GRIZZLY BEAR RESEARCH

IN

YOHO AND KOOTENAY NATIONAL PARKS

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GRIZZLY BEAR RESEARCH IN YOHO AND KOOTENAY NATIONAL PARKS

YEAR II INTERIM REPORT

Prepared for

CANADIAN PARKS SERVICE
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Prepared by

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WHOSE EFFORTS?

ABSTRACT

Results of the second year of a multi-year study of grizzly bear ecology in Yoho and Kootenay National Parks are presented. Most efforts were directed towards following the 7 bears captured during Year 1, as opposed to trapping additional bears. Two new bears, however, were captured and radio-collared in Yoho National Park. The radio signal from 1 bear was never picked up in the spring of 1989, and 3 collared bears died during the 1989 field season. Thus only 5 bears were followed intensively during 1989.

Four hundred and sixty-five telemetry locations were obtained in total in the 2 parks. Of these, 156 sites were investigated by the study team to determine the vegetation type that the bears were using, to record feeding sign observations and to collect scats.

Four grizzly bear seasons were derived from observations of bear feeding sign: 1). Pre-vegetation (den emergence - 21 May). 2). Vegetation (22 May - 15 July). 3). Berry (16 July - 8 September). 4). Post-berry (9 September - den entry). Analysis of 239 scats collected indicated that hedysarum (*Hedysarum* spp.) was the most important food during the pre-vegetation season (95% importance value). Once green vegetation began to grow in mid to late May, bears were found to feed mainly upon graminoid vegetation (72.4%), cow parsnip (*Heracleum lanatum*: 12.0%) and horsetails (*Equisetum* spp.: 7.9%). During the berry season, buffaloberries (*Shepherdia canadensis*: 64.2%), cow parsnip (12.2%) and graminoid vegetation (10.0%) were found to be the dominant foods in the diets of the collared grizzly bears. In fall, hedysarum was found to again gain prominence (29.3%) in the diets of grizzly bears. They also ate buffaloberries (17.9%), crowberries (*Empetrum nigrum*: 19.4%) and blueberries (*Vaccinium* spp.: 18.7%) during this season.

Two radio-collared adult males had minimum area home range sizes of 1166 and 1305 km^2, 1 adult female had a range of 428 km^2 and 2 sub-adult females had ranges of 185 and 410 km^2. Radio-locations were tabulated by ecoregion, ecosite, vegetation type and elevation.

Objectives and recommendations for the next year of study are presented. The southern and northern halves of Kootenay and Yoho National Parks, respectively, have been inadequately sampled to date. This is primarily due to budgetary and logistical restraints.

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ACKNOWLEDGEMENTS

This study is being conducted under contract to the Canadian Parks Service, and in 1989 was supervised by Gordon Rutherford, Chief Park Warden, of Yoho National Park and by Acting Chief Park Warden, Brian Sheehan, of Kootenay National Park. Park Wardens Kevin McLaughlin, Harry Abbott, Alan Dibb and John Niddrie ably assisted with all aspects of the study. We would like to thank Joanne Cairnes, Allan Knowles, Edwin Know, Rick Kubian, Doreen McGillis, Spencer Pledge, Brian Sheehan, Doug Wilkinson, Chris Worobets and others for assisting with various aspects of the project.

1.0 INTRODUCTION

1.1 STUDY BACKGROUND

This report outlines the results of the second year of a grizzly bear study in Yoho and Kootenay National Parks (YNP and KNP, respectively). 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.

1.2 OBJECTIVES

The principal goal of the study is to obtain detailed information on grizzly bear ecology in YNP and KNP to support their future management and protection. More specific objectives are outlined below:

- to determine the status and distribution of grizzly bears in YNP and KNP by estimating their numbers, age/sex structure, population dynamics and home range sizes.

- to determine the food habits of grizzly bears within the study area and to relate these to food availability.

- to determine the seasonal habitat requirements of grizzly bears relative to food, cover and den use, and to describe these requirements in terms of existing Ecological (Biophysical) Land Classification (ELC) for the 2 parks.

- to integrate and compare grizzly bear habitat use with the results of the Four Mountain Parks Grizzly Bear Habitat Evaluation Project (Kansas et al. 1989a).

- to identify important areas to grizzly bears within the 2 parks such as den sites, migration routes, mating areas, specific prime feeding areas and areas that have a high potential for human/bear conflicts.

- to increase the knowledge and expertise of the Warden Service by training assistants and conducting in-house seminars on the research.

- to develop a practical and effective means of censusing grizzly bears and monitoring the availability of principal food items from year to year.

2.0 STUDY AREA

YNP and KNP 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) (Figure 2.1).

Field work for the first year of study (Raine et al. 1988, Raine 1989) 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

The second year of study encompassed a much wider use of watersheds inside and outside of the 2 parks. Movements of subadult bears in particular greatly expanded the study area westward to Golden, B.C. and east to Lake Louise in BNP. In addition to the watersheds used heavily in the first year much effort was also directed to study animal use of the following watersheds:

- Bow River - Mid and Upper
- Glenogle Creek
- Ice River
- Pipestone River
- Simpson River
- Verdant Creek
- Waitabit Creek
- Kimpton Creek ?? - TRAPPING

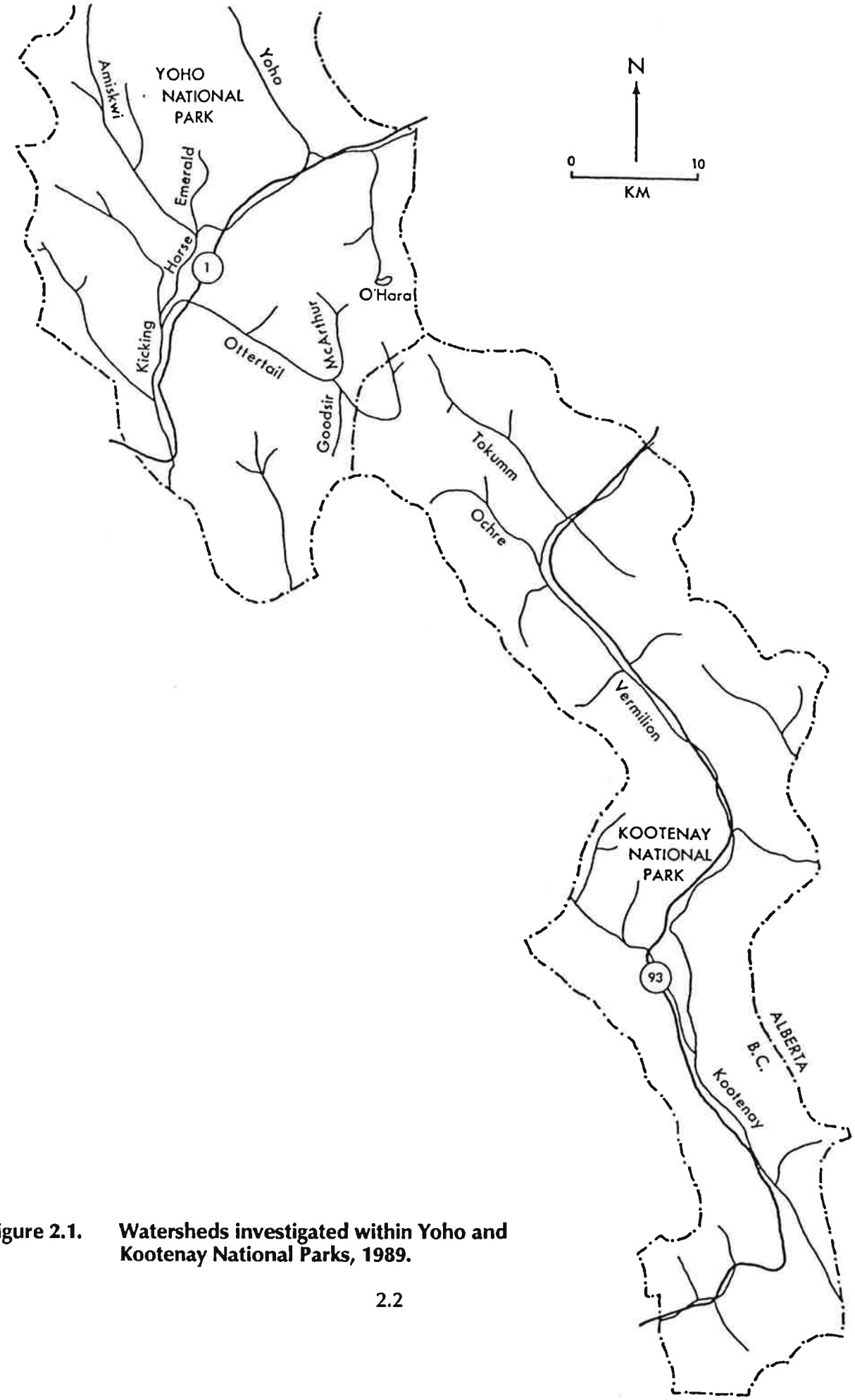

Figure 2.1. Watersheds investigated within Yoho and Kootenay National Parks, 1989.

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 2 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 2 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 BEAR CAPTURE AND HANDLING

Bears were captured in culvert traps and Aldrich foot snares set at baited cubbies (LeCount 1986). Light-weight culvert traps that could be moved by helicopter were also used. Road-killed ungulates were used as bait.

Bears were handled with the assistance of the Warden Service. They were immobilized with Telazol (Zolatil) and blindfolded with a cotton hood. The following information was collected from both grizzly and black bears:

- weight
- body length
- tail length
- chest girth
- neck girth
- foot measurements
- shoulder height
- baculum length
- testes length and width
- physical condition
- sex
- presence of lactation
- presence of vulval swelling
- anal temperature
- respiration rate
- presence of markings and scars
- trap-related injuries
- colouration
- reactions to drugs
- tooth wear and presence

A first premolar tooth was removed from each bear for aging, an ear tag was placed in the left ear and an identification number was tattooed on the lip of most bears handled. Radio-collars (Lotek Engineering Ltd.) were placed on all grizzly bears captured. Subadult bears were instrumented with collars designed to break off after a certain time period. These collars were cut and spliced with cotton fire hose. The bears were released on site and monitored until they recovered in order to ensure that accidental contact with the public, scavengers and predators did not occur. Wardens were trained to take the above measurements consistently and accurately.

3.2 TELEMETRY MONITORING

Fixed-wing telemetry flights were flown to delineate the collared bears' home range sizes, to determine the distances that they moved between locations and to better understand their territorial spacing. Telemetry flights were made every 4 to 7 days depending on weather conditions. Daily ground telemetry fixes were also attempted. A minimum of 3 bearings were taken for each location, with 2 of the bearings being as close to 90^{o} as possible to minimize the size of the error polygon. Consecutive bearings were made within a minimum time period of 45 minutes. Locations made with error polygons of greater than 0.25 km were not used for ecosite determination. Locations that fell close to an ecosite boundary were investigated further by the utilization of more bearings or by approaching the study animal more closely before trying to make another fix. Only 1 location was made each day to preserve the statistical independence of the data collected.

The accuracy of telemetry locations were classified into the following 3 categories:

1) Site-specific - A visual sighting of the bear was made during the initial location, or fresh sign was observed during follow-up investigations.

2) Remote - A sighting of the bear was not made during the initial location, and a follow-up investigation was not done or no sign was encountered during the investigation. Ecosites were only assigned to remote fixes when the error polygon was less than 0.25 km^2.

3) Home Range Only - Approximate position of the bear determined by telemetry: no ancillary data such as ecosite or elevation recorded.

In addition, incidental visuals made on collared and uncollared bears, and grizzly bear tracks or sign found opportunistically, were recorded in a separate category labelled "Incidental Visual". Observations made by wardens, and reliable sightings by members of the public, were also included in this category. Follow-up investigations of locations made on bears were conducted once the bears had left the area (Kansas et al. 1989b). The area was systematically searched on foot for signs of bear activity.

The following information was collected from each location at which bear activity was found:

- ecoregion, ecosite, ELC vegetation type, aspect and slope class
- distance to nearest ecosites
- elevation
- UTM coordinates
- bear activity: feed, bed, travel, mate
- bear foods utilized
- distance to nearest cover, water, trail, campsite and road

When feeding sign was found, the area of most concentrated use was selected, and the following information recorded from an area within a radius of 10 m:

- percent cover of each plant species
- percent cover of deadfall and rocks
- rank of bear foods utilized
- berry production: nil, trace, low, medium, high
- berry phenology: green, coloured, ripe, dropped
- phenology of other foods: emerging leaf, full leaf, flower, cured

3.3 DERIVATION OF BEAR SEASONS

Bear seasons were determined from an analysis of bear feeding patterns and the results of the food availability transects (as per Kansas et al. 1989b).

3.4 SCAT COLLECTION

Scats were collected in conjunction with site-specific fixes, incidental observations and captures (Raine et al. 1989). 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 or feeding sign were found in close association with an incidentally discovered scat.

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.

Scats were analyzed using methods similar to those of Russell et al. (1979), Aune et al. (1986) and Kansas et al. (1989b). 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.

Frequency = Number of scats having the same item

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

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

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

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.

3.5 FOOD AVAILABILITY TRANSECTS

The phenology and productivity of key grizzly bear food species were investigated through the use of permanent transects. Buffaloberry (*Sheperdia canadensis*), horsetail (*Equisetum arvense*) and cow parsnip (*Heracleum lanatum*) transects established in Year 1 were again monitored.

Buffaloberry. Transects were approximately 100 m in length. At 5 m intervals, the nearest female plant to the transect was selected and flagged. Plants were chosen alternatively on the left and on the right of the line. A total of 20 plants were flagged per transect. All of the stems arising from a single point were considered to be 1 plant. When plants were too large to be reasonably handled, a cluster of stems was randomly chosen and marked to represent that plant.

Each transect was visited periodically during the summer and plant phenology (flower, green, coloured, ripe) and production (nil, trace, low, medium, high) was recorded. When the majority of the berries on a transect were ripe, the plants with predominantly ripe berries were picked, counted and weighed. The remaining plants were picked as they ripened.

Horsetail. Permanent transects of 10 - 30 m in length were established. The observer measured the height and phenology of the tallest plant within 1 m of him, at 1 - 3 m intervals. A total of 10 plants were measured on each transect.

Cow Parsnip. Same methodology as for horsetail.

3.6 DETERMINING SEASONAL GRIZZLY BEAR HABITAT USE

Insufficient data was collected on grizzly bear habitat use to allow for detailed analysis during the first and second years of study. In Year III, a structured, subjective assessment of seasonal ecosite importance to grizzly bears will be conducted independently by each field researcher at the end of the field season, and then a final rating will be conducted in concensus. Ecosites will be ranked by their importance to grizzlies by month or bear season on a 5 tier scale (very high, high, medium, low, nil). Information that will be used in the ranking procedure will include the data collected on the habitat components found to be important for grizzly bear survival and reproduction (e.g. Beak Consultants 1985, Kansas et al. 1989b, Shea 1981). All wardens that participate in the project will be asked to assist with the subjective evaluation.

The final product will allow park managers to pinpoint areas of seasonal importance to grizzly bears. Results of the subjective assessment will be compared to the results of the Four Mountain Parks Grizzly Bear Habitat Evaluation Project (Kansas et al. 1989a), and changes to the model may be made in light of the new food habits information collected during this study.

3.7 IDENTIFYING IMPORTANT AREAS FOR GRIZZLY BEARS

In Year III, results of the telemetry investigations and subjective ecosite evaluations will be used to delineate ecosites and areas that are deemed critical to the maintenance of a healthy grizzly bear population in the 2 parks, and areas where the possibility of a high frequency of human/bear interactions exist. The home ranges of the study bears will be analyzed to determine the size of area that is required for a typical bear of each age and sex class to survive. Each watershed within each park will then be rated on its' inherent ability to support grizzly bears, as well as the number of bears that each is likely to be able to support (i.e carrying capacity).

General locations of all bear dens are known for 1989-90 from aerial telemetry flights. After a review of budget and manpower constraints it was decided that site specific investigation of the dens would not be feasible or necessarily productive for park plannning purposes.

3.8 ESTIMATING POPULATION SIZE AND MONITORING TRENDS IN NUMBERS

Due to manpower constraints further establishment and monitoring of permanent grizzly bear digging transects for hedysarum was not possible. However this aspect should be investigated in detail in future studies.

In subsequent years, a comparison of the number of marked versus unmarked bears observed by the Warden Service will be undertaken to provide a rough population estimate. Teeth extracted from captured bears will be aged and a life history table of the population will be constructed.

4.0 RESULTS AND DISCUSSION

4.1 BEAR CAPTURE AND HANDLING

The main objective of the contractor in the second year of study was to monitor the movements and habitat use of collared bears. The Warden Services of both parks continued to capture and collar as many grizzly bears as possible given their budget and manpower allottments.

Twelve and 11 trap locations were used in YNP and KNP, respectively (Tables 4.1.1 - 4.1.2). Trapping was initiated in early May and continued through November. Trap sites ranged from 3500 - 6100' (1100 - 1900m) in elevation. Two subadult, sibling, female grizzly bears (bears #9 and #23) were captured in 520 trap nights of effort. One of these bears was subsequently recaptured, so that a total of 3 captures were made in all (173 trap nights per capture: Tables 4.1.3, 4.1.4). Two black bears were also captured (260 trap nights per capture). All captures were made in culvert traps.

A third sub-adult, female grizzly bear was caught outside of KNP in Fairmont by provincial wildlife officers. This bear was radio-collared and released near Luxor Pass. It returned to the province and was later destroyed in the townsite of Brisco.

All grizzly bears captured in Year II were estimated to be 3 years of age. Confirmation of their ages will be obtained once results of the tooth cementum analysis is received.

The 2 new study bears both weighed 100 lbs (45 kg) when captured (Table 4.1.5).

4.2 TELEMETRY MONITORING

A total of 465 locations were obtained on the collared grizzly bears before they denned (Figure 4.2.1). Sixty-one incidental visuals and site-specific locations of grizzly bears were also made by wardens and park visitors in 1989. For all locations, 180 were site-specific, 229 were remote, 55 were home-range-only and 62 were incidental (Table 4.2.1). There were 165 fixes obtained by aerial telemetry.

TABLE 4.1.1. Trap locations in Yoho National Park, 1989.

No.	Name	Location	Ecosite	Elevation (ft.)
1	Field Back Road	NG354927	BG-DP	4100
2	Carrion Pit	NG302918	OL-P	4000
3	Kicking Horse/Chancelor Peak	NG294757	WR-P	3700
4	Yoho Valley Road	NH391000	OG-SF	4500
5	Field Ranch	NG342916	WR-P(z)	4100
6	Field Trailer Court	NG355930	BG-TB	4100
7	Lake O'Hara Fire Road 1	NG456976	NA-w	5700
8	Lake O'Hara Fire Road 2	NG454922	TA-SF	6100
9	Takakkaw Falls 1	NH384004	BG-A	4700
10	Takakkaw Falls 2	NH374024	OG-SF	4800
11	Ice River	NG388705	WR-GSd	4900
12	Kicking Horse River	NG263734	BG-DP	3500

TABLE 4.1.2. Trap locations in Kootenay National Park, 1989.

No.	Name	Location	Ecosite	Elevation (ft.)
1	Hector Gorge	NG680396	DR7	4100
2	W. Kootenay Fire Road	NG652343	DR6	4300
3	Assiniboine Slide #2	NG728499	DR7	6000
4	Dolly Varden	NG651343	DR6	4300
5	E. Kootenay Fire Road	NG707329	AT1	3900
6	Kimpton Creek	NG745089	DR5	4600
7	Vermillion Pit	NG658751	BV2	5500
8	Numa South	NG611639	BY7	4600
9	Helmut Falls	NG481712	HC1	5800
10	Daer Creek	NG730301	FR1	4000
11	McLeod	NG740248	AT4	3800

TABLE 4.1.3. Trap nights and capture success of bear trapping efforts in Yoho and Kootenay National Parks, May - November 1989.

Park	Month	Trap Nights		Bear Captures	
		Snare	Culvert	Grizzly	Black
Yoho	May		47	1	1
	June		12	1	
	July		50	1 *	
	August		25		
	September	7	24		
	October	15	16		
Kootenay	May	9	55		
	June	12	48		
	July	31	9		
	August				
	September	47	20		
	October	42	51		1
TOTAL		**163**	**357**	**3 ***	**2**

* Includes 1 recapture.

Table 4.1.4. **Sex, reproductive status and capture information for grizzly bears captured in Yoho and Kooteny National Parks, 1988-1989.**

Bear I.D.	Sex	Age at First Capture	Date Captured	Location	Method	Collar Frequency	Left Ear Tag No.
1988							
8	M	3	21 June	NG428804	Culvert	150.189	7
10	M	3	24 June	NG424856	Snare	150.268	11
7	F	9	27 June	NG429843	Snare	150.168	12
1	M	7	30 July	NG596698	Snare	150.009	105
5	F	-	29 Aug.	NG434786	Snare	150.131	15
7*			2 Sept.	NG331861	Culvert		
10*			21 Sept.	NG525664	Culvert		
6	F	6	25 Sept.	NG611639	Snare	150.149	6
1*			13 Oct.	NG599698	Snare		
10*			15 Oct.	NG483713	Culvert		
4	M	12	15 Oct.	NG660594	Culvert	150.109	8
1989							
9	F	3	18 May	NG354927	Culvert	150.250	20
23	F	3	6 June	NG354927	Culvert	150.	25

* Recapture

Table 4.1.5 **Body measurements (cm) of grizzly bears captured in Yoho and Kootenay National Parks, 1988-1989.**

Bear I.D.	Sex	Age at First Capture	Date	Body Length	Tail Length	Chest Girth	Neck Girth	Shoulder Height	Weight kg	Weight lb
1988										
8	M	3	21 June	140	8	84	48	77	73	160
10	M	3	24 June	148	9	78	46	80	75	165
7	F	9	27 June	155	8	86	48	84	77	170
1	M	7	30 July	192	8	85	58	81	100	220
5	F	-	29 Aug.	173	15	99	64	52	116	255
6	F	6	25 Sept.	161	10	100	64	90	107	235
6	M	12	15 Oct.	169	8	127	90	96	205	450
1989										
9	F	3*	18 May	140	14	61	38	66	46	100
23	F	3*	20 May	150	20	76	50	74	46	100

* Estimated

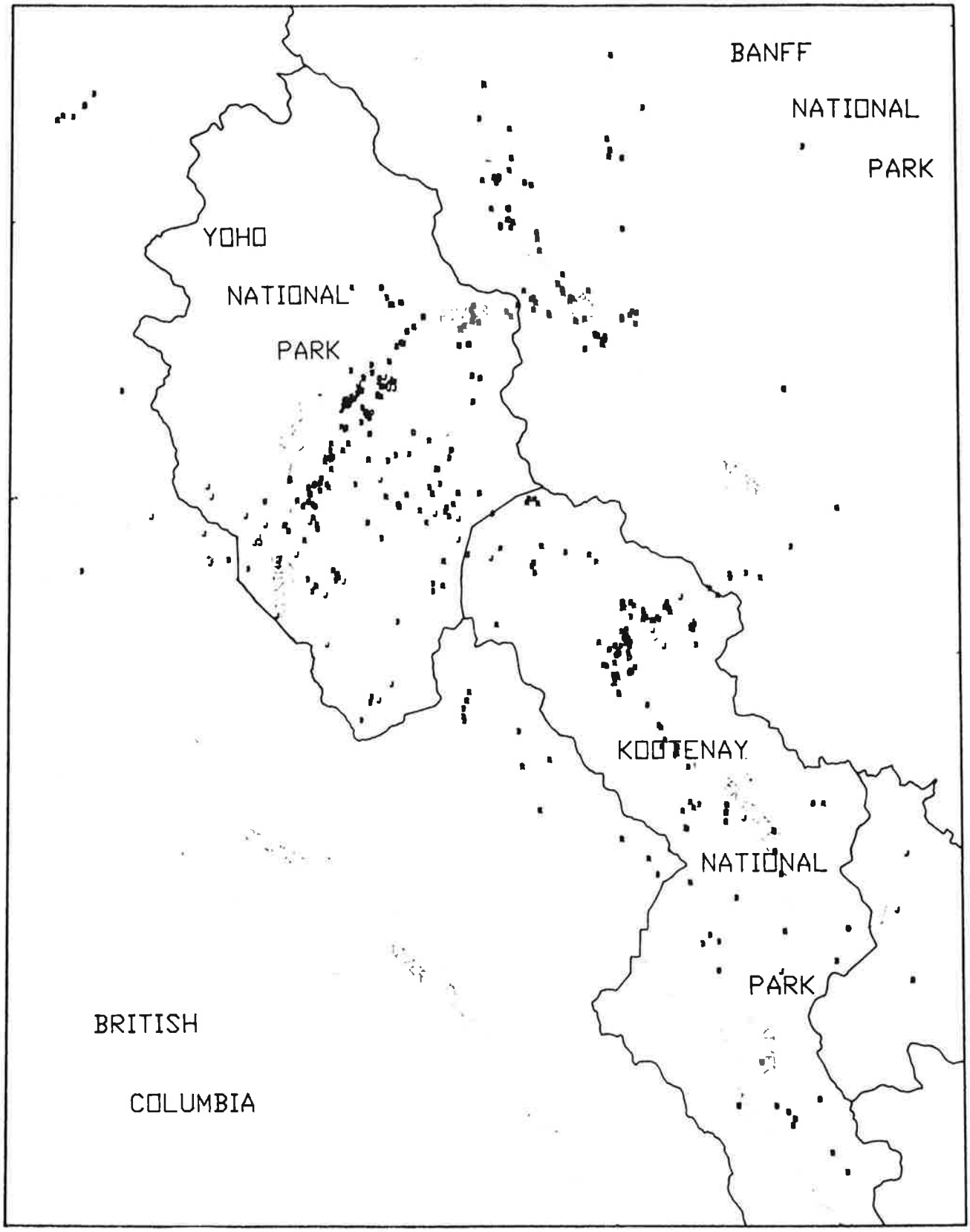

Figure 4.2.1. **Locations of radio-collared grizzly bears in Yoho and Kootenay National Parks, 1989.**

TABLE 4.2.1. Number of locations of collared and incidentally observed grizzly bears by fix type in Yoho and Kootenay National Park, 1989.

Fixtype	Number of Locations	
	Bear Study	Warden Cards
Home Range	55	N/A
Remote	229	N/A
Site Specific	156	24
Incidental	25	37
TOTAL	**465**	**61**

- MAP SHOWING INCIDENTAL OBSERVATIONS OF STUDY / OTHER BEARS

Sufficient locations to warrant home range mapping were obtained on 7 bears (Table 4.2.2, Figures 4.2.2 - 4.2.4).

BEAR #1

Bear 1, an 8 year old, adult male, had been captured in 1987 during trapping for the Banff Black Bear Study (Kansas et al. 1989b). He was re-captured and collared near the Paint Pots in KNP on 30 July 1988. Early aerial telemetry flights in April 1989 did not determine #1's denning site. He was first located on 30 April on Mt. Whymper above Marble Canyon and was subsequently located 70 times before he denned in the fall. He spent the majority of May digging for hedysarum (*Hedysarum* spp.) on Mt. Whymper and on the avalanche slopes of the Stanley Creek bowl.

He then travelled to the Pipestone River in BNP and spent June feeding between Hector Lake and the headwaters of the Red Deer River. In July he returned to the Paint Pots area of KNP and fed on grasses, cow parsnip, and other vegetation until berry season. Later on in July he began feeding, primarily in the Vermilion burn, on buffaloberries and blueberries (*Vaccinium* spp.) through until early September. At this time he returned to the Pipestone River near Molar Creek and seemed to feed mainly on crowberries (*Empetrum nigrum*).

#1 then returned to KNP and denned in late November near the Paint Pots. Although his radio transmitter first went on inactive mode on 10 November, he still appeared to be active until 22 November. Number 1's total minimum area home range for 1989 was 1166 km^2 (Figure 4.2.2, Table 4.2.2).

BEAR #4

This adult male was trapped near Floe Lake parking lot in KNP in October 1988. No den site location was determined for this bear and he was first located near the Simpson River upstream of Verdant Creek on 30 April 1989. He travelled to the Wardle Mountain area and then north to Vermilion Crossing. Four days later he was located in the Ice River, Yoho, accompanied by a female. He was seen on many occasions accompanied by another bear through to 17 July. These sightings with a sow

Table 4.2.2 **Minimum home range size for grizzly bears in Yoho and Kootenay National Parks, 1989.**

Bear I.D.	Sex	Age	Number of Locations	Home Range Size (km^2)	Maximum Range Length (km^2)
1	M	8	70	1166	56
4	M	13	78	1305	63
5	F	-	51	428	40
7	F	10	31	25 *	8
8	M	4	19	979 *	59
9	F	3	89	185	20
10	M	4	11	178 *	22
23	F	3	108	410	32

* Less than a full active season of data collected due to bear mortalities.

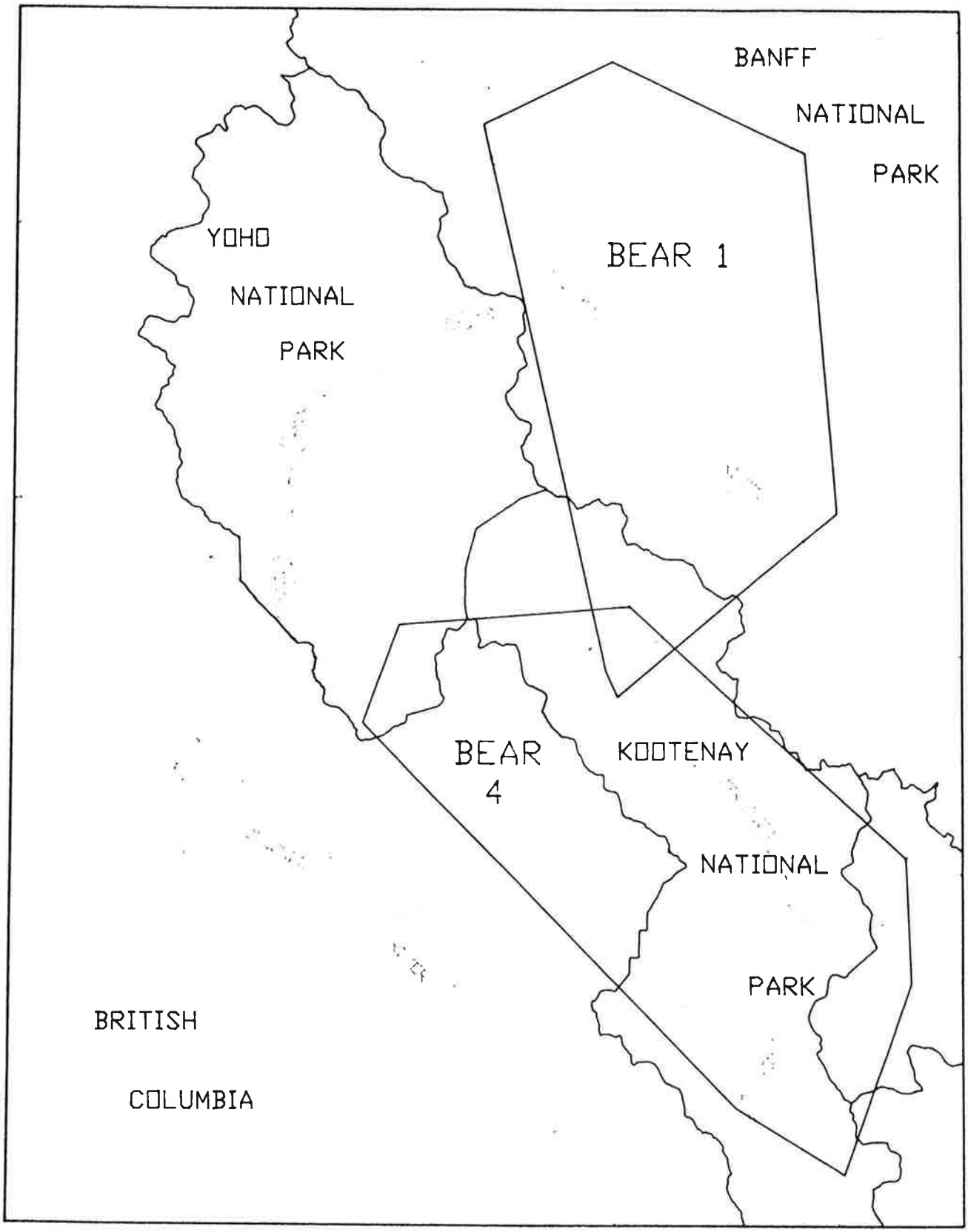

Figure 4.2.2. **Home ranges of adult male grizzly bears 1 and 4, 1989.**

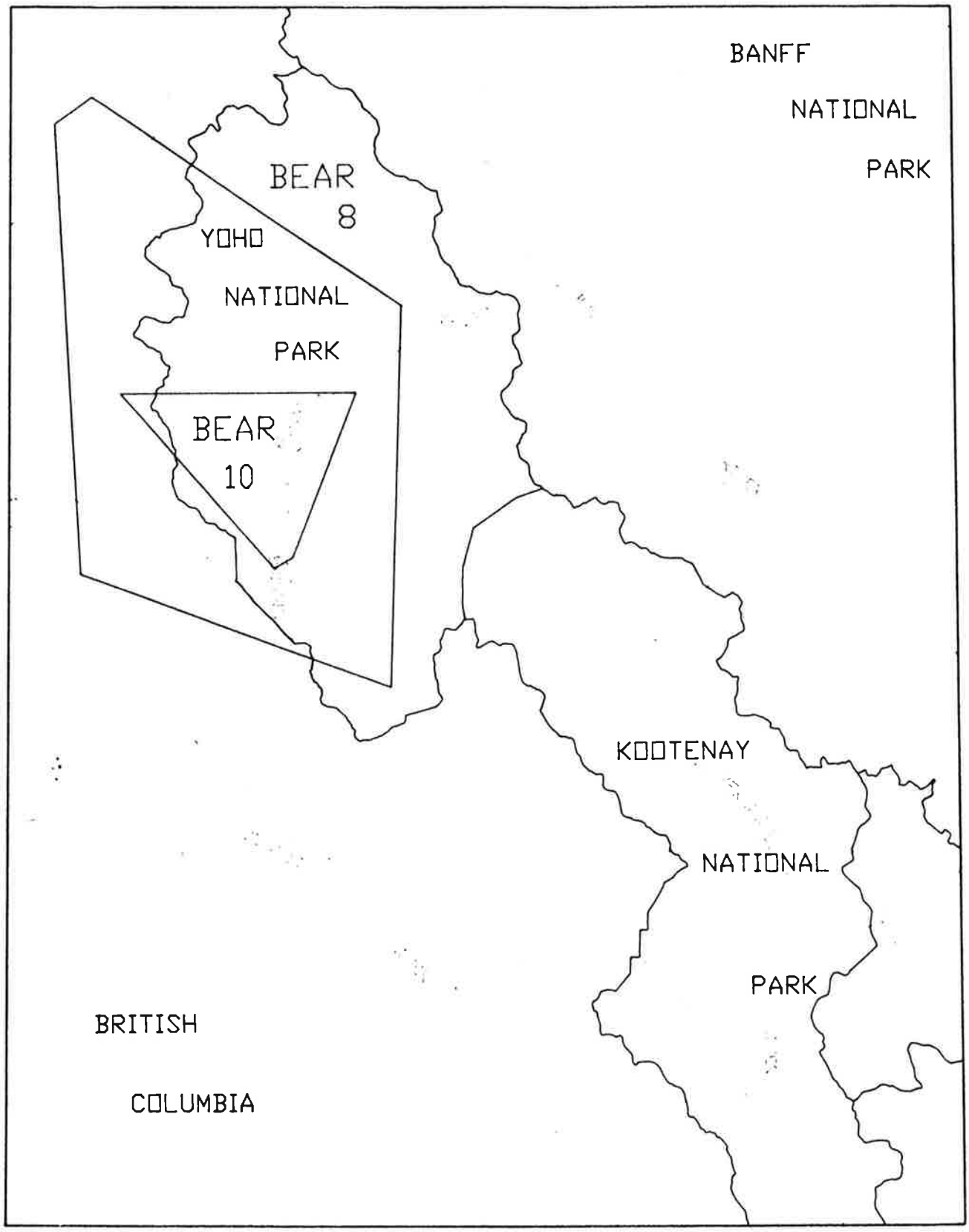

Figure 4.2.3. **Home ranges of sub-adult male grizzly bears 8 and 10, 1989.**

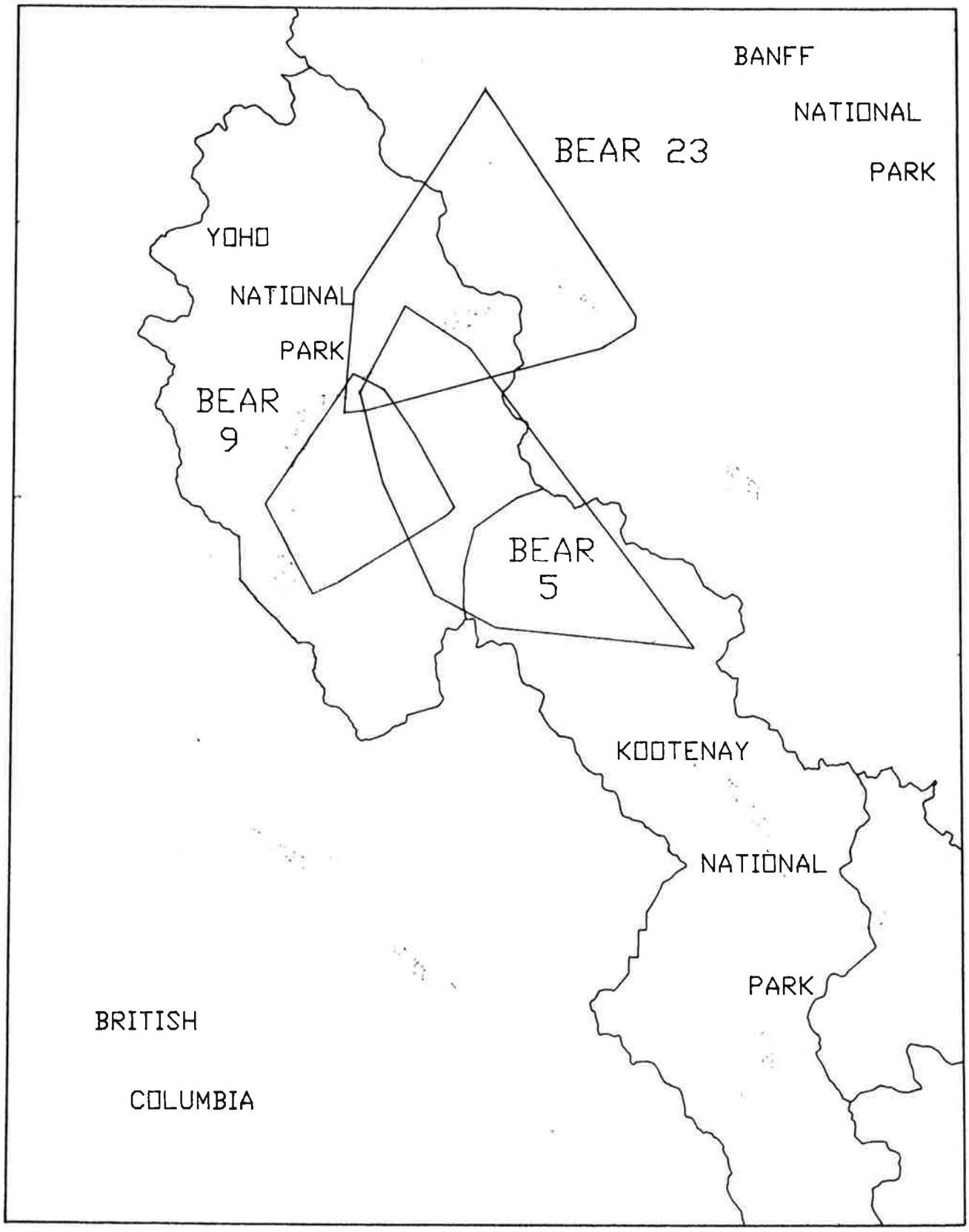

Figure 4.2.4. **Home ranges of adult female grizzly bear 5 and sub-adult female grizzly bears 9 and 23, 1989.**

occurred from the Ice River south to Symond Creek in the province and in Serac Creek in KNP.

For the duration of the growing season #4 continued to range widely from Wardle Mountain north to the Paint Pots and from the Simpson River west to Moose Creek. In late fall he killed a goat north of the Paint Pots and was also located in close proximity to elk rutting grounds for about a week where he possibly was actively hunting. He then travelled south to Pitts Creek and was found to have fed on a road killed elk near Crooks Meadows. He was last located in Daer Creek drainage on 3 December before being located at his den site near Lachine Creek in early February 1990. A total of 76 telemetry locations (home range = 1305 km^2) were made on #4 in 1989 (Figure 4.2.2).

BEAR #5

This female emerged from her den site on Misko Mountain still accompanied by her cub (now likely 3 years old). Her den was at the 6800' (2073 m) level on a north facing slope. From spring to fall #5 and her cub repeatedly visited the McArthur, Tokumm, Ottertail, Misko and Goodsir drainages. Before the berry season started they made considerable use of glacier lily (*Erythronium grandiflora*) on the north side of Ottertail Pass and in the headwaters of Tokumm Creek.

This pair also dug extensively for hedysarum in the Goodsir Basin and on the south side of Odaray Mountain in YNP. A well used resting location was found on a rock outcropping mid way up a gravel dry wash above the McArthur Trail approach to McArthur Pass. Numerous scats were found at this particular location which warrants future monitoring of the site.

After the berry season had passed, #5 and her cub were found feeding on hedysarum some 4 kilometres north of Lake OHara on Mt. Victoria. Later in October they fed on a goat carcass half way up the road to Lake OHara. From here they travelled towards Highway #1 and fed on a moose carcass upslope of Narao Lakes. Still later in October they fed on another goat carcass near the washout on the Ottertail Fire Road.

By 26 November #5 had denned on the east side of Mt. Owen at the 7100' (2164 m) level on an east facing slope. There were 51 locations determined for #5 and her cub

with the majority being from aerial telemetry due to their use of more remote locations. Inability to obtain more ground telemetry locations was also complicated by fire road closures in YNP. Her minimum home range size was 428 km^2 (Figure 4.2.4).

BEAR #6

This 6 year old female was captured south of the Numa parking lot in October of 1988. The few fixes possible in 1988 saw her make use of Floe Creek, Paint Pots area, Tumbling Creek, and Ochre Creek. No signal was obtained in 1989 despite extensive telemetry flights from the town of Radium to Hector Lake and from Sunshine Meadows west to the Columbia River. Frequency bracketing during these flights failed to detect her signal. To date the whereabouts of the collar and/or bear #6 are unknown.

BEAR #7

Bear 7, an adult female, was captured in McArthur Creek in YNP in June 1988. She denned on Mt. Stephen near tree line about 2 kilometres upslope above the town of Field. The den appeared to be located in spruce-fir at about 7300' (2225 m) facing west. #7 emerged from her den later than the other study bears and spent the early part of May in close proximity to her den site. Investigation of these slopes revealed several older dens but not her 1988/1989 den. The good abundance of hedysarum diggings near her den site would explain why she remained near her den for such an extended period upon emergence.

During May, #7 fed on hedysarum and then switched to green vegetation on the slopes of Mt. Stephen and Mt. Dennis west to the avalanche slopes opposite the community ranch. A few times she was seen to feed on grass amd horsetails at the ranch and in close proximity to the 2 subadult females, #9 and #23.

In early June #7 moved into the back-country and frequented the Boulder Creek, Ottertail River and Float Creek drainages. On 18 June a mortality signal for #7 originated from the Float Creek drainage. Subsequent investigation indicated that she had been killed by a large bear presumed to be another grizzly (based on scats and a day bed found). Thirty-one fixes were made on #7 before her death.

BEAR #8

Bear #8, a 4 year old male, was captured in the McArthur Creek drainage on 21 June 1988. Both #8 and his sibling, #10, denned in the steep Porcupine Creek drainage within about 1 km of each other at the 6400'(1951 metres) level. #8's denning slope faced north while #10's faced east.

Upon emerging, #8 ranged widely but initially spent most of his time in the area of Mt. Hunter, Chancellor Peak and Wapta Falls. He then travelled west and was located near tree line immediately southeast of the town of Golden, B.C. on 31 May. Extensive telemetry flights did not locate #8 until 23 June in the head waters of Waitabit Creek, north of the Blaeberry River.

On 21 July #8 was found dead and badly decomposed. He had travelled some 800 metres from his last known location of 17 July. Due to the state of it's decomposition, the carcass was not removed and cause of death is still unknown. There was no apparent problem with the fit of the collar and no obvious gross injuries were observed. There was a recent, normal looking scat composed of cow parsnip near the carcass. It would appear as though #8 possibly suffered a major infection as a result of an injury from natural or possibly firearm related origin. Only 19 fixes were obtained on #8 before his death (Figure 4.2.3).

BEAR #9

This bear was a subadult female of approximately 3 years of age (pending tooth analysis). She first appeared in early spring and summer on the Mt. Dennis avalanche slides and at the Field community pasture in the company of #23. This pair's diet at this time consisted primarily of grasses and horsetails foraged at and near the community pasture. After #23 had been relocated (see below) #9 was located over several days in close proximity to #7 in the Boulder Creek drainage.

Her movements for the duration of the summer were generally quite limited and predictable (Figure 4.2.4). She spent the early part of July in the Hoodoo Creek Basin apparently feeding on cow parsnip and other vegetation. Other drainages used for short periods included the Ottertail River, Hagarth Creek, Silverslope Creek, and lower and upper McArthur Creek. In upper McArthur Creek she appeared to mainly feed on

hedysarum and possibly ground squirrels. During late summer she was found on the northeast shoulder of Mt. Hurd, and in late fall she moved to the Kicking Horse River flats and west to the Porcupine River.

On 26 October during an aerial telemetry flight it became evident that #9 was excavating a den on the Boulder Creek side of Mt. Dennis near tree line. On a previous morning her transmitter had been noted to be on inactive mode changing to active mode later in the day. It is believed that she denned in early to mid November. There were 89 locations made on #9 before she denned.

BEAR #10

Bear 10, a 4 year old, subadult male, was snared in the McArthur Creek drainage in June 1988. As indicated above he denned in the Porcupine Creek drainage. He spent the early spring feeding in the area of Mt. Hunter and Mt. Hurd with limited daily movements. The last telemetry fix was taken on 16 May and his radio signal was not detected on a subsequent telemetry flight. On 27 May, #10 was shot by a hunter on an avalanche slope in the Glenogle Creek drainage located west of YNP. This mortality occured during the spring grizzly season and thus was a legal kill. The hunters responsible were interviewed and the hide was examined. The actual kill site and remaining carcass were also investigated. There were 11 fixes taken on #10 before his death (Figure 4.2.3).

BEAR #23

This subadult female was also thought to be 3 years old and was often in the company of #9 during the early spring and summer. After she entered the townsite of Field several times, and appeared aggressive towards a dog, she was trapped on 6 June and relocated to the upper Porcupine River by the Warden Service. On 11 June she reappeared at the community ranch and continued to feed in the area for several days before making use of the avalanche slopes of Wapta Mountain in the Yoho River Valley. At this time she became accustomed to tourists viewing her at close range. She did not appear to be distressed or aggressive in these situations. Subsequently, she was trapped again on 16 July in this same vicinity and was then fitted with a radio transmitter. At this time she began feeding on the ripening buffaloberries on Mt. Stephen, in the Yoho River Valley and around the Kicking Horse Campground.

About 24 July #23 bear moved into BNP and fed on buffaloberries alongside Highway #1. Soon afer this, and continuing through to late fall, #23 fed almost exclusively on the abundant roadside buffaloberries from Wapta Lake to Lake Louise along Highway #1 and also along #93 north to Hector Lake. She made numerous forages along these routes and became a primary tourist attraction, thus causing repeated "bear jams". Even though she came into frequent close proximity to unwary tourists, and was subjected to some harrassment, there was no record of antagonistic behavior by her towards the public.

In September #23 fed for about 2 weeks on the Lake Louise ski slopes amongst intensive clearing and development activity. Here she apparently fed on pockets of lush graminoids and horsetails in areas where ground water surfaced, and also fed on remnant buffaloberries. After travelling to Hector Lake, and then to the Lake Louise area, she returned to the town of Field, and then Kicking Horse Campground, where she fed on hedysarum in late October. She appeared to den near the switchbacks in the Yoho River Valley and remained there until mid-November. However, a telemetry flight on 26 November showed that #23 had moved to the opposite side of the ridge (i.e. north side) on Mt. Dennis from where #9 was denned. At present it is believed that she is denned in this area. There were 108 fixes obtained on #23 to 28 November.

4.3 DERIVATION OF BEAR SEASONS

Four bear seasons (Table 4.3.1) were derived from an analysis of feeding signs (Table 4.3.2), bear food phenology observed during site-specific locations and phenology transects. The timing of the seasons will vary from year to year in response to variations in phenology.

Pre-Vegetation Season. Only hedysarum spp. were observed to be fed on at feeding sites investigated during early spring, stressing the importance of this plant as the main spring food of grizzly bears in the 2 parks. Hedysarum has also been found to be important to grizzly bears in other areas of the Rockies (Hamer and Herrero 1987). Hamer and Herrero also found that grizzly bears fed on overwintered bearberries (*Arctostaphylos uva-ursi*), graminoids and ants in early spring.

TABLE 4.3.1. Grizzly bear feeding seasons for Yoho and Kootenay National Parks, 1989.

Season		Period	
No.	Description	Start	Finish
1	Pre-Vegetation	den emergence	21 May
2	Vegetation	22 May	15 July
3	Berry	16 July	8 September
4	Post-Berry	9 September	den entry

Table 4.3.2. Seasonal observations of grizzly bear feeding in Yoho and Kootenay National Parks, 1989.

Food Item	SEASON			
	Pre-Vegetation	Vegetation	Berry	Post-Berry
Horsetail (*Equisetum arvense*)		11	5	6
Horsetail spp.		1	4	
Graminoids		31	10	7
Glacier Lily		1	3	
Twisted stalk		1		
Nettle		3		1
Spring Beauty		1		
Meadow Rue		2		1
Gooseberry			2	
Hedysarum	15	8	8	14
Crowberry				1
Buffaloberry		1	41	7
Fireweed		4		
Cow Parsnip		9	11	2
Sweet Cicely		1	3	
Bearberry		4		3
Grouseberry				1
Blueberry spp.			7	
Bedstraw		2	7	
Triangular-leaved ragwort		1		
Dandelion		1		
Ants		1	21	
Ground Squirrel		3	5	5
Moose				4
Elk				1
Mountain Goat				6

Vegetation Season. In this season the 8 study bears were found to feed primarily on lush green vegetation such as graminoids, horsetails, cow parsnip stalks and flower heads, fireweed (*Epilobium angustifolium*) and nettle (*Urtica* spp.). The high use of graminoids observed during this season was influenced by the easily observed feeding behavior of bears #9 and #23. These 2 bears were regularly seen feeding on grasses at the community pasture during late May and well into June. Hedysarum continued to be an important food for grizzly bears during this season. They also made isolated use of bearberries and spring beauty (*Claytonia lanceolata*) and glacier lily bulbs.

Berry Season. The 5 bears that were still alive during this season were found to feed principally on buffaloberries. Blueberries were the second most common berry fed upon during this season. Bear #1 fed almost exclusively on blueberries for several weeks indicating that this food, when present in abundance, can be as important as buffaloberries. Vegetative foods such as graminoids, horsetails and bedstraw (*Galium*) continued to be fed on regularly. It appeared that cow parsnip flowers and stalks continued to be widely sought by most of the study bears in this season. Hedysarum was still utilized regularly by bears #5 and #9. Ants were commonly fed upon at many of the feeding sites investigated but did not make up a large percentage, by volume, of the scats analyzed (see Section 4.4). Commonly, the bears would flip rocks in search of ant colonies as they travelled through an area feeding on one of the more primary foods. Five diggings for ground squirrels were investigated in this season.

Post-Berry Season. With diminishing berry crop avalibility, following early September frosts, the bears again turned to feed mainly on hedysarum roots. Pockets of remaining buffaloberries were fed on as were patches of graminoids, horsetails and cow parsnip which were unaffected by frost. Bearberry was also utilized to some degree. Bear #1 appeared to have actively sought out an area of the Pipestone River in BNP where crowberry was abundant. Possible predation upon ground squirrels, goats and moose by bears #4 and #5 was detected during this season. In total, 3 goats and 1 moose were fed upon and possibly killed by these bears. Also, a road-killed young of the year elk was scavenged by #4 in early December near Crooks Meadows, KNP. The carcass was dragged into the woods a short distance to be fed upon.

The number of seasonal locations made on radio-collared bears is outlined in Table 4.3.3.

TABLE 4.3.3. **Number of seasonal locations made on collared grizzly bears in Yoho and Kootenay National Parks, 1989.**

Bear I.D.	Season				
	Pre-Vegetation	Vegetation	Berry	Post-Berry	Total
1	11	8	32	19	70
4	5	17	20	36	78
5	6	14	12	19	51
7	14	17	- [a]	-	31
8	11	8	- [a]	-	19
9	3	33	25	28	89
10	10	1	- [a]	-	11
23	1	18	31	58	108

a mortality

4.4 SCAT COLLECTION

Two hundred and thirty-nine grizzly bear scats were collected in total. The analysis (Tables 4.4.1 - 4.4.2, Figure 4.4.1) indicated that hedysarum was the most important food during the pre-vegetation season (95% importance value). Once green vegetation began to grow in mid to late May, bears were found to feed mainly upon graminoid vegetation (72.4%), cow parsnip (12.0%) and horsetails (7.9%). During the berry season, buffaloberries (64.2%), cow parsnip (12.2%) and graminoid vegetation (10.0%) were found to be the dominant foods in the diets of the collared grizzly bears. In fall, hedysarum was found to again gain prominance (29.3%) in the diets of grizzly bears. They also ate buffaloberries (17.9%), crowberries (19.4%) and blueberries (18.7%) during this season.

The results of the scat analysis 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.

Table 4.4.1. **Percent volume and frequency of occurrence of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, by season, 1989.**

FOOD ITEM	SEASON							
	PRE-VEGETATION		VEGETATION		BERRY		POST-BERRY	
n =	21		96		93		29	
Horsetail	0.9[a]	(4.8)[b]	12.4	(30.2)	2.1	(12.9)	3.6	(10.3)
Graminoid	7.2	(23.8)	47.9	(71.9)	11.9	(41.9)	1.6	(20.7)
Locoweed			0.1	(1.0)				
Glacier Lily					0.3	(2.2)		
Nettle			0.1	(2.1)	0.2	(3.3)		
Gooseberry					0.1	(1.1)		
Hedysarum	74.1	(76.2)	16.4	(18.8)	7.5	(25.8)	24.1	(37.9)
Crowberry					0.1	(1.1)	16.0	(37.9)
Buffaloberry			0.9	(1.0)	43.6	(73.1)	14.7	(37.9)
Fireweed			0.1	(1.1)				
Cow Parsnip	4.8	(4.8)	18.2	(31.2)	19.4	(31.2)	5.6	(6.9)
Bunchberry					0.1	(1.1)	0.1	(3.4)
Blueberry					10.8	(29.0)	14.1	(41.4)
Dryas					0.1	(1.1)		
Willow					0.1	(1.1)		
Dandelion					0.1	(1.0)		
Ants	0.1	(9.6)	1.3	(14.6)	3.2	(35.5)	0.9	(10.3)
Ground Squirrel	6.2	(9.6)			0.1	(1.1)		
Moose							3.4	(3.4)
Elk			0.5	(1.0)				
Mountain Goat			0.8	(1.0)			15.6	(20.7)
Grizzly Bear			0.1	(1.0)				
Small Mammal	4.3	(4.8)						
Unid. Vegetation	1.9	(9.6)	1.3	(28.1)	0.5	(29.0)	0.3	(20.7)

a Percent volume.
b Percent frequency of occurrence.

Table 4.4.2. **Percent importance values of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, by season, 1989.**

FOOD ITEM	SEASON			
	PRE-VEGETATION	VEGETATION	BERRY	POST-BERRY
n =	21	96	93	29
Horsetail	0.1	7.9	0.8	1.2
Graminoid	2.9	72.4	10.0	1.1
Locoweed		tr		
Glacier lily			tr	
Nettle		tr	tr	
Gooseberry			tr	
Hedysarum	95.0	6.5	3.8	29.3
Crowberry			tr	19.4
Buffaloberry		tr	64.2	17.9
Fireweed			tr	
Cow Parsnip	0.3	12.0	12.2	1.2
Bunchberry			tr	tr
Bearberry		tr	tr	
Blueberry			6.3	18.7
Dryas			tr	
Willow			tr	
Dandelion		tr		
Ants	tr[a]	0.4	2.3	0.3
Ground Squirrel	1.0		tr	
Moose				0.4
Elk				
Mountain Goat		tr		10.4
Grizzly Bear		tr		
Small Mammal	0.3			
Unid. Vegetation	0.3	0.8	0.3	0.2

a Trace: importance vlaue < 0.1%.

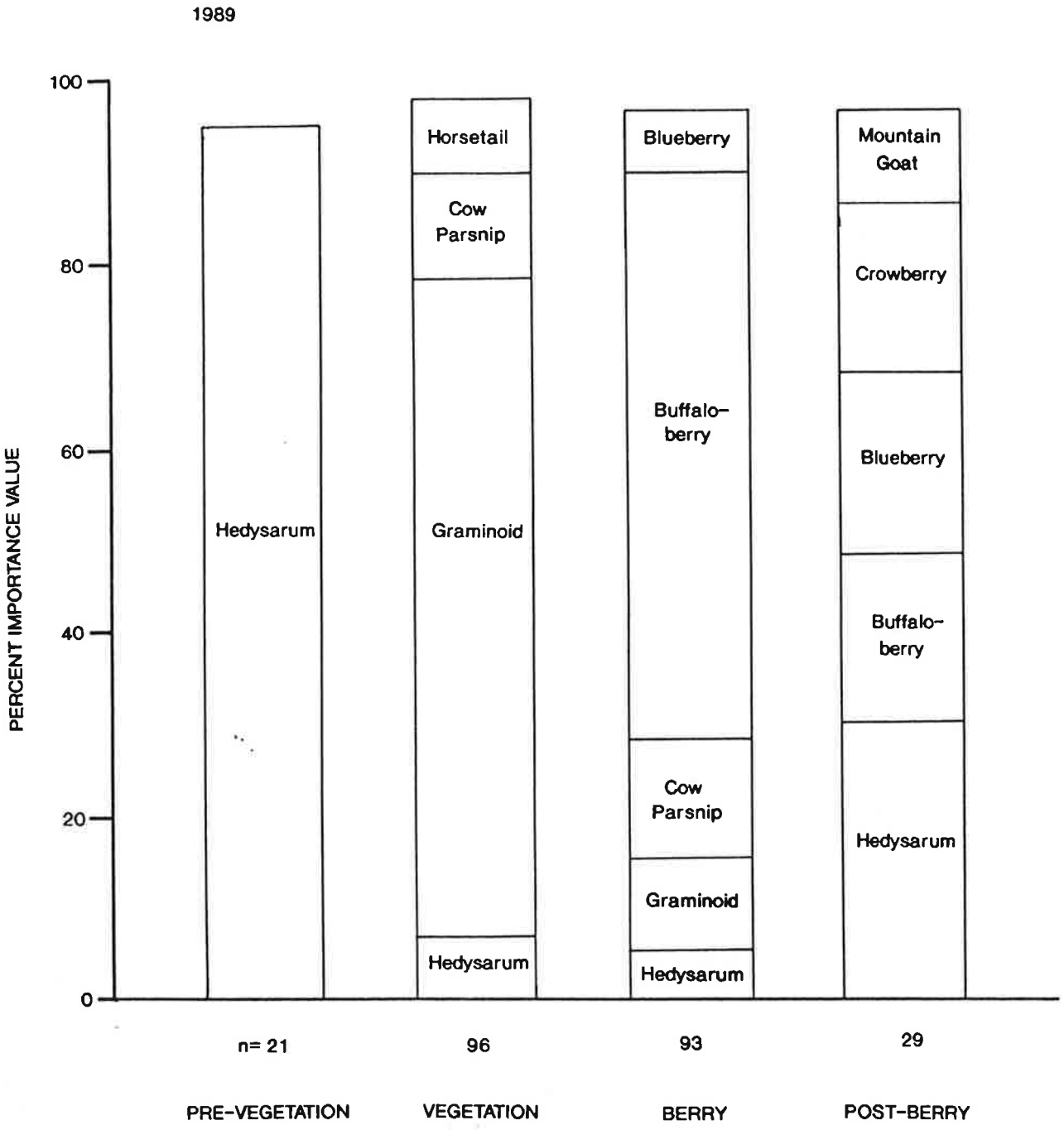

Figure 4.4.1. Percent importance values of food items found in grizzly bear scats collected in Yoho and Kootenay National Parks, by season, 1988.

In BNP, Hamer and Herrero (1987) found that grizzly bears fed upon hedysarum roots during the spring and fall. Russell et al. (1979) also found hedysarum to be a major food of grizzly bears in Jasper National Park.

4.5 FOOD AVAILABILITY TRANSECTS

The food availability transects that were established in the 2 parks are mapped in Figure 4.5.1.

Buffaloberry. Elevation had a strong influence on the date at which berries became ripe on the 6 transects that were flagged in the 2 parks (Table 4.5.1). The transect at Radium Hot Springs had an elevation of 3300' (1005 m), and the berries were ripe by 15 July. Berries on the highest transect, situated at 5400' (1650 m) at Sink Lake, did not ripen until 17 August. Effects of aspect and latitude undoubtably also played a role in the timing of the ripening of berries. Berry production in Yoho failed at the Ottertail and Reservoir transects with many plants having no, or very few berries. In 1988, both of these transects produced abundantly. In comparison to 1988 the Sink Lake transect had a slightly later maturity date but produced the same weight of berries per plant.

In KNP the Marble Canyon transect yielded over twice the number of berries per plant as compared to production in 1988. The average weight of berries produced per plant was 2.7 times the 1988 level. There was virtually no change in performance of the Wardle Creek transect compared to 1988. The Radium transect matured slightly later than in 1988 with less than half as many berries per plant and 3.5 times less average weight of berries per plant.

Horsetail. The 6 horsetail transects established in the parks were monitored from May to mid-July, when the plants on all transects had reached their maximum height.

Cow Parsnip. The 6 cow parsnip transects were from May to early August, by which time most seed heads were cured.

The data collected on horsetail and cow parsnip height and phenology is not presented in this report. It will be presented in subsequent reports.

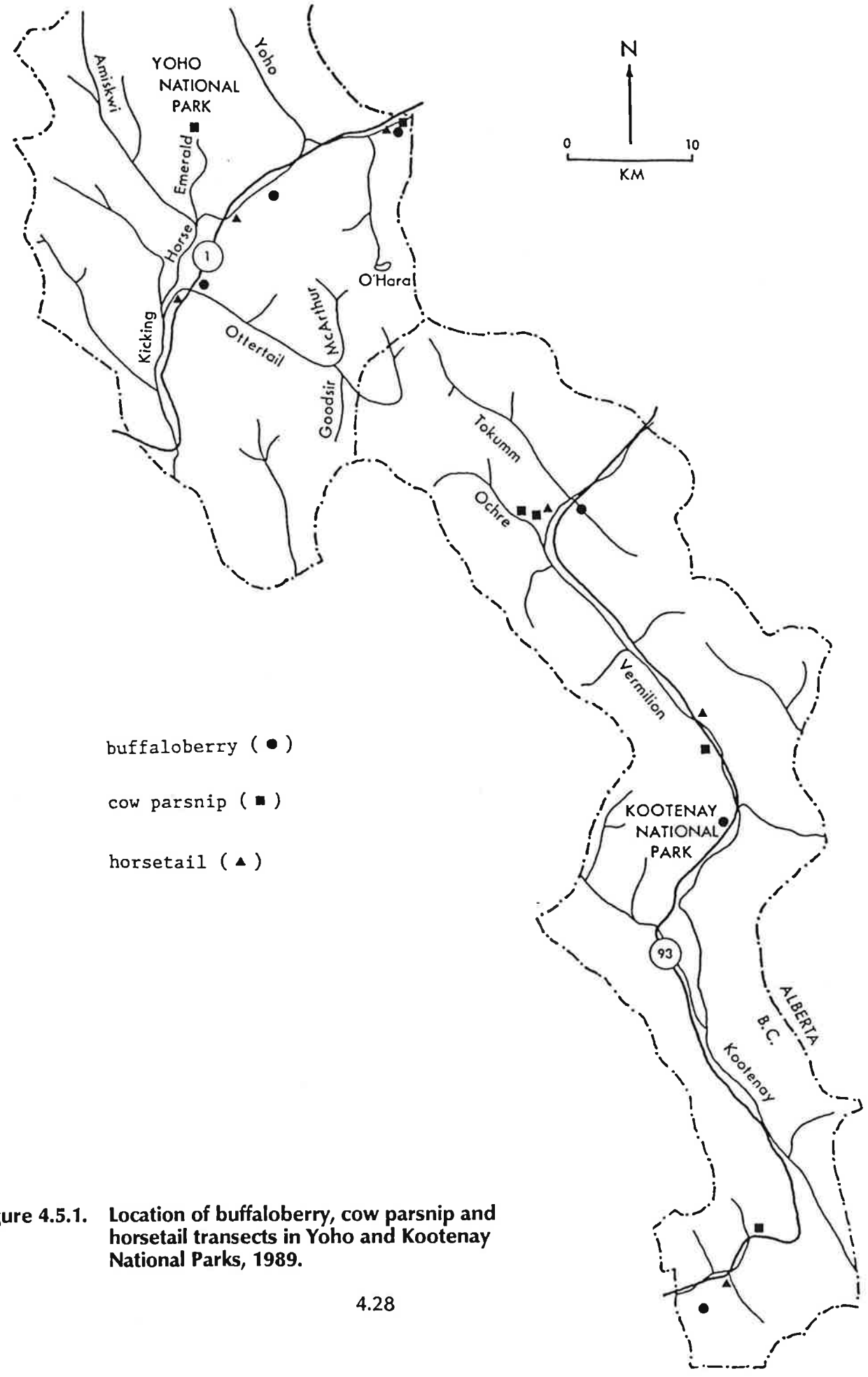

Figure 4.5.1. Location of buffaloberry, cow parsnip and horsetail transects in Yoho and Kootenay National Parks, 1989.

Table 4.5.1. Production of buffaloberry transects in Yoho and Kootenay National Parks, 1989.

Location	Elev. (ft)	Aspect	Date First Ripe	Mean Number of Berries per plant	Mean Weight (gm) of Berries per plant
Yoho					
Sink Lake	5400	NW	17 Aug.	134.7 ± 49.6	25.0 ± 11.2
Reservoir	4300	NW	31 July	11.4 ± 9.2	1.0 ± 1.0
Ottertail	3900	W	21 July	5.2 ± 8.1	0.6 ± 0.8
Kootenay					
Marble Canyon	4800	-	4 Aug.	184.8 ± 72.6	27.2 ± 11.0
Warble Creek	4100	SE	27 July	31.0 ± 20.3	4.3 ± 3.8
Radium	3300	-	15 July	60.4 ± 35.7	5.8 ± 3.6

4.6 SEASONAL GRIZZLY BEAR HABITAT USE

Use of Ecoregions

The number of locations found within each ecoregion for 1989 is presented below:

Ecoregion	Locations
Montane	144
Montane/Subalpine	5
Lower Subalpine	245
Upper Subalpine	72
Alpine	18

A seasonal analysis of ecoregion use (Table 4.6.1) indicates that grizzly bears frequented the Montane and Lower Subalpine Ecoregions more than the other ecoregions in the first 2 seasons. Use of the Montane Ecoregion appeared greatest during the vegetation season. Use of the Lower Subalpine Ecoregion increased during the berry season, while use of the Upper Subalpine and Alpine Ecoregions was greatest in the post-berry season.

Use of Ecosites

Grizzly bears were found to make use of a wide range of ecosites in all seasons. As seen in Tables 4.6.2 - 4.6.5, certain ecosites appeared to be used by grizzlies more frequently than others. Of particular importance in Yoho were the following ecosites: BG-DP, BG-SD, OL-P, WR-P(z), BG-A and BG-SF. It should be noted that Bear #9 and #23 made extensive use of the Field community pasture and this accounted for the high use of the WR-P(z) ecosite type.

WHAT ABOUT KJP?

No attempt will be made to interpret the relevance of ecosite data in this report. At least 1 more year of bear location data will be required to indicate possible preferences of certain ecosites.

TABLE 4.6.1. **Number of locations by ecoregion for radio-collared and incidentally observed grizzly bears in Yoho and Kootenay National Parks, 1989.**

Season	ECOREGION				
	Montane	Montane/ Subalpine	Lower Subalpine	Upper Subalpine	Alpine
1	26		27	9	3
2	65	2	52	4	1
3	20	2	95	25	4
4	33	1	71	34	10
TOTAL	**144**	**5**	**245**	**69**	**18**

Table 4.6.2 . Number of locations by ecosite for radio-collared and incidentally observed grizzly bears in Yoho National Park, 1989.

	MONTANE															
Season	BG-DN	BG-DP	BG-P	BG-SD	BG-TB	FL-D	FL-PD	OL-D	OL-P	OL-SPD	TA-P	WR-P	WR-P(z)	WR-SC	WR-SPDT	WR-ST
1		7	2	4	1	1	2	1	3				1			
2		19		3	1				7	1	1		19	1	2	2
3	1	1		3			2		3		2					2
4	1	1	1	6			2		1		2	2	1		1	
TOTAL	2	28	3	16	2	1	6	1	14	1	5	2	21	1	3	4

	MONTANE & SUBALPINE		LOWER SUBALPINE									UPPER SUBALPINE				ALPINE	
Season	BC-w	WR-GSd	BG-A	BG-SF	CM-SF	CO-SF	DS-SF	FL-SF	OG-SF	TA-SF	TO-SF	OD-F	SI-aL	SI-F	SI-whP	OO-H	SK-H
1			2	7													
2		1	8	13	2		1	1	4	3							
3	1	1	4	12	4	1		2	2	6	1	1		1	1	1	2
4			8	7				4	2				2			2	
TOTAL	1	2	22	39	6	1	1	7	8	9	1	1	2	1	1	3	2

	OTHER					
Season	M	R	R+H	R-whP	T	Z
1		5		4	1	
2						
3	1	1			2	
4		13	3	1	1	1
TOTAL	1	19	3	5	4	1

Table 4.6.3. Number of locations by ecosite for radio-collared and incidentally observed grizzly bears in Kootenay National Park, 1989.

	MONTANE												LOWER SUBALPINE				
Season	AT1	AT4	DG6	DR1	DR2	DR3	DR4	DR5	DR6	DR7	FR3	VL6	AL3	BV2	BY1	BY3	BY4
1								1							4	2	1
2	1		1		1				1	1					2		1
3														1	1		
4		1		2	1	1	2			2	2	1	4			1	
TOTAL	1	1	1	2	2	1	2	1	1	3	2	1	4	1	7	3	2

	LOWER SUBALPINE														UPPER SUBALPINE		
Season	BY5	BY7	CA2	FV3	FV4	FV5	FV6	HC1	IB4	PP3	PP4	SB1	SB3	SB6	EG1	EG4	EN3
1	1		1			2	1	2				1					
2		1				2	1	1	1	1		1					
3		7		3	1	9	2	1	1		1	2	4		1	1	1
4		1	1				3	3				4	4	1	1		
TOTAL	1	9	2	3	1	13	7	7	2	1	1	8	8	1	2	1	1

	UPPER SUBALPINE													ALPINE		OTHER
Season	LV2	LV3	PL1	PL4	PL6	SX1	WF1	WF3	WF5	WH4	WH6	WH7	WH8	RD2	RD2+CR	R+T
1							1	1								
2			1										2		1	
3	1	1	3		2	3	5	1				1				
4			1	1			1	1	2	3	1	1		1		1
TOTAL	1	1	5	1	2	3	7	3	2	3	1	2	2	1	1	1

Table 4.6.4. Number of locations by ecosite for radio-collared grizzly bears in Banff National Park, 1989.

	LOWER SUBALPINE													
Season	AL1	BK1	BK4	BK4+R	BV1	BV2	BY4	CA4	CV1	HC1	HC4	MC1	ML1	PP1
1														
2			1					1						
3	3		3	3	3	1	1		4	1				1
4		3	1		2				6		3	1	1	1
TOTAL	3	3	5	3	5	1	1	1	10	1	3	1	1	2

	LOWER SUBALPINE							UPPER SUBALPINE					OTHER
Season	PP3	PR1	PR3	PR4	SB2	VD1	VD2	EG1	EN2	LV1	LV3	SX2	SC
1													
2	1			1	1								
3		1		4			1			1		1	1
4			3		1	1		6	3		3		
TOTAL	1	1	3	5	2	1	1	6	3	1	3	1	1

Table 4.6.5. Number of locations by ecosite for radio-collared and incidentally observed grizzly bears in Kootenay, Yoho and Banff National Parks combined, 1989.

	MONTANE															
Season	AT1	AT4	BG1	BG2	BG4	DB3	DG1	DG6	DR1	DR2	DR3	DR4	DR5	DR6	DR7	FR3	HD2
1			9	4	1		1	2		3	1		1				
2	1		19	3	1			1		7	1			1	1		1
3	2		1	3		1		2		3							1
4	2	1	2	6		1		2	2	2	1	2			2	2	
TOTAL	**5**	**1**	**31**	**16**	**2**	**2**	**1**	**7**	**2**	**16**	**3**	**2**	**1**	**1**	**3**	**2**	**2**

	MONTANE			LOWER SUBALPINE													
Season	HD3	HD5	VL6	AL1	AL3	BK1	BK4	BK4+R	BV1	BV2	BY1	BY3	BY4	BY5	BY7	CA2	CA4
1		1									4	2	1	1		1	
2	5	19					1			3	6		1		1	2	1
3	2		1	3	1		3	3	3	8	3		1		7	4	
4	1	3	1		4	3	1		2		2	1			1	1	
TOTAL	**8**	**23**	**2**	**3**	**5**	**3**	**5**	**3**	**5**	**11**	**15**	**3**	**3**	**1**	**9**	**8**	**1**

	LOWER SUBALPINE																
Season	CV1	FL1	FV3	FV4	FV5	FV6	GT3	HC1	HC4	IB4	MC1	ML1	PP1	PP3	PP4	PR1	PR3
1					2	1		2									
2		1			2	1		1		1				2			
3	4	2	3	1	9	2	1	2		1			1		1	1	
4	6	4				3		3	3		1	1	1				3
TOTAL	10	7	3	1	13	7	1	8	3	2	1	1	2	2	1	1	3

Table 4.6.5. continued

Season	LOWER SUBALPINE								UPPER SUBALPINE								
	PR4	SB1	SB2	SB3	SB6	SP1	VD1	VD2	EG1	EG4	EN2	EN3	LV1	LV2	LV3	PL1	PL4
1		3	7														
2	1	9	14			1										1	
3	4	6	12	4				1	1	1		1	1	1	1	3	
4		12	8	4	1		1		7		3				3	1	1
TOTAL	5	30	41	8	1	1	1	1	8	1	3	1	1	1	4	5	1

Season	UPPER SUBALPINE												ALPINE				
	PL6	SI1	SI2	SX1	SX2	WF1	WF3	WF5	WH4	WH6	WH7	WH8	BS1	HE2	JN1	RD2	RD2+CR
1						1	5										
2												2					1
3	3	1		3	1	5	2				1		1	1	2		
4			2			1	2	2	3	1	1		2	3		1	
TOTAL	3	1	2	3	1	7	9	2	3	1	2	2	3	4	2	1	1

Season	OTHER				
	R	R+T	SC	T	Z
1	5			1	
2					
3	1		1	2	
4	13	1		1	1
TOTAL	19	1	1	4	1

Use of Vegetation Types

More information from site specific investigations are required to indicate active selection of specific vegetation types (Table 4.6.6). Further refinement of the vegetation types on avalanche slopes is also required. For the purpose of this study 2 new vegetation types have been identified. These are avalanche slopes with significant abundance of cow parsnip (H98) and scoured slopes that support good levels of hedysarum (S80). The latter vegetation type was found to be used by grizzly bears predominantly in spring and fall. H98 was mostly used during the vegetation season.

Use of Elevation

The grizzly bears used a wide range of elevations in each of the 4 seasons for which data was collected (Table 4.6.7). In 1989 they were located at a mean elevation of 5567 $\pm$ 266 feet (1697 $\pm$ 81 m) during the pre-vegetation season, 4957 $\pm$ 157 feet (1515 $\pm$ 47 m) during the vegetation season, 5717 $\pm$ 157 feet (1742 $\pm$ 48 m) during the berry season and 5815 $\pm$ 178 feet (1772 $\pm$ 54 m) during the post-berry season.

Use of Burns and Avalanche Slopes

Grizzly bear use of burns and avalanche slopes is presented in Table 4.6.8. Of known locations (ie. site specific or incidental observations only), grizzly bears were found to use avalanche paths during the pre-vegetation season for 74% of their locations. Slopes with an abundance of hedysarum attracted the bears during this season. During the vegetation season, 41% of bear locations were found to be on avalanche slopes. The lush growth of grass and cow parsnip were the primary foods at this time and these foods were prevalent on many avalanche slopes.

Avalanche slopes were used the least (19%) during the berry season. In the post berry season, 28% of locations were associated with avalanche slopes. At this time hedysarum slopes again attracted grizzly bears as did remaining pockets of succulent green vegetation.

It should be noted that bear #23 fed almost exclusively along roadsides during the berry season. This feeding behaviour was considered to be atypical for Yoho and

TABLE 4.6.7. Location of collared and incidentally observed grizzly bears by elevation in Yoho and Kootenay National parks, 1989.

Seasons	Mean Elevation + 95% CL		
	Feet	Metres	n
1	5567 ± 266	1697 ± 81	64
2	4957 ± 157	1515 ± 47	128
3	5717 ± 157	1742 ± 48	147
4	5815 ± 178	1772 ± 54	136

TABLE 4.6.8. **Use of burns and avalanche slopes as a percentage of known grizzly locations in Yoho and Kootenay National Parks, 1989.**

Season	Percent of Locations			
	% Burn	n	% Avalanche	n
1	15	26	74	23
2	0	77	41	76
3	5	78	19	69
4	0	52	28	50

Kootenay grizzly bears. It is probable that avalanche use during this season may ordinarily be greater than that reflected in the 1989 figures.

The limited expression of recent burns in the 2 parks restricted use of this type of habitat to only certain study bears. The 15% use of burns in the vegetation season can be attributed solely to bear #1 as he made extensive use of the avalanche slopes of the Vermilion burn in KNP. He also used other portions of this same burn during the berry season for it's abundance of blueberries. Bear #9 used a burn on the northeast side of Mt. Hurd during the berry season as well. The 5% of locations on burns during the berry season can be attributed to these 2 bears. There was no use of burns detected during the vegetation and post-berry seasons.

4.7 IMPORTANT AREAS FOR GRIZZLY BEARS

Results of the telemetry investigations and subjective ecosite evaluations (Section 3.6) of future years will be used to delineate ecosites and areas that are deemed critical to the maintenance of a healthy grizzly bear population in the 2 parks. These areas will also help to determine where the possibility of a high frequency of human/bear interactions exist.

The preliminary results of the first 2 years indicate that the following areas are very important to some of the collared bears during the indicated seasons:

Pre-vegetation Season:

- Mt. Dennis slide paths west of Field (hedysarum)
- Mt. Stephen above Field (hedysarum)
- Upper McArthur/Mt. Odaray slopes (hedysarum)

} YOHO

Vegetation Season:

- avalanche paths of McArthur Creek (cow parsnip)
- avalanche paths of Ice River (grasses and cow parsnip)

} YOHO / PROV

Berry Season:

- Goodsir flats (buffaloberry)
- Mt. Whymper(blue berry)
- Goodsir Pass (ground squirrels)
- Rockwall Pass (ground squirrels)
- along Hwy #1 and Hwy #93 (buffaloberry)

Post-berry Season:

- Goodsir flats (hedysarum)
- upper Helmet Creek (hedysarum)
- avalanche paths of McArthur Creek (hedysarum)
- Molar Creek at the Pipestone River (crow berry)

Denning:

- Porcupine River
- Mt. Stephen above Field
- Misko Mountain up slope of McArthur Creek
- Paint Pots slope between Ochre Creek and Tokkum Creek
- east side of Mt. Owen
- west side of Mt. Dennis near ridge line
- Bow # 4 snow / wetlands ??

4.8 ESTIMATING POPULATION SIZE AND MONITORING TRENDS IN NUMBERS

Grizzly bear populations are notoriously difficult to census for the following reasons (Servheen 1987):

- they are difficult to see due to their use of forested habitat.
- individual bears have different probabilities of capture, therefore capture-recapture population estimate techniques are suspect.
- they have large home ranges and low population densites, thus sample sizes for estimates are usually small.
- age and sex classes are difficult to determine without handling.
- black bear sign can be mistaken for that of grizzly bears.

Despite these problems, we propose the following methods that could be used by the warden service on a long term basis to monitor trends in bear numbers:

1. **Compilation of Warden Records**. Warden sightings should remain as one of the mainstays of monitoring grizzly bear population trends. Although there are many problems in trying to determine how many individual bears were sighted during the course of a year (pers. comm. - Tom Davidson, BNP), the task should be made somewhat easier by the collaring of part of the population. A comparison of the percentage of marked versus unmarked bears seen will assist with the estimation of the population size. This analysis will be done for the subsequent years of study. As females with cubs or yearlings are the most easily recognizable segment of a bear population, and also the most important segment in terms of reproduction, their numbers should be more closely investigated.

2. **Tooth Analysis of Captured Bears**. The ages of bears captured will be used to monitor trends in the age structure of the population. For example, a lack of juvenile recruitment would be indicated if only older bears are being captured.

5.0 RECOMMENDATIONS

1990 FIELD SEASON

- Due to the loss of 4 collared bears during 1989, an intensive period of trapping should be conducted by the Warden Service in the south of KNP and the north of YNP in the spring of 1990.

- The remaining collared bears, however, should still be monitored. Beak staff will play a minor role in trapping so that they can direct most of their efforts to monitoring collared bears.

- Effort should also be directed to recapture radio-collared, sub-adult bears to check the condition of their collars. Their collars should be expanded as necessary and modified so that the chance of their falling off is increased at the end of the study.

- Trapping efforts should include active trapping of #5's cub early in the year if he/she is still accompanying the sow.

- A review of trapping safety should be included in the initial spring meeting.

- Fire road access should be permitted so that bears can be trapped and followed more efficiently. Ground locations and follow-up investigations of remote locations are much more time consuming to complete without vehicular access to fire roads, substantially reducing the amount of data that can be collected.

- We strongly recommend that 1 warden in each of the parks be assigned to the study full-time. This initiative would improve the usefulness of the end product and will lend itself to better training of wardens in both bear research and ELC.

- Volunteer assistance greatly improved the results of the 1989 field season. Select volunteers should be contacted prior to the 1990 field season to permit early training and involvement in the study.

- Involvement of the 2 Park's interpretive services should be more formally solicited.

- Due to the hazards involved in feeding site investigations, it is recommended that 2 individuals travel together during back country field studies. A lack of manpower has made this unfeasible to date.

- Manpower shortages have created difficulties in ensuring that vegetation transects are inspected on a regular basis and berry harvesting occurs at the peak of ripeness. A greater effort will be required in the 1990 field season by all researchers to ensure that these transects are monitored on a weekly basis.

- The telemetry flight schedule should continue to be overseen by the YNP research group due to logistics. However, it is recommended that KNP make available 1 or 2 individuals (volunteer or warden) to conduct a portion of these flights when required.

- Investigation of the more remote feeding sites can only be feasible with either more manpower to delegate to overnight excursions, or through increased funding for helicopter use in investigating these sites. If possible, the use of in-park helicopters should be relied upon more often in 1990.

- * Adequate accommodation is still required for the Beak biologist while staying in KNP. Attention to this aspect would be greatly appreciated. K XING BUNKHOUSE?

- Extension of the study for a fourth year is sought to yield 3 years of data collection. The first year of the study was focussed on trapping and not data collection.

- To more accurately estimate each parks' grizzly bear population size, the use of hedysarum plots should be examined in detail. This would necessitate a separate study that would make use of existing records such as the Grizzly Bear Habitat Evaluation Study (Kansas et al. 1989a). Long-term monitoring of spring time hedysarum digging observations would be related to the Wardens Service's bear monitoring program to yield an index of bear numbers for a given year.

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7.0 APPENDIX - 1988 TABLES

7.1 Number of locations of collared and incidentally observed grizzly bears by fix type in Yoho and Kootenay National Parks, 1988.

7.2 Number of locations by ecoregion for radio-collared and incidentally observed grizzly bears in Yoho and Kootenay National parks, 1988.

7.3 Number of locations by ecosite for radio-collared and incidentally observed grizzly bears in Kootenay and Banff National Parks, 1988.

7.4 Number of locations by ecosite for radio-collared and incidentally observed grizzly bears in Yoho National Park, 1988.

7.5 Number of locations by vegetation type for radio-collared and incidentally observed grizzly bears in Banff National park, 1988.

7.6 Use of burns and avalanche slopes as a percentage of known grizzly bear locations i Yoho and Kootenay National Parks, 1988.

7.7 Location of collared and incidentally observed grizzly bears by elevation in Yoho and Kootenay National Parks, 1988.

Table 7.1. **Number of locations of collared and incidentally observed grizzly bears by fix type in Yoho and Kootenay National Park, 1988.**

Fixtype	Number of Locations	
	Bear Study	Warden Cards
Home Range	19	N/A
Remote	64	N/A
Site Specific	22	13
Incidental	3	47
TOTAL	**108**	**60**

TABLE 7.2. **Number of locations by ecoregion for radio-collared and incidentally observed grizzly bears in Yoho and Kootenay National Parks, 1989.**

Season	Ecoregion				
	Montane	Montane/ Subalpine	Lower Subalpine	Upper Subalpine	Alpine
1	4	1	3		
2	8	2	26	2	
3	4	6	54	14	8
4			22	8	1
TOTAL	**16**	**9**	**105**	**23**	**9**

Table 7.4. Number of locations by ecosite for radio-collared and incidentally observed grizzly bears in Yoho National Park, 1988.

Season	MONTANE				MONTANE AND SUBALPINE		LOWER SUBALPINE											
	BG-DP	BG-SD	OL-P	TA-P	CO-SPD	WR-GSd	BG-A	BG-SD	BG-SF	CM-SF	CO-SF	FL-SF	OG-SF	OH-SF	TA-SF	TO-SF	WR-GSd	WR-SF
1	2		1		1										1			
2	2	1	1			2	2	1	6		1	7			3			1
3	1			2		6	2		6	1		6	8	1	2	1	1	2
4									2		1	2				2		
TOTAL	5	1	2	2	1	8	4	1	14	1	2	15	8	1	6	3	1	3

Season	UPPER SUBALPINE			ALPINE		OTHER			
	KI-Hm	SI-whP	SL-aL	OO-H	SK-H	R	R-whP	T	Z
1									1
2		1							
3	1	1		2	4	1		1	
4			1			1	1		
TOTAL	1	2	1	2	4	1	1	2	1

Table 7.5. Number of locations by vegetation type for radio-collared and incidentally observed grizzly bears in Yoho and Kootenay National Parks, 1988.

	Closed Forest	Open Forest		Shrub				Herb-Dwarf Shrub	
SEASON	C30	O03	O13	S01	S02	S05	S80	H16	H98
1							2		1
2	2	1		1			1		6
3			1			5	1	1	3
4					1	1			1
TOTAL	2	1	1	1	1	6	4	1	11

TABLE 7.6. **Use of burns and avalanche slopes as a percentage of known grizzly bear locations in Yoho and Kootenay National Parks, 1988.**

Season	Percent of Locations			
	% Burn	n	% Avalanche	n
1	0	9	50	8
2	0	21	43	21
3	5	39	16	25
4	0	9	11	9

TABLE 7.7. **Location of collared and incidentally observed grizzly bears by elevation in Yoho and Kootenay National parks, 1988.**

Seasons	Mean Elevation + 95% CL		
	Feet	Metres	n
1	4689 ± 623	1429 ± 190	9
2	5191 ± 271	1582 ± 83	35
3	5834 ± 200	1778 ± 61	86
4	5984 ± 358	1824 ± 109	31