . One bear broke into our spike camp 3 times, ruined back side of tent.
Excellent guides, good stock, good camp. I would hunt with these folks again.
Excellent cooperation and hospitality at Mile 222 resource office. Very good weather and a pleasant experience.
Very poor year for caribou calves.
Excellent accommodations and service from knowledgeable personnel at XX outfitters. Very enjoyable experience – recommend hunting grizzly in this area since we had them all around camp. Thank you for your management.
Please open grizzly bear season for more complete hunts.
Game was very hard if not impossible to find, very disappointed in late starts in morning - 10:30 till 11:00 before we got out of camp.
Great people, great hunt, spectacular country. I'll be back soon.
The friendliness and overall support of the Fish and Wildlife Officer at Mile 222 was overwhelming! Many thanks - any office would be proud of personnel like this.
Beautiful country and a wonderful place to hunt.
Would like to see some bears taken each season.
We kill a grizzly bear in the camp.
Open the grizzly season, they are a problem (not afraid).
Archery hunted and didn't get a caribou. No shots.
Good people to go hunting - patient, knowledgeable accommodating to older hunters. Lots of game for future generations if present management continues.
Feel like, as many bear sign we observed throughout the hunt, this area definitely justifies a grizzly bear season.
Too many bears in area I hunted. Need to do something with this.
Between my guide and I plus the rest of the party we saw several bear (grizzly) including being charged by one bear. Obvious that the grizzlies have no fear of humans or their camps.
We had two bad bears around camps.
Nothing to add to an excellent experience.
Lot of bear sign. Many caribou. The country was very clean.
Saw a lot of bear sign in several different areas.
Area is overpopulated with the grizzlies. I believe the odd license should be given.
Awesome territories - excellent abundance of animals - outfitter outstanding with great appreciation for the land and game. I will be back.
Hot water in camps for showers
We saw seven bears and several were close.
Beautiful area – well maintained - great people - very helpful. Thank you.
Not the quality or numbers of caribou bulls as expected.

Grizzly bears are a big problem. My hunter and I got charged by one for no reason at all. I hope the season will be opened before someone gets hurt bad.
Overall great time. Game numbers low compared to what was anticipated and described from the guide.
Rams much smaller than expected.
The outfitter and guides were very professional and a joy to be with.
We had many camp troubles through the summer. Four of these bears were in camp.

Appendix 2. Outfitters licenced to provide services to non-resident hunters in the Mackenzie Mountains, NWT - 1999

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

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

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

S/OT/05 - *REDSTONE TROPHY HUNTS*
David and Carol Dutchik
P.O. Box 621
Cochrane, AB
T0L 0W0
Ph: 403-932-2624
Fx: 403-932-2624

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

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

Appendix 3. Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1965-1999.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean (cm)	Sample Size
1967-1968	168	8.4	Unknown	86.4	168
1979	200	-	-	90.7	159
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
1993	191	9.7	181	87.6	190
1994	195	9.5	191	88.6	196
1995	190	9.7	189	89.3	189
1996	201	9.5	200	88.8	201
1997	207	10.0	207	89.9	200
1998	215	10.0	207	90.0	209
1999	204	10.2	183	88.8	184

Appendix 4. Horn and antler measurements for 1995 to 1999 for ungulates harvested by non-resident hunters in the Mackenzie Mountains. (All measurements are in centimetres unless otherwise shown and the sample size is given in brackets).

Measurement	1995	1996	1997	1998	1999
Dall's sheep right horn length	89.3 (189)	88.7 (201)	90.3 (203)	90.0 (209)	88.8 (184)
Dall's sheep horn annuli age (yr)	9.7 (189)	9.5 (200)	10.0 (203)	10.0 (207)	10.2 (183)
Woodland caribou right antler length	116.5 (171)	116.3 (128)	116.2 (131)	113.9 (106)	116.2 (77)
Moose antler spread	143.7 (47)	142.4 (29)	147.2 (33)	142.4 (36)	144.2 (26)
Mountain goat right horn length	21.4 (5)	17.5 (2)	21.8 (2)	18.2 (5)	19.5 (1)

Appendix 5. Outfitted non-resident hunter harvests in the Mackenzie Mountains, 1991-1999.

Year	Number of licences sold	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
Mean 1991-99	356	198	164	46	5	12	2

Appendix 6. Summary of age and sex ratios calculated from non-resident hunter observation reports in the Mackenzie Mountains, 1995-1999.

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	101