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GRIZZLY BEAR FOOD HABITS IN YOHO AND KOOTENAY NATIONAL PARKS

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ABSTRACT

The analysis of 57 grizzly bear scats collected in Yoho and Kootenay National Parks in 1988, and 16 grizzly bear scats collected in Banff, Yoho and Kootenay National parks in 1987 are presented and discussed. In 1988, no scats were collected prior to June due to the late start-up of the study. The remainder of the bear active period was divided into the following seasons: 1) Vegetation Season (1 June - 20 July). Cow parsnip (Heracleum lanatum) and graminoid vegetation (grasses, sedges and rushes) were the food items of most importance to grizzly bears during this season, with percent importance values of 43.3 and 40.3%, respectively. Horsetails (Equisetum spp.) trailed with the third highest importance value of 15.8%. 2) Berry Season (21 July - 15 September). Buffaloberries (Shepherdia canadensis) had a percent importance value of 50.9% during this season, while blueberries (Vaccinium myrtillus and V. scoparium) and hedysarum (Hedysarum spp.) had values of 17.9 and 14.2%, respectively. 3) Post-berry Season (16 September - den entry). The importance value of hedysarum rose to 82.3% during this period, while the importance value of buffaloberries fell to 9.5%.

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1.0 INTRODUCTION

This report presents results of the analysis of scats collected during the first year of a grizzly bear study in Yoho and Kootenay National Parks (YNP and KNP, respectively) (Raine et al. 1988). In addition, analysis of grizzly bear scats collected in the two parks the year previously during field work for the Four Mountain Parks Grizzly Bear Habitat Evaluation Study (Kansas et al. 1989) are presented.

The study was designed to investigate grizzly bear numbers, trans-boundary movements, distribution, food habits and habitat use. These aspects of grizzly bear ecology are poorly understood within the main ranges of the Canadian Rockies where these parks are situated. Although grizzly bear studies have been conducted in Banff and Jasper National Parks in the past (Hamer 1985, Russell et al. 1979), these projects were situated in the biophysically dissimilar front ranges of the Rockies. The food habits and habitat use of Yoho and Kootenay grizzly bears were expected to be quite different in the moister main ranges.

2.0 STUDY AREA

Yoho and Kootenay National Parks are situated primarily in the Main Ranges of the Rocky Mountains in southeastern British Columbia between 50° 34' and 51° 39' N and 115° 48' and 116° 47' W. The Continental Divide forms the eastern border of the 2 parks where they share a common boundary with Banff National Park (BNP).

Field work for the first year of study was concentrated in the southern and northern halves of YNP and KNP, respectively. The majority of work was conducted in the following watersheds:

- Emerald
- Kicking Horse - Lower and Upper
- Ochre
- O'Hara
- Ottertail - Lower and Upper
- Tokumm
- Vermilion - Lower and Upper
- Yoho

Ecological (Biophysical) Land Classification inventories of the parks (Coen and Kuchar 1982, Achuff et al. 1984) have divided the landscape into Montane, Subalpine (Lower and Upper) and Alpine Ecoregions based mostly on vegetational features. The elevational boundaries between the different ecoregions vary with latitude and aspect. The boundaries are higher at lower latitudes and on southerly aspects. In KNP, the upper limit of the Montane Ecoregion varies from 1450 - 1800 m, the upper limit of the Lower Subalpine zone is approximately 2000 m and the upper limit of the Upper Subalpine zone is from 2300 - 2400 m. Conceptual differences, however, resulted in the Upper Subalpine - Alpine and Montane - Lower Subalpine boundaries being mapped lower in YNP than in KNP (Kansas et al. 1989a).

The mean annual temperature for the Montane Ecoregion in the two parks varies from 1.6° - 4.9° C, while the mean annual precipitation is 457 mm. Thirty to forty-five percent of the precipitation falls as snow. Climate in the Subalpine and Alpine Ecoregions is colder and moister than in the Montane Ecoregion. A stronger maritime influence on climate exists in the two parks than in BNP as they lie west of the Continental Divide (Achuff et al. 1984).

This results in more precipitation and perhaps milder temperatures than in BNP.

The Montane Ecoregion is dominated by lodgepole pine (Pinus contorta), Douglas fir (Pseudotsuga menziesii), white spruce (Picea glauca) and trembling aspen (Populus tremuloides) forests, and grasslands. Soils are classed in the Brunisolic, Regosolic, Luvisolic and Chernozemic orders. The Lower Subalpine is dominated by Engelmann spruce (Picea engelmannii) - subalpine fir (Abies lasiocarpa) closed forests, while the Upper Subalpine is characterized by coniferous closed and open forests at lower elevations and a mosaic of open forest and heath tundra or herb meadows at higher elevations. Brunisolic soils predominate in the Subalpine Ecoregion. The Alpine Ecoregion is above treeline and dominated by heath, avens and herb tundras.

3.0 METHODS

3.1 Scat Collection

Scats obtained during the first year of study were collected in conjunction with site-specific fixes, incidental observations and captures (Raine et al. 1988). Scats were collected only if a grizzly bear had been located within 200 m of the scat and the estimated age of the scat was within ± 2 days of the date of the location, or if recent grizzly bear tracks were found in close association with an incidentally discovered scat.

Scats collected during 1987 were obtained opportunistically while field workers conducted habitat transects for the Four Mountain Parks Grizzly Bear Habitat Evaluation Study (Kansas et al. 1989a). Although all scats that could be reliably aged were collected, only those that could be attributed to grizzly bears were analyzed. Scats were considered to be from grizzly bears if they were found in close association (< 200 m) with grizzly bear tracks or sightings, or if they were found at an elevation of greater than 7000 feet (2133 m). Radio-collared black bears were almost never found above this altitude during three years of research in BNP (Kansas et al. 1989b).

Portions (0.1 - 0.4 L) of scats were collected and stored in 70% alcohol. Only one scat was collected per bear per location. If several scats of similar age were found at one site, a portion of each scat was combined into one composite sample.

3.2 Derivation of Bear Seasons

Four bear seasons were derived from an analysis of feeding signs and bear food phenology observed during site-specific locations, phenology transects and a review of pertinent grizzly bear food habits (Raine et al. 1988).

Season 1.	Pre-vegetation	den emergence - 31 May
Season 2.	Vegetation	1 June - 20 July
Season 3.	Berry	21 July - 15 Sept.
Season 4.	Post-berry	16 Sept.- den entry

The timing of the seasons was only roughly estimated for 1988, since most bears were captured during late summer to fall, and most emphasis was placed

on trapping bears as opposed to following them. The timing of the seasons will vary from year to year in response to variations in phenology.

3.3 Scat Analysis

Scats were analyzed using methods similar to those of Russell et al. (1979) and Aune et al. (1986). They were washed several times in sieves to remove most of the preservative and berry dyes. They were then suspended in approximately 1.0 L of water and vigorously swirled. Two 100 ml subsamples were withdrawn from this solution and placed in enamel pans measuring 22 by 32 cm. The relative percent volume of each item was ocularly estimated for each subsample by superimposing a grid on the enamel pan. Debris (spruce needles, dirt, gravel, wood chips) was noted but not given a volume figure unless it composed a large proportion (> 30%) of the scat. Items found in trace amounts were assigned an arbitrary volume of 1%. The percent volume of each item for the scat as a whole was calculated by averaging the results of the two subsamples. The remainder of the scat was scrutinized in 100 ml portions to determine if all items present were included in the first two subsamples. A list of the components (e.g. leaf, stem, berry, root) of each item was made, and the relative percent volume of each component was estimated.

Items were identified by comparison with a reference collection of plants, berries and hair, and with the aid of reference texts and keys (e.g.: Moss 1983, Adorjan and Kolenosky 1969).

Results were tabulated by percent frequency occurrence, percent volume and percent importance value of each item.

$$\text{Frequency} = \text{Number of scats having the same item}$$

$$\text{Percent Frequency of Occurrence} = \frac{\text{Frequency of item} * 100}{\text{Total number of scats}}$$

$$\text{Percent Volume} = \frac{\text{Total percent volume of item}}{\text{Total number of scats}}$$

$$\text{Importance Value} = \frac{\text{Percent volume} * \text{percent frequency occurrence}}{100}$$

$$\text{Percent Importance Value} = \frac{\text{Importance value of an item} * 100}{\text{Sum of all importance values}}$$

Both frequency of occurrence and volume of food remains in scats should be taken into consideration when analyzing scats. Hatler (1972) and Poelker and Hartwell (1973) found that animal matter in scats was greatly reduced as it passed from a bear's stomach through its' digestive system, while green vegetation was not altered much. Thus, volumetric analysis of scats tends to overestimate the amount of green vegetation consumed, and understimate animal foods. Russell et al. (1979) and Aune et al. (1986), amongst others, have utilized the above formulae to consider both frequency of occurrence and volume of food remains simultaneously.

4.0 RESULTS

Fifty-seven scats were collected during the first year of study. Results of their analysis are portrayed biweekly in Table 1 and Figure 1. These results should be interpreted with caution due to small sample sizes. Thirteen categories of food items were found, excluding unidentified vegetation. No scats were collected prior to June in 1988 due to the late start-up date of the project and the fact that the first grizzly bear was radio-collared on 21 June 1988.

In June, scat analysis indicates that grizzly bears were primarily feeding upon graminoid vegetation (grasses, sedges and rushes: 55.2% volume), horsetails (22.4%) and cow parsnip (20.0%). Ants (Formicidae) and ungulates only formed minor components of their diets (0.2 and 2.1%, respectively).

The importance of cow parsnip increased in the diet of grizzly bears to 68.8% volume by early July. Bears were found to consume cow parsnip flower heads and stems at this time. The percent volume of graminoid vegetation in their diet fell to 1.0% by July, while the percent volume of horsetails remained relatively constant at 22.6%. As most field work was conducted in the McArthur Creek valley at this time, where avalanche paths containing cow parsnip were common, the scat results for July may not be representative of the study area as a whole.

By late July to early August, the percent volume of cow parsnip and horsetails fell to 37.9 and 10.0%, respectively, while hedysarum (26.0%) and buffaloberries (14.3%) appeared in the diets of bears for the first time. Buffaloberries were the food item with the highest percent volume (58.4%) in late August, while blueberries (9.3%) and gooseberries (Ribes lacustre: 5.0%) were also found in the scats collected at this time.

The percent volume of blueberries in the diets of grizzly bears peaked at 43.1% in early September. Most of these scats were collected from a collared bear that frequented the Vermilion burn at this time. Blueberries were relatively abundant in this burn in 1988. One scat collected in the Goodsir Pass area was found to contain the jaw of a Columbian ground squirrel (Spermophilus columbianus). Numerous fresh bear diggings for ground squirrels were observed in the vicinity of this scat.

Table 1. Percent volume of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, 1988.

Food Item	June* 1-30	July 1-15	July 16* -Aug 15	Aug 16-31	Sept 1-15	Sept 16* -Oct 15
n =	12	8	10	7	8	12
Horsetail	22.4	22.6	10.0	13.4	11.2	0.1
Graminoid	55.2	1.0		0.4		11.7
Gooseberry				5.0	4.4	9.2
Hedysarum			26.0	12.1	16.5	67.1
Buffaloberry		14.3	58.4	16.9	10.0	
Cow Parsnip	20.0	68.8	37.9			
Blueberry			0.8	9.3	43.1	2.0
Ants		0.2	0.8	0.8		1.0
Ground Squirrel					6.9	
Elk			6.9			
Ungulate	2.1					
Small Mammal			1.5			
Unid. Vege.			8.7	1.4		

* biweekly periods grouped to increase sample sizes.

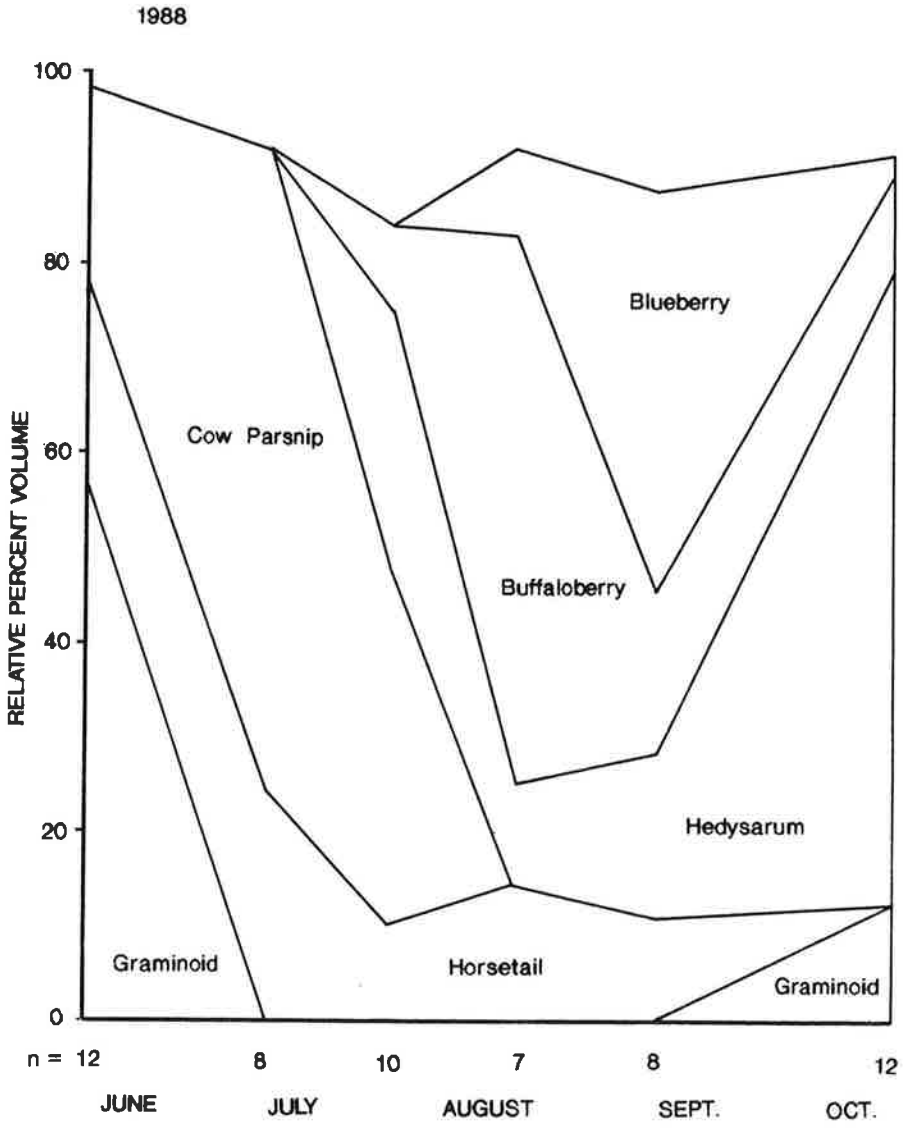

Figure 1. Percent volume of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, 1988.

Hedysarum appeared to be the main autumn food of grizzly bears as it had a percent volume of 67.1% during late September to early October. Graminoid vegetation (11.7%), buffaloberries (10.0%) and gooseberries (9.2%) also formed significant portions of their diet at this time.

The percent volume and frequency of occurrence of food items are portrayed by season in Table 2 , while percent importance values are shown by season in Table 3 and Figure 2. Cow parsnip and graminoid vegetation had the highest percent importance values for the vegetation season (1 June - 20 July: 43.3 and 40.3%, respectively), while horsetails had the third highest value (15.8%). Buffaloberries had a percent importance value of 50.9% during the berry season (21 July - 15 September), while blueberries and hedysarum had values of 17.9 and 14.2%, respectively. The importance value of hedysarum rose to 82.3% during the post-berry season (16 September - den entry), while the importance value of buffaloberries fell to 9.5%.

Sixteen scats were collected during 1987 that could be confidently attributed to grizzly bears. The results of the analysis of these scats are presented below.

	Percent Volume	Frequency of Occurrence
Horsetail	12.9	25.0
Graminoid	16.8	43.8
Gooseberry	2.6	25.0
Hedysarum	40.2	50.0
Buffaloberry	5.0	8.3
Cow Parsnip	18.1	25.0
Ungulate	1.2	6.2
Unid. Vegetation	1.2	6.2

These results, although too limited for biweekly or seasonal analysis, will be pooled with the final results of the scat analysis at the end of the study.

Table 2. Percent volume and frequency of occurrence of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, by season, 1988.

Food Item	Season		
	Vegetation	Berry	Post-berry
n =	20	25	12
Horsetail	22.5*(35.0)**	11.3 (20.0)	0.1 (8.3)
Graminoid	33.6 (60.0)	0.1 (4.0)	11.7 (16.7)
Gooseberry		2.8 (10.0)	9.2 (25.0)
Hedysarum		19.1 (24.0)	67.1 (75.0)
Buffaloberry		27.5 (60.0)	10.0 (58.3)
Cow Parsnip	39.5 (55.0)	15.2 (16.0)	
Blueberry		16.7 (35.0)	2.0 (33.3)
Ants	0.4 (30.0)	0.6 (20.0)	
Ground Squirrel		2.2 (4.0)	
Elk	2.8 (5.0)		
Ungulate	1.2 (5.0)		
Small Mammal		0.6 (4.0)	
Unid. Vegetation		3.9 (8.0)	

* Percent volume

** Percent frequency of occurrence

Table 3. Percent importance values of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, by season, 1988.

Food Item	Season		
	Vegetation	Berry	Post-berry
n =	20	25	12
Horsetail	15.8	7.1	tr*
Graminoid	40.3	tr	3.3
Gooseberry		0.9	3.8
Hedysarum		14.2	82.3
Buffaloberry		50.9	9.5
Cow Parsnip	43.3	7.4	
Blueberry		17.9	1.1
Ants	tr	0.3	
Ground Squirrel		0.3	
Elk	tr		
Ungulate	tr		
Small Mammal		tr	
Unid. Vegetation		0.9	

* trace: importance value < 0.1%.

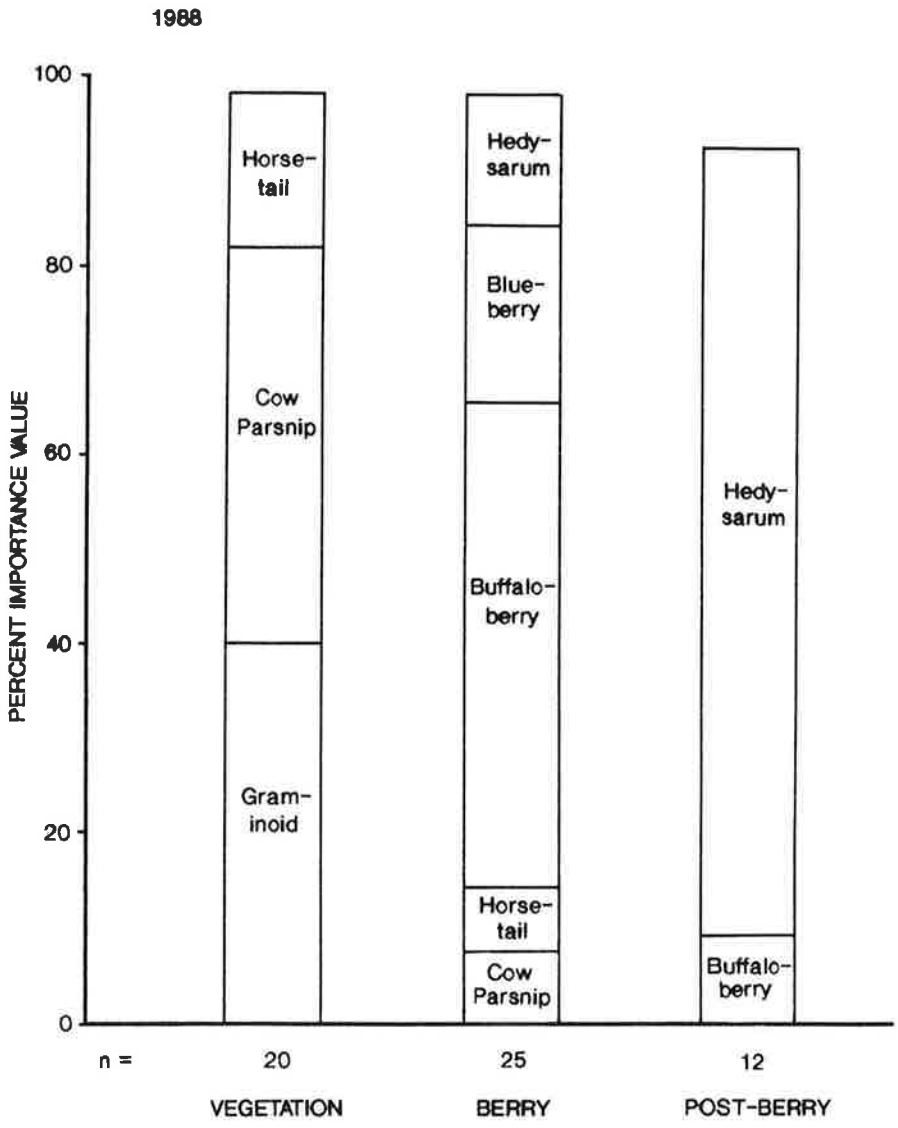

Figure 2. Percent importance values of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, by season, 1988.

5.0 DISCUSSION

The results of the scat analysis, although limited due to a small sample size, indicate that grizzly bears in YNP and KNP have many similarities in their diets to grizzly bears in other areas of the Rocky Mountains (Servheen 1987).

Graminoid vegetation was found to be an important food of grizzly bears in the front ranges of BNP (Hamer and Herrero 1987), Jasper National Park (Russell et al. 1979), Kluane National Park (Pearson 1975), Waterton National Park (Hamer et al. 1985) and in northwestern Montana (Aune and Brannon 1987). Scat analysis in this study indicated that graminoid vegetation was important for grizzly bears in June.

Cow parsnip was found to be an important bear food from June through August in Waterton National Park (Hamer et al. 1985), as it was from June through July in this study. Likewise, horsetails were found to be eaten by grizzly bears through spring and summer in YNP and KNP, as they were in Banff (Hamer and Herrero 1987), Jasper (Russell et al. 1979) and Waterton National Parks (Hamer et al. 1985).

Buffaloberries and blueberries were found to be important for grizzly bears during August and September in this study. They were also found to be the main summer foods of grizzly bears in Jasper and Banff.

In BNP, Hamer and Herrero (1987) found that grizzly bears fed upon hedysarum roots during the spring and fall. Although no scats were collected during early spring in this study, bears were found to consume considerable amounts of hedysarum in their fall diets. Russell et al. (1979) also found hedysarum to be a major food of grizzly bears in Jasper National Park.

Certain bear foods, such as glacier lily (Erythronium grandiflorum), crowberries (Empetrum nigrum), bearberries (Arctostaphylos uva-ursi), tall bilberry (Vaccinium membranaceum) and oval leaf blueberry (Vaccinium ovalifolium) were not found in the scat analysis. These food items, and others, will most likely be found to be consumed by grizzly bears within the study area as more scats are collected in subsequent years.

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