MACKENZIE MOUNTAIN NON-RESIDENT AND NON-RESIDENT ALIEN HUNTER HARVEST SUMMARY 2009

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ABSTRACT

Each of the eight licensed outfitters and Renewable Resource Officers with the Sahtu and Dehcho Environment and Natural Resources (ENR) Regional offices, collected data on big game harvested in the Mackenzie Mountains during the 2009 hunting season. Harvest data and observations of wildlife from non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded. For 2009, 339 hunters bought non-resident licences. This is lower than the average 360 (range 321-407) sold to non-resident hunters from 1991-2009. Hunters (n=253) from outside Canada (non-resident aliens) were primarily from the USA (n=210) and comprised 62% of the outfitted hunters; 16, 6, and 5 of the 35 European hunters were from Germany, Spain, and Austria respectively. There were 79 (23%) Canadian hunters, whose residency was from outside the Northwest Territories (NT). Of the 339 non-resident licence holders, 304 came to the NT and most spent at least some time hunting. Only 215 tags were purchased for Dall's sheep, the lowest number in the past 15 years; 179 rams were harvested (including six by resident hunters). The average annual harvest of rams is 198 over the past 19 years. The mean (±SD) age of harvested rams was 10.9 ± 1.9 years; the 22nd consecutive year the average age of harvested rams from the Mackenzie Mountains has been 9.5 years or older. This is the highest average age of harvested rams recorded in the Mackenzie Mountains since records have been kept (1967). Hunters reported seeing an average of 7.5 legal rams (horns at least ¾ curl) per hunt and observed an estimated 54.7 lambs and 94.4 rams per 100 ewes, respectively. This year the lamb:ewe ratio equals the average reported since 1995. Of 252 tags purchased for mountain woodland caribou, 125 bull caribou were harvested. Only once in the past 19 years have fewer caribou been harvested. Hunters observed

an estimated 45.3 caribou calves, and 39.4 bulls per 100 adult female caribou, respectively. Of the 96 tags purchased for moose, 59 bull moose were harvested, somewhat higher than the average of 52 (range 32-75) from the past 19 years. Hunters observed an estimated 30.9 moose calves, and 89.7 bulls per 100 adult female moose, respectively. The number of calves per 100 adult females is higher than the mean 29:100 recorded since 1995 and the ninth time in the past 15 years when the ratio has been $\geq$30:100. Of the 45 tags purchased for mountain goat 20 goats were harvested, 18 billies and 2 nannies. This is the second highest harvest of mountain goats since we started records in 1991 and may be related to greater accessibility to the more rugged and remote parts of the various outfitter ranges where goats are resident. The mean age, determined by horn annuli of 16 harvetsed goats, was 7.7 years (range 2.5-13.5 years). One goat was >13 years old. Hunters observed an estimated 64.6 goat kids and 59.0 billies per 100 adult nannies. Twenty wolves were harvested from 252 tags purchased including 2 harvested during a hunt in March 2010, a time outside of the normal hunting season in the mountains. During 1991-2009 mean annual wolf harvest was 14 (range 7-23). Three wolverines were harvested from 133 tags purchased. The majority of the 20 wolverines observed by hunters were solitary individuals. The number of observed wolverines in 2009 is similar to the 20-35 observed during 1995-1999 and 2004-2006. One male black bear was harvested from 22 tags purchased; this is only the second year black bears have been harvested in the Mackenzie Mountains. There has been no grizzly bear hunting season for non-residents since 1982, however a resident hunter guided by an outfitter did harvest a grizzly bear this year. This resident hunter also harvested 1 mountain caribou and 1 moose. Hunter satisfaction remains high; 98% of respondents (n=191) rated their experience as either excellent (86%) or very good (12%). A number of hunters made specific comments about the

high quality hunting experience, the abundance of wildlife in the Mackenzie Mountains (both game and predators), and the impressive management and stewardship of the land; 21% were repeat clients returning for their 2nd to 11th hunt in the Mackenzie Mountains, and 87% indicated they would like to return in future years. Disappointingly we received only 62% of the Voluntary Hunter Observation Forms, returning to pre-2004 levels. ENR worked with AMMO to provide a better reporting system of wild game meat distribution prior to the 2009 hunting season. By providing supplemental summary forms to all outfitters in addition to meat record forms we got information on wild game meat distribution from 6 of the 8 outfitters. Based upon the new reporting system we estimate that at least 11 140 kg (24 508 pounds) of wild game meat, mostly moose and mountain caribou, was reported distributed locally in 2009. Replacement cost of meat from local northern retailers is estimated conservatively at about $222,800, using $20/kg average replacement cost. There was a sale of one of the outfitting zones in 2009. The boundaries of Nahanni National Park Reserve were substantially expanded in 2009. The new boundary overlaps outfitting zones Ramhead, South Nahanni, and Nahanni Butte by 4.7%, 27.2% and 79.4% of the total area respectively. Until negotiations between these outfitters and Parks Canada are completed ENR will continue to issue licenses, tags, and export permits for harvesting by these 3 outfitters in their zones.

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INTRODUCTION

General Background

The 140 000 km^2 (54 000 mi^2; 34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NT) was first opened to non-subsistence hunters in 1965 (Simmons, 1968). Since then, the Mackenzie's 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 certainly provide in excess of the $2.5 million estimated annually, to individuals, businesses, and governments in the NT (Harold Grinde, personal communication). 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, personal communication). Additionally, fresh meat from many harvested animals is provided to a number of local communities including Tulita, Fort Good Hope, and Norman Wells in the Sahtu and Wrigley, Nahanni Butte, Fort Liard and Fort Simpson in the Dehcho. This meat is distributed among local elders and residents and to health/long term care facilities. Estimated annual replacement value of this meat has ranged from *ca.* $60,000 - $200,000.

Eight outfitters are currently licenced by the Government of the Northwest Territories (GNWT) to provide big game outfitting services within the Mackenzie Mountains (Fig. 1; Appendix A). No hunting is permitted within the original boundaries of Nahanni National Park Reserve (Figs. 1 and 2), except for subsistence harvest by NT General Hunting Licence holders. Under the terms of the NT *Wildlife Act*, each licensed

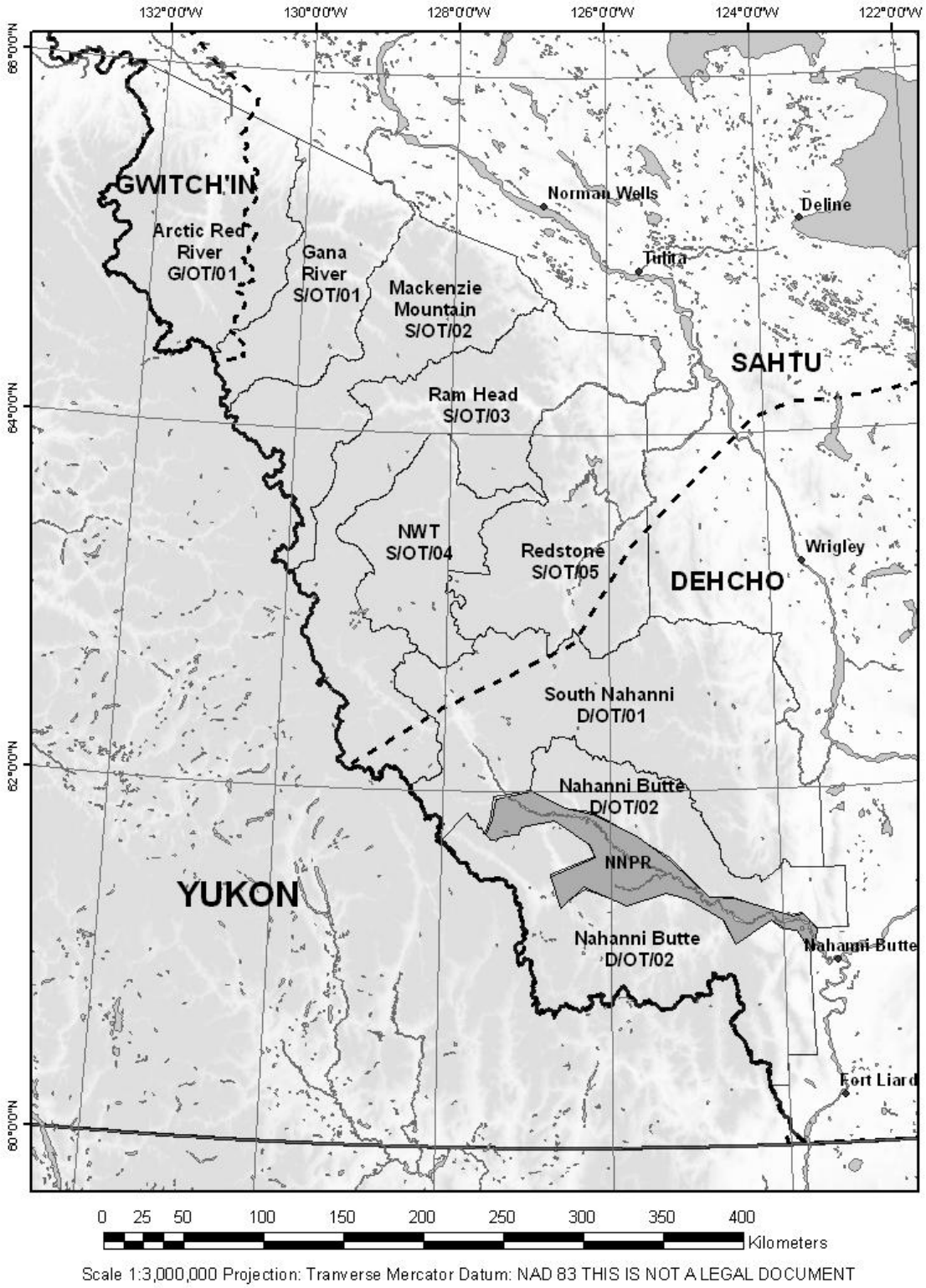

Figure 1. Outfitting zones and land claim areas (dotted lines) of the Mackenzie Mountains, Northwest Territories, with Nahanni National Park Reserve (NNPR) original boundary indicated.

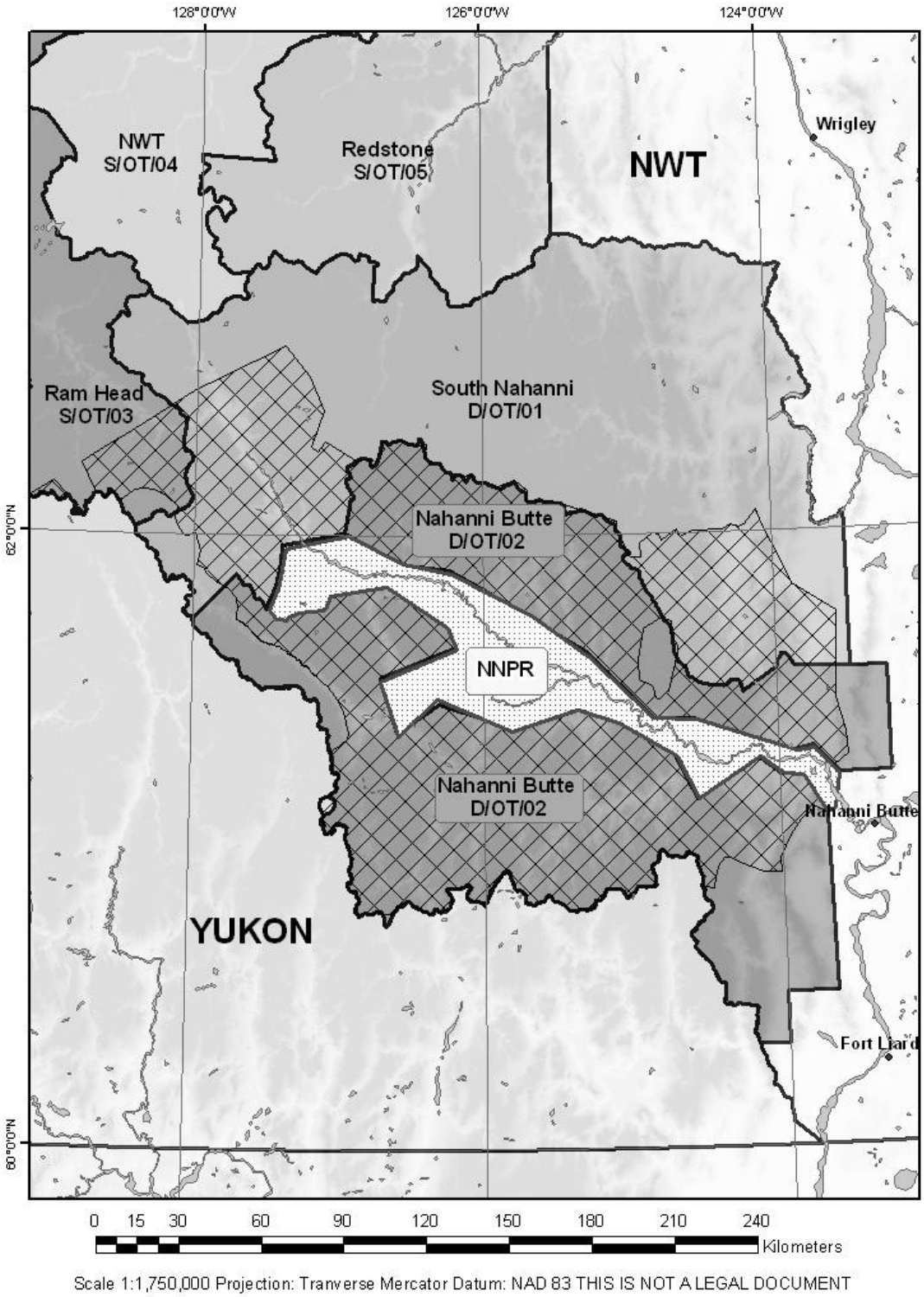

Figure 2. The original boundary of Nahanni National Park Reserve (NNPR), in white, and the newly expanded boundary, checkered polygon.

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 NT runs from 01 July to 30 June and those who desire to hunt big game within the NT must annually obtain a big game hunting licence and must be at least 16 years old (Department of Environment and Natural Resources, 2009). There are four classes of licenced big game hunters in the NT:

1) *General* - subsistence harvesters, primarily aboriginal people.
2) *Resident* - Canadian citizens or landed immigrants who have been living in the NT for at least two consecutive years prior to application for the licence.
3) *Non-resident* - Canadian citizens or landed immigrants who live outside the NT, or have not resided in the NT for a full two years prior to application for the licence.
4) *Non-resident Alien* - an individual who is neither a NT resident nor a non-resident.

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 big game. 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 data from 6 resident hunters, who harvested Dall's sheep in the Mackenzie Mountains without a guide, have been included in the number of sheep harvested and the age and horn length measurements in this report as indicated.

Individual non-resident hunters are annually restricted to one each of the following big game species (Appendix B): Dall's sheep (male with at least ¾ curl horns),

mountain woodland caribou (either sex), moose (either sex), mountain goat (either sex), wolf (either sex)[1], wolverine (either sex), and black bear (adult not accompanied cub(s)). Although non-resident hunters are allowed to hunt female moose and caribou they prefer to hunt males for their trophy antlers. 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 (4766 km^2 original boundary) 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 Resource Board (SRRB) and the Gwich'in Renewable Resource Board (GRRB), respectively. Approximately 68 000 km^2 of the central and northern Mackenzie Mountains are within the Sahtu Settlement Area and 8300 km^2 are within the Gwich'in Settlement Area, which encompasses the extreme north end of the range (see Fig. 1). However, the GNWT maintains ultimate jurisdiction for management of wildlife and wildlife habitat within each of the claim areas. The Department of Environment and Natural Resources (ENR) of the GNWT is responsible for licencing outfitters, guides, and hunters and for annually monitoring non-resident big game harvest in the

[1] In the Sahtu Region non-resident alien hunters are allowed to hunt 2 wolves from 1 August – 15 April.

Mackenzie Mountains. Under the terms of the *Dehcho First Nations Interim Measures Agreement* (signed in 2001), and its recent extended agreement period, ENR has primary responsibility for wildlife management within the Dehcho region (approximately 59 000 km^2) of the southern half of the Mackenzie Mountains (see Fig. 1).

Each year ENR, under provisions in the GNWT's *Wildlife Business Regulations*, requires outfitters to submit an Outfitter Return on Client Hunter Success form for each person that purchased a NT non-resident big game hunting licence (Fig. 3). 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 ENR to ensure that the harvest of each species is within sustainable limits.

In 1995, the then Department of Resources Wildlife and Economic Development, requested that all non-resident hunters also fill out a voluntarily questionnaire. The questionnaire has evolved through the years based upon suggestions from outfitters, their clients, and government staff. Different questions pertaining to wildlife observations, the quality of the hunting experience, the quality of services related to hunter travel, and specific topics for hunter comment have come and gone. However, one key component of the questionnaire that has remained constant pertains to reporting the different types and numbers of wildlife species seen during their hunts. These data have been recorded and the questionnaire forms have been and will be referred to as hunter observation forms in this report (Fig. 4).

This is the fifteenth consecutive year that a summary of the data collected by ENR on non-resident hunters in the Mackenzie Mountains has been made. In the text of

Department of Environment and Natural Resources
Pursuant to the *WILDLIFE ACT*

Ministère de l'Environnement et des Ressources naturelles
En vertu de la *LOI SUR LA FAUNE*

Northwest Territories / Territoires du Nord-Ouest

OUTFITTER RETURN ON CLIENT HUNTER SUCCESS

RAPPORT DU POURVOYEUR SUR LES RÉSULTATS DE CHASSE D'UN CLIENT

OR017556

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.
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.

OUTFITTER/CLIENT HUNTER - POURVOYEUR/CLIENT CHASSEUR

Outfitter Name - Nom du pourvoyeur: Gana River Outfitters Ltd

Client Hunter Last Name - Nom de famille du client chasseur: Jonn

First Name - Prénom: Mikael

Hunting Lic. No. - N° du permis de chasse: 502205

RETURN FOR THE PERIOD OF - RAPPORT MENSUEL POUR

Month: Mois: August

2009

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	Guide	Guide Lic. No. N° de licence du guide	Kill Date Date de l'abattage D-J	M-M	Latitude D	M	Longitude D	M	Miscellaneous - Divers.
Woodland Caribou Caribou des bois	81954										Right Antler Length: Longueur du bois droit : cm — Left Antler Length: Longueur du bois gauche : cm Widest Antler Spread: Largeur du panache (au plus large) : cm Right Horn Length: Longueur de la corne droit : cm — Left Horn Length: Longueur de la corne gauche : cm Hide Length: Longueur de la peau : cm — Population Species - Espèce/No. Seen - Quantité aperçue/Sex - Sexe — Sex - Sexe
Moose Orignal											
Mountain Goat Chèvre de montagne											
Polar Bear Ours polaire											
Barren-Ground Caribou Caribou de la toundra											
Other, specify - Autre préciser Wolf	48731										
Other, specify - Autre préciser Wolverine	48849										
Other, specify - Autre préciser											
Other, specify - Autre préciser											
Dall's Sheep Mouflon de Dall	30693	8	Nathan Martin	012556	19	08	64	37	129	41	

Plug No. - N° de poinçon	Cert. No. - N° de cert.	Disc. No. - N° de disque	Right Horn Base: Corne droit à la base : cm	Left Horn Base: Corne gauche à la base : cm	Right Horn Length: Longueur de la corne droit : cm	Left Horn Length: Longueur de la corne gauche : cm	Spread - Largeur entre les cornes	Broomed - Corne abîmée: Right Droit ☐ Left Gauche ☐	Age
							cm		

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, behaviour, etc.) on the harvested animals.

Nous sommes intéressés par les observations que vous avez faites sur la quantité et la qualité de la faune observée, sa localisation, son état, son âge, son sexe, son espèce, etc. En outre, veuillez commenter les conditions inhabituelles observées sur des animaux abattus (cicatrices, comportement, etc.)

OFFICE USE ONLY - RÉSERVÉ AU BUREAU

Export Permit No. - N° du permis d'exportation

Cites Permit No. N° du permis CITES

Checked By - Vérifié par

Entered By - Inscrit par

Date 20

Date 20

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 plein 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 - Signature du pourvoyeur

Date 04092009

Headquaters – Administration Centrale

NWT/4430/0305

MACKENZIE MOUTAINS, NORTHWEST TERRITORIES
HUNTER WILDLIFE OBSERVATION REPORT – 2007

Dear Hunter: The Department of Environment and Natural Resources request your kind assistance with completing this questionnaire about your NWT hunting experience, in order to assist us with the management of Mackenzie Mountain big game populations. All the requested information is completely voluntary, but your providing it to us is most appreciated.

HUNTER INFORMATION

Last Name	First Name and Initials	
CLIFFORD	GREGORY P.	
Address- number and street, box number	**Town, City**	**Province, State, Country**
14 SAGE ROAD	LANDER	WYOMING. USA

Hunting License # HL715052 Outfitter Zone: 6/0T/01 Outfitter: ARCTIC RED RIVER

Start Date of Hunt 7/15 2007 End Date of Hunt 7/24 2007 Observations Made Over 10 Days

ESTIMATED NUMBER OF DALL'S SHEEP SEEN			
¾ and Full Curl Rams	Less than ¾ Curl Rams	Ewes	Lambs
25	46	24	17

ESTIMATED NUMBER OF WOODLAND CARIBOU SEEN		
Bulls	Cows	Calves
2	1	Ø

ESTIMATED NUMBER OF MOOSE SEEN		
Bulls	Cows	Calves
Ø	Ø	Ø

ESTIMATED NUMBER OF MOUNTAIN GOAT SEEN			
Billys	Nannys	Kids	Unknown Age
Ø	Ø	Ø	Ø

Other Species						
	Wolf	Wolverine	Black Bear		Grizzly Bear	
			Adult	Cub	Adult	Cub
Number(s) Seen	3	Ø	Ø	Ø	1	Ø

How would you rate you overall hunting experience in the Mackenzie Mountains?
Excellent X Very Good _____ Good _____ Fair _____ Poor _____

How many times have you hunted in the Mackenzie Mountains, **including** this year's hunt? 2

Do you plan to return to hunt in the Mackenzie Mountains again? Yes X No _____

COMMENTS: Excellent Area / outfitter.

Thank You! Please give this form to the Officer or Clerk when you are exporting your trophies, or to the guide/outfitter with whom you hunted. We would appreciate receiving this form whether of not you harvested an animal(s).

Figure 4. Example of a fully completed Hunter Observation Report Form.

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, for 1999 and 2000 in Veitch and Simmons (2000; 2002; respectively), for 2001 by Veitch and Simmons (unpublished data), for 2002-2008 in Larter and Allaire (2003; 2004; 2005a; 2006; 2007; 2008; 2009 respectively). Additionally, Latour and MacLean (1994) summarized data for 1979 to 1990. This report compiles the harvest data collected during the 2009 hunting season and compares it with available data collected since 1995, and earlier when available.

Nahanni National Park Reserve Expansion

Nahanni National Park Reserve (NNPR) in the southern Mackenzie Mountains was originalliy established in 1972, after Prime Minister Pierre Elloit Trudeau canoed down the Nahanni River, encompassing an area of 4766 km². The Park was in “reserve” status pending settlement of outstanding aboriginal land claims in the region, which remain ongoing. On 9 June, 2009, the Canadian Government, with Dehcho First Nations, announced legislation increasing the area of NNPR to *ca* 30 000 km² (11 583 mi²). This newly enlarged boundary included 91% of the Greater Nahanni ecosystem and most of the South Nahanni River watershed in the Dehcho region (www.pc.gc.ca). The enlarged boundary also overlaps 3 of the 8 outfitting zones which were established in the Mackenzie Mountains in 1965: Ram Head Outfitters (S/OT/03), South Nahanni Outfitters (D/OT/01) and Nahanni Butte Outfitters (D/OT/02). Of the total area of their outfitting zones 4.7% of the Ramhead zone, 27.2% of the South Nahanni zone and 79.4% of the Nahanni Butte zone fall within the newly expanded boundary of the NNPR (Table 1).

Table 1. The area (km²) and percent of the outfitting zone that lies within the newly expanded boundary of Nahanni National Park Reserve.

Outfitter	Area of outfitting zone before NNPR expansion	Area of outfitting zone within new NNPR	Percent of zone within new NNPR
Ram Head Outfitters	19 734.82 km²	921.27 km²	4.7 %
South Nahanni Outfitters	25 024.16 km²	6811.10 km²	27.2 %
Nahanni Butte Outfitters	21 962.30 km²	17 450.66 km²	79.4 %

Parks Canada is currently negotiating with the operators of these outfitting zones in regards to third party interests of the land and land transfer. A tentative 10 year time line from the date of the announced expanded boundary has been proposed. Until negotiations have been completed, and the Government of the Northwest Territories has been advised of such, it remains business as usual for these outfitters; ENR will continue to issue licenses, tags, and export permits for harvesting by these 3 outfitters in their zones.

The Prairie Creek mine, established in 1966, now falls completely within the newly expanded boundary of NNPR. However, the mine and an area of *ca*. 300 km^2 surrounding the site were specifically excluded from NNPR so that the mine owned by Canadian Zinc was assured of its third party rights to operate and access the mine site. A new bill amending the National Parks Act solely for NNPR was required to assure these third party rights (www.canadianzinc.com).

Share Sale Agreement of Outfitting Zone

Arctic Red River Outfitters (ARRO, G/OT/01) completed a share sale agreement during 2009. ARRO obtained a surrender of rights of first refusal from the Gwich'in Tribal Council as part of the sale requirements. ARRO operates in 2 settled Land Claim areas, 78% falls within the Gwich'in Land Claim area and 22% within the Sahtu Land Claim area (Fig. 1). Rights of first refusal, however, cannot be provided to two different Land Claim Organizations. Five of the 8 Mackenzie Mountain Outfitting zones operate over more than one Land Claim area (Table 2). ENR plans on reviewing the Big Game licensing procedures in regard to this situation for future share sale agreements of outfitting zones.

Table 2. The areas (km^2) and percent of each outfitting zone that falls within different land claim areas. Bold indicates zones found exclusively within one land claim area.

Outfitter Zone	Total Area (km^2)	Dehcho Claim (km^2)	%	Sahtu Claim (km^2)	%	Gwitch'in Claim (km^2)	%
G/OT/01	14 753.70	n/a	0.0	3207.90	22.0	11 545.80	78.0
S/OT/01	9272.87	n/a	0.0	9029.01	97.4	243.86	2.6
S/OT/03	19 734.82	1247.15	6.3	18 487.67	93.7	n/a	0.0
S/OT/05	14 014.24	1810.61	12.9	12 203.63	87.1	n/a	0.0
S/OT/02	12 721.28	n/a	0.0	12 721.28	100.0	n/a	0.0
D/OT/01	25 024.16	22 385.62	89.5	2638.54	10.5	n/a	0.0
S/OT/04	8125.57	n/a	0.0	8125.57	100.0	n/a	0.0
D/OT/02	21 962.30	21 962.30	100.0	n/a	0.0	n/a	0.0

METHODS

Prior to the start of the 2009 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 biologist in the Dehcho or Sahtu, whether or not a client actually hunted and whether or not harvest occurred. In co-operation with ENR Renewable Resource Officers 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 2009.

Data from both the outfitter return forms and hunter observation forms were entered into *Excel 2007* (Microsoft Corporation, Seattle, WA) spreadsheets. Data were cross-checked with the records, of sequentially numbered, unique identifier plugs inserted in the horns of legally harvested rams, found in the License Information System-IntraNet (LIS-IN) data management system maintained by ENR offices across the Northwest Territories, and also with GNWT wildlife *Export Permit* forms to ensure that all data were verified and that the spreadsheets contained all appropriate available data required for the analyses.

We distributed new hunter observation forms in 2009 for consistency and we recorded all observations directly from these hunter observation forms. If we did not receive a hunter observation form, but wildlife observation data were recorded on the outfitter return form, we used these wildlife observation data. If observation information differed between the hunter observation form and the outfitter return form for the same

client we used the data from the hunter observation form. Occasionally we received identical observation data from forms of different hunters. These hunters had had the same guides and lengths of hunts and obviously had hunted together. We recorded forms with data that had been provided, but for the wildlife observation analyses only one set of these observations was used.

All descriptive statistical analyses were performed using *Excel 2007* (Microsoft Corporation, Seattle, WA). We present means ± standard deviation. Some statistical analyses were performed using Minitab 7.2 software (Minitab Inc. 1989).

RESULTS AND DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains were bought by 339 non-resident hunters in 2009 (Table 3). This is less than the 360 average number sold between 1991-2009 (range 321-407) (Fig. 5; Appendix F). Of those, 304 came to the NT and spent some time hunting; 35 either cancelled their hunts, decided not to hunt for themselves but participated with other hunters they knew, or decided not to hunt due to unforeseen complications after arriving in the NT. A majority of these were guides, who purchase licenses every year but rarely have the opportunity to hunt themselves. In 2009, licence sales to non-resident Canadians (n=79) represented 23% of the number of licenses sold. This is up from the 20% reported in 2006 and 2007, but less than the 25% reported in 2008. We presume that continued strength of the Canadian dollar is a major contributing factor to the higher number of Canadian sport hunters over the past

few years. Guided hunts are marketed in American dollars. The number of foreign non-resident hunters in 2009 was lower than in 2008 (253 vs 305). However, for a sixth year the number of hunters from countries other than the United States, mostly Europeans and South Americans, increased (Table 3). The change in ownership of South Nahanni Outfitters (D/OT/01) has resulted in an increased number of European and South American clients. Also, the American dollar has not fared as well against foreign currencies in recent years, which may make hunts more attractive to foreign clients. Unique to the 2009 hunting season was a resident hunter hunting with an outfitter in zone S/OT/01 who successfully harvested a grizzly bear (as well as a moose and mountain caribou) and two hunters hunting in March 2010 who each harvested wolves. This is the first time hunting has taken place outside of the normal July to October time.

We received all but three mandatory Outfitter Return forms for the 332 people that purchased non-resident licences. Voluntary Hunter Observation Report forms were received from 193 (62%) of the 311 that did at least some hunting in 2009 (Table 4). After consensus by outfitters at the 2003 annual general meeting of the Association of Mackenzie Mountain Outfitters to increase the number of Voluntary Hunter Observation Forms returned, the 2009 level of return is disappointing being similar to pre-2004 return levels. Although most outfitters endeavour to have these forms completed and submitted, there are unfortunately two zones with fairly large clientele which continue to be more lax in providing returns. We received only 18%, 6 of 33 forms, from zone S/OT/03 and 37%, 23 of 62 forms, from zone S/OT/02 in 2009. In order to be able to generalize observations over the entire Mackenzie Mountains, it is crucial that we receive representative observations from all outfitting zones**;** these two outfitter zones

Table 3. Province, state and/or country of origin of the 332 non-residents who purchased licences for hunting in the Mackenzie Mountains, 2009.

Canada		United States		Europe		Other	
Yukon	2	Eastern States[1]	89	Spain	6	Mexico	4
British Columbia	40			Germany	16	Chile	1
Alberta	29	Western States[2]	121	Austria	5	Russia	1
Saskatchewan	4			Denmark	1	Luxemberg	1
Manitoba	0			France	3	Australia	1
Ontario/ Quebec	2			Belgium	2		
Atlantic Provinces	2			Netherlands	1		
				Scotland	1		
Total	79		210		35		8

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

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

Table 4. Percent of Mackenzie Mountain outfitter and non-resident hunter forms submitted, 1995-2009.

Form Type	2009	2008	2007	2006	2005	2004	2003
Outfitter Return (mandatory)	99	99	98	99	100	99	98
Hunter Observation (voluntary)	62	71	65	64	65	74	60

Form Type	2002	2001	2000	1999	1998	1997	1996	1995
Outfitter Return (mandatory)	95	92	96	96	97	98	100	98
Hunter Observation (voluntary)	59	57	53	51	60	50	71	80

encompass the greatest range in latitude in the Mackenzie Mountains (Fig. 1). See Figure 4 as an example of a fully completed hunter observation form.

It is obvious that non-resident hunters immensely enjoy their hunting experience in the Mackenzie Mountains (Table 5). In 2009, 98% of respondents rated their experience as either excellent (86%) or very good (12%). Not only do voluntary client comments make specific mention of the high quality of hunts (n=77), and the abundance/quality of animals (n=33; Appendices C and D), but many comments make reference to the 1) professional and world class experience with their chosen guides, 2) the abundance of a wide variety of game species and predators, 3) the apparent health and condition of the game animals, 4) the pristine and scenic environment of the Mackenzie Mountains, and 5) compliments on the management and stewardship of the land.

Since the inception of the voluntary hunter observation forms we consistently receive comments about grizzly bears, normally to do with their abundance and problems when encountered in and around camps, and the need for or want of a hunting season on grizzly bears. This year was no different (Appendices C and D). Comments of high wolf numbers started in 2000 and continued through this year. Most reports about wolves were from zones G/OT/01, S/OT/01 and S/OT/05. Not surprisingly we had more comments about the Nahanni National Park Reserve expansion which was announced about 1 month before the start of the hunting season. Many questioned the need for such a large expansion. Others commented on to the timing and speed of the announcement. Weather was not an issue in the 2009 season and unlike in other years, weather comments, especially inclement, were relatively absent.

Table 5. Satisfaction ratings for non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1996-2009.

Rating	2009	2008	2007	2006	2005	2004	2003
Number of Hunters Reporting	191	239	239	230	256	229	191
Excellent (%)	86	85	81	80	90	84	82
Very Good (%)	12	10	12	16	7	10	15
Good (%)	2	4	5	3	2	5	3
Fair (%)	0	1	2	1	1	0	0
Poor (%)	0	0	0	0	0	1	0
Rating	2002	2001	2000	1999	1998	1997	1996
Number of Hunters Reporting	193	191	158	157	202	144	224
Excellent (%)	82	75	76	73	80	78	77
Very Good (%)	15	16	17	20	17	17	17
Good (%)	3	6	6	5	2	3	2
Fair (%)	0	1	0	1	1	1	3
Poor (%)	0	1	1	2	0	1	1

It was the first time hunting in the Mackenzie Mountains for 150 of 191 (79%) respondents (including non-hunting guides). The 41 repeat hunters had hunted from 1-11 times previously. Of 191 respondents (including non-hunting guides) 87% indicated they would like to return to the Mackenzie's to hunt in the future.

This year, 83 Association of Mackenzie Mountain Outfitters (AMMO) meat forms were voluntarily submitted to ENR by some of the outfitters (D/OT/02, S/OT/03 and S/OT/05); a similar number of submissions as in previous years. These forms record the amount of meat (Dall's sheep, mountain caribou, moose, and mountain goat) taken from harvested animals and how the meat was utilized/distributed. Other outfitting

zones also distribute meat to local communities, but unfortunately the meat forms from outfitters in the Sahtu do not always get turned in and/or forwarded to the Dehcho ENR office. Some outfitters keep the meat forms for their own records in order to have them available for inspection by Renewable Resources Officers (Kelly Hougen, personal communication).

Prior to the 2009 hunting season ENR worked with AMMO to try and come up with a better way to determine how wild game meat is used and distributed by all outfitters in the Mackenzie Mountains. We produced a meat record summary form which was forwarded to all outfitters at the start of the hunting season. In addition to the 83 meat forms submitted by some outfitters we also received summary forms from six outfitters, G/OT/01, S/OT/01, S/OT/03, S/OT/05, D/OT/01 and D/OT/02. The provision of wild game meat by outfitters is an important and greatly appreciated local benefit but can often be a topic of heated local debate. With summary forms supplementing individual meat forms we believe we have a better picture of the amount of wild game meat being distributed by the outfitters. We plan on providing meat record summary forms to all outfitters in future.

Generally the majority of meat from harvested Dall's sheep and mountain goats is utilized in the outfitter camps. Nonetheless, at least 1326 kg (2943 pounds) from 139 harvested Dall's sheep and 387 kg (852 pounds) from 21 harvested mountain goats, was distributed locally. Mountain caribou and moose meat is also utilized in the camps; but harvested mountain caribou and moose make up a large portion of the wild game meat that is distributed locally: at least 3053 kg (6717 pounds) from 89 mountain caribou and at least 6362 kg (13 996 pounds) from 41 moose. The replacement cost of

this amount of meat from local northern retailers is estimated conservatively at about $222,800, using $20/kg.

Dall's Sheep (*Ovis dalli dalli*)

Dall's sheep is one of the most desired species sought by non-resident hunters in the Mackenzie Mountains. Tags to hunt Dall's sheep were purchased by 215 (63%) non-resident hunters in 2009. This is the fewest number of tags purchased in the past 15 years (Table 6). At least 83% of sheep tag holders pursued Dall's sheep and harvested 179 rams (including seven resident hunters). The 2009 harvest was lower than the average number of 199 sheep harvested in the Mackenzie Mountains (1991-2008) (Fig. 5; Appendices E and F). The mean (± SD) length of a sheep hunt in was 3.9 ± 2.6 days, similar to hunt lengths from 1997 to 2008 (Table 7), but less than the 5.3 day average from 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

Table 6. Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1995-2009.

Species	2009 339 hunters		2008 391 hunters		2007 399 hunters		2006 407 hunters		2005 394 hunters		2004 337 hunters		2003 347 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	215	63	261	67	266	67	276	68	246	62	229	68	257	74
Mountain Caribou	252	74	275	70	272	68	274	67	285	72	243	72	247	71
Moose	96	28	109	28	108	27	112	28	101	26	84	25	85	24
Mountain Goat	45	13	45	12	50	13	21	5	40	10	24	7	18	5
Wolf	252	74	228	58	227	57	201	49	214	51	166	49	207	60
Wolverine	133	39	111	28	150	38	108	27	154	39	89	26	141	40
Black Bear	22	6	2	1	7	2	3	1	40	10	8	2	9	3

Species	2002 329 hunters		2001 339 hunters		2000 332 hunters		1999 321 hunters		1998 345 hunters		1997 352 hunters		1996 387 hunters		1995 343 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	218	66	220	65	231	70	227	71	246	71	252	72	252	65	218	64
Mountain Caribou	229	69	201	59	206	62	181	56	223	65	260	74	274	71	233	68
Moose	68	21	65	19	69	21	63	20	69	20	73	21	74	18	70	20
Mountain Goat	18	5	12	4	12	4	6	2	23	7	30	8	14	4	16	5
Wolf	159	48	137	40	155	47	89	28	165	48	209	59	193	50	72	21
Wolverine	97	29	83	25	85	26	65	20	99	29	135	38	114	30	35	10
Black Bear	3	1	0	0	6	2	2	<1	2	<1	8	2	0	0	0	0

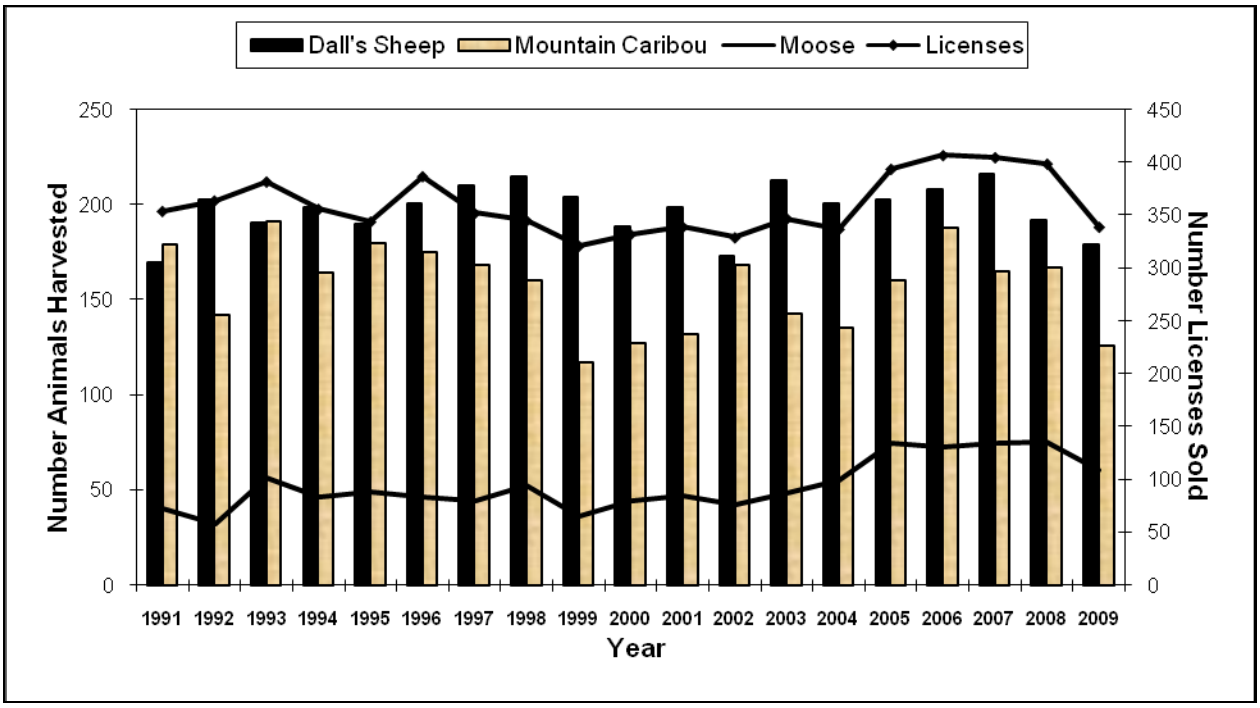

Figure 5. The number of Dall's sheep, mountain caribou, and moose harvested in the Mackenzie Mountains by non-resident hunters, and the number of non-resident licences sold during 1991-2009.

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.

There has been remarkable consistency in the mean outside contour length of the right horns from rams harvested by non-residents from 1972-2009, mean 89.0 ± 1.7cm (SD) (Appendix E; Table 8), which is surprising given the increase in average age of harvested sheep during that same period. We expected 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 2009, of 179 harvested rams, 127 (71%) were ≥10-years-old. The mean age (± SD) of harvested rams was 10.9 ± 1.9 years (range 7.5 to 17.5 years; Table 9). This is the highest average age of harvested rams recorded in the Mackenzie Mountains

Table 7. Mean length, standard deviation, and range (in days) of Dall's sheep hunts where at least one day was spent hunting from 1997-2009.

		2009	2008	2007	2006	2005	2004
Number of reports		179	192	216	214	190	167
Mean hunt length		3.9	3.7	4.1	4.1	4.1	4.0
Standard deviation		2.6	2.6	2.6	2.7	2.6	2.9
Range		1-10	1-14	1-13	1-12	1-14	1-17
	2003	2002	2001	2000	1999	1998	1997
Number of reports	189	174	176	198	201	224	216
Mean hunt length	3.8	4.7	4.8	4.6	4.7	4.4	4.3
Standard deviation	2.9	2.7	3.0	2.7	3.1	2.8	2.6
Range	1-12	1-12	1-15	1-15	1-16	1-15	1-12

Table 8. Measurements of Dall's sheep ram horns from sheep harvested by non-resident hunters in the Mackenzie Mountains, 2009.

	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	88.5	34.8	88.2	34.7	32.4	12.8	32.5	12.8	58.0	22.8
Std Dev	10.0	3.9	10.2	4.0	3.0	1.2	3.0	1.2	11.1	4.4
Maximum	103.0	40.6	102.3	40.1	37.0	14.6	37.0	14.6	93.0	36.6
Minimum	60.0	23.6	66.0	26.0	28.0	11.0	28.0	11.0	37.0	14.6

since records have been kept (1967) and the 22nd consecutive year where the reported mean age of harvested rams has been 9.5 years or older (Appendix E). Brooming of 33% of left and 33% of right horns from plugged trophies was relatively similar to the 31% (left) and 32% (right) brooming average over the past 13 years. The continued high age and consistent brooming reported on harvested trophy sheep may likely be a factor of harvest being spread out in time and space within hunting zones. Exclusivity of non-resident big game harvesting within the each zone provides this opportunity. Outfitters have indicated that they harvest in different parts of their zone on a rotational basis and forgo hunting in some areas for 2 or 3 seasons.

From hunters' classifications of sheep observed during their hunts in 2009 we calculated an estimated 55 lambs per 100 ewes (Table 10). This matches the 55:100 lamb:ewe average ratio reported since 1995 (Appendix G). For the Richardson Mountains of the northern Yukon and NT, 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. Subsequent to a decline in this unhunted population from 1997-2003, Nagy et al. (in prep.) reported 28 lambs per 100 'nursery sheep' in August 2003. Jorgenson (1992) summarized 17 years of lamb:ewe classification data for a population of bighorn sheep in west-central 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)

Table 9. Age-structure of Dall's sheep rams harvested by non-resident and resident (n=7) hunters in the Mackenzie Mountains, 1995-2009, based upon counting horn annuli.

	2009		2008		2007		2006		2005		2004		2003		2002		2001		2000		1999		1998		1997		1996		1995	
Age	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0
4.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	1	0.5	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5	1	0.5
6.5	0	0.0	1	0.5	2	0.9	1	0.5	1	0.5	3	1.5	8	3.8	2	1.2	4	2.2	3	1.6	1	0.5	4	2.0	1	0.5	5	2.5	4	2.1
7.5	6	3.4	4	2.1	7	3.2	8	3.8	11	5.6	14	7.0	12	5.7	6	3.6	15	8.2	16	8.5	13	7.1	9	4.3	12	5.8	21	10.5	16	8.5
8.5	19	10.7	21	11.0	17	7.9	26	13.9	24	12.2	41	20.0	43	20.5	44	26.5	33	18.0	39	20.8	23	12.6	39	18.8	39	18.8	47	23.5	49	25.9
9.5	26	14.6	48	25.0	33	15.3	49	25.5	54	27.6	49	24.5	72	34.3	43	25.9	41	22.4	40	21.2	49	26.8	45	21.7	52	25.1	56	28.0	51	27.0
10.5	46	25.8	53	27.6	54	25.0	54	26.4	47	24.0	43	21.5	45	21.4	39	23.5	45	24.6	41	21.8	47	25.7	63	30.4	58	28.0	36	18.0	34	18.0
11.5	39	21.9	28	14.6	65	30.1	36	17.8	39	19.9	27	13.2	11	5.2	16	9.6	29	15.9	28	14.9	29	15.8	30	14.5	24	11.6	26	13.0	14	7.4
12.5	23	12.9	25	13.0	19	8.9	23	12.0	13	6.6	16	7.8	12	5.7	9	5.4	11	6.0	14	7.5	15	8.2	12	5.8	15	7.2	6	3.0	14	7.4
13.5	11	6.1	7	3.6	15	6.9	6	2.9	5	2.6	3	1.5	2	1.0	6	3.6	10	5.5	3	1.6	6	3.3	2	1.0	4	1.9	1	0.5	5	2.6
14.5	6	3.4	4	2.1	2	0.9	1	0.5	1	0.5	3	1.5	3	1.4	1	0.6	0	0.0	3	1.6	0	0.0	1	0.5	2	1.0	0	0.0	1	0.5
15.5	1	0.6	1	0.5	1	0.5	2	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0
16.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
17.5	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
>10y	127		118		156		122		105		92		74		71		95		90		97		109		102		69		68	
%>10	71.3		61.5		72.2		59.2		53.6		46.0		35.2		42.7		51.0		47.9		53.0		52.6		49.5		34.5		36.0	
>12y	42		37		37		32		19		22		18		16		21		21		21		16		21		7		20	
%>12	23.6		19.3		17.1		15.5		9.7		11.0		8.6		9.6		11.2		11.2		11.4		7.7		10.1		3.5		10.6	

suggested that this difference is a result of injuries and stress accumulated by males during the breeding season.

Table 10. Observations of Dall's sheep reported by non-resident hunters in the Mackenzie Mountains, 2009.

	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Sheep Classified
Rams	167	2801	16.8	37.9
Ewes[1]	150	2966	19.8	40.1
Lambs	142	1621	11.4	22.0

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

The 94.4:100 ram to ewe ratio (ram:ewe) estimated from hunters' observations in 2009 is generally similar to that reported since 2004 (Appendix G). Since 2004 hunters have generally observed more rams with <¾ curl than rams with >¾ curl observed. Strong cohorts of juvenile rams may be a factor in the recent higher ram:ewe ratios reported.

In the Yukon, mid to late June annual aerial surveys to count and classify sheep from 1973 to 1998 reported a mean of 48 rams (range 28 to 74) per 100 'nursery sheep' (Jean Carey, Yukon Dept. of Renewable Resources, unpublished data). For the unhunted Richardson Mountains herd (Yukon-Northwest Territories), Nagy et al. (in prep.) reported 41 rams per 100 'nursery sheep' in 2003 following a decline from peak population size in 1997. In Alaska, ram:ewe for two unhunted herds in Denali and Gates of the Arctic National Parks typically averaged 60-67:100 (Nichols and Bunnell, 1999). In more heavily hunted Alaskan herds, ram:ewe ranged from 33:100 (heavily hunted) to 87:100 (lightly hunted). The ram:ewe ratios reported for the Mackenzie Mountains since

Table 11. Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1995 - 2009.

Ram Class	2009		2008		2007		2006		2005		2004		2003	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	139	132	184	174	150	168	180	171	186	182	188	183	127	121
Number of rams classified	1040	1093	1520	1698	1902	2266	1769	2019	1787	1899	2185	2324	1662	1654
Percent of rams classified	48.8	51.2	47.2	52.8	45.6	54.4	46.7	53.3	48.5	51.5	48.5	51.5	50.1	49.9
Mean number of rams observed/hunt	7.5	8.3	8.3	9.8	11.0	13.5	9.9	12.0	9.6	10.4	11.6	12.7	11.9	11.9

Ram Class	2002		2001		2000		1999		1998		1997		1996		1995	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	148	133	186	174	151	147	144	138	177	177	205	205	172	174	181	180
Number of rams classified	1720	1720	1812	1765	1351	1717	1579	1756	1848	1924	1538	1586	1713	1699	2070	1645
Percent of rams classified	50.0	50.0	50.7	49.3	44.0	56.0	47.3	52.7	49.0	51.0	49.2	50.8	50.2	49.8	55.7	44.3
Mean number of rams observed/hunt	11.6	12.9	9.7	10.1	8.9	11.7	11.0	12.7	10.4	11.3	7.5	7.7	10.0	9.8	11.4	9.1

1995 (Appendix G) suggests that the harvest of rams in the Mackenzie Mountains is sustainable at current levels.

In 2009, hunters observed fewer rams (2801) that could be classified by curl than in previous years (Tables 9, 11). This year saw the fewest sheep hunters in the Mackenzie Mountains in 15 years (Table 6), and a greater number of unclassified rams reported than in previous years, both which could have affected the total classified sheep observations reported. Hunters observed slightly fewer legal (>¾ curl) rams (n=1040) than rams with <¾ curl (n=1093) during their hunts. The mean number of legal rams observed per hunt was 7.5 (Table 10).

Mountain Caribou (*Rangifer tarandus caribou*)

Mountain caribou are another of the more desired species sought by non-resident hunters. Tags were purchased by 252 (74%) of non-resident hunters (Table 6), and at least 50% of tag holders hunted caribou harvesting 125 bulls. The 2009 harvest is dramatically lower than the mean annual harvest of 157 recorded from 1991-2009, with only one year having a lower harvest (Fig. 5; Appendix F). The mean (±SD) length of a mountain caribou hunt, determined from the 153 reports where hunters spent at least 1 day hunting, was 4.0 $\pm$ 3.0 days (range 1-14 days), comparable to that of previous years (Table 12).

From hunters' classifications of mountain caribou observed during their hunts, we calculated ratios of 45.3 calves and 39.4 bulls per 100 adult females (cows); bulls comprised 21.0% of all caribou classified (Table 13). Both calf:cow and bull:cow are

slightly higher than the averages since 1995 of 44:100 (range 36-59:100) and 37:100 (range 21-61:100), respectively (Appendix G).

Table 12. Mean length, standard deviation, and range (in days) of mountain caribou hunts where at least one day was spent hunting from 2000-2009.

	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	155	190	172	171	191	120	172	181	178	141
Mean hunt length	4.0	3.0	4.0	4.3	3.7	4.9	3.8	3.6	4.3	4.0
Std Dev	3.0	3.0	3.2	3.1	3.8	3.9	2.8	2.7	3.2	2.7
Range	1-14	1-15	1-16	1-14	1-32	1-34	1-14	1-12	1-15	1-12

Table 13. Observations of mountain caribou reported by non-resident hunters in the Mackenzie Mountains, 2009.

Sex/Age Class	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Total Classified
Bulls	158	4310	25.1	21.3
Cows	153	10929	63.5	54.1
Calves	131	4956	28.8	24.6

In 2009 we received antler lengths from 86 (68%) of successful hunters; a lower percentage than in previous years. Antler measurement information sometimes goes unreported on outfitter forms. This year, as in other years, there was substantial variation in antler lengths, range 73.0-144.8 cm (28.7-57.0 in.). The maximum left and right antler lengths reported were 144.8 and 144.5 cm respectively (Table 14). The maximum antler length recorded by Boone and Crockett for mountain woodland 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). Eighteen of the top 50 mountain woodland caribou recorded in the 12th edition of the Boone and Crockett Club record book are from the Mackenzie Mountains; the highest scoring antlers hold 6th place (Boone and Crockett Club, on-line trophy database accessed 2010).

Table 14. Antler measurements of mountain caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2009.

	Contour Length	
	Left Antler	Right Antler
Number Measured	86	86
Mean (cm)	114.7	114.6
Mean (in)	45.2	45.1
Standard Deviation (cm)	54.7	54.6
Standard Deviation (in)	21.5	21.5
Maximum (cm)	144.8	144.5
Maximum (in)	57.0	56.9
Minimum (cm)	75.0	73.0
Minimum (in)	29.5	28.7

Another measuring system for antlered animals is from Safari Club International (SCI), which has a unique all-inclusive record keeping system for measuring trophies; the most used system in the world. Unlike Boone and Crockett this system has no deductions or penalizing for asymmetry. Some outfitters prefer using this measuring system, especially for caribou, because it provides points for all tines and there are no

deductions, (Jim Lancaster, personal communication). Eight of the top 20 mountain woodland caribou recorded in the Safari Club International record book are from the Mackenzie Mountains with a caribou harvested in 2006 holding 2nd place in scoring (Safari Club International, on-line trophy database accessed 2010).

Over the past 6 years bulls have comprised *ca.* 22% of the observed mountain caribou in the Mackenzie Mountains. This is a consistently lower percentage than the cumulative 39% average adult bull component reported by Bergerud (1978) in his summary of 8 North American caribou populations that were either non-hunted or hunted non-selectively (i.e., both males and females included in the harvest). Veitch et al. (2000c) classified 2659 of an estimated 5000 caribou in the central Mackenzie Mountains in August 1999 and reported only 25% of those animals were classified as males. Surveys made on the rutting grounds of the South Nahanni caribou herd provided in 1995, 1996, and 1997 reported 24, 28, and 20% of animals classified as males $\geq$1-year-old (Gullickson and Manseau, 2000) and in 2001 reported 27% bulls (Gunn et al., 2002). A 2007 survey during the rut estimated 33.7 bulls:100 adult cows (R. Farnell and K. Egli, Yukon Territorial Government, unpublished data). A 2008 composition count during the rut in the same general area estimated a slightly higher ratio of 35.5 bulls:100 adult cows (Troy Hegel, personal communication). Therefore, further investigation is warranted to determine the reason for the consistently lower bull:cow ratios reported for caribou in the Mackenzie Mountains.

In their 2002 assessment, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated the boreal population of woodland caribou as “threatened” and the Northern Mountain population of woodland caribou as “special

concern". These two populations of woodland caribou were subsequently listed under the Federal Species at Risk Act in 2004-2007 respectively. Caribou of the Mackenzie Mountains are part of the Northern Mountain population of woodland caribou. In order to be more specific and to avoid confusion this report will use "mountain caribou" when referring to caribou from the Mackenzie Mountains.

Caribou in the Mackenzie Mountains are estimated to number between 13 000 and 18 000 from at least 3 separate herds shared between the Yukon and Northwest Territories: Bonnet Plume herd (5000 estimated), the greater Redstone herd (5-10 000 estimated), and the greater Nahanni herd (2-3000 estimated) (Jan Adamczewski, personal communication; Mark O'Donoghue, personal communication; Alasdair Veitch, personal communication). They are subjected to an annual bull-selective non-resident harvest averaging 157 males per year (1991-2009). The resident harvest of mountain caribou in the Mackenzie Mountains also tends to be bull-selective (but not restricted to bulls) and is generally light (i.e., 30 animals/year); subsistence harvest includes both males and females, with the proportion of each dependent on the time of year that animals are harvested (J. Snortland, unpublished data; Ken Davidge, personal communication). Subsistence harvesters in the Mackenzie Mountains include residents of both the NT and Yukon Territory; harvest is not generally reported.

Studies on the Redstone herd of mountain caribou were initiated in March 2002, with 10 female caribou being equipped with satellite radio collars as part of a study of caribou in the central and north-central Mackenzie Mountains initiated by the Sahtu Renewable Resources Board (Creighton 2006; Olsen 2000; 2001; Olsen et al., 2001). A recent analysis of these location data indicates that some of the collared animals in the

range of the Redstone herd are relatively sedentary yearround, while others show the more typical seasonal migratory movements (John Nagy, personal communication).

Satellite radio collars were deployed on 9 adult female caribou during March 2000 and October 2001 by the Yukon Department of the Environment (Jan Adamczewski, personal communication). These animals were believed to be part of the greater Nahanni herd. In October 2004, 18 female caribou were equipped with satellite collars along the Yukon-Northwest Territories border. These caribou were also believed to be from the greater Nahanni herds, but 3 animals were determined to be from the Finlayson herd. This was a co-operative study between Yukon Territorial Government, Parks Canada (Nahanni National Park) and the Wildlife Conservation Society (Weaver 2006). In October 2008 30 female caribou were equipped with satellite collars along the Yukon-Northwest Territories border. Partners in this project include the Yukon Territorial Government, Nahanni National Park Reserve, Parks Canada, Park Establishment Branch, Parks Canada, Department of Environment and Natural Resources, GNWT and the Canadian Parks and Wilderness Society, NWT Chapter (Troy Hegel, personal communication).

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, with the Mackenzie's representing the eastern limit of the subspecies' range. This is the largest of the four subspecies of moose that occur in North America (Bubenik, 1997). Tags to hunt moose were purchased by 28% (n=96) of non-resident hunters in 2009 (Table 6). At least 62%

of tag holders hunted moose and harvested 59 bulls. This is somewhat lower than the last 4 years of harvest but is more representative of the harvest since 1991 when reporting started (range 32-75). Over the past 4-5 years, there have been more moose hunts and moose harvested (Fig. 5; Appendix F). The mean (± SD) length of a moose hunt, determined from the 68 reports where hunters spent at least 1 day hunting, was 4.2 ± 3.4 days (range 1-14 days), similar to what was reported for previous years (Table 15).

The higher numbers of moose harvested in recent years is likely in part related to the change in ownership of outfitting zone D/OT/01. This zone is one of the largest with an abundance of good moose habitat. Prior to 2005 few moose were harvested in this zone annually (<4 moose/year 1991-2004) because the majority of clients were interested in sheep hunting, very few were interested in moose hunting. The new owner has a client base which includes a large number of European hunters who are specifically looking for trophy moose for European mounts.

Over the past few years ENR has been collecting front incisor teeth from moose harvested by hunters in the southern portion of the Mackenzie Mountains on a voluntary basis. These teeth are forwarded to Matson's Laboratory for aging. Age is determined by counting the cementum annuli much like the growth rings of a tree. 1 June is used as the birth date for moose and caribou (Matson, 1981). We currently have ages from 59 harvested moose. The ages range from 3 to 15 years (mean 7.5 years; median 7.0 years).

Table 15. Mean length, standard deviation, and range (in days) of moose hunts where at least one day was spent hunting from 2000-2009.

			2009	2008	2007	2006
Number reports			68	82	80	72
Mean hunt length			4.2	3.6	4.0	3.6
Standard deviation			3.4	2.9	2.5	2.7
Range			1-14	1-16	1-9	1-11
	2005	2004	2003	2002	2001	2000
Number reports	85	49	60	46	42	48
Mean hunt length	4.4	4.8	3.9	3.6	3.7	4.4
Standard deviation	3.1	3.3	2.8	2.6	2.9	2.7
Range	1-14	1-12	1-14	1-12	1-12	1-12

The mean (± SD) tip-to-tip spread of measured antlers from bull moose harvested by in 2009 was 143.5 $\pm$ 48.4 cm (56.5 $\pm$ 19.1 in., n=53). This year we received fewer antler measurements than average (n=57) over the last five years (Table 16). This year's maximum recorded antler spread was 175.0 cm (68.9 in.), lower than the maximum recorded antler spread of 196.9 cm (77.5 in.) for a record Alaska-Yukon moose taken in the NT in 1982. 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 15 and 20; the rest of the top 20 were all taken in Alaska and the Yukon. Another top 25 Alaska-Yukon moose recorded with the Boone and Crockett Club that was harvested in the NT in 2008; it was accepted May 2009 and holds 23rd place.

Table 16. The yearly mean and range in measured bull moose tip-to-tip antler spread (cm).

	2009	2008	2007	2006	2005
Measured (n)	53	63	62	56	53
Mean spread	143.5	145.5	141.1	141.3	144.9
Range	92-175	101-174	102-179	107-170	122-188

	2004	2003	2002	2001	2000	1999
Measured (n)	38	34	32	32	34	26
Mean spread	150.3	150.0	149.3	144.3	147.0	144.2
Range	127-174	107-165	103-178	113-165	127-179	109-166

From hunters' observations of moose during hunts we calculated ratios of 30.9 calves:100 adult females (cows) and 89.7 bulls:100 cows (Table 17; Appendix G). This is somewhat higher than the mean 29:100 calf:cow ratio recorded since 1995 and the ninth time in the past 15 years when the ratio has been $\geq$30:100. The ratio still remains lower than the 40-60:100 that is 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) (Appendix G). However, these surveys were conducted after the major fall subsistence harvest and variable female harvest can certainly impact the interpretation of calf:cow ratios. As no research has been done on moose in the Mackenzie Mountains, 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 a calf:cow ratio of 18:100 (ENR Norman Wells, unpublished data), and an aerial survey of the Mackenzie River Valley and vicinity in the Dehcho Region south from the Blackwater River to Jean Marie River conducted in November 2003 estimated 32:100 (Larter, 2009). These studies indicate that low calf:cow ratios may not be restricted to the Mackenzie Mountains and that further studies are required to determine the cause(s). A program has recently been established in the Mackenzie and Liard River Valleys of the Dehcho to document calf:cow ratios annually in November (ENR Fort Simpson, unpublished data; Larter, 2009).

Table 17. Observations of moose reported by non-resident hunters in the Mackenzie Mountains, 2009.

Age/Sex class	Number of Hunters Reporting	Number Observed	Mean Number Observed/Hunter	Percent of Total Classified
Bulls	79	375	4.7	40.7
Cows	77	418	5.4	45.3
Calves	43	129	3.0	14.0

The bull:cow ratio of 90:100 reported for 2009 is lower than the 104:100 average from 1995-2009, but falls within the reported range of 76-137:100 (Appendix G). Bull:cow ratios from the Mackenzie Mountains continue to be generally higher than the range of 27-105:100 reported in the Yukon (R. Ward cited in Schwartz 1997) and from heavily harvested populations in Alaska of 16:100 (Schwartz et al., 1992) and Norway of average 46:100, range (25-69:100) (Solberg et al., 2002). There has been concern that low bull:cow ratios could influence conception dates, pregnancy rates and newborn sex

ratios (Bishop and Rausch, 1974; Crête et al., 1981; Solberg et al., 2002) and that management strategies should maintain a high bull:cow ratio (Bubenik, 1972).

Studies on tundra moose in Alaska have not found evidence that moose populations with low bull:cow ratios have reduced reproductive rates (Schwartz et al., 1992); populations with a more skewed sex ratio had a relative rate of population increase greater than populations without a skewed sex ratio (Van Ballenberghe, 1983). However, a recent study of eight heavily harvested moose populations in Norway indicated a relationship between declining recruitment rate and skewed adult sex ratio (Solberg et al., 2002). Based upon hunter observations since 1995, there is no indication of any decreasing trend in the bull:cow ratio of moose in the Mackenzie Mountains, hence the adult sex ratios are an unlikely factor in the low calf:cow ratios reported. The reported sex ratios may have an inherent bias towards a greater number of bulls if harvesters consistently spend more time searching for moose in areas frequented more by large males than females.

Mountain Goat (*Oreamnos americanus*)

Sales of mountain goat tags show more annual fluctuation than for any other ungulate species harvested by non-resident hunters in the Mackenzie Mountains, range 6-50 during 1995-2008 (Table 5) with a mean annual harvest of eight goats (range 1-21) over the same time (Appendix F). In 2009, mountain goat tags were purchased by 45 (13%) of non-resident hunters. Twenty goats were harvested in 2009; 18 billies and two nannies. This years' harvest is the second highest harvest of mountain goats from 1991-2009 (Appendix F). The mean (± SD) length of a goat hunt, determined from the

22 reports where hunters spent at least one day hunting, was 2.5 ± 2.0 days (range 1-8 days), within the range of what was reported in previous years (Table 18).

Table 18. Mean length, standard deviation, and range (in days) of goat hunts where at least one day was spent hunting from 2000-2009.

	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	22	21	27	12	18	8	6	4	2	1
Mean hunt length	2.5	3.0	2.7	2.8	3.8	3.9	3.0	2.8	1.5	3.0
Std Dev	2.0	1.8	1.7	1.5	2.8	1.6	2.6	1.9	0.7	n/a
Range	1-8	1-8	1-6	2-6	1-14	2-6	1-8	1-5	1-2	3

Mountain goats are known to inhabit five of the eight outfitting zones in the Mackenzie Mountains, occurring almost exclusively below 63^{o} 00' N (Veitch et al., 2002). They are most numerous in high relief terrain along the Yukon-Northwest Territories border between 61^{o} 00' and 62^{o} 00' N. However since 1995, we have received hunter observations or harvest reports of goats from only four of those outfitter zones - D/OT/01, D/OT/02, S/OT/03, and S/OT/04 (see Fig. 1). In 2009, observations of mountain goats by hunters came from just two of those zones D/OT/01 (n=116), and D/OT/02 (n=211), but goats were harvested from three zones including S/OT/03. We estimated 64.6 kids and 59.0 billies per 100 nannies based upon this year's hunter observations. The kid:nannie being higher and the billie:nannie being lower than the average 61.4:100 and 67.4:100, respectively, reported since we requested mountain goat observations in 2002 (Appendix H).

In 2005, we started to estimate the age of harvested goats based upon counting horn annuli and have tried to age as many harvested goats as possible since then. Of the 76 goat (66 billies and ten nannies) ages we have to date the age range has been from 2.5 to 15.5 years with 40 aged <8 years, 36 aged >8 years, and 22 animals >10 years (Fig. 6). Of the 16 goats (15 billies and one nanny) aged in 2009, two were aged aged >11 years. The largest horns from a mountain goat taken in 2009 were 24.8 cm (left) and 24.8 cm (right). No mountain goats from the NT are listed in the 11th edition of the Boone and Crockett Club record book (Byers and Bettas, 1999). Based upon the horn age and length data over the past five years there is somewhat of a linear relationship between age and horn length from 2.5-8.5 years, but after that age there is almost no relationship. This relationship implies that large horned animals are found over a wide range in animal ages (Fig. 6).

There is some evidence that goat numbers and distribution have been increasing in zone D/OT/02 in the southern Mackenzie Mountains (Larter, 2004; Jim and Clay Lancaster, personal communication). The total number of goats observed has been increasing in recent years and billies have been observed in places they had not been seen previously in zone D/OT/02 (Clay Lancaster, personal communication; Appendix H).

In a 2.5 hour rotary-winged survey of zone D/OT/02 on 11 September 2006, 88 goats were observed (38 billies, 27 nannies, 19 kids, and four yearlings), producing estimates of 140.8 billies and 70.4 kids per 100 nannies (N. Larter, unpublished data). This survey was conducted in an area that could not be surveyed during a 2004 aerial survey and provided similar numbers of goats and ratio estimates as the 111 billies and

71.4 kids per 100 nannies from that 2004 survey (Larter, 2004). These observations support the contention of increasing goat numbers and distribution. ENR hopes to conduct future surveys of mountain goats in zones D/OT/01 and D/OT/02 in 2010 as part of the work required to update the current status of mountain goats in the Mackenzie Mountains. Surveys would be mid-summer and conducted later in the day rather than during the morning and early afternoon. Mountain goat nursery groups are more active and visible above treeline at those times (Werner Aschbacher, personal communication; Jim and Clay Lancaster, personal communications).

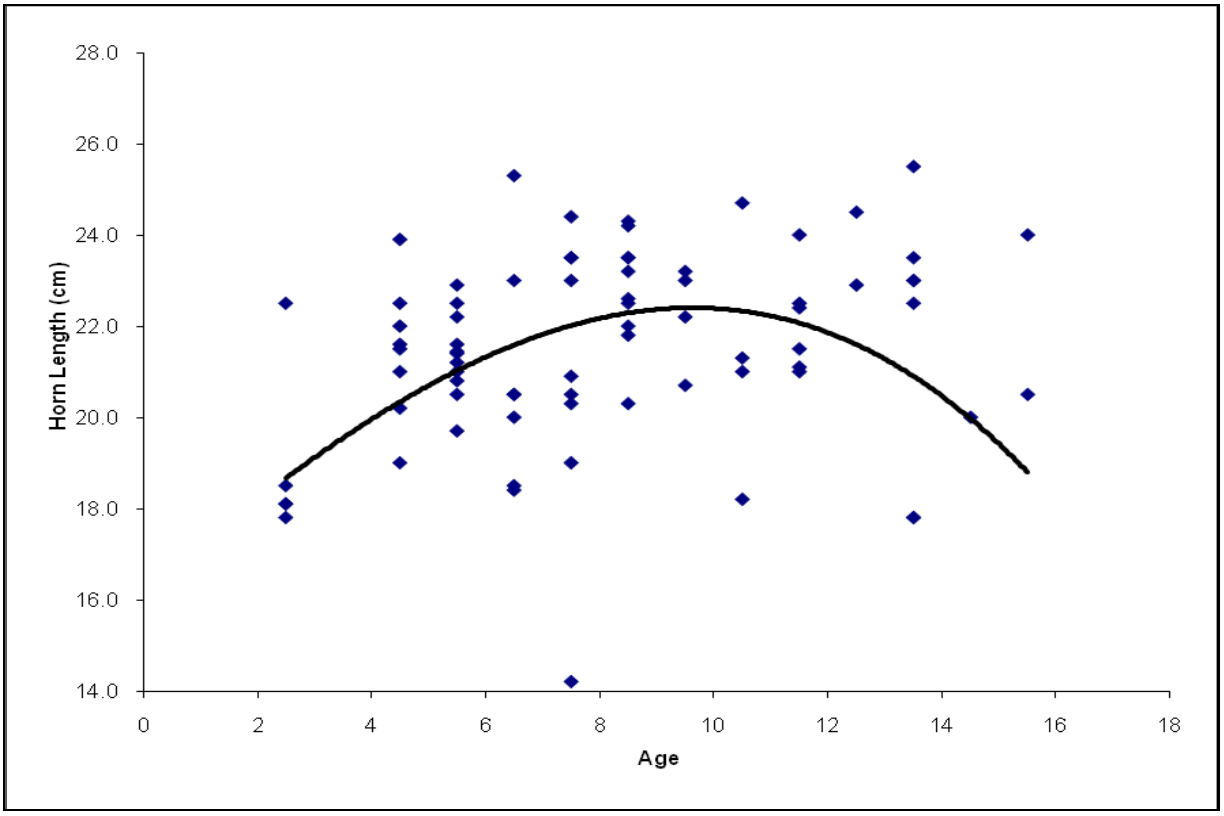

Figure 6. The relationship between the horn length (cm) and age (based upon horn annuli) of 76 mountain goats harvested in the Mackenzie Mountains 2005-2009. Line of best fit is a 3rd order polynomial

The recent increase in the number of mountain goats harvested (see Appendix F) may be related to changes in accessibility to the more remote and rugged parts of the various outfitter ranges where goats are resident. The use of rotary aircraft in recent years has permitted outfitters to get into some areas of their zones where they have never been before, areas where goats have been found. This accessibility to increased areas of untouched goat range has likely had some effect on the increased success in goat harvest.

Wolf (*Canis lupus*)

Wolf tags were purchased by 74% (n=252) of non-resident hunters in 2009 (Table 6) with 20 wolves harvested (Appendix F). This is the first year that wolves were hunted in the winter, 2 wolves were harvested in March 2010 in zone S/OT/01. The wolf harvest was similar to that from 1991-2008 (mean 14, range 7-23). The number of wolves observed in 2009 (n=167) was the lowest since 1999 (Table 19). Only 3% of responding hunters indicated that they believed wolf numbers were high, similar to 2003-2005, but less than other years. 2000 was the first year that hunters had commented on wolf numbers in the wildlife observation forms.

The number of hunters reporting since 2001 has been consistently higher than in previous years, which is attributed to a change in how we defined hunter reporting. For data collected after 2001, we assumed that all returned observation forms where there was a blank, a zero, or a dash in the box indicating the number of wolves observed was a report of no wolves being observed. When looking at the forms this seemed like a

reasonable assumption. This assumption may well be invalid for previous years' data and would bias the post 2001 values to be higher than the previous years.

Table 19. Observations of wolves reported by non-resident hunters in the Mackenzie Mountains, 1995-2009.

	2009[1]	2008[1]	2007[1]	2006[1]	2005[1]	2004[1]	2003[1]
Number hunters reporting	241	239	244	239	254	244	203
Number wolves observed	167	260	262	202	245	317	200
Mean observed/hunter	0.7	0.8	1.1	0.8	1.0	1.3	1.0
Number hunters seeing ≥1	65	76	88	84	76	81	74

	2002[1]	2001	2000	1999	1998	1997	1996	1995
Number hunters reporting	197	142	116	103	148	141	76	119
Number wolves observed	249	215	228	142	148	200	186	269
Mean observed/hunter	1.3	1.5	2.0	1.4	1.0	1.4	2.4	2.3
Number hunters seeing ≥1	69	65	61	40	57	76	26	26

[1] Change in reporting since 2002 may have resulted in the number of hunters reporting for 1995-2001 being artificially low, see text.

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 39% (n=133) of non-resident hunters in 2009 (Table 6). At least 22% (n=29) of tag holders actively hunted wolverines, three wolverines were harvested in 2009. Hunters reported spending from 1-13 days actively hunting wolverine (mean ± SD of 6.0 ± 1.75 days). Hunters reported seeing 2 wolverines together and 18 observations of solitary wolverines. Observations were reported from six of the eight outfitter zones, but most observations came from D/OT/01, D/OT/02, S/OT/01 and G/OT/01 (Fig. 6). Historically, wolverine observations have been

mostly of solitary animals with few family groups being observed. The number of animals observed this year is similar to the 20-35 observed during 1995-1999 and 2004-2006 (Table 20; Fig. 7). Wolverine numbers are believed to be declining in other parts of their range in the Northwest Territories (Suzanne Carriere, personal communication); our observations since 1995 in the Mackenzie Mountains are equivocal.

There is no relationship between the number of wolverine observed/year and annual harvest nor does the number of tags purchased/year explain annual differences in wolverine observations (Table 20). Wolverines occur throughout the Mackenzie Mountains, but sightings are considered rare. Most wolverine observations are made in hunting zones G/OT/01, S/OT/01, and S/OT/05.

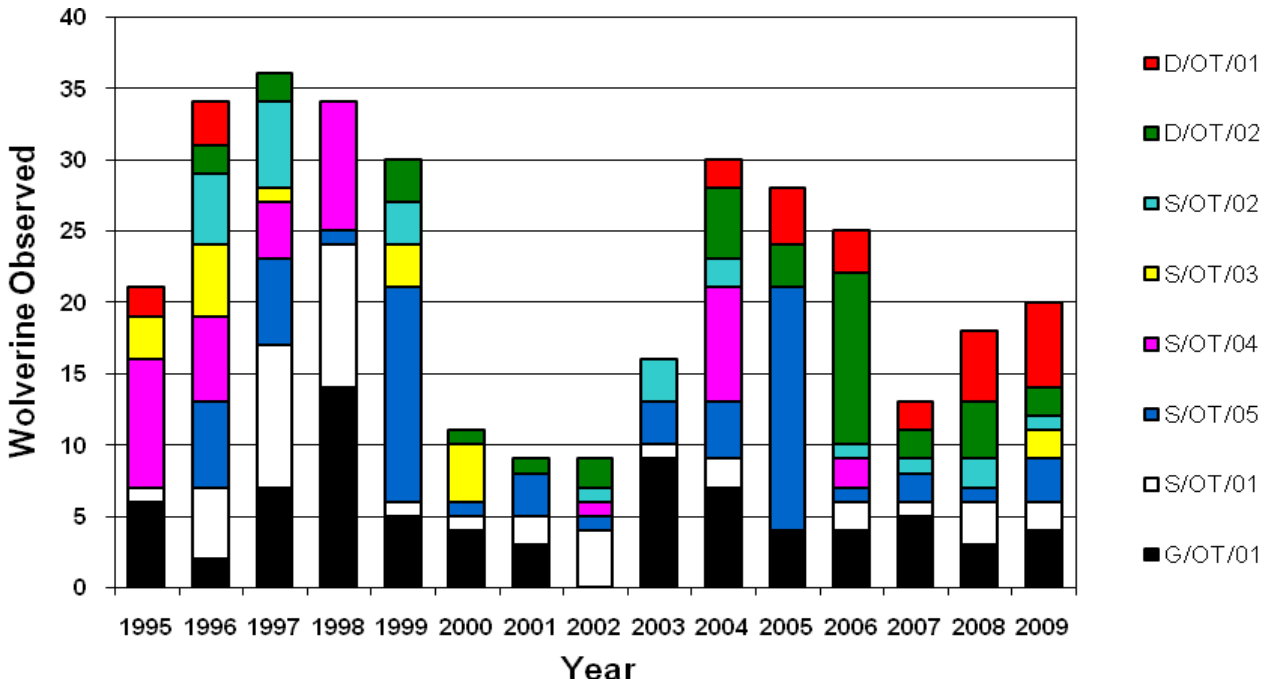

Figure 7. The number of wolverines observed by hunters from 1995-2009 and the outfitter zones where the observations occurred. Data are based upon voluntary hunter observation forms.

Table 20. The number of reported observations of wolverine, the number of wolverine harvested, the number of hunters with wolverine tags, the percentage of total hunters with wolverine tags, and the total number of hunting tags purchased for 1995-2009.

Year		2009	2008	2007	2006	2005	2004	2003
Reported Observed		20	18	13	25	28	30	12
Number Harvested		3	1	0	1	1	0	0
No. Wolverine Tags		133	111	150	108	154	89	141
% Wolverine Tags		39	28	37	27	39	26	40
Total Hunting Tags		339	391	399	407	394	337	347
Year	2002	2001	2000	1999	1998	1997	1996	1995
Reported Observations	9	9	11	30	34	36	34	21
Number Harvested	1	2	0	3	0	1	4	1
No. Wolverine Tags	97	83	78	65	99	135	114	35
% Wolverine Tags	29	26	23	20	29	38	29	11
Total Hunting Tags	338	344	332	321	345	352	387	333

Black Bear (*Ursus americanus*)

This year 22 tags were purchased for black bears by non-resident hunters, the second highest total since records have been kept in 1995 (Table 6). This is only the second year that a black bear have been harvested in the Mackenzie Mountains. Black bears are relatively rarely seen in the Mackenzie Mountains and in most years are reported only from south of 63^{o} 00 N. In 2009, 17 black bears (14 adults and 3 cubs) were observed based upon returned voluntary hunter observation forms. Bears were observed in outfitter zones D/OT/01 (6 adults and 2 cubs), D/OT/02 (4 adults and 1 cub) and S/OT/05 (4 adults) (Table 21). The number of black bears observed in 2009 is fewer than the increasing numbers seen since 2005 (Table 21). As with the other post 2001 carnivore data, we assumed that all returned observation forms where blanks,

zeroes, or dashes occurred in the boxes indicating the number of carnivores observed was a report of no carnivores being observed. This assumption is likely invalid for previous years' data and likely somewhat inflates the post-2001 values relative to 1996-2001 values.

Table 21. Observations of black bear reported by non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1995-2009.

	2009[1]		2008[1]		2007[1]		2006[1]		2005[1]		2004[1]		2003[1]	
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad
Total # Observed	3	14	8	48	4	34	2	27	4	21	1	23	3	34
% of Total Observed	18	82	14	86	11	89	7	93	16	84	4	96	8	92
No. Hunters Reporting	194	194	244	244	244	244	239	239	256	256	229	229	191	191
No. Hunters Saw at Least 1	3	10	3	10	2	17	1	14	3	18	1	19	2	21
Maximum # Observed	1	3	3	4	2	8	2	11	2	2	1	3	2	7

	2002[1]		2001		2000		1999		1998		1997		1996		1995[2]
	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	Cub	Ad	All Bears
Total # Observed	3	17	0	7	2	15	4	7	0	15	2	3	1	10	11
% of Total Observed	15	85	0	100	12	88	36	64	0	100	40	60	9	99	nil
No. Hunters Reporting	199	199	127	130	88	93	87	89	121	124	96	96	6	14	44
No. Hunters Saw at Least 1	2	14	1	7	1	10	2	6	0	8	2	3	1	9	9
Maximum # Observed	2	3	0	1	2	3	2	2	0	3	1	1	1	2	2

[1] Change in reporting for 2002 may have resulted in artificially lower numbers of hunters reporting for 1995-2001, see text.

[2] All bears not separated out by cubs and adults.

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). This year a resident hunter using an outfitter harvested a grizzly bear in zone S/OT/01 during the 15 August – 31 October hunting season; the hunter also harvested a mountain caribou and a moose. It is clear from the comments made by hunters on voluntary observation forms that, despite the lack of hunting opportunities, grizzly bears remain a subject of considerable interest for non-resident hunters and their guides in the Mackenzie Mountains (Appendices C and D). Consistent with the past 11 years, hunters in 2009 reported the loss of meat, capes and food to grizzly bears, a perception that there were too many grizzly bears, and that a hunt should be considered. Outfitters also continue to mention camp and equipment damage by grizzly bears both during and after the season. Even though moose calf numbers, based upon hunter observations, are generally lower in the Mackenzie Mountains than those reported in the Mackenzie valley and predation by grizzly bears could be a potential cause (Ballard, 1992) there were few hunter comments indicating low moose or caribou calf numbers. One outfitter commented that there were more moose calves this summer than in previoius summers which he attributed to grizzly predation on calves. A frequent comment of guided hunters is that bears have lost their fear of humans because of a lack of hunting and a concern that this was a human safety issue. Although there have been no documented injuries from grizzly bear attacks in the Mackenzie Mountains since the closure of the non-resident grizzly bear hunting season (Veitch, 1999), there were five incidents in 2009 in the southern Mackenzie Mountains

when grizzlies claimed meat from a moose or caribou kill while guides were in the vicinity or while they were at camp, the grizzlies came at night and took the meat. In these instances the guide and hunter left the area or the grizzly got what he wanted and left without incident (Carl Lafferty, personal communication). Since 1993 there have been 57 nuisance grizzly bears killed, the majority in the Sahtu (n=35) and Gwich'in (n=14) Regions with eight in the Dehcho, six of those eight kills occurred in the past four years (ENR Norman Wells and Fort Simpson, unpublished data). To minimize human-grizzly bear interactions electric fences have been used at main camps, temporary camp time use has been reduced, clean camp policy is standard, and some known high use grizzly bear areas have been avoided.

While the mean number of adult grizzly bears observed by hunters has fluctuated around a mean of 305 from 1996-2009, the cub to adult ratio calculated from the hunter observations has shown marked fluctuations with some periodicity (Fig. 8; Table 22). There was a peak in 2000, with 40 cubs/100 adult bears observed, followed by a decline to a low of 14 cubs/100 adult bears in 2003, with a subsequent increase to 33 cubs/100 adult bears in 2006. The 35 cubs/100 adult bears in 2009 is the second highest reported (Fig. 8; Table 22). Because cub grizzlies in the Mackenzie Mountains tend to stay with their mothers for three years (Miller et al., 1982), reported observations of 'cubs' likely refers to cubs-of-the-year, yearlings, and 2-year-old bears. Miller et al. (1982) documented a low reproductive rate for female grizzly bears in the Mackenzie Mountains, with no sows less than 8-years-old producing cubs, an average inter-litter interval of 3.8 years, and a mean litter size of 1.8. The 'cubs'/100 adult bears determined from reported hunter observations during 1996-2009 shows somewhat of a

periodicity, but whether it matches an underlying four year interval is debatable (Fig. 8). What is currently happening may or may not be similar to what was reported by Miller et al. (1982) during 1973-1977 when there was non-resident hunting of grizzly bears. We estimated the mean litter size from hunter observation reports by analyzing just those observations of groups of grizzly bears where cubs were present with only one adult. The estimated mean litter size in 2009 was 1.9, which falls within the range of 1.4-2.0 reported from 1996-2009. The 1.9 litter size reported for 2009 falls between the mean found by Miller et al. (1982) and the 2.2 reported for grizzly bears of Kodiak Island, Alaska (Troyer and Hensel 1964). The demographic parameters of Mackenzie Mountain grizzly bears estimated during 1996-2009 remain generally comparable to those reported during 1973-1977 by Miller at al. (1982).

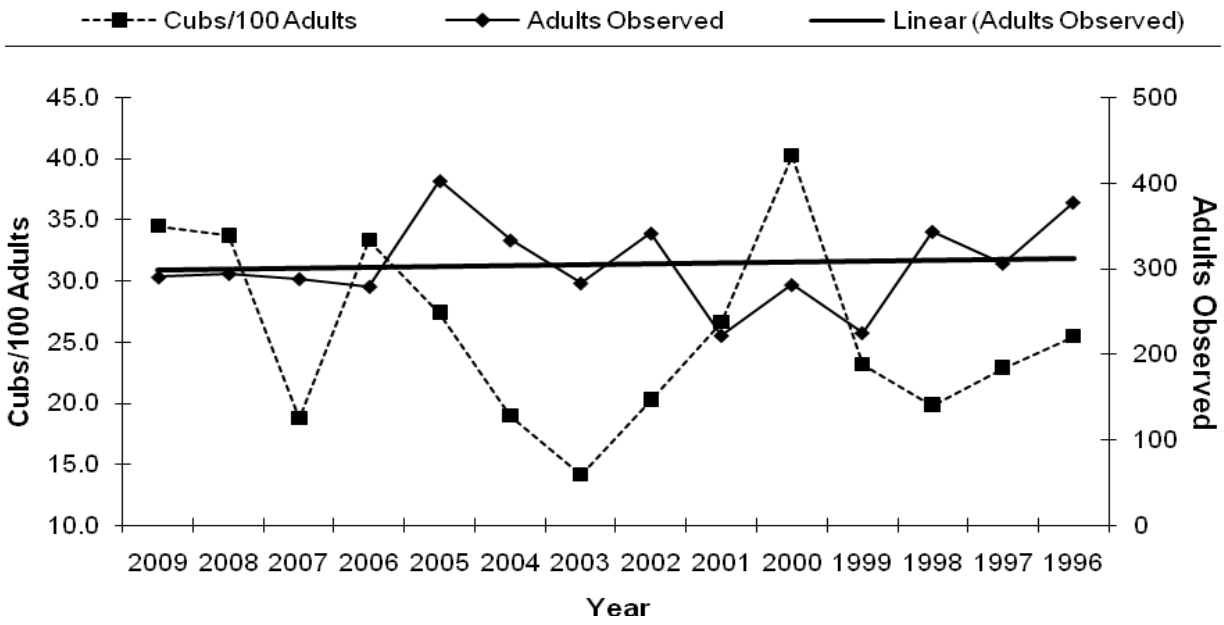

Figure 8. The number of 'cubs'/100 adults and the total number of adult grizzly bears observed by hunters from 1996-2009. Data are based upon voluntary hunter observation forms. The linear trend of total adult bears observed during the same time period is indicated.

Table 22. Observations of grizzly bear reported by non-resident hunters in the Mackenzie Mountains, 1995-2009; total number of bears observed, percent of cubs/adults, number of hunters reporting grizzly observations, number of hunters seeing at least one cub/adult, the mean and maximum number of cub/adults observed. [1] All bears were not separated out by cubs and adults.

	2009		2008		2007		2006		2005		2004		2003	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total # Observed	100	290	99	294	54	288	93	279	110	402	63	333	40	283
% of Total #	26	74	25	75	16	84	25	75	21	79	16	84	12	88
# Hunters reporting	47	109	48	139	28	127	50	122	49	150	34	131	19	120
# Hunters saw ≥1	36	64	31	64	17	56	32	70	10	65	15	57	9	53
Mean # Observed	2.1	2.7	2.1	2.1	1.9	2.3	1.9	2.3	2.0	2.3	1.9	2.5	2.1	2.4
Max. # Observed	6	20	6	12	5	15	5	12	10	16	4	15	12	7

	2002		2001		2000		1999		1998		1997		1996		1995
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	All Bears[1]
Total # Observed	69	341	59	222	113	281	52	225	68	343	70	306	96	377	389
% of Total #	17	83	21	79	29	71	19	81	17	83	19	81	20	80	nil
# Hunters reporting	34	128	136	171	108	131	98	117	139	177	110	170	49	132	138
# Hunters saw ≥1	11	48	28	104	51	97	28	81	31	105	32	129	46	129	123
Mean # Observed	2	2.7	0.4	1.3	1.1	2.1	0.5	1.9	0.5	1.9	0.6	1.8	2.0	2.9	2.8
Max. # Observed	8	20	5	10	8	12	4	12	6	16	12	17	5	15	16

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We thank Mary Knox for ensuring that all data she received by the Sahtu ENR office was forwarded to the Fort Simpson ENR office, and Jeff Walker for providing the nuisance bear data. John Nagy provided unpublished data from Richardson Mountain Dall's sheep work and a reanalysis of satellite collared mountain caribou data. We gratefully acknowledge the Boone and Crocket Club for providing us with access to their on-line trophy database and Safari Club International for providing us with caribou data from their on-line trophy database. Matson's Laboratory aged all of the moose teeth.

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Appendix A.

Outfitters licenced to provide services to non-resident hunters in the Mackenzie Mountains, NT – 2009.

D/0T/01 – *SOUTH NAHANNI OUTFITTERS LTD.*

Werner and Sunny Aschbacher
PO Box 31119
Whitehorse, YT Y1A 5P7
Ph: (867)-399-3194
Fx: (867)-399-3194
e-mail: info@huntnahanni.com
website: www.huntnahanni.com

D/0T/02 – *NAHANNI BUTTE OUTFITTERS*

Clay and Jim Lancaster
PO Box 3854
Smithers, BC VOJ 2N0
Ph: (250)-846-5309
2nd Ph: (250)-263-9197
e-mail: jladventures@xplornet.com
website:
www.lancasterfamilyhunting.com

G/0T/01 – *ARCTIC RED RIVER OUTFITTERS*

Tavis Molnar
PO Box 1
Whitehorse, YT Y1A 5X9
Ph: (867)-633-4934
Fx: (867)-633-4934
e-mail: arcticred@canada.com
website: www.arcticred-nwt.com

S/0T/01 – *GANA RIVER OUTFITTERS*

Harold Grinde
P.O. Box 528
Rimbey, AB T0C 2J0
Ph: (403)-357-8414
e-mail: ganariver@pentnet.net
website: www.ganariver.com

S/0T/02-*MACKENZIE MOUNTAIN OUTFITTERS*

Stan and Helen Stevens
P.O. Box 175
Dawson Creek, BC V1G 4G3
Ph: (250)-786-5118
Fx: (250)-786-5404
e-mail: stevens.mmo@pris.bc.ca
website: www.mmo-stanstevens.com

S/0T/03 – *RAM HEAD OUTFITTERS*

Stan and Debra Simpson
P.O. Box 89
Warburg, AB T0C 2T0
Ph: (780)-848-7578
Fx: (780)-848-7550
e-mail: ramheadoutfitters@hotmail.com
website: www.ramheadoutfitters.com

S/0T/04 - *NWT OUTFITTERS*

Eric and Lorna Mikkelson
PO Box 106
Lazo, BC V9N 8Z8
Ph: (888)-293-2299
Fx: (250)-897-0054
e-mail: nwtoutfitters@shaw.ca
website: www.nwtoutfitters.com

S/0T/05 - *REDSTONE TROPHY HUNTS*

Dave Dutchik
P.O. Box 18
Pink Mountain, BC VOC 2BO
Cell: (250)-261-9962
Ph/Fx: (250)-772-5992
e-mail: redstone@netkaster.ca
website: www.redstonehunts.com

Appendix B.

Summary of fees, bag limits, and seasons for big game species available to non-resident hunters in the Mackenzie Mountains, NT - 2009. [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		15 Aug – 30 June
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	25 Jul - 31 May
	Non-resident alien	$50.00	$100.00	2	1 Aug - 15 Apr
Wolverine	Non-resident	$20.00	$100.00	1	25 July - 31 Oct
	Non-resident alien	$50.00	$100.00		25 July - 31 Oct

Source: Department of Environment and Natural Resources. 2009. Northwest Territories Summary of Hunting Regulations. Department of Environment and Natural Resources, Yellowknife, NT. 30 pp.

Appendix C.

Comments provided from non-resident hunters in the Mackenzie Mountains, NT on voluntary Hunter Wildlife Observation Report forms, 2009. We have not printed actual names of outfitters or their guides (XXX).

Best place on earth

Amazing place, lots of animals, great outfitter. XXX and XXX welcome you into their family + look forward to my time to introduce them to my family.

Great hunt with good outfitter and camp. Beautiful country.

All the guys at XXX were great and very organized. I had a wonderful experience and plan to come back again soon as possible. 2:1 guided with XXX for Primos TV Show.

XXX is a well run organized operation. One of the best outfitters I have hunted with. Had a great experience in the Mackenzie Mountains and have already planned a return trip with XXX.

Great hunt

XXX presents himself in a very professional manner. I consider him to be first class guide. The entire XXX group is top notch. XXX and XXX go out of their way to make your stay with them great.

All was perfect, we enjoyed our Dall Sheep hunt. Very professional team. I will be happy to return with hunters for moose and caribou hunt. 2:1 guided with XXX

I believe the outfitter is excellent, the guide was good, and very willing, but a bit inexperienced (by his own assessment). I killed a great sheep on day 4, and then spent 10 days hunting hard with no other opportunity. Bad luck, I suppose.

Killed both with a bow!

Very efficient and very well organized outfit with excellent guides and management.

Jo he pasado de puti medre. Me hen tratado excelentemente y regresere en avento me la permite mi economie femiber.

Perfect!

I had a excellent hunt, but do not plan (I don't see it will not happen) to come back as I got what I wanted!

I'm enjoy a lot.

It was a great and unforgetable experience to hunt in this outragious landscape with excellent guidance and support.

Guide could be a little more cooperative!

Too many brown bears - too close to tent!!!

Fantastic service, unique experience of a breathtaking beautiful contry, challenging hunting, very professional and personable guiding.

Nice time, hard hunt, not so much luck

Too many brown bears!!

Shot a one-eyed moose, lots of grizzlies.

47" green core in Boone and Crocket.

This is a real wild hunting that I really appreciate. The association is very good and they are very professional in the guiding.

2:1 guided with his son XXX.

Bow hunter

But apparently the expansion of Nahanni Park will compromise the hunting opportunity.

Great hunt, lots of sheep. Don't understand why the government is making this a park. It seems like this will limit access.

Great hunt and outfitter.

Great area and beautiful country.

Hunt cut short by copter crash, very sad. Would like to thank C.O. at Ft Liard, XXX, who came after hours & did export permits & plugged horns. It helped me & also XXX at this sad time. Saved us both a day. Please thank him again.

Shot my sheep on the first day.

First Class operation - the best I ever hunted with.

Excellent number of animals, lots of grizzly sign and damage to cabin. Would be nice to be able to hunt grizzly bear as well in this area. I would come back if I could continue to hunt this area. I hear its being taken over by parks!!
Excellent hunt, quality animals, overall great experience.
The greatest hunting adventure of my life, more than I ever would have dreamed of. I will never forget the Mackenzie Mountains.
Wonderful hunting with XXX - a first class company.
Come back for sheep.
Outfitter + guides very professional, courteous, safety conscious. Very well organized. Beautiful country, great people.
Did not kill because of helicopter accident, had to cut hunt short.
Storms confined us to the tent. 4 out of 7 days and weather confined us to base camp 1 day. Only able to hunt 2 1/2 days. Did not harvest missed + bad weather.
Beautiful, unspoiled, rugged mountains. Did not harvest, bad weather.
Awesome guide. No harvest.
On a scale of 1-10 this operation is a definite 10. Client 82 could not do it because of a bad back.
Old hunter/missed.
Rams scattered
Good hunt sheep + caribou looked good. Ram shot was old + sick.
Saw a lot of rams in the 5-6 yr old range, other than that all animals appeared in excellent condition.
All animals looked in great shape.
Good condition of all animals, small growth on shoulder of ram taken.
All game healthy.
All animals appeared in good condition.
Animals in all good condition.
Amazing! Sheep in fair condition. Not as fat as expected. Some sheep with winter hair. Food source good.
All animals looked in excellent shape.
Topnotch Outfitter A+. All animals looked in good-excellent condition.
All animals looked good except for the sheep being chase by the wolves!
This is amazing country - I can't wait to come back! XXX does it right. They are the best outfitter I've ever been out with. All animals good shape. Lots of smoke from fires.
6 grizzlies under 50 yards/1 very skinny old boar.
All animals looked in great shape.
All animals looked in great shape.
All animals looked in great shape.
Excellent lamb count.
All game in good condition.
All animals in good health.
All in good shape. Lucky, lucky, lucky wolf!
All game healthy, Ram in good shape (teeth + condition) despite age.
I've hunted Alaska, BC and 6 states in the lower 48. The NWT is by far the best due to the quality and quanity of game and the low hunting pressure. Healthy sheep, caribou looked good, griz healthy.
Rams teeth were uneven + infected slightly on one side, but was still in good condition, fat. Wolf was in good shape, some fat. 1 ewe appeared to have lumpy jaw. All other game in good shape. Early rut.
Have had 2 years of great hunting - time to hunt other places. Animals in good shape.
All animals looked in great shape.
Animals in good health.
All game healthy.
All animals in good condition. Saw lots of bulls. Wolves in very good condition. Rut is just starting.
All animals looked in great shape.
High calf crop numbers in caribou.
Good hunting and very good outfitter. All in good shape, high calf count.
All animals seem to be in good health. Saw lots of cows without calves (caribou).

Saw lots of bulls, excellent genetics, all other animals appeared to be in healthy condition.
All game healthy. Caribou killed 1st day, game count is for 6 days.
Lots of bulls, all in good shape.
Lots of bulls, all in good shape.
Lots of sheep, all young rams. Bears looking for food, there is no blueberries for them.
All appeared in good condition. Lots of young rams.
All animals looked in great shape.
All game in good health.
Great hunt
XXX has a wonderful outfit and area. The game is plentiful and the country is awesome.
XXX rates at the top! Intrigity, service, ability and more.
Left in a hurry! Was not able to comment on hunt!
Great hunt. Wonderful 1st time sheep hunting experience.
Great Hunt. Great experience.
Classy outfit!
Excellent hunt, awesome time. A grizzly bear season would be a good idea.
Very positive experience. XXX is a well run operation. XXX and his crew are very professional and kind.
Beautiful mountains lots of game, outfitter and guides " top notch". Came on recommendations and will give many recommendations for this outfitter.
Charged by 1 lone grizzly bear @ camp! Charged by 1 sow with 2 cubs that was just protecting her cubs and walked into us in a small gorge. I would like to se a non resident bear tag. Note - no bears were shot!
Once again - excellent hunt + beautiful country.
Great hunt with a great outfitter.
Outstanding camp, plane/pilot, gear, equipment, cooks and guide. Outfitter took great care with the meat and has a wonderful cooler system. Looking forward to returning next year. Making more of the Mackenzie Mountains a park is a terrible mistake and one that as a taxpayer, naturalist, hunter, hiker and outdoorsman sickens me. Its an embarassment. There is not one good reason in the world and it is immoral for our politicians to push their agenda.
The hunts are fair chase, which I like. I would like to see grizzly open season, a great experience.
Where we were hunting called the Purple Mountains there was a ton of wolf sign, all the sheep were really small it was very depressing! Less wolves more sheep would have been nice.
Hunt was super.
Would be nice to be able to hunt all these grizzly bears.
Charged by 2 bears 1 of them had 2 cubs, saw plenty of sheep not many lambs, 6 golden eagles, awesome mountains.
It was way more than I ever expected.
Hunter just tagged along, did not hunt.
Hunter had health problems + left early because of problems breathing.
The outfitter and the guide were both great! I had an outstanding experience with all the help I needed for my first Dall's sheep hunt. I got my sheep at the end of the 4th day. If anyone would ask about a hunt for themselves I would recommend XXX and my guide without any hestitation.
Great area, lots of sheep, XXX was a great guide. XXX and XXX & crew are great people who respect the land they oversee and ensure fair chase. I would come again as I feel safe and well looked after.
For the number of hours out, I saw many great animals, had a great time in this area of the world. Beautiful land. Desire to come back very soon to hunt again.
My hunt with XXX was outstanding in all areas. The XXX family and their employees represent the best the outfitter business has to offer.
Great outfitter - good guides - could not have been better. I will come back with XXX again.
Great outfit! Excellent area amd experience!
An outstanding hunt with an outstanding outfitter and guide. A safe hunt with emphasis on safety and well-being.
Great food and camp. All staff were extremely helpful.
Fantastic outfitter, great cook, very knowledgeable guides, very friendly and helpful staff lots of game seen every day.
It was just an awesome time and all the guides are great.
Excellent hunt should open grizzly hunt

Amazing experience.

Bowkill

Ram had been ham stringed by wolf.

Enjoyed the hunt, outfit is run well.

Way too many Grizzly bears in area. They came into camp every night. You need to make some bear tags available before someone gets malled or killed.

Number of moose was for only three day trip. Quality of hunt was considered excellent.

I saw a large number of mature bull caribou and would like to return in the future to harvest one of them. I saw a good number of sheep with a good number being mature rams. Caribou were plentiful with a large percentage being mature bulls.

Excellent quality of game + game management. Had a great time saw LOTS of game. Camps were well organized + my guide XXX was a lot of fun. He was the reason I was able to take such a nice ram. Would highly recommend XXX to any hunter.

Great Hunt. Excellent hunt, enjoyed myself.

Great country, will hunt again. Saw many rams and caribou.

Wild Country. Great outfitter. Very few caribou calves. Should allow grizzly hunting.

Had a great time. XXX and XXX are great people.

This is my first trip to Mackenzie Mts. + I am impressed with the amount of game seen. I only hunted 1 day. This is a clean, unspoiled + beautiful area. Please keep it that way. There were many 3/4 full curl rams. Saw caribou and grizzly. Saw many sheep flying into and out of camp. Many ewes and lambs on the front range.

Very well run professional camp.

The experience in the Mackenzie Mountains was only possible through the guides and services of XXX and XXX.

Incredible guides, cowboys, horseman and best of all great people! Thank you XXX - XXX. Sheep population seen good/okay. Caribou seem to be less/much less than average... Beautiful country however wildlife numbers seen low for such remote country. Take care of your wilderness.

Had a great time, great wildlife.

Great hunt. Bear raided camp - stole meat! Abundant game - 2 bears one raided base camp stole meat one at spike camp was a menace. Otherwise abundant moose, caribou + sheep.

I saw a large number of high quality moose, caribou and sheep. I also saw signs of a significant number of wolves and bears.

Very well run outfit. I also was extremely fortunate to be paired with a great guide who gave me the latitude to hunt the way I wanted (long bow & muzzle loader). Wide variety of game. It looked to me like a good variety of age class of caribou as well.

This outfitter is very well operated. They have the cleanest camps I've stayed in + the guide was excellent. Would come here again + recommend XXX to everybody. There was not as many caribou as I expected. All the animals I seen looked healthy.

Had a good time, lots of game.

Awesome experience, great food, clean camp. XXX was really great to hunt with, learned a lot. He was very good (the best).

The country is great, the outfitter is great and the guides are great. XXX is the best outfit I've been with. They have the cleanest camps that I have seen + the guide was excellent and everyone was very friendly.

Great hunting. Saw a lot of game nothing old.

Great country + people. Great hunt, would return.

Awesome lots of game and beautiful country.

Outfitter + guides were excellent. My physical condition made this hunt marginal for me, at best. Guides XXX + XXX were very good.

Large number of sheep were seen, good numbers of rams, exes and lambs.

Too many wolves and bears. Lots of sheep and lots of big rams.

A very good hunting experience and time well spent.

XXX is a resident hunter from Yellowknife.

Appendix D.

A summary of the 2009 voluntary hunter comments broken down into specific topics.

No. of hunters reporting	No. of hunters mentioning good quality hunts	No. of hunters mentioning abundance /quality of animals	No. of hunters mentioning grizzlies	No. of hunters mentioning wolves	No. of hunters mentioning Park expansion	No. of hunters mentioning bad weather
148	77	33	20	8	4	2

Appendix E.

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2009. Number harvested includes [1]10, [2]2, [3]10, [4]6, [5]8 and [6]6 harvested by resident hunters.

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	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

Appendix E (cont.)

Number, age, and horn length measurements of Dall's sheep rams harvested by non-resident hunters in the Mackenzie Mountains, 1967-2009. Number harvested includes [1]10, [2]2, [3]10, [4]6, [5]8 and [6]6 harvested by resident hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean	Sample Size
1992	203	9.7	199	88.0	202
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
2001	199	10.0	188	87.7	189
2002	173	9.9	166	89.2	166
2003	213	9.7	210	89.8	212
2004	201 [1]	10.0	199	89.3	200
2005	203 [2]	10.2	196	89.4	199
2006	208 [3]	10.4	206	88.4	207
2007	216 [4]	10.8	216	88.3	216
2008	192 [5]	10.6	192	88.8	192
2009	179 [6]	10.9	178	88.2	178
Mean 1972-2009	173	9.3	153	89.0	165

Appendix F.

Outfitted non-resident hunter harvests in the Mackenzie Mountains, 1991-2009. Number harvested includes [1]10, [2]2, [3]10, [4]6, [5]8 and [6]6 harvested by resident hunters.

Year	Number of Licences Sold	Number of Animals Harvested						
		Dall's Sheep	Mountain Caribou	Moose	Mountain Goat	Wolf	Wolverine	Black Bear
1991	354	170	179	40	6	14	3	0
1992	364	203	142	32	5	7	0	0
1993	382	191	191	56	9	7	3	0
1994	356	199	164	46	5	15	2	0
1995	344	190	180	49	6	14	1	0
1996	387	201	175	46	4	11	4	0
1997	352	210	168	44	2	17	1	0
1998	345	215	160	52	5	9	0	0
1999	321	204	117	36	1	11	3	0
2000	332	189	127	44	1	14	0	0
2001	339	199	132	47	2	15	2	0
2002	329	173	168	42	5	11	1	0
2003	347	213	143	48	6	12	0	0
2004	337	201 [1]	135	55	6	18	0	0
2005	394	203 [2]	160	75	18	19	1	0
2006	407	208 [3]	188	72	12	23	1	0
2007	405	216 [4]	165	74	21	12	0	0
2008	399	192 [5]	167	75	21	17	1	2
2009	339	179 [6]	125	59	20	20	3	1
Mean 1991-2009	360	198	157	52	8	14	1	0

Appendix G.

Summary of age and sex ratios calculated from non-resident hunter observation reports in the Mackenzie Mountains, 1995-2009.

Year	Dall's Sheep		Mountain 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
2001	59	89	56	61	28	120
2002	58	89	59	31	29	96
2003	50	83	39	36	25	129
2004	53	93	42	38	30	101
2005	51	98	42	42	33	110
2006	53	96	43	37	33	137
2007	64	83	52	37	36	101
2008	49	98	41	40	31	115
2009	55	94	45	39	31	90
Mean 1995-2009	55	87	44	37	29	104

Appendix H.

Summary of age and sex ratios calculated from non-resident hunter observation reports of mountain goats, 2002-2009.

Year	Kids:100 Nannies	Billies:100 Nannies	Total Animals
2002	55.2	75.9	69
2003	61.5	70.5	182
2004	57.1	77.1	84
2005	66.0	50.4	306
2006	61.5	51.4	245
2007	71.2	57.7	393
2008	54.3	97.1	264
2009	64.6	59.0	327
Mean	61.4	67.4	234