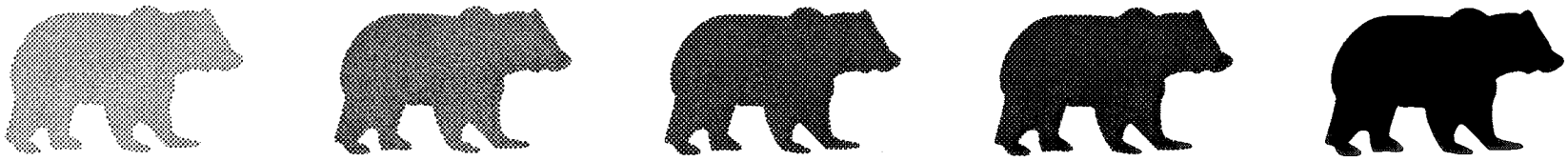
EXTENSION REPORT

Hunt Wisely:

A GUIDE TO MALE—SELECTIVE GRIZZLY BEAR HUNTING



Barney Smith
Fish and Wildlife Branch
1991

Yukon
Renewable Resources

Hunt Wisely:

A guide to male-selective grizzly bear hunting

Yukon Department of Renewable Resources
Box 2703
Whitehorse, Yukon
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Director, Fish and Wildlife Branch

Chief, Big Game Management

1991

Foreward

This technical report was written with hunters, naturalists, and biologists in mind. It presents the results of 12 years of investigations into the relationship between hunters and grizzly bears in the Yukon.

Achieving an appropriate balance between science and readability has not been easy. Your comments, both positive and negative, are important. Please take a moment to let us know if you found the report interesting, understandable or useful.

Additional Information

Readers desiring more detailed information are encouraged to contact local librarians who can help obtain the detailed studies cited here.

A video explaining how to distinguish trophy male from smaller male or female grizzly and brown bears has been produced. It is available on loan from Audiovisual Services, Yukon Libraries and Archives Branch (Phone 667-5240) or for purchase ($25.00) from the Yukon Fish and Game Association, P.O. Box 4095, Whitehorse. Y1A 3S9

Direct questions and comments to:

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Acknowledgements:

Many people contributed to this report. Hunters shared details of their hunts with with P. Merchant and District Conservation Officers. Outfitters and guides recalled observations of patterns in the behaviour of their hunters and bears. Their cooperation has been particularly noteworthy. Alaska Deptartment of Fish and Game biologists R. Boertje, J. Hechtel, and H. Reynolds generously provided observations, opinions and unpublished data. Analysis by J. Carey and T. Fox and reviews by J. Carey, D. Cooley, G.Hare, B. Hayes, M. Hoefs, K. Jingfors, C. Martin, B. Moise, R. Sumanik, L. Van Daele, and D. Van de Wetering were appreciated. I am grateful to M. Hoefs, H. Monaghan, B. Pelchat and D. Russell for encouragement in this work. Final thanks are extended to D. Milne for typing, and J. Brown and S. Green for typing, figure preparation and layout.

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Increasing the Proportion of Males in the Harvest

Yukon hunters and guides could safely take twice as many grizzly bears each year, if they did not increase the kill of female grizzlies. This is no easy task. But it's possible if grizzly hunters and guides know more about bears. This paper is one of a series of educational materials designed to help hunters and guides learn how to find more male grizzly bears and how to distinguish trophy male bears from other bears[a].

Why is this important?

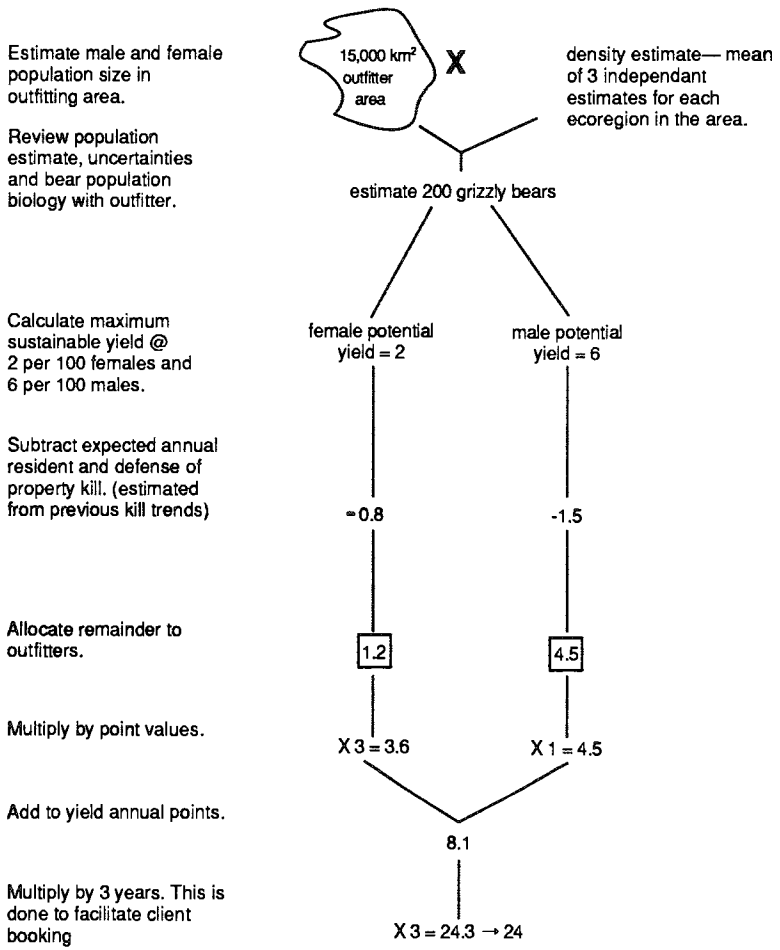
The response to the demand to increase the grizzly bear harvest is constrained by the current female kill. Female kills are at close to maximal levels in most accessible mountainous uplands of the central and southern Yukon[b]. But only about 40% of the males that could be harvested are taken. We could harvest more grizzlies if we reduce the proportion of females taken.

Incentives to hunt male grizzly bears have changed hunting behaviour but have not reduced the proportion of females taken. Under the point system introduced in 1985, outfitters have a 3:1 incentive to take males (Figure 1). The bears taken now are older, larger, and greater in number, but overall the sex proportions remain the same[cd].

A few guides and outfitters, however, developed highly efficient, male-selective hunting practices. Our goal is to duplicate their success. They learned, through observation and experimentation, how male and female bears use the landscape and how to judge bears.

Increasing the proportion of male bears in the harvest will also benefit moose populations. Male bears take significantly more adult moose than do females.

Figure 1. How are grizzly numbers and point values determined for outfitting areas?



Why Should Hunters Be Concerned About Excessive Female Harvests?

Excessive female harvests can lead to declining populations and reduced hunting and viewing opportunities.

Grizzlies reproduce very slowly. Females produce their first cubs at age seven or later and only every three to five years afterwards. The reproductive biology of female grizzlies has several implications for hunters:

- Grizzly populations are very slow in recovery from overharvest at any given time.
- Many females will be solitary (without offspring) and therefore legally available to unselective hunters.
- Most young females remain in their mother's home range after weaning so adjacent hunted areas are re-colonized very slowly.

This report summarizes the influence of several factors affecting hunter selection of male versus female grizzly bears.

Guides will likely recognize some of these factors at work in their hunting areas and may choose to modify hunting practices to maximize male encounters. The result will be greater potential harvests, better trophies, more satisfied clients, fewer crippling losses, higher quality recreation, and a better understanding and appreciation of our grizzly bears.

More information

a. See also the video "Take A Closer Look."
b. Smith and Osmond-Jones. Grizzly Bear Abundance and Harvest in Yukon Ecoregions.
c. Smith 1990a. Sex weighted Point System regulates grizzly bear harvest.
d. Smith 1990b. Grizzly Bear Point System Update, 1985 to June 1990.

METHODS

The methods used to collect the data on which this report is based fall into four categories:

1. **Hunter interviews/biological submissions:** Since 1973, Yukon hunters have been required to submit their grizzly bear skulls for measurement and aging. Information on the location, time, date, and location of kill, rump fat thickness, pelt color and condition, and whether the bear was taken near animal remains is also required (Figure 2). Co-operation has been excellent. Since the questions evolved over time, analyses are based on the longest period for which comparable data are available.
2. **Radio collaring studies:** There have been 16 studies of northern interior grizzly bears, principally in Alaska. Most studies focused on population size however a few documented information on bear distribution during hunting seasons.
3. **Outfitter interviews/observations of hunting parties:** The behaviours of guided hunters were determined by **a)** observation of hunting parties in different outfitting areas (OA 1-3 weeks, OA 2-2 weeks, OA 14-1 week, OA 11-1 week, OA 7-1 week), and **b)** through structured interviews with outfitters.
4. **Non-resident hunter questionnaires:** Single-mail-out surveys were sent to non-resident hunters who purchased grizzly bear seals in 1978 and 1980. The results provided background information on their preferences in trophy quality.

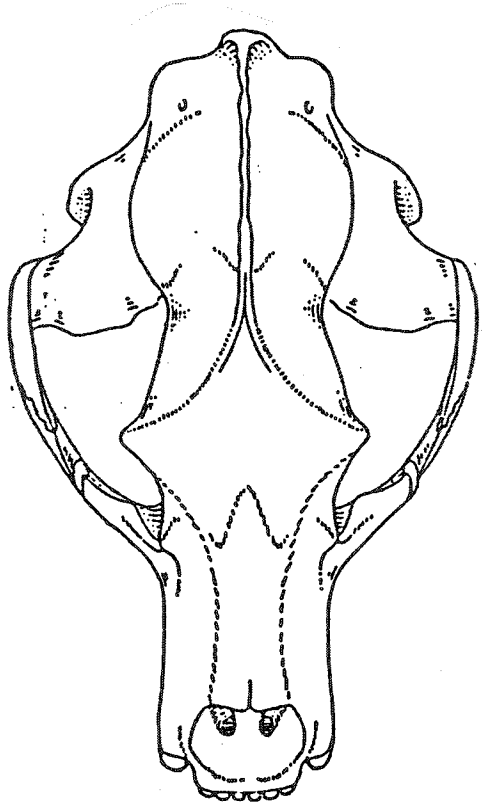
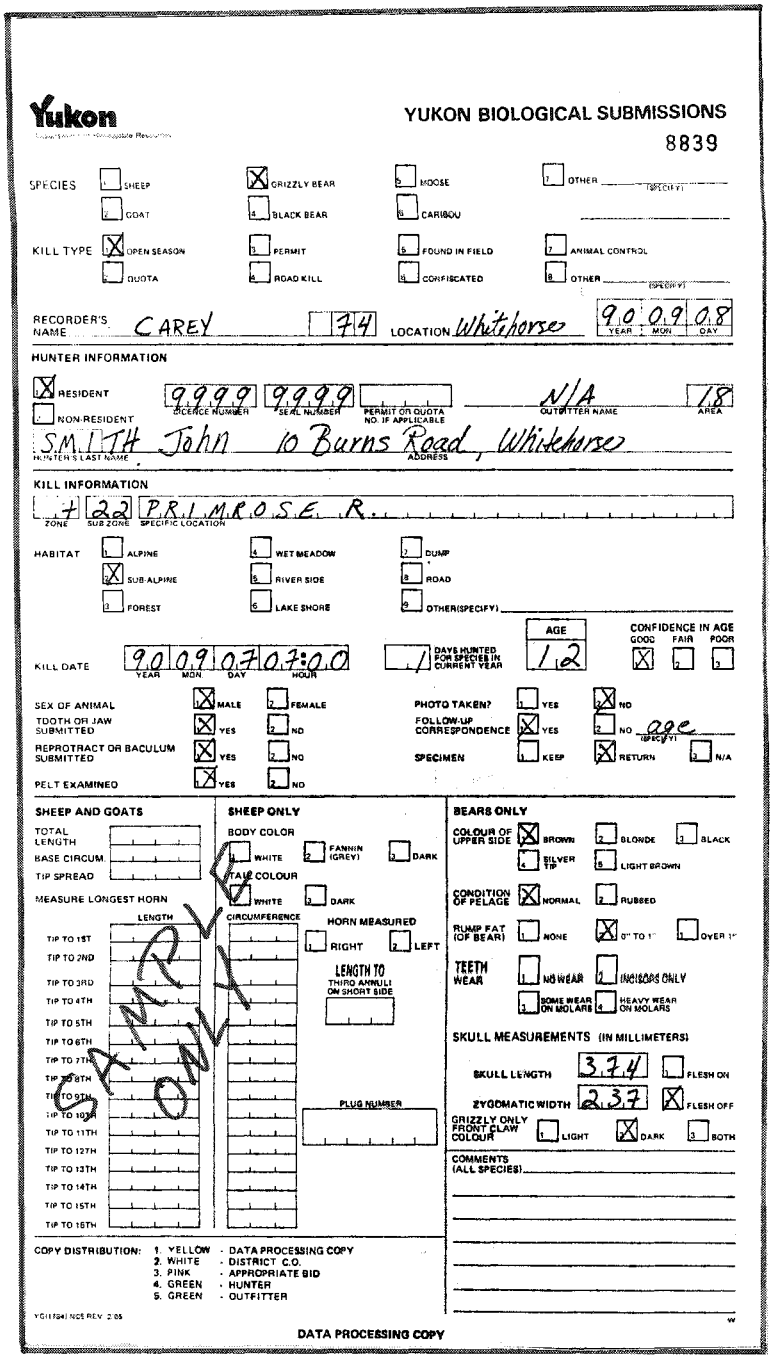


Figure 2. An example of the records kept for each grizzly bear killed.



Yukon

YUKON BIOLOGICAL SUBMISSIONS

8839

SPECIES: [ ] 1 SHEEP [X] 3 GRIZZLY BEAR [ ] 5 MOOSE [ ] 7 OTHER (SPECIFY)
[ ] 2 GOAT [ ] 4 BLACK BEAR [ ] 6 CARIBOU

KILL TYPE: [X] 1 OPEN SEASON [ ] 3 PERMIT [ ] 5 FOUND IN FIELD [ ] 7 ANIMAL CONTROL
[ ] 2 QUOTA [ ] 4 ROAD KILL [ ] 6 CONFISCATED [ ] 8 OTHER (SPECIFY)

RECORDER'S NAME: CAREY 74 LOCATION: Whitehorse YEAR: 90 MON: 09 DAY: 08

HUNTER INFORMATION

[X] 1 RESIDENT [ ] 2 NON-RESIDENT
LICENCE NUMBER: 9999 SEAL NUMBER: 9999 PERMIT OR QUOTA NO. IF APPLICABLE: OUTFITTER NAME: N/A AREA: 18
HUNTER'S LAST NAME: SMITH FIRST NAME: John ADDRESS: 10 Burns Road, Whitehorse

KILL INFORMATION

ZONE: 7 SUB ZONE: 22 SPECIFIC LOCATION: PRIMROSE R.

HABITAT: [ ] 1 ALPINE [X] 2 SUB-ALPINE [ ] 3 FOREST [ ] 4 WET MEADOW [ ] 5 RIVER SIDE [ ] 6 LAKE SHORE [ ] 7 DUMP [ ] 8 ROAD [ ] 9 OTHER (SPECIFY)

KILL DATE: YEAR 90 MON 09 DAY 07 HOUR 07:00 DAYS HUNTED FOR SPECIES IN CURRENT YEAR: 1 AGE: 12 CONFIDENCE IN AGE: [X] 1 GOOD [ ] 2 FAIR [ ] 3 POOR

SEX OF ANIMAL: [X] 1 MALE [ ] 2 FEMALE
TOOTH OR JAW SUBMITTED: [X] 1 YES [ ] 2 NO
REPROTRACT OR BACULUM SUBMITTED: [X] 1 YES [ ] 2 NO
PELT EXAMINED: [X] 1 YES [ ] 2 NO
PHOTO TAKEN? [ ] 1 YES [X] 2 NO
FOLLOW-UP CORRESPONDENCE: [X] 1 YES [ ] 2 NO (SPECIFY) age
SPECIMEN: [ ] 1 KEEP [X] 2 RETURN [ ] 3 N/A

SHEEP AND GOATS
TOTAL LENGTH
BASE CIRCUM.
TIP SPREAD
MEASURE LONGEST HORN

SHEEP ONLY
BODY COLOR: [ ] 1 WHITE [ ] 2 FAWN (GREY) [ ] 3 DARK
TAIL COLOUR: [ ] 1 WHITE [ ] 2 DARK
HORN MEASURED: [ ] 1 RIGHT [ ] 2 LEFT
LENGTH TO THIRD ANNULI ON SHORT SIDE
PLUG NUMBER

	LENGTH	CIRCUMFERENCE
TIP TO 1ST		
TIP TO 2ND		
TIP TO 3RD		
TIP TO 4TH		
TIP TO 5TH		
TIP TO 6TH		
TIP TO 7TH		
TIP TO 8TH		
TIP TO 9TH		
TIP TO 10TH		
TIP TO 11TH		
TIP TO 12TH		
TIP TO 13TH		
TIP TO 14TH		
TIP TO 15TH		
TIP TO 16TH		

SAMPLE ONLY

BEARS ONLY
COLOUR OF UPPER SIDE: [X] 1 BROWN [ ] 2 BLONDE [ ] 3 BLACK [ ] 4 SILVER TIP [ ] 5 LIGHT BROWN
CONDITION OF PELAGE: [X] 1 NORMAL [ ] 2 RUBBED
RUMP FAT (OF BEAR): [ ] 1 NONE [X] 2 0" TO 1" [ ] 3 OVER 1"
TEETH WEAR: [ ] 1 NO WEAR [ ] 2 INCISORS ONLY [ ] 3 SOME WEAR ON MOLARS [ ] 4 HEAVY WEAR ON MOLARS

SKULL MEASUREMENTS (IN MILLIMETERS)
SKULL LENGTH: 374 [ ] 1 FLESH ON
ZYGOMATIC WIDTH: 237 [X] 2 FLESH OFF
GRIZZLY ONLY FRONT CLAW COLOUR: [ ] 1 LIGHT [X] 2 DARK [ ] 3 BOTH

COMMENTS (ALL SPECIES)

COPY DISTRIBUTION:
1. YELLOW - DATA PROCESSING COPY
2. WHITE - DISTRICT C.O.
3. PINK - APPROPRIATE GID
4. GREEN - HUNTER
5. GREEN - OUTFITTER

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DATA PROCESSING COPY

Background

In his fieldwork with outfitters in the early 1970's, Pearson found that autumn hunters rarely passed up the first legal grizzly bear that they encountered[a]. By 1988, after 3 years under the point system incentive to take males, outfitters reported that, on average only about half the hunting parties took the first legal grizzly that they encountered; the rest were passing up young, small and light coloured bears[b].

Evaluation

The questionnaires revealed that 36 percent of non-resident hunters are searching for large bears while 29 percent are willing to shoot any bear. Since size is often overestimated, it is not surprising that most guides reported difficulty in persuading hunters to pass up the first legal bear they encountered and to continue searching for a larger bear. Most hunters wanted bear trophies mounted as rugs, yet little emphasis was placed on hair length (Figure 3).

Spring bear hunters were reported by outfitters as being more selective and knowledgeable than autumn hunters. These hunters selected large, well-furred bears for lifelike mounts. Male grizzlies taken in the spring had significantly larger heads (length plus width of skull) than those taken in the autumn. There was no significant difference in female skull sizes between seasons.

No evidence was found to suggest that resident grizzly bear hunters behaved any differently, although many purchased tags so they could legally keep a pelt if they had to shoot a bear in defence of life or property.

Implications

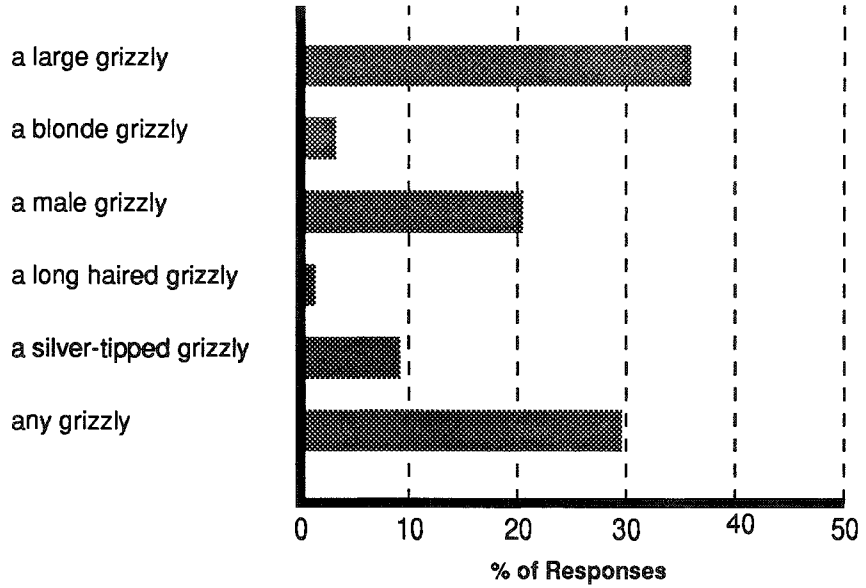
1. Because hunters are unselective, outfitters and guides face two challenges. They must be very firm to keep hunters from taking the first legal grizzly bear seen. They also must take clients to settings where male grizzlies are active.
2. All hunters and guides need training to judge trophy quality.
3. Where excessive female harvest continues, restrictions will be needed to promote hunting only by serious and selective hunters, only in periods when male grizzlies are most frequently encountered.

More Information

a. Pearson 1975. The Northern Interior Grizzly Bear.
b. Smith 1990a. Sex weighted point system regulates grizzly bear harvest. Most of these were autumn kills.

Figure 3.

Question: When you decided to come to the Yukon to hunt grizzly bears, were you interested in taking:



Note: based on 120 responses to 215 questionnaires mailed after the 1980 hunting season to all non-resident grizzly bear hunters. Fractional values were assigned if hunters identified 2 or more qualities. The majority of seals sold and respondents were autumn hunters.

LEGAL MALES AND FEMALES

Background

Female bears accompanied by young and all young less than 2 years of age (family groups) are protected. Pearson[a] suggested that about two-thirds of the adult females would gain protection by this legislation because they had young for 2 years out of their 3 year reproductive cycle. Based on this study, Lortie and McDonald[b] predicted that 71% of the bears in the huntable population should be male. Harvests from 1973 to 1976 contained a lower proportion of males than this, leading them to the conclusion that overhunting had removed many males from the population[c].

Evaluation

Subsequent studies throughout the range of the northern[d] interior grizzly reveal relatively high losses of cub and yearling litters in the first few months after den emergence (Table 1). This leaves about half of the adult females without offspring (51% in the Alaska Range[e] and 47% in the Ogilvie Mountains[f]), and therefore, legal to be hunted in the autumn. In total, less than 40% of females over age 2 gain protection from legislation that protects family group members.

Based on computer models[g] we now predict that females comprise about half of the autumn and about 40% of the spring population of solitary bears that are legally available to hunters (Figure 4).

Table 1. Survival of offspring observed in marked family groups from northern interior grizzly studies.

Area	Observation		Source
	Age	Survival %	
W. Alaska Range, Alaska	COY[a]	64[b]	Reynolds et al. 1987
	YRL	88	
	TYO	93	
W. Brooks Range, Alaska	COY	56	Reynolds & Hechtel 1983
	YRL	81	
	TYO	86	
Susitna River, Alaska	COY	63	Miller 1987
	YRL	78	
E. Brooks Range, Arctic National Wildlife Reserve, Alaska.	All cubs and yearlings Survived in1982. In 1983 only 61% of cubs and yearlings survived.		Garner et al.1984

a COY = cubs of the year, YRL = yearling, TYO = two year old
b Cubs observed soon after den emergence that were alive a year later.

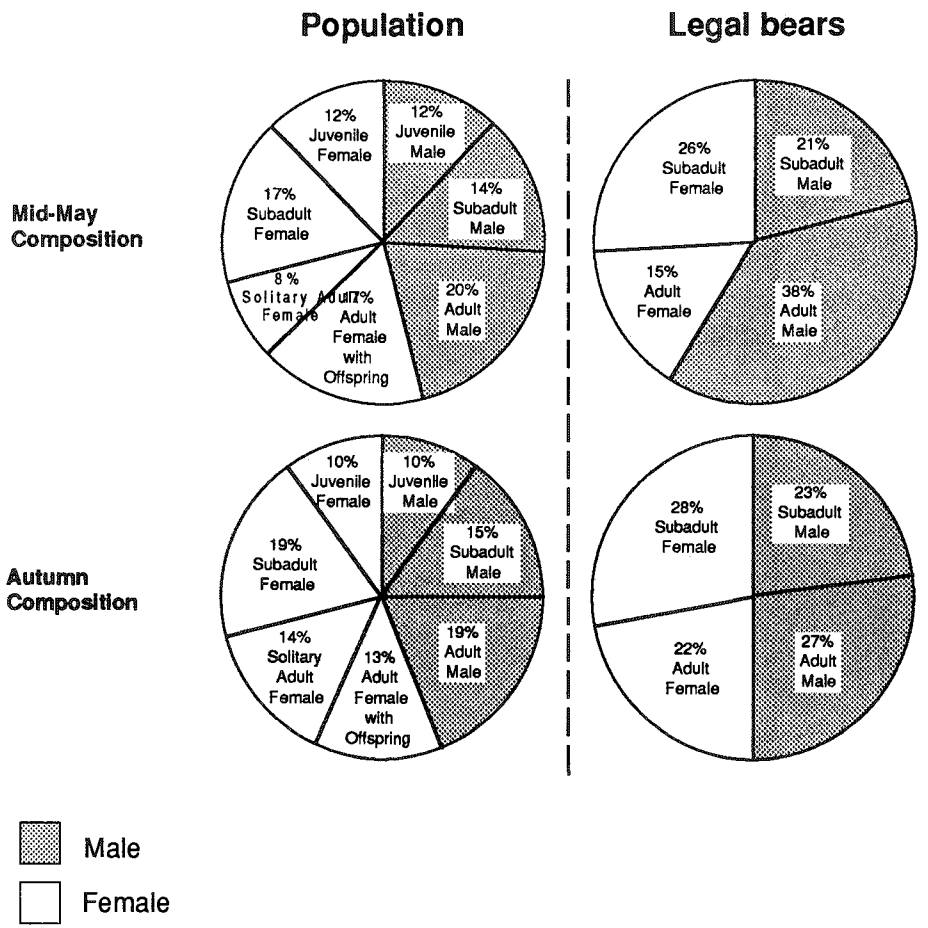
Implications

1. More females are barren and more solitary bears are female than was previously believed.
2. Legislation protecting family group members does not adequately protect bear populations from non-selective hunters. Selective hunting is essential.
3. Caution is required in interpreting population status from short-term, sex ratio data.
4. An apparent abundance of females with litters of newborn cubs may imply low offspring survival. A long-term abundance of females with older offspring in the autumn would be more suggestive of high offspring survival and production.

More Information

a. Pearson 1975. The Northern Interior Grizzly Bear.
b. Lortie and McDonald 1976. A 23 year grizzly bear harvest analysis. - note that declining hunter success (bear kills/bear tags) and the high proportions of adult females in the kill supported their diagnosis of overharvest.
c. This diagnosis was consistent with the predictions in Bunnell and Tait 1980.
d. LeFranc et al. 1987. Grizzly Bear Compendium. Note litter losses are apparently less frequent in southern grizzly bear populations.
e. Reynolds and Hechtel 1988. Population dynamics of a hunted grizzly bear population in the north central Alaska Range.
f. Smith in prep. Female Grizzly Bear Abundance, Productivity and Potential Harvest in the Ogilvie Mountains, Yukon.
g. Smith 1987. Anursus population projections for Yukon grizzly bears.

Figure 4. Changes in the age and sex composition of bears available to hunters. Proportions are based on computer simulations.



Note: a)Juveniles include cubs and yearlings, subadults aged 2 to 6, adults 7+ years.

b)Percentages are approximate, and may vary as a result of hunting, and chance in local areas. Bears legally available to hunters exclude juveniles and females with offspring. More females are solitary in the fall than spring because they have lost litters.

Background

Male grizzly bears are taken in greater proportion in the spring than in the fall hunting season. Explanations given for this include: more females are with offspring in the spring and therefore protected, females emerge from dens later than males, and breeding males roam about more. A closer look at hunting data provided an insight into vulnerability within the spring and fall seasons.

Evaluation

Data collected from hunters were examined to identify weeks in which hunters had the greatest success and took the greatest proportion of males.

The greatest proportion of male bears and the greatest success was found in the spring season, particularly May 6 to 19 (Figure 5). Adult males were most often taken in the earliest part of the spring and latest periods of the fall season.

Implications

1. The "best" time to hunt grizzly bears optimizing sex and success should be the middle 2 weeks of May.
2. The best chance for average hunters to take male bears would be April, May, or October.

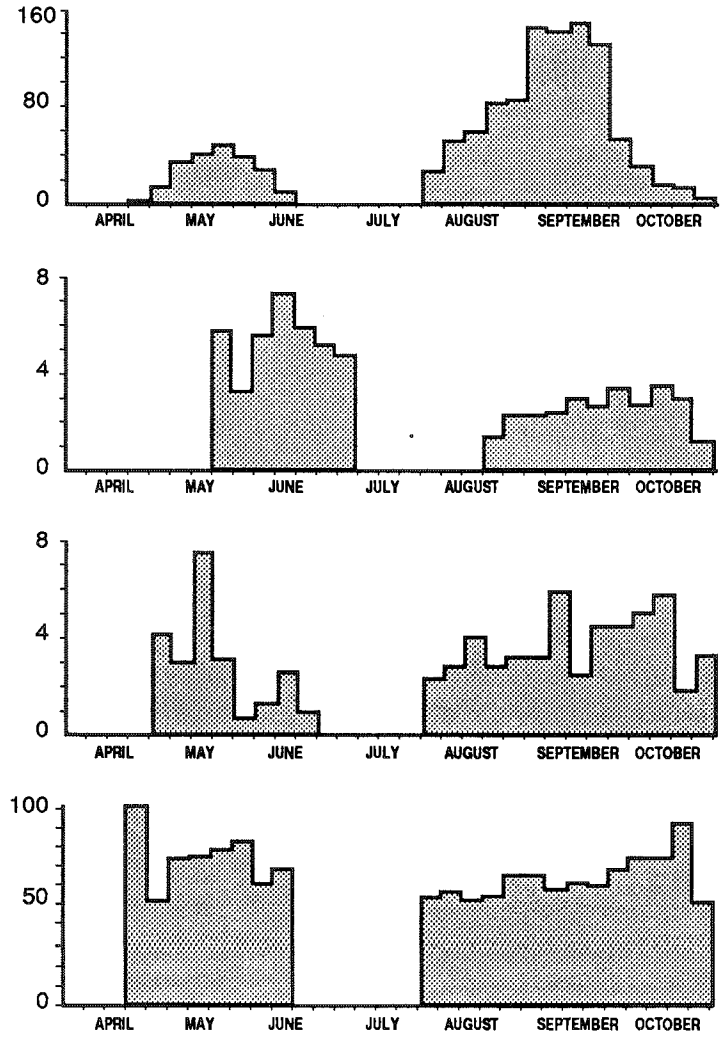
Figure 5. Weekly patterns in:

Number of grizzlies taken 1973 –1987

Resident kills per 100 days effort 1979 – 1987 (based on 189 kills)

Non-resident kills per 100 days effort 1979– 1987 (based on 443 kills)

Percent males in grizzly sport kill for each week of the 1973 – 1987 seasons (based on 1075 kills)



Background

Pearson observed that residents often killed grizzlies while hunting moose, caribou, or sheep in accessible alpine areas.[a] He observed that non-residents encountered and took grizzlies as they rode in mountainous areas seeking other game, or at "gutpiles" left from earlier kills[b].

Evaluation

The attitudes and abilities of some non-resident hunters limited potential hunting techniques. These hunters wanted to ride through magnificent country looking for game and listening to hunting stories. Generally, they didn't want to suffer the flies while glassing over berry patches or overlooking gutpiles. As a result, some of the most common hunting methods were also the least selective and most inefficient (Table 2). Despite this, few clients complained and most outfitters took as many bears as they wanted or were permitted.

Some outfitters, however, used extremely sophisticated and selective hunting methods based on hundreds of hours of observation, and a knowledge of bear behaviour that most researchers would envy. The outfitters and guides who had made this investment catered to a different group of hunters — those who demanded trophy class males for lifesize mounts, and were prepared to pay for highly specialized guides.

Table 2. Characteristics of grizzly bear hunting methods employed by guided non-resident hunters.

Name	Description	Season	How Common Is It	Potential Success	Potential Selectivity
1. Afternoon Glassing	a fairweather activity from elevated vantage points overlooking alpine or subalpine expanses. Associated with lunch and siestas and appeared to be viewed as a guide resting activity	Fall	Mod	Low	Low
2. Transit Trail Rides	ranged from 1 or 2 hour evening and morning rides connecting camps and hunting areas, to 9 hour pack train rides. Often in forested valley floors. Little opportunity to use binoculars.	Fall	Mod	Low	Low
3. Berrypatch Trail Rides	horserides through open areas where bears/wildlife previously seen. Often on established hunting trails along ridges, benches or contours where berries were abundant.	Fall	Low to Mod	Mod	Mod
4. Berrypatch Glassing	short duration glassing of adjacent subalpine areas was common during trailrides, but extended glassing was not common, particularly in tundra and valleyfloor settings or if weather cool and/or wet.	Fall	Low	High	Mod
5. Monitoring Ungulate Gutpiles	hunters would ride to vantage points overlooking the remains of previous moose and caribou kills. If there was evidence the site had been visited, the kill would be watched. See text for details.	Fall Spring	Mod	Mod	High
6. Floodplain Survey	Ranged from river drifts to travel along active floodplains rich in bear foods, by horse, foot or ATV.	Spring Fall	Low	Mod	Mod
7. Spring Glassing	Extended glassing taking advantage of 24 hr. light, partial snowcover, broad open valleys and seasonal bear concentrations in alpine and floodplains.	Spring	Low	High	High
8. Monitoring Estrous Females	Required a thorough knowledge of local breeding behaviour, female distribution,and aggressive behavior.	Spring	Low	High	High

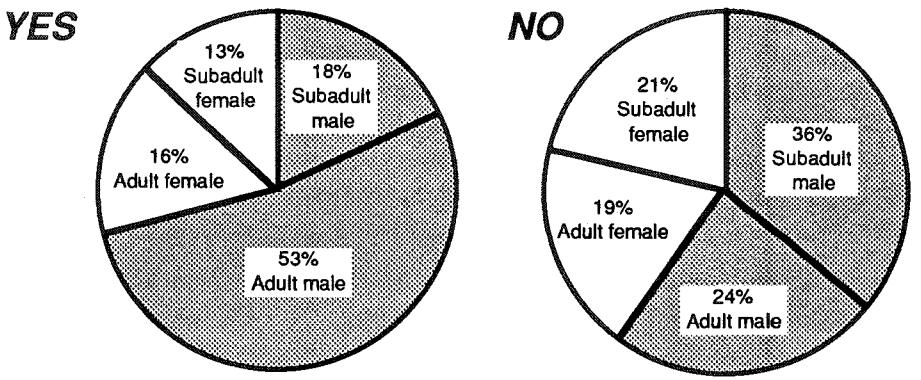
A special effort was made to obtain reliable data on the age and sex of bears killed near gutpiles. Twice as many adult males were taken in these settings than in random encounters (Figure 6). Hunters and guides were reluctant to admit to gutpile hunting, so more of the grizzlies may have been taken near animal remains than were declared. This could increase the differences between these two categories. Gutpile hunting was most common in brushy areas where moose hunting was concentrated and bears were difficult to locate. It was most common when berry crops were poor. Seventeen outfitters estimated that 39% of their grizzly bear kills were taken over animal remains during the 1985–88 period.

No data were obtained that suggested that illegal hunting methods (such as spotting and hazing from aircraft, or baiting) were common, or that these methods would have been particularly efficient or selective. Aerial checks of gutpiles occurred to an unknown degree and could lead to extremely efficient and selective hunting if observers were experienced, but a bear seen this way could not legally be hunted until 48 hours after the aircraft had landed.

Implications

1. Guides and hunters who lack bear sex identification skills should hunt over gutpiles.
2. Guide training is needed so that the most selective and successful techniques are used more often.
3. Master-class bear guides need to be identified, rewarded and marketed so there is incentive for improvement in hunting methods.

Figure 6 Question: Was your grizzly taken near animal remains?



Note: Based on 221 answers given to this question by hunters and outfitters during compulsory reports regarding each kill between 1984 and 1986. Forty-five hunters responded "Yes" and 176 responded "No". Distributions were significantly different ($p<0.005$, $X^2 = 17.03$). Adults include bears 7+ years, subadults ages 1–6.

More Information

a. Pearson 1975. The Northern Interior Grizzly Bear.
b. Gutpiles consist of moose and caribou viscera, skeletons, and skins, as well as meat that is gunshot damaged, has severe parasite infestations or is illegally not taken from the killsite. Generally these last less than a week before they are cleaned up by scavengers.

DAILY ACTIVITY PATTERNS

Background

Different sexes may have different time-of-day foraging habits. Pearson[a] observed larger grizzly bears feeding on floodplains more in the late afternoon during the late summer. This was tested by collecting information on the time-of-day of all hunter kills, and comparing this to daily activity patterns observed in non-resident hunting parties in the autumn.

Evaluation

Non-resident hunters generally kept business hours when they hunted in the autumn[b]. They usually left camp between 7:30 and 8:00 a.m., stopped for lunch between 12:00 and 2:00, and returned for dinner by 7:00 p.m. (Figure 7).

Comparing this hunting activity to the daily pattern in the bear kill (Figure 7), it is obvious that bears are much easier to hunt in the late afternoon and evening[c]. Bears are difficult to see as they rest in daybeds, but become more visible later as they move about foraging. Limited bear activity, or the sounds of travelling horses could lead to low success in the morning.

During the day female kills were relatively constant, and roughly proportional to hunter activity. Male kills, in contrast, show a pulse before noon and in the late afternoon or early evening, suggesting that males were more active in late afternoon, as noted by Pearson.

The proportion of males and females taken by hunters varied significantly during the day in August and September (Figure 7). Female proportions in the kill exceeded 40% between 9:00 and 11:00a.m., between 1:00 and 3:00 pm, and between 7:00 and 8:00 pm. Female proportions in the kill were less than 35% between 7:00 and 9:00 am, 12:00 am and 1:00 pm, and with 2

exceptions, after 4:00 pm. Age and sex composition of the kill within different time of day periods per month reveals considerable variation. Within this variation, September evenings offered the greatest proportion of adult males. Adult females reached their highest proportion in September afternoons.

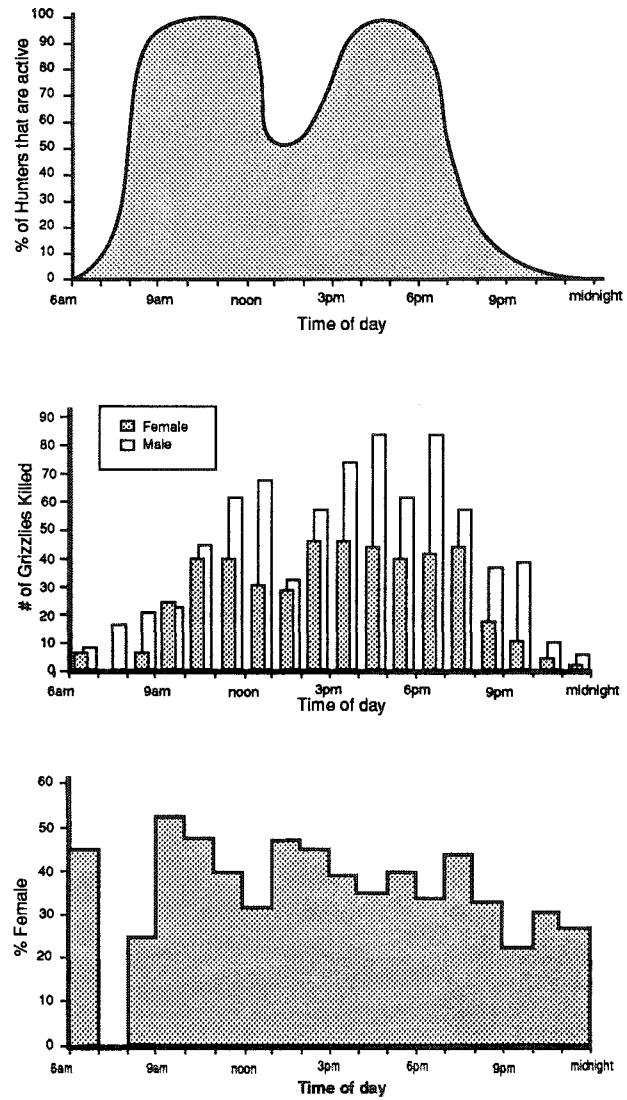
Implications

1. When is the best time of day to hunt grizzly bears in the fall? Considering both the chance of success, and the chance of taking a male, hunters should concentrate on late afternoon and evening hunts.

More Information

a. **Pearson 1975.**
b. **The operative word here is 'hunted'. Returning to camp was delayed by stalking and recovering game, but generally hunters did not hunt from dawn to dusk, particularly early in the autumn season.**
c. **This is seen in the relatively high number of kills compared to the low levels of hunter activity.**

Figure 7. Time of day patterns in August and September in:



Note: based on 1979–88 compulsory hunter interviews

Background

The variation in grizzly bear fur colour is almost overwhelming: a single hair can vary in colour, and the fur colour overall can vary depending on the position of the body, bleaching, moulting or the bear's age. To determine if overall colouration varied between the sexes, we examined fur colours of bears captured in studies and those killed by hunters. To determine if different coloured pelts had different camouflage values, we looked at what time of year different coloured pelts were taken.

Evaluation

Blonde bears seem to be much easier to see than dark bears against the green background of the growing season, but not against the yellows and oranges of autumn, or the browns of the "leafless" seasons (Figure 8). Dark bears are probably less camouflaged than blonde bears when most bears are taken during the spring and fall hunting seasons.

Capture and kill data suggest that more females than males are blonde (Figures 9 and 10). The exact proportion likely varies between areas, and could only be determined by a capture method that was not visually based (e.g. snaring).

About 1 in 5 bears taken had light coloured claws. These light clawed bears were more frequently adult females and less frequently subadult males (Figure 11).

Figure 8. Proportion of blonde coloured bears out of all bears taken by hunters, during four plant growth periods.

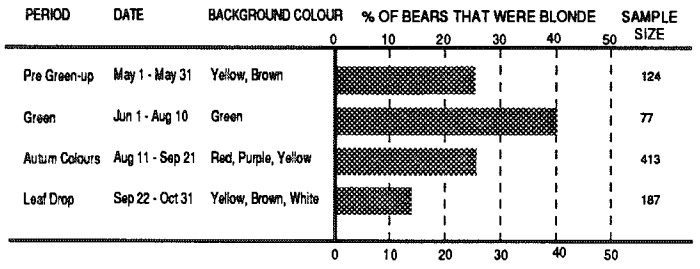
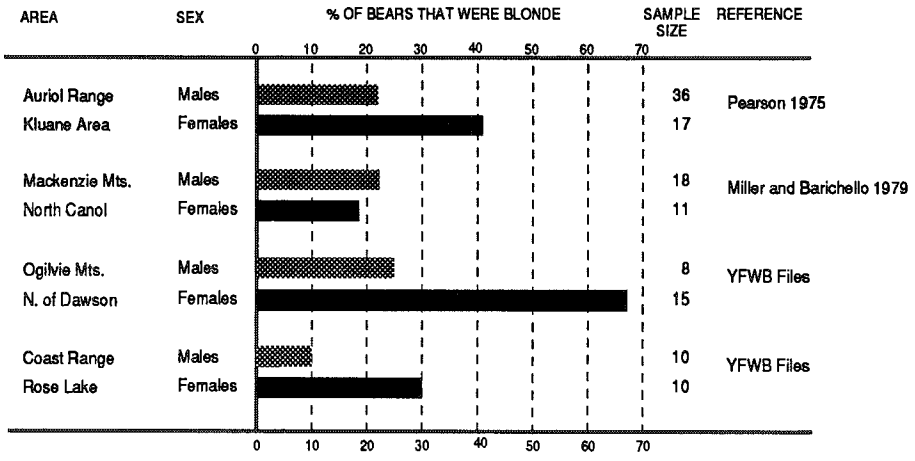


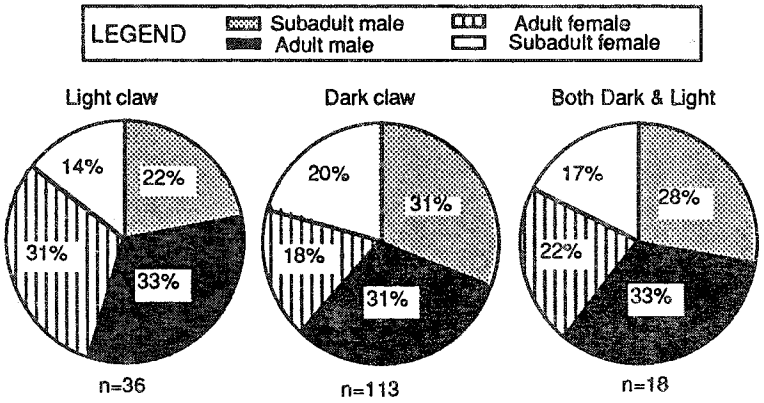
Figure 9. Proportion of blonde coloured bears out of all bears captured.



Implications

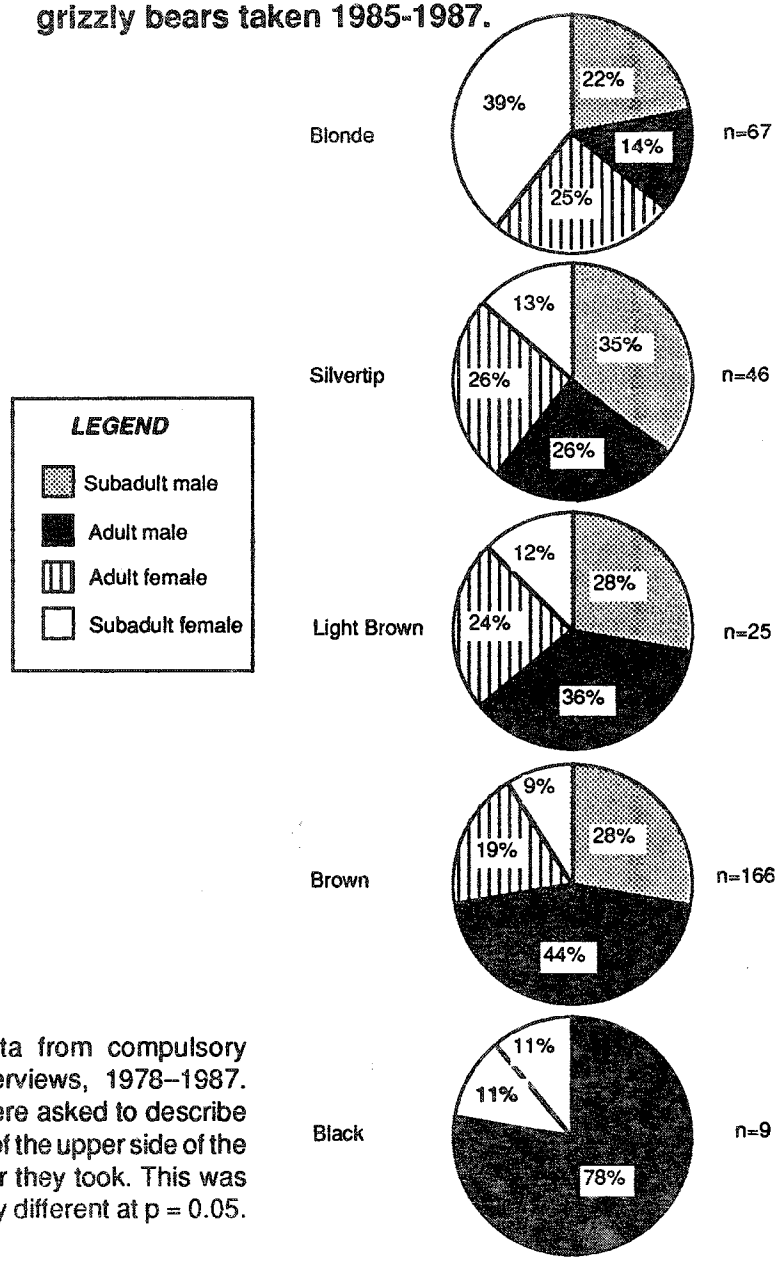
1. Because blonde bears are more camouflaged during hunting seasons, and females are more often blonde than males, fur colour tends to protect females.
2. Hunters should avoid blonde bears to minimize the risk of taking females.They should select the darkest bears possible if they wish to maximize their chances of taking an adult male.
3. In medium sized bears - that is adult females, a few subadult females and many subadult males - hunters should avoid animals with light claws if they wish to avoid female harvest.

Figure 11. Age and sex composition of grizzly bears having light versus dark front claws.



Note: Differences not significant.

Figure 10. Age and sex composition of different coloured grizzly bears taken 1985-1987.



Note: Data from compulsory hunter interviews, 1978–1987. Hunters were asked to describe the colour of the upper side of the grizzly bear they took. This was significantly different at p = 0.05.

Background

Different sexes have been found to use habitats differently in the northern Yukon[a], Jasper National Park[b], and the Kananaskis area[c]. In all of these studies, females had a greater tendency to use higher elevation habitats than males. If this tendency is widespread, then hunters active on upper slopes should encounter more females than males, all else being equal.

Evaluation

One consistent pattern is the avoidance of male-preferred habitats by females with cubs. As far as solitary bears are concerned, information on sex differences in habitat use is limited and suggests much variation. An Alaskan study suggested no obvious differences in late autumn habitat selections[d], however researchers did not collect detailed habitat data. In that study there were no significant differences in the elevations of the autumn relocations of the 3 males and 3 solitary adult females. In the Ogilvie Mountain study, kill data suggested strong separation: females comprised 14 of 18 kills at or above an upper treeline, but only 1 out of 11 kills at or below a lower treeline (Figure 12). The outfitter in the area observed that the bears found in the autumn on the large tundra expanses were generally large and dark and, when taken, were always males. The final observation, a correlation, comes from the outfitter interviews: All the outfitters that reported difficulty finding male bears in the autumn also reported abundant valleyfloor berries.

Implications

1. We need to learn more about how male and female bears use habitats differently. Until we do, hunters should consider the following points.

   a) Expect males to use lower elevation habitats if they can take advantage of a greater diversity and abundance of food items.

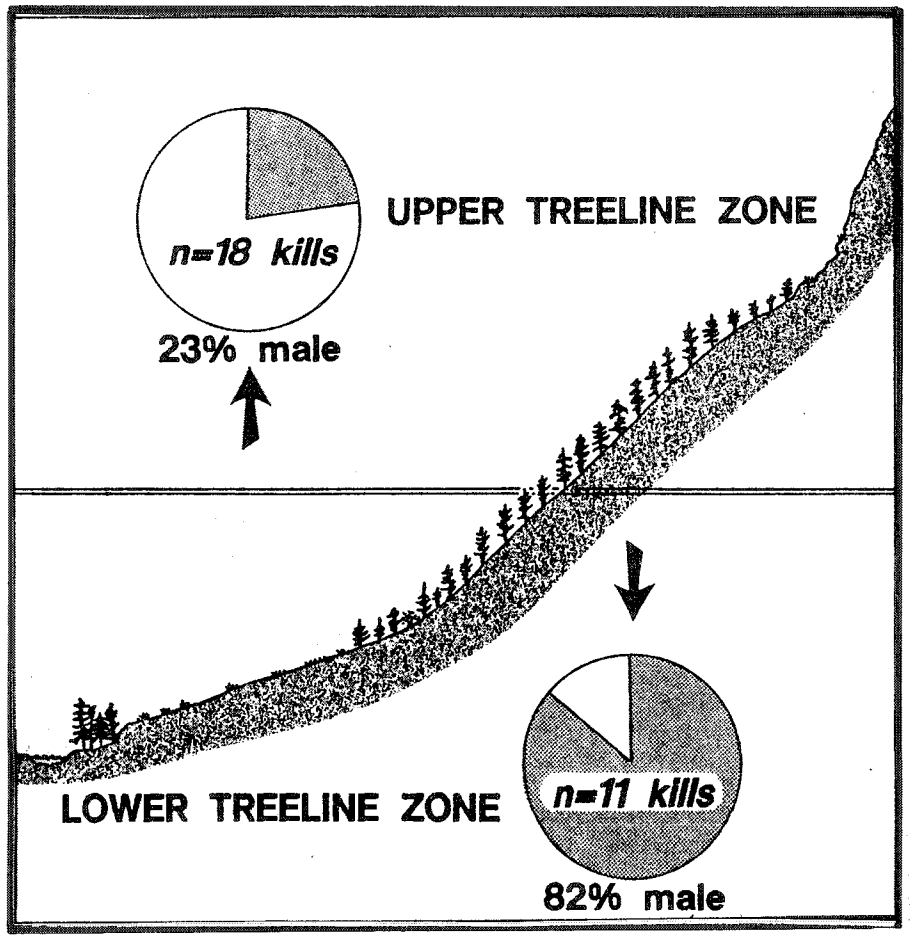
   b) Avoid habitats where females with newborn cubs are seen since these females tend to avoid adult males[b,e].

2. Individual grizzly bears return to forage at specific sites where they previously encountered rich food resources[f,g]. An individual bear may move to the same place at the same time, year after year. In this way bears can be very predictable.

More Information

a. Nagy et al. 1983. Ecological studies of grizzly bears in the Arctic Mountains, Northern Yukon Territory, 1972 to 1975
b. Russell et al. 1979. A Study of the grizzly bear in Jasper National Park.
c. Wielgas 1986. Habitat ecology of the grizzly bear in the southern Rocky Mountains of Canada.
d. Boertje and Hechtel. ADF&G pers. comm.
e. Darling 1987. Habitat use by grizzly bear family groups in interior Alaska.
f. Judd and Knight 1980. Movements of radio instrumented grizzly bears within the Yellowstone area.
g. Pearson pers. comm. Over three years one of his marked males was only in his study area (in a particular berry patch) one week per year.

Figure 12. A cross sectional view of an Ogilvie Mountain slope, illustrating the upper and lower treeline zones, and the sex composition of the autumn bear harvest.



Note: The unforested areas below the lower treeline were 'tundra flats', that is pediment slopes with permanently frozen soils. Blueberries were abundant in some of these areas.

Background

Most of the information we have on bear movements comes from observations of radio-collared animals. These long lived animals move within large home ranges where they intensively search for the most energy rich foods available. They usually travel to sites that previously offered good feeding opportunities, yet they are always alert for rich new food resources. Males, with their larger home ranges, (eg. 1035 vs 233 km^2 for females[a]) likely move further, faster, and more often than females. This greater male movement should translate into greater time spent standing or moving and a greater chance that their movements will be detected by a hunter[b].

Data to evaluate this come from a study in east central Alaska where male and female grizzly bears were relocated once each day during month long periods in the spring and fall[c]. Distances between these daily relocations provide a minimum estimate of distance travelled, and are assumed to be proportional to actual distance travelled.

Evaluation

The Alaskan study revealed the greatest distances were travelled by adult males in the spring, followed by solitary adult females in the spring, adult males in the fall and lastly, solitary adult females in the fall (Table 3). These differences in movement rates between the sexes were not as great as would be expected given the 4 to 5 fold differences in home range size.

Since most hunters "still hunt" in the spring (back packing to vantage points, although some travel extensively on rivers), the slightly greater distance travelled by males may make them more vulnerable

Table 3. What are the minimum distances that adult males and solitary adult females travel each day in the spring and fall? In this east central Alaskan study, 28.4% of the distances between daily relocations of males in the spring were under 2 km (1.25 miles).

Km between relocations	Spring		Fall	
	Male	Female	Male	Female
0	28.4	34.4	30.0	34.0
2	11.2	14.9	18.5	36.0
4	9.5	8.4	6.8	14.0
6	8.6	19.5	6.8	4.0
8	10.3	6.5	6.8	8.0
10	8.6	4.0	8.5	2.0
12	7.7	4.5	5.1	2.0
14	2.6	1.3	1.7	0.0
16	5.2	1.3	3.4	0.0
18	2.6	4.0	1.7	0.0
20	1.70	0.6	0.0	0.0
22	0.9	0.0	1.7	0.0
24	0.9	0.0	0.0	0.0
26	0.0	0.6	0.0	0.0
28	0.9	0.0	0.0	0.0
30	0.0	0.0	0.0	0.0
32	0.0	0.0	0.0	0.0
34	0.0	0.0	0.0	0.0
36	0.9	0.0	0.0	0.0
38	0.0	0.0	0.0	0.0

Notes:

1. This data from east central Alaska provided by ADF&G biologists R. Boertje and B. Gasaway. The spring data included a total of 150 relocations of 4 females and 116 relocations of 4 males, between 2 May and 10 June. The fall data included 49 relocations of 3 females and 58 relocations of 3 males, between 21 September and den entry or 18 October if still active.

2 In some instances the bear was in the same location on successive days. These "stationary" bears in the spring included 14.3% of the male observations and 10.7% of the female observations. Females were "stationary" at den sites in early May and males were "stationary" at "carcasses" almost exclusively after 24 May. These "stationary" bears in the fall included 32.8% of the male observations and 2.0% of the female observations. All these bears were on carcasses.

than females. In the fall the guided hunters on horseback ride about 30 km. each day. Both male and female grizzlies appear to move only a fraction of this (females 3.3 km, males 5.3 km between daily relocations). They are both almost stationary compared to the highly mobile hunting parties. Because of this, autumn hunters would not be much more likely to encounter a male or a solitary female, all else being equal.

The data revealed a surprisingly high proportion of stationary bears (Table 3, Note 2). Under certain circumstances this absence of movement could radically influence the relative vulnerability of the sexes. For example, in the spring females that emerge from dens later and confine their activities near dens would be less vulnerable than wide ranging males. Courting pairs that are stationary may result in greater male vulnerability if this courting takes place on exposed ridgetops where bears can be seen[d], since hunters will select larger, male bears. Females entering dens earlier will result in greater relative male vulnerability. Finally, greater predation rates by male grizzly bears on adult moose[e] could radically reduce their vulnerability. Unless hunters spotted the broad white palm of an antler from such a kill, a stationary bear lying on top of a buried moose in dense brush would never be seen and never taken.

Implications

1. Sex differences in average movement rates likely increase male kill proportions and hunter success in the spring.
2. Male observability may be reduced in the autumn due to their greater predatory behaviour, particularly during the moose breeding season.

More Information:

a. Reynolds and Hechtel 1986. Population structure, reproductive biology, and movement patterns of grizzly bears in the north central Alaska Range.
b. Bunnell and Tait 1980. Bears in models and reality—implications to management.
c. Boertje et al 1988. Predation on moose and caribou by radio-collared grizzly bears in east central Alaska.
d. Herrero and Hamer 1977. Courtship and copulation of a pair of grizzly bears, with comments on reproductive plasticity and strategy.
e. Boertje et al 1988. (see c above)

ACTIVITY AREAS AND THEIR DISTRIBUTION

Background

Bears have home ranges that overlap with those of other bears. This allows them to share food resources rather than waste energy defending them. In the fall they use small portions of these home ranges, those that are richest in foods and safe. Studies[a] reveal that males use areas about 25 km (16 miles) in diameter (they aren't usually circular), and females areas about 11 km (7 miles) in diameter, in the fall.

Since the feeding areas in a region are clumped, so are the male and female activity areas. Where you hunt, relative to these clumps, will influence the number of male and female bears that you will encounter.

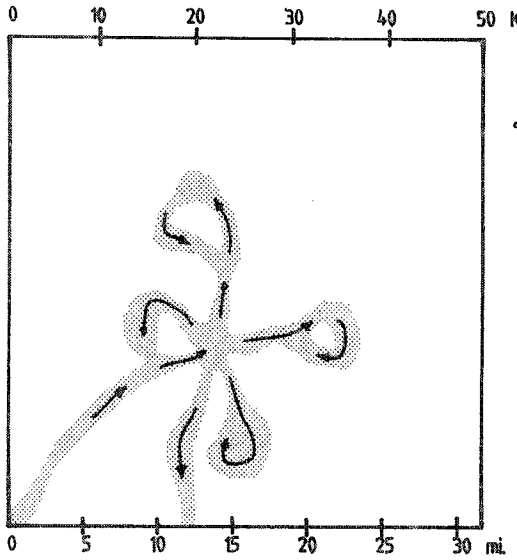
Here we consider an example. Figure 13a shows a 400 km^2 area covered by a guide and hunter working from a subalpine spike camp, over a six day period. In this and the surrounding 250km^2 area live 40 grizzly bears. There are 28 legal (solitary bears) here: 14 males and 14 females.

Evaluation

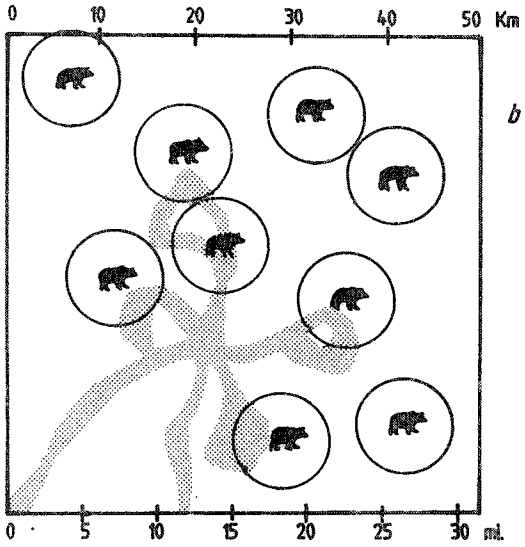
In our evaluation we first show a scattered distribution of the 14 females (Figure 13b). Note how much of the landscape has no solitary female activity — about half the area. The hunters could encounter 5 solitary females in their hunting areas.

If the females were clumped in 2 areas, (say these were like the mountainous uplands where Pearson[b] found females clumped in their activities) and the hunters were primarily looking for sheep and caribou so that they were hunting these upland areas, they could encounter 10 of the 14 solitary females (Figure 13c). Even hunting only 16% of the area they overlap with 71% of the solitary females.

Figure 13. Distributions of the autumn activity areas of hunters, female grizzly bears and male grizzly bears — hypothetical.



a) *a hunter and guide over a 6 day period on horseback, this was typical of Ogilvie Mtn. fall hunting.*



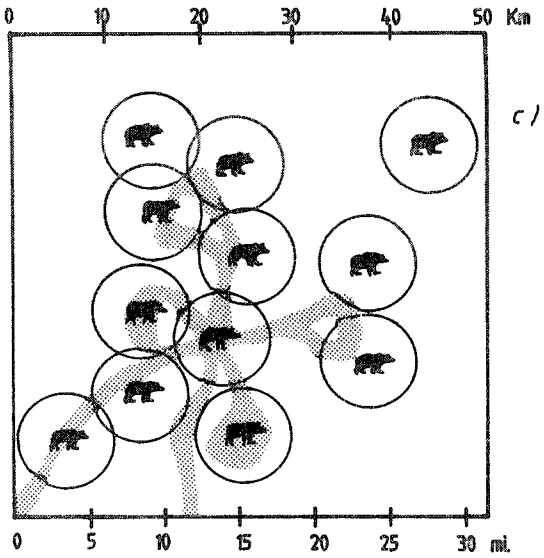
b) *the hunters could encounter 5 solitary females, in this situation.*

Now lets look at the males, assuming that they were scattered. Recall that their larger home ranges give them more feeding areas to choose from, and their larger size allows them to worry less about other bears. The hunters' travels would overlap with 9 male activity areas (Fig. 13d).

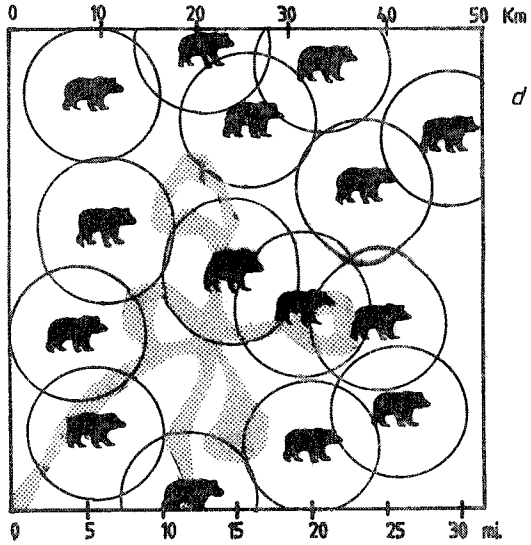
It is tempting to oversimplify the likelihood of a hunter seeing a bear in this example, but this depends on many other factors. The point is that there is good evidence that females clump their activities in more mountainous areas. Where the only fall foods are in the mountainous areas, most bears will clump there. There are also reasonable grounds to suspect that males may be scattered if there are rich foods elsewhere, along rivers, in tundra flats or in burned areas, not even close to where the females are clumped.

Grizzly bear spatial distribution is influenced by many factors. Studies consistently reveal great variation between individuals in how they 'make a living' and use the landscape. In the fall it is important to keep in mind that activity area size, shape and distribution are keyed to the distribution of feeding opportunities and that females, perhaps because of their greater needs for security when they are with offspring, may tend to use upland food resources to a greater degree, even when they are solitary.

In the spring, courting increases the size of activity areas of solitary adult males and females. Between early May and 10 June, a little before the peak of breeding, male activity areas were 36 km (23 miles) in diameter, and solitary females were 28 km (18 miles)[a].



c) the hunters could encounter 10 solitary females, if the females were clumped as in this example.



d) the hunters could encounter 9 males

Implications

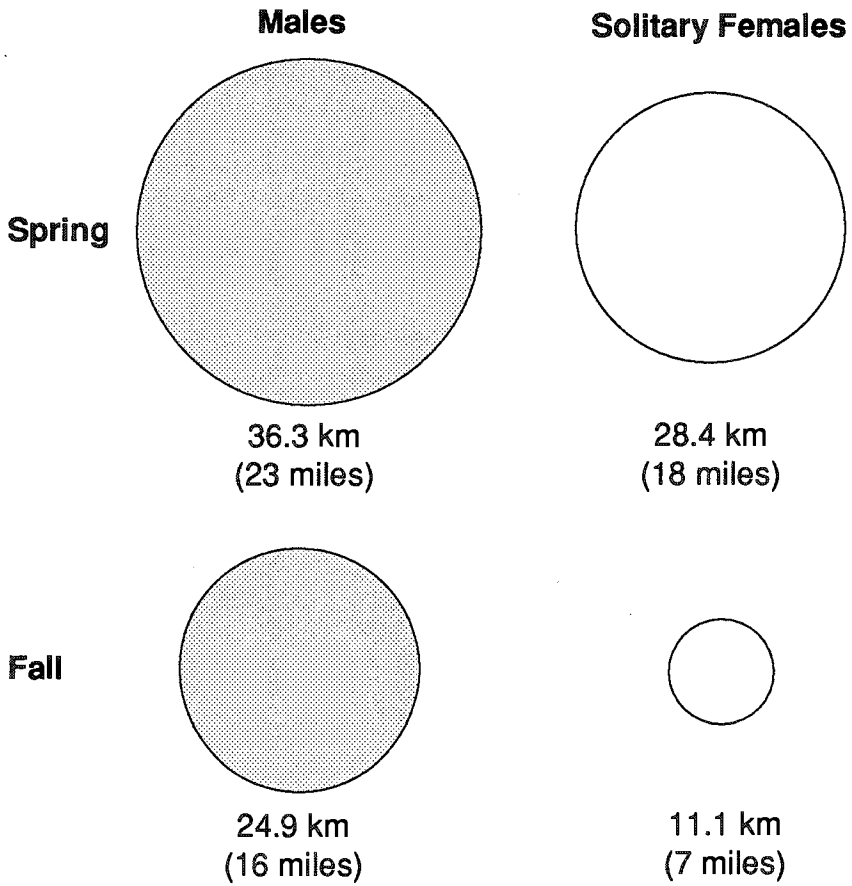
1. Much of the landscape is unoccupied by bears in the fall. The few legal bears in a small hunting area can be predominantly male or female — this cannot be easily predicted . Monitoring track and bear size during different seasons in different areas may be the fastest way to learn these patterns.
2. Hunters should anticipate female concentrations in upland areas in the autumn.

More Information

a. R. Boertje and W. Gasaway. ADF & G. Unpublished telemetry data from their east central Alaska study.
b. Pearson 1975. The Northern Interior Grizzly Bear.

Figure 13. (continued)

e. Relative sizes of the diameter of spring and fall, male and female, activity areas[a].



Background

Grizzly bears have evolved to be wary of people[a]. However, since fleeing from people uses energy and this energy may be in short supply, grizzlies have evolved to tolerate people to within about 50 m[b,c] – closer than this they attack or retreat. This adaptation suited grizzlies well until firearm use became widespread.

Under this new threat, strong avoidance responses had to be learned.[d,e] But grizzlies are well equipped for this learning: they have the largest brain/body ratio in carnivores[f], they have acute senses including colour[g] and night vision, they can learn from a single experience[h], and they have good memories[i]. In our management we are only now appreciating the ability of bears to learn (Table 4).

In this section, we explore potential differences between male and female grizzlies in their wariness of hunting parties. Remember: to appear wary, a grizzly only has to restrict its activities in the open, in traditionally hunted areas, during daylight, or when humans are detected.

Table 4. Wariness to hunters and how it could be learned in bear populations

Description	Comment
Direct Experience	
Bears avoid areas near people after being harassed, hurt, or injured (Gilbert 1989).	The variety of ways a bear could be harassed, hurt, or injured by people could result in a great diversity in this learning, and in what specific stimuli a bear associates with human related threats to its safety.
Maternal Training	
Observation of maternal response to stimuli provides an important education for cubs (Gilbert 1989).	Without flight, wariness may be a somewhat ambiguous message to young bears.
Observations of Other Bears/Animals	
Bear trainers observe that bears learn routines faster if they watch other bears (R. Leonard Parks Canada, pers. comm.).	Wariness, fear, or an avoidance response could be transferred between bears by observing the responses of siblings, mates, or other bears and through the non-response of hunter-killed bears.
Related Experience	
A grizzly bear that has little fear of people and a history of food conditioning may approach camps when it is hungry (Herrero 1989).	This related experience would reduce wariness to hunters and could increase vulnerability. Negative experiences such as being shot at near mining camps, chased by helicopters, handled by researchers, caught in furbearer traps, sickened by eating refuse or industrial products could also be associated with similar stimuli produced by hunting parties and thus increase wariness.
Selective Breeding	
Bears that exhibit aggressive traits towards humans or their property are more likely to be shot, thereby limiting their chance to pass their traits on to future generations, while wary bears live long and can pass their "wary" traits onto more generations. (Elgmork 1986)	The European populations of brown/grizzly bears are exceedingly wary, to the point of being largely nocturnal.

Evaluation

The critical question is whether, in hunted populations, males become warier that females. The prediction is that males, with greater dispersal, larger annual ranges and larger life ranges[j], have a much greater chance to learn to link hunters and human activities with threats to their safety[k]. Removal of bold young males means that most males that survive to adulthood are particularly wary. In contrast, wariness in females should vary much more since human activities and hunting levels vary between their smaller home ranges. Also when a female has cubs hunters may avoid her, yet try to stalk her when she is solitary. Certain older females that survive next to hunting camps may only be those that are particularly wary[l].

Data to evaluate this are limited, but seem to support this prediction (Tables 4, 5 and 6). In the few observations described, limited wariness of young bears is seen, while there are high levels of wariness in adult males. Most outfitters knew of specific large bears that had eluded their hunting parties for years. The variability in adult female response is also seen. There is also an indication that bears are more wary in open habitats.

We lack an understanding of learned avoidance responses in bears. Females, at weaning, could be more wary than males since such behaviors could have evolved to protect their vulnerable offspring. Also, in some years, in some settings, and in some animals, the need to feed may outweigh the need to avoid a stimulus that may or may not represent a serious threat. Finally, there may be an energetic and reproductive cost to extreme avoidance responses[m], particularly if females decrease their nutritional input during the autumn.

Table 5. Selected observations of wariness and learning in grizzly bears— Hunting situations

Situation	Observation
Strangers arrive at remote Stanton family residence in Knight Inlet, B.C., usually to hunt bears in nearby valleys.	Bears regularly seen from cabin disappear for 5 to 10 days when strangers arrive. *Day 1965.*
Cold Bay, Alaska Peninsula community with hunted brown bears and garbage dump.	Adult males uncommon over 6 year period while other sex and age groups present. Adult males believed to actively avoid areas of human activity. *Dau 1989.*
A 1978 Ogilvie Mountain hunting party observed a female with older offspring approach a moose gutpile. Males and females hunted in this area since 1970.	The adult female remained in forest cover while her 2 young approached and fed on the kill. *Obs. occurred and was described by hunters and guides to the author while in camp.*
A 1987 Ogilvie Mountain hunting party stalked a breeding pair on an alpine ridgetop. Females hunted there 1972–1977, but males regularly hunted every spring since 1972. Bears upwind, 50 m.	At the click of the safety being released, the male jumped up, ran down the mountain, crossed the valley, ascended, and crossed over the next ridge, and was seen, a short time later, running up and over the next ridge. The female remained in the vicinity, staring at hunters before slowly moving off. (In similar instances, females often remained 100 m distant after male killed watching skinning unaggressive, apparently curious. Others are aggressive and leave dead male reluctantly). *S. Reynolds pers. comm.*
July, 1978 observation of a solitary grizzly bear. Medium sized animal crossed our scent 250 m downwind. Bears hunted here since 1972.	Bear turned and ran downwind in alpine at 40 km/hr over a map-measured distance of 2km. Ran out of sight around a hill. *Pers. obs.*
A 1978 Ogilvie Mtn. hunting party unsuccessfully stalked a large grizzly on a moose kill in a shrubby upland valley. Kill visited by hunters each day thereafter, until gone.	Thereafter the kill was visited by a grizzly only at night. Contents of large diameter scats found there contained valley floor berries abundant 3 km distant. *Pers. obs.*
Hunter-killed carcasses of moose, caribou, and bears. One hundred to 300 kg of edible carcass remains for bears to eat.	Grizzlies are attracted to moose and caribou carcasses but not to bear carcasses. However, researchers observations suggest that grizzly bears frequently eat grizzly bears that they kill. *Pers. obs. and interviews with all outfitters and hunters.*
Kodiak Island brown bears frequently hide in alder thickets when they detect hunters.	By going upwind of the bear, a guide can usually frighten a young adult into leaving the thicket. Old adult males stay put until they can leave under the cover of darkness. *J. Want, Masterguide, Pers obs.*

Implications

1) Many adult males in hunted areas may be sufficiently wary that they are not vulnerable to traditional hunting methods. To take these wary bears, hunting parties need to be less predictable and much more innovative (An opponent will always win chess games if you keep making the same moves).

2) Bears learn from every encounter with humans. Bungled stalks and poor shooting make bears even warier.

More Information

a. Herrero 1989. The role of learning in some fatal grizzly bear attacks on people.
b. Herrero 1985. Bear attacks: their causes and avoidance.
c. Jope, in press (Cited in Herrero 1989)
d. Gilbert 1989. Behavioural plasticity and bear-human conflicts.
e. Bunnell and Tait 1980. Bears in models and reality-implications to management.
f. Gittleman 1986. Carnivore brain size, behavioural ecology and phylogeny.
g. Jonkel 1987. Brown bears
h. Gilbert 1989. See d above
i. Gilbert 1989. See d above
j. Blanchard Personal communication
k. Warner 1987. Human impacts on brown bears at Pack Creek, Admiralty Island, Alaska.
l. Bunnell and Tait 1980. Bears in models and reality - implications to management.
m. Mattson et al 1987. The effects of developments and primary roads on grizzly bear habitat use in Yellowstone National Park, Wyoming.

Table 6 Selected observations of wariness and learning in grizzly bears— Other situations

Situation	Observation
At Alaska's McNeil River State Game Sanctuary, hunting terminated in 1955 and area was managed as viewing sanctuary. This is a site where brown bears concentrate to feed on spawning salmon. Human behavior is benign, consistent.	Ten people on an adjacent observation pad can see up to 100 different bears in one day. Females with spring cubs pass 2m from people. Some bears,usually large males, visit site only when people are absent. *Aumiller pers. comm.*
Denali National Park, Alaska, officials developed bear-proof storage containers and bruised bears with rubber bullets to train them to avoid backpackers' camps.	Program successful. Bear related problems decreased by 95%. *Dallemolle and VanHorn 1989.*
Pack Bay, Alaska, a small salmon spawning area where grizzlies concentrate to feed on salmon has become a popular bear viewing area.	A high proportion of the bears observed (80%) are females. Processes of habituation, conditioning and learning through previous generations of females may allow females there to exhibit minimal wariness to humans. Male home ranges extended beyond the sanctuary into hunted areas. *Warner 1987.*
In the Ogilvie Mtns. study, selected females were helicopter darted to attach and replace collars up to 3 times, 1 to 2 years apart.	All bears easily hazed in the first capture. Most harder to haze in second. By the third capture, bears couldn't be hazed and when first seen, were always running toward trees. *Pers. obs.*
Yellowstone grizzlies have been captured, marked, and handled since 1959, leaving this population with the greatest experience of handling and research activities. They also have a long history of exposure to visitors.	Five instances are described where grizzly bear use increased dramatically following closure to the public of highly used recreational areas. *Mattson 1987*

CONCLUSION AND RECOMMENDATIONS

What emerged in this investigation is a portrait of a hunter/bear system where the likelihood of a hunter encountering a male or female bear is dependent on a number of factors. Which factor is most important varies from region to region and season to season.There is much that guides and outfitters can do to contribute to their own understanding of these factors and to increase male bear encounters. First there is an urgent need to experiment more, such as hunting lower areas, hunting habitats where large tracks predominate, hunting late in the day, spending more time glassing than moving, and using ravens to detect moose and caribou killed by grizzly bears. Keeping accurate records of sightings and sign is important.

We have a poor understanding of male habitat use, movements, and activity patterns during the hunting seasons. Predation behaviour in bears is also not well understood, particularily as it affects vulnerability to hunting. The large predatory males may be spending one third of the autumn on kills where they will never be seen or taken by hunters. Liberalized hunting to remove these bears will be fruitless. Some areas within heterogenous ecoregions likely have much greater value than others in terms of their contribution of offspring to the regional populations. These areas where females clump need to be set aside from hunting. Finally, considering that bears are taken for their pelts, we know surprisingly little about the biology of the moult, and hunter satisfaction with pelts taken at various stages of the moult.

The strongest recommendation arising from this work however, concerns guides. Skilled and motivated guides are essential to grizzly bear management and the outfitting industry. To achieve this, guides need training, regular technical information, recognition and ...good binoculars.

1. Hunting guides can play an important role in grizzly bear management by locating and hunting areas rich in trophy males and by passing up females and small bears. This booklet presents information to help guides develop male selective hunting methods.
2. Female kills are a concern in most mountainous regions of the south and central Yukon. Hunters and guides can only increase harvests if they take more males.
3. The information here is based on biological submissions, radiocollaring studies, conversations with guides and outfitters, and 2 surveys of non-resident hunters, over 12 years.
4. Guides determine if bears are 'good bears'. Non-resident hunters care little about the sex, colour or fur quality of their grizzly.
5. More females are barren and more solitary bears are female than was previously believed. Only half of the solitary bears in the fall and 60% of the solitary bears in the spring are male.
6. Spring hunts are most successful and most male dominated. October hunts are less successful, but contain a high percentage of males. August kills are often female.
7. Grizzly hunting observed in camps was generally inefficient and non-selective, with too much riding, too little glassing, too much noise, and too little attention to the wind. The few outfitters and guides that have developed efficient and selective hunting methods hunted from boat or backpack, used top quality optics, took almost entirely males, and were booked in advance for several years.
8. Grizzlies taken over gutpiles are larger, older and comprised of twice as many adult males than grizzlies that are 'randomly' encountered.
9. In the fall grizzlies, particularily males, are taken more frequently than expected in the late afternoon and evening. Grizzly hunters and guides should sleep in, and not start hunting before 3:00 pm.
10. Dark bears are more observable than blonde bears during hunting seasons. The darker the bear the greater the likelihood that it is a male.
11. If low elevation berries or salmon are available, males may spend more of the autumn down low. Females appear to clump their fall activities in small upland areas. Unfortunately, these areas are usually those where hunters are most active.
12. Limited data suggests that some males may spend one third of their autumn on moose and caribou they kill, often bulls injured in the rut. These kills and the bears are tough to locate.
13. Old bears and male bears are easily wary enough to avoid most hunters.
14. Research should focus on male distribution, predation behaviour, female concentration areas, and the moult.
15. Guides need more training, information, recognition and... better binoculars.

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