CABINET MOUNTAINS

GRIZZLY BEAR STUDY
1984 ANNUAL PROGRESS REPORT

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ABSTRACT

The Cabinet Mountains grizzly bear study began in April of 1983 supported by funding from U.S. Borax and Chemical Corporation, the U.S. Fish and Wildlife Service, and the Montana Department of Fish, Wildlife and Parks. Trapping during 1983 and 1984 resulted in the capture of 2 grizzlies and 103 black bears. Both grizzlies and 11 black bears were radio collared and monitored. Composite minimum home range for the female grizzly was 489 km^2. Minimum home range for the male grizzly was 1290 km^2 during 1984. Average male and female black bear minimum home ranges were 84.8 km^2 and 19.7 km^2, respectively. Track measurements indicated the presence of at least 4 other grizzlies in the area used by the 2 radio collared individuals. Grizzly bear density was estimated to be 1 grizzly per 44 km^2 for a portion of the study area judged to be good habitat. Average density of black bears was estimated to be 1 bear per 3.5 km^2. Characteristics of habitat used by black and grizzly bears is reported and discussed. Effects of hunter harvest on black bear sex and age structure was evaluated and two methods of monitoring harvest are proposed.

INTRODUCTION

The grizzly bear (Ursus arctos horribilis) is currently listed as a "threatened species" in the 48 adjacent states under the provisions of the 1973 Endangered Species Act. Six ecosystems were identified as supporting self-perpetuating or remnant grizzly populations (USFWS 1981). The Cabinet-Yaak Ecosystem (CYE) was one of three ecosystems designated by the recovery plan for concentrated recovery effort.

The CYE is located in northwest Montana and northern Idaho. There is concern that human developments along U.S. Highway 2 are fragmenting the 5576 km^2 CYE and creating an "island" population in the Cabinets (southern half). The Yaak (northern half) borders Canadian grizzly populations to the north. Occupied habitat south of Hwy. 2 covers 4204 km^2 while 1372 km^2 occur north of Hwy. 2.

The Cabinets have recently been subjected to increasing resource demands through mineral exploration, timber harvest and human recreation. Division of the CYE makes the Cabinet grizzly population more vulnerable to impacts resulting from these activities because of the lack of potential immigration. Therefore, the Montana Department of Fish, Wildlife and Parks (MDFWP) initiated the Cabinet Mountains Grizzly Study which began in April of 1983 through funding provided by U.S. Borax and Chemical Corporation. Funding was also provided by the U.S. Fish and Wildlife Service (USFWS).

Existing information on grizzly bears in the Cabinets consists largely of habitat surveys and examination of reports of sightings and sign (Hamlin and Frisina 1974, Erickson 1976, 1978, Joslin et al. 1976, Moore and Gilbert 1977). From 1979 until 1980 an unsuccessful effort was made to capture and radio-collar a grizzly in the Cabinet Mountains (Thier 1981). A large portion of the Cabinets has been grizzly bear habitat component mapped through use of a procedure described by Madel (1982). Present U.S. Forest Service (USFS) grizzly habitat management is based on the Cumulative Effects Analysis Process (Christensen 1982) and Management Prescriptions for the Intergated Forest Plan (USFS 1983).

OBJECTIVES

1. Review and analyze all previously collected data on grizzly bear distribution, movements, and habitat-use, in the Cabinet Mountains.

2. Determine general seasonal patterns regarding distribution, movement corridors, habitat-use and preference, food habits, and behavioral patterns of radio-collared grizzlies.

3. Use collected data to make recommendations regarding validation or modification of the Cumulative Effects Analysis Process and other management policies.

4. Conduct black bear (Ursus americana) studies incidental to grizzly bear investigations to provide basic ecological data on local black bear populations. Black bear productivity, population status, habitat-use, distribution movements, and behavioral data will be gathered and analyzed.

STUDY AREA

The Cabinet Mountains are located in Lincoln and Sanders counties of northwest Montana and Bonner and Boundary counties in northern Idaho. The mountain range extends along north-south trending faults between the Clark Fork River on the south and the Kootenai River 56 km to the north. The East and West Cabinets are separated by the Bull River which flows south to the Clark Fork River and Lake Creek flowing north to the Kootenai River (Fig. 1). Most of the CYE grizzly bear habitat is on public land administered by the Kootenai, Lolo and Panhandle National Forests. Plum Creek Timber Company and Champion International are the main corporations holding significant amounts of land in the area. Individual ownership exists primarily along the major rivers and creeks and numerous patented mining claims along the Cabinet Wilderness boundary. The Cabinet Wilderness is an elongate area covering 381 km^2 of the upper elevations in the East Cabinets.

The Cabinets are a rugged range of mountains shaped by alpine and continental glaciation during the Pleistocene. Elevations range from 610 m along the Kootenai River to 2664 m atop Snowshoe Peak. The climate is characterized by short, warm summers and heavy, wet winter snowfalls. Average monthly temperatures at Libby vary from 19.4°C in July to -5.3°C in January. Annual precipitation varies from 49.3 cm in the valleys to 280 cm in some mountainous areas. (Appendix Table 11). Most mountain precipitation occurs as snow. Heavy snow accumulation and the resultant mountain avalanches maintain many of the seral shrub and forb fields thought to be important foraging areas for grizzlies during spring and summer. Valley bottoms to upper slopes are heavily forested with stands of mixed conifers. The Cabinet Range is vegetatively diverse with six habitat type series represented (Pfister et al. 1977). River bottoms are also diverse. Mixed stands of coniferous and deciduous trees are interspersed with riparian shrubfields and wet meadows. The study area has also been described by Joslin (1980).

Current resource development demands in grizzly bear habitat center around mineral exploration and extraction, timber harvest, and recreation. ASARCO operates the Troy mine complex 3 km west of Bull Lake. This facility began operation in 1979. Silver and copper are the primary minerals extracted. Mineral exploration activity centers in the southwestern portion of the Cabinet Wilderness Area. The Revett Formation, a quartzite bearing strata in the middle of the Belt Supergroup (Precambrian Rocks), crops out extensively in the vicinity of St. Paul Peak where it contains copper and silver deposits (Bannister et al. 1981). ASARCO and U.S. Borax conducted intensive exploration in this area until December 31, 1983. Congress imposed a 20 year limit on mineral exploration in wilderness areas in the 1964 Wilderness Act. Exploration will continue outside the wilderness and on validated claims inside the wilderness. In 1984 ASARCO proposed a plan of development for a mine in the West Fork of Rock Creek.

Recreation and other demands involve wilderness designations and a proposed ski area. The West Cabinets (Scotchman Peaks) and areas adjoining the Cabinet Wilderness are under consideration as additions to the wilderness system. On the east side of the main Cabinets, a ski area has been proposed on Great Northern Mountain. The U.S. Forest Service is reviewing this proposal (Madel 1983). Big game hunting provides recreation and is part of the local economy. Hunting districts 103 and 121 encompass the Cabinet Mountains on the north and south, respectively. In 1983 district 121 had the largest harvest and number of hunter days for black bear of all districts in Montana (Table 1). These two districts had a combined harvest of about 3300 deer and about 750 elk.

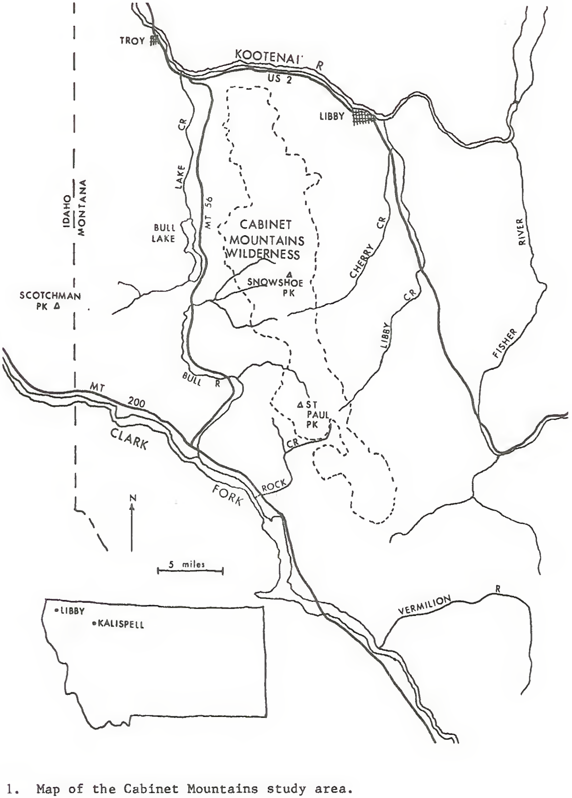


Fig. 1. Map of the Cabinet Mountains study area.

Table 1. Harvest and hunter recreation days of black bear, deer, and elk in hunting districts 103 and 121 (Brown et al. 1984).

	103		121	
	Harvest	Hunter Days	Harvest	Hunter Days
Black Bear	82	2936	238	6497
Deer	1827	24844	1496	23628
Elk	174	16793	570	25623

Timber harvest is the principal land management activity over much of the CYE. During January of 1984, there were 126,124,000 board feet of timber in active sales or under contract in occupied grizzly bear habitat on the Kootenai National Forest (KNF) south of U.S. Highway 2 (A. Bratkovich, E. Garcia, and D. Henry, Pers. Comm.).

METHODS

Information about historical distribution and kills was gathered from existing documentation and personal interviews with long time residents or persons familiar with the observation. Veracity of all reports was determined by the interviewer and only those judged reliable were included in this report. Criteria used to judge reliability of sightings and sign are shown in Appendix Table 12.

Bears were trapped with foot snares (Aldrich Snare Company, Clallam Bay, Washington) in cubbies or trail sets baited with road-killed deer and miscellaneous meat scraps. Scraps of bait were dragged along roads and trails to produce scent trails to attract bears to cubbies. Snares were boiled for several hours with bark, needles, leaves and paraffin. From that point, snares were handled only with gloves. Warning signs were posted to minimize bear/human encounters. Snares were checked daily by vehicle and/or on foot.

Captured bears were immobilized with ketamine hydrochloride (Ketaset or Vetalar) and xylazine (Rompun). Dosages used were reported by Perry (1978). Drugs were delivered with a Palmer Cap-Chur gun, jab stick or a blow gun.

Plastic ear tags (Rototags) were used to mark captured bears. One numbered tag was placed in each ear. Although each ear held a different number, the tags were usually sequential. Colored armortite streamers, 3.75 cm in width and 15 cm in length, were attached to the ear tags. Physical measurements of the bear were also taken. Scale weights were obtained from as many bears as possible. The first premolar was extracted and used to determine the age of the individual by counting cementum annuli (Stoneberg and Jonkel 1966).

All grizzlies and selected black bears were fitted with radio collars (Telonics, Mesa, Arizona). Radio instrumented bears were monitored from air and ground. Locations were plotted on 1:24,000 USGS topographic maps by Universal Transverse Mercator (UTM) coordinates. Home ranges were calculated by the minimum polygon method (Mohr 1947, Hayne 1959) and measured with a planimeter. Radio locations were also classified by habitat type (Pfister et al. 1977), grizzly bear habitat component (Appendix Table 13), land type (USFS 1984), management allocation (USFS 1983), elevation, slope, aspect, topography. Distance measurements from roads and trails to radio locations were used to examine their relationships to bear distribution. Closed roads were considered to be trails for analysis. If open roads were closer to locations than the nearest trail, the distance to the road was entered as the measurement for the nearest trail as well. Distance to perennial water was also recorded. Statistical analyses were performed through use of the computer package MSUSTAT (Lund 1983).

Several radio locations were visited to determine bear activity at the site. If activity could be determined or some sign located, a circular vegetation plot ($375m^2$) was delineated. Vegetation canopy coverage and structure were recorded. Plant nomenclature followed Hitchcock and Cronquist (1973). Seasons were defined as Spring (den emergence - June 30), summer (July 1 - August 15), and fall (August 16 - denning).

Scats were collected, tagged, and frozen for food habit analysis. Only scats accompanied by other sign (tracks, hair, or radio locations from instrumented bears) were considered to be grizzly.

Real time motion sensing collars aided in determining activity patterns through continuous monitoring for 24 hour periods. Motion sensing collars emit two different pulse rates dependent upon orientation of the collar. Bears were monitored every one-quarter to one-half hour to record signal strength, constancy, mode, and location. Motion sensitive collars were used only on grizzlies.

Bear dens were located by chance and reports from individuals. Physical and vegetative data were recorded about the site as well as the condition and type of den.

RESULTS AND DISCUSSION

Historical and Current Grizzly Bear Distribution

Distribution and a listing of 51 known grizzly bear kills in the Cabinet Mountains from 1950 until the present are shown in Figure 2 and Table 2 respectively. The number indicated may not reflect total man-caused mortality during the specified time frame. Illegal kills probably occur, but the magnitude of this mortality factor is unknown. Of the total known legal and illegal kills, at least 12 were adult females. For the period indicated by the time span between the earliest and latest known kills, an average of 1.8 mortalities/year was calculated. The list will be updated as more information becomes available. A special licensing system for grizzly bear hunters began in 1967 and detailed information for hunter kills is available only since that date. The grizzly bear hunting season in the Cabinets was closed in 1974.

Distribution of sightings and sign for the 1959-1983 time period is shown in Figure 3. This map applies only to the Kootenai National Forest south of U.S. Highway 2. Two areas of concentrated sightings and sign appear on this map. One is the area in the center of the Cabinet Mountains Wilderness around Snowshoe Peak and the other is in the southerly portion of the Cabinet Mountains Winderness Area. Evaluations concerning this information must consider observer effort or number of persons visiting an area and the observability or the nature of the habitat (e.g. more animal observations may come from open habitat than from thickly vegetated habitat). Since 1975, 15 observations of females with young have been reported. Eight of these observations occurred since 1980.

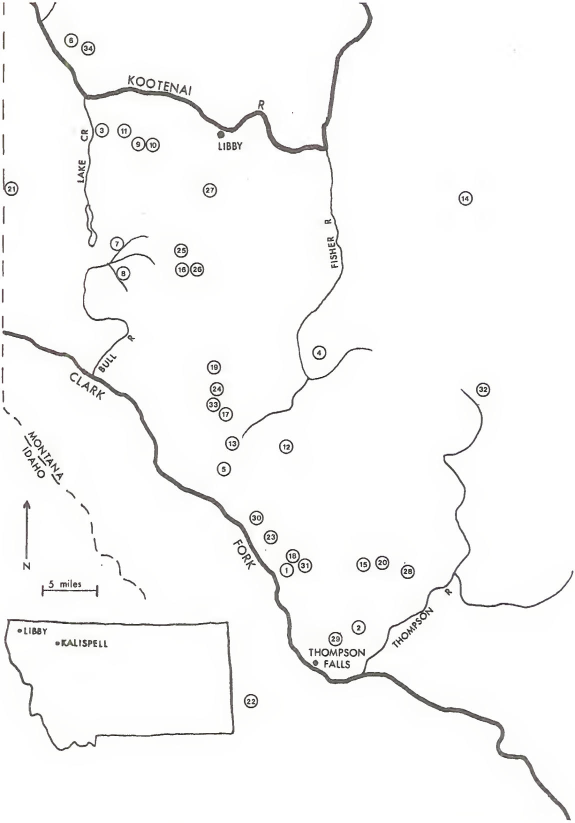


Fig. 2. Distribution of known grizzly bear kills in the Cabinet Mountains, 1950-1984 (Numbers refer to Table 2).

Table 2. Known grizzly bear kills in the Cabinet Mountains, 1950-1984 (some information compiled from Halvorson 1974, Madel 1983, K.R. Greer Pers. Comm.).

Map Number[1]	Date	Location	Sex-Age
1	Summer 1950	Squaw Cr.	1 subadult
2	Fall 1951	Goat Cr.	1 subadult male
3	Spring 1952	Lake Cr.	2 adult females, 3 yearling males and 1 yearling female
4	1953	Kenelty Mtn.	unknown bear
5	1953	20-Odd Mtn.	unknown bear
6	Fall 1953	O'Brien Cr.	1 subadult male
7	1954	N. Fk. Bull R.	unknown bear
8	1954	S. Fk. Bull R.	unknown bear
9	1954	Cedar Lk.	unknown bear
10	1954	Cedar Lk.	unknown bear
11	1954	Taylor Pk.	unknown bear
12	1954	Allen Pk.	unknown bear
13	Fall 1954	Silverbow Cr.	1 adult female
14	Spring 1955	Wolf Cr.	1 adult male
15	Summer 1955	Mt. Headley	1 yearling
16	Fall 1955	Bear Cr.	1 male yearling
17	Fall 1955	Baree Cr.	1 adult male, 1 adult female
18	Fall 1958	Squaw Cr.	1 adult female
19	Fall 1959	Rock Lk.	1 adult female, 1 cub
20	Fall 1959	W. Fk. Thompson R.	1 adult female, 3 cubs
21	Fall 1959	Cliff Cr.	unknown bear
22	Fall 1960	Prospect Cr.	1 adult female, 1 cub
23	Summer 1964	Graves Cr.	2 yearlings
24	Fall 1964	Wanless Lk.	3 subadults (1 adult wounded)
25	Fall 1965	Snowshoe Lk.	2 subadults
26	Spring 1968	Bear Cr.	1 adult female
27	Spring 1968	Granite Cr.	1 subadult male
28	Fall 1969	Priscilla Pk.	1 adult female
29	Spring 1970	Thompson Falls (?)	unknown bear
30	Fall 1970	Cameron Gulch	2 subadult males
31	Fall 1970	Squaw Cr.	1 adult female, 1 subadult female
32	Fall 1971	Murr cr.	1 adult female
33	Fall 1974	Swamp Cr.	1 adult male
34	Fall 1977	Rabbit Cr.	1 adult male

[1] - Map number refers to Figure 2.

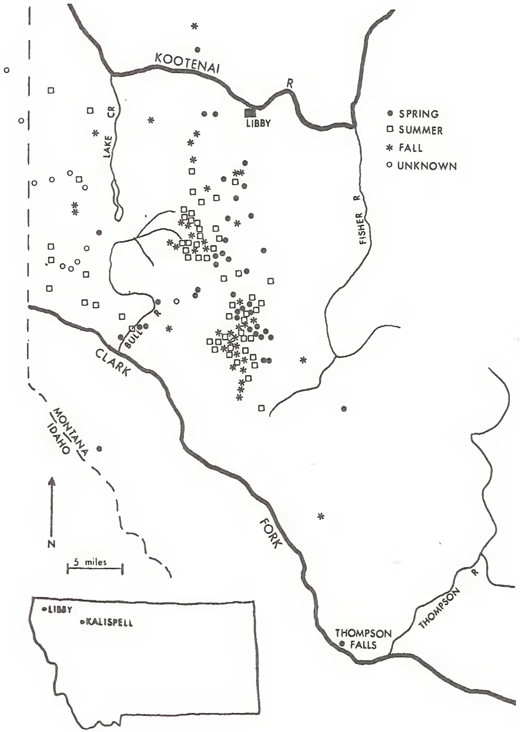


Fig. 3. Seasonal distribution of grizzly bear sightings in the Cabinet Mountains on the Kootenai National Forest, 1959-1983.

TRAPPING

Spring trapping activities began on 18 April and ended on 4 July for a total time of 77 days. Two trap teams were used in 1984. Trapping was concentrated on the west side of the main Cabinets in the Bull River, Swamp Creek, Rock Creek, and Blue Creek drainages. One trap team was moved to the east side of the Cabinets in June. Fall trapping activities lasted 20 days and were concentrated on the east side of the Cabinets in the Fisher River drainage. Four days were spent trapping in the Vermilion River in early September.

A total of 71 black bears were captured 86 times during 1984. A single adult male grizzly was captured in the Libby Creek drainage on 19 June. Six black bears and the grizzly were fitted with radio collars.

Trap success during 1984 was less than 1983 during nearly all comparable time periods (Figure 4). Poorer trap success in 1984 may have been related to weather. Late April and early May were wetter and slightly cooler than 1983 and may have reduced bear movements and decreased trap success. Radio location data from black bears tracked during April and May would support this hypothesis. Overall trap success for 1984 was 5.9% compared to 12.3% in 1983. Trap success on the east side was roughly double that of the west side (Table 3). Most spring grizzly sign and the two grizzly captures occurred on the east side.

Table 3. Snare-nights, bear captures, and trap success from the east and west sides of the main Cabinet Mountains during 1983 and 1984.

	Snare-nights	Bears Captured	% Success
East	680	68	10.0
West	1146	63	5.5
TOTAL	1826	131	7.2

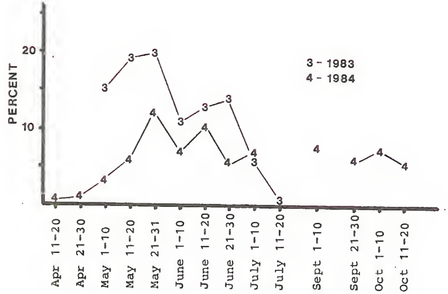


Fig. 4. Percent trap success during 10 day time periods in the Cabinet Mountains, 1983-1984. Trap success expressed as the percent of operational snares capturing bears each night.

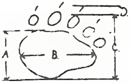
GRIZZLY BEAR POPULATION DATA

A male grizzly was captured on 19 June 1984 in the upper Libby Creek drainage. Physical measurements and an estimated weight of 184 kg were obtained (Table 4). The bear appeared to be in good physical condition and a count of cementum annuli from the extracted tooth indicated an age of 11.5 years.

Table 4. Physical measurement of grizzly 680 captured in the Cabinet Mountains, 1984.

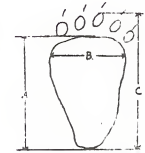
Date	6/19/84
Age and Sex	11.5 yr. Male
Weight (estimate	184.1 kg (405 lb.)
Color	Dark brown, silvertip
Total body length[2]	172.7 cm (68 in.)
Neck girth[3]	71.1 cm (28 in.)
Chest girth[4]	124.5 cm (49 in.)
Shoulder height[5]	97.8 cm (38.5 in.)
Shank length[6]	38.1 cm (15 in.)
Foot measurements[7]	
Front pad width	14.6 cm (5.75 in.)
Front pad length	7.6 cm (3.0 in.)
Front foot length	12.7 cm (5.0 in.)
Front claw length	4.8 cm (1.9 in.)
Front claw arc	9.5 cm (3.75 in.)
Hind pad width	14.0 cm (5.5 in.)
Hind pad length	16.5 cm (6.5 in.)
Hind foot length	21.6 cm (8.5 in.)
Testicle width	3.8 cm (1.5 in.)
Testicle length	6.4 cm (2.5 in.)
Baculum length	16.5 cm (6.5 in.)
Fat index	3
Ear tags	Yellow plastic rototags
Left	680
Right	681
Lip tattoo	680
Collar color	White

1. Age was determined by the number of cementum annuli rings in extracted tooth.
2. Total body length indicates length from tip of nose to base of tail, following natural body contours.
3. Neck size measured at smallest circumference of neck.
4. Chest girth measurement around the body just posterior to the shoulders.
5. Shoulder height is the distance from heel of front foot to midline between shoulders.
6. Shank length is the distance from the knee to the heel of the hind foot.
7. Foot measurements:
   A. Front pad length
   B. Front pad width
   C. Front foot length
   D. Front claw length



A. Hind pad length

B. Hind pad width
C. Hind foot length



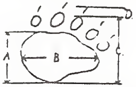
8. Front claw outside arc is measured from base of claw to tip over contour.
9. Fat index is an arbitrary measure of the bear's condition on a scale of 1 to 5; 1 being emaciated, 3 being average, and 5 being extremely fat.

Five other instances of grizzly bear sign (tracks, hair, verified scats) were located during 1984. Four of these were tracks that provided measurements for comparison. Tracks were considered to be made by a grizzly when claw length exceeded 4 cm. Of 103 black bear captured in the Cabinet Mountains, only one had a claw length that exceeded 3.2 cm. during 1983, six instances of grizzly bear sign were encountered (Martin 1983, J. Brown Pers. Comm., Kasworm 1984). Four of these were tracks that provided measurements. Using all eight track measurements and the foot measurements of the two collared grizzlies, six individuals were identified (Table 5). Separation of individuals was based on front track widths that differed by at least 1.3 cm or were made at a time when instrumented bears were not in the vicinity. In an attempt to generate an estimate of density based upon data of similar nature, all eight locations of grizzly track measurements and the capture sites of the two radio-collared grizzlies were plotted on a map. Minimum home range polygon techniques (Mohr 1947, Hayne 1959) were used to establish a total area (Fig. 5). Dividing this total area by six (identified grizzlies in the area) produced a density of one bear per 44 km^2. It should be noted that this density estimate came from areas of the Cabinet Mountains that appear to be the best habitat and may not be indicative of density throughout the study area.

Table 5. Grizzly bear track measurements collected in the Cabinet Mountains, 1983-1984.

				Front Track[2] (cm)				Indv.	
Date	Map No.[1]	Sign	Substrate	A	B	C	D	No.	Source
04/14/83	1	Track	Mud		10.8	9.8	7.6	1	Martin 1983
04/14/83	2	Track-Hair	Snow		16.5	16.5		2	Martin 1983
06/24/83	3	Track-Hair	Mud	6.7	12.7	13.2	4.8	3	Martin 1983
06/29/83	4	Capture		5.7	11.4	11.4	5.1	1	MDFWP
07/15/83	5	Track-Hair	Mud	7.0	12.4	12.1	4.1	3	MDFWP
06/19/84	6	Capture		7.6	14.6	12.7	4.8	4	MDFWP
06/26/84	7	Track	Mud	5.1	9.8	10.2	4.1	5	MDFWP
09/05/84	8	Track	Mud	8.3	15.2	15.6	5.1	6	MDFWP
09/14/84	9	Track	Mud	7.6	15.2	14.0	4.8	4	MDFWP
10/02/84	10	Track	Mud	7.0	13.3	13.0	4.4	3	MDFWP

1 - See Figure 5.
2 - Foot measurements:
A. Front pad length
B. Front pad width
C. Front foot length
D. Front claw length



3 - Grouping of individuals based on measurements and location.

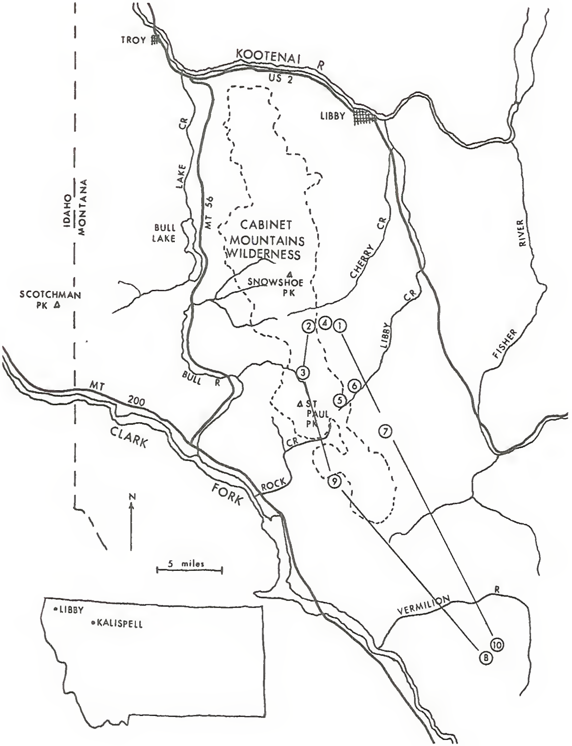


Fig. 5. Location of grizzly bear track observations and captures in the Cabinet Mountains, 1983-1984 (Numbers refer to Table 5).

BLACK BEAR POPULATION DATA

Black bear hunting in northwest Montana has shown a dramatic increase in popularity since the early 1970's. In 1971, Region 1 of the MDFWP recorded about 19,000 black bear hunter days and a harvest near 650 bears. By 1979, hunter days had increased to 55,000 and harvest increased to almost 1,000 bears (Figure 6). With this increase in harvest and hunting pressure, MDFWP biologists became concerned about whether black bear populations could sustain this increased harvest.

Hunting districts which appeared to be receiving a large part of increased hunter days and harvest were districts 100, 101, and 103. In 1979 these 3 districts provided 16% of total statewide black bear hunter days and 23% of the statewide harvest. Hunter days increased 271% and harvest increased 114% from 1973 until 1979 (Fig. 7). In 1976, collection of teeth from harvested black bears began in order to obtain information on age structure. Median age of the harvest increased from 1977 until 1978, but this may have been related to a change in the spring season (Table 6). Median age of the harvest declined through 1983. Subadults ($\leq$ 4 years old) averaged 73% of the harvest for the period 1976-1983. Interviews with hunters and residents indicated a general decline in bear sightings and nuisance bear complaints. An average of 62% of the annual harvest during 1978-1980, occurred during the spring season and most of that occurred in May. Black bears may be most vulnerable to harvest in spring because snow cover forces animals searching for food into limited areas of early green-up. Since females and particularly females with cubs tend to emerge from dens later in the spring than males (Hugie 1982, Beecham 1980, Waddel and Brown 1984), curtailing the spring season during May might be most effective in decreasing overall harvest and affording protection to reproductively active females. These factors prompted MDFWP biologists to reduce the spring season to 2 weeks in late April beginning in 1981.

Table 6. Hunting season, percent females, percent subadults, and median of the harvest in MDFWP hunting districts 100, 101, and 103, 1976-1984.

Year	Season	% Females	% Subadults	Median Age	N
1976	04/01-11/28	--	75	2.0	28
1977	04/01-06/30 09/01-11/27	47	88	2.0	17
1978	04/15-05/31 09/09-11/26	58	64	4.0	50
1979	04/15-05/31 09/08-11/25	50	58	3.0	12
1980	04/15-05/31 09/06-11/30	37	74	2.0	35
1981	04/15-04/30 09/04-11/29	67	70	4.0	10
1982	04/15-04/30 09/04-11/28	50	82	2.0	28
1983	04/15-04/30 09/10-11/27	34	74	2.0	50
1984	04/15-05/15 09/08-11/25	34	45	5.0	91

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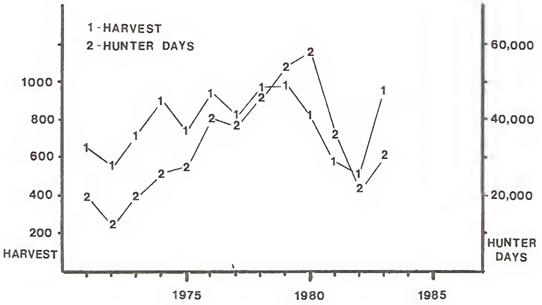

Fig. 6. Black bear harvest and hunter days in MDFWP Region 1, 1971-1983.

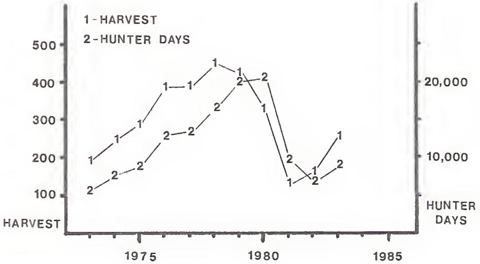

Fig. 7. Black bear harvest and hunter days in MDFWP hunting districts 100, 101, and 103, 1973-1983.

Forty and seventy-one individual black bears were captured in 1983 and 1984, respectively (Appendix Table 14). This total was stratified into samples from the east and west sides of the main Cabinet Range. These two study areas correspond to MDFWP hunting districts 103 (east) and 121 (west). Districts 103 and 121 have had different black bear hunting seasons since 1981 when district 103's spring season was reduced from 6 weeks to 2 weeks. In 1984 the spring season in district 103 was increased to 4 weeks while district 121 has remained at 6 weeks since 1978.

Trapping information from 1983 and 1984 provided an opportunity to compare age/sex data between years and areas. Though insufficient data exist for a comparison between trapped samples from 1983 and 1984 on the west side, sample size was sufficient from the east side for such a comparison. East side sex ratios differed from a 50:50 ratio in 1983 ($p=.002$), but not during 1984 ($p=.117$). Sex ratios from 1983 and 1984 were not significantly different ($p=.186$). Subadults constituted 28% and 29% of the trapped samples during 1983 and 1984, respectively. Median age of captured bears was 6.0 in 1983 and 7.5 in 1984. On the basis of these results, 1983 and 1984 data were pooled to form a single sample for each study area. Ages from the 1984 sample were backdated to 1983 ages and pooled. Recaptures during 1984 of bears marked in 1983 were eliminated.

Black bear population data from the east side (district 103) is probably not representative of the entire district. Black bear captures were made while attempting to capture grizzly bears. East side captures came from areas very lightly hunted. West side captures came from an area of moderate hunting pressure and are probably indicative of all district 121. Hunter questionnaire data suggest that more restrictive spring seasons in districts 100, 101, and 103 may have shifted more hunting pressure to district 121. Hunter days in district 121 increased 68% and harvest increased 213% from 1981 (initiation of restricted spring seasons in 100, 101, 103) until 1983. Comparisons of the east side areas (lightly hunted) to the west side study area (moderately hunted) should be viewed in this manner.

Summarization of population statistics from the two trapped samples is presented in Table 7. Proportions of females trapped from the east (35%) and west (23%) were not significantly different ($p=.172$). Differences in proportions of subadults between east (33%) and west (50%) study areas did approach statistical significance ($p=.086$). West side subadult ratios were higher than east side ratios for both males and females, but differences were not significant ($p \geq .168$). Differences in median age between east (6.0) and west (4.0) samples approached significance ($p=.072$). Stratification of this sample into male and female median ages also indicated a lower median age for west side males and females.

Table 7. Black bear population statistics from two study areas in the Cabinet Mountains.

	EAST SIDE (Lightly Hunted) N = 51	WEST SIDE (Moderately Hunted) N = 52
% Males	65	77
% Females	35	23
% Subadults	33	50
% Male Subadults	24	40

% Female Subadults	10	10
Median Age	6.0	5.0
Male Median Age	6.0	4.0
Female Median Age	6.0	5.0

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Relating these study area comparisons to the effects of hunting would tend to indicate that as hunting pressure increases, median age of the population decreases and subadult ratios increase. Both of these changes appear more pronounced in males. Similar relationships for the effects of increased harvest have been shown by Beecham (1980) in Idaho, Waddell and Brown (1984) in Arizona, Hugie (1982) in Maine, Kohn (1982) in Wisconsin, and Modafferi (1982) in Alaska.

Developing allowable harvest projections may be another useful method to manage harvest. This technique involves population estimates, annual harvest rates, and estimates of annual harvest. In the fall of 1983 and 1984, MDFWP biologists conducted helicopter surveys of shrubfields on about 810 km^2 of the Cabinet Mountains. Total black bear counts were 250 and 128 in 1983 and 1984, respectively (Brown et al. 1984 and In Prep.). Observed densities were 1 bear per 3.2 km^2 (1983) and 1 bear per 6.3 km^2 (1984). Sixty marked black bears were available in the survey area during 1984 for Lincoln index population estimation. Only 16.7% of the marked bears were seen during this survey. A density of 1 bear per 1.1 km^2 was calculated from the Lincoln index population estimate. Density estimates from fall survey flights of shrubfield areas may overestimate average annual density due to concentration of bears at these sites to forage for berries. Therefore an average of all three density estimates was used to produce a more realistic annual density. This resulted in an average density of 1 bear per 3.5 km^2. This value is similar to other black bear density estimates for the northwest U.S. (Jonkel and Cowan 1971, Poelker and Hartwell 1973, Beecham 1980). A mean annual density of 1 bear per 3.5 km^2 was used to estimate populations in several hunting districts adjoining the Cabinet Mountains. Recommended rates of harvest for black bear vary from 10-20% (Erickson 1965, Poelker and Hartwell 1973, Waddell and Brown 1984, Kohn 1982). A conservative rate of 10% appears to be most applicable to northwest Montana because age of females at first successful breeding is 4.5-5.5 years old and average litter size is 1.6 (Jonkel and Cowan 1971, Brown et al. 1984, Kasworm 1984). Females in northwest Montana appear to mature later and have smaller average litters than black bear in Michigan (Erickson et al. 1964), Washington (Poelker and Hartwell 1973), Idaho (Reynolds and Beecham 1980), or Wisconsin (Kohn 1982).

Scale weights were obtained from 89 captures of black bears during 1983 and 1984. Scale weights ranged from 11.4-131.8 kg. A weight regression based on chest girth and total body length was generated similar to McLellan's (1981) regression for grizzly bears. The regression is as follows:

$W = .0000688\ LG^2$

W-predicted weight (Kg)

L-total body length (cm)

G-chest girth (cm)

$R^2 = .991$

$p = .001$

The same regression expressed in the English system:

$W = .00248\ LG^2$

W-predicted weight (lbs)

L-total body length (in)

G-chest girth (in)

HOME RANGE AND MOVEMENTS

Grizzly Bear

Annual composite home range of female grizzly 678 during 1983 and 1984 is shown in Figure 8. Sixty-two specific and 33 general locations were obtained (Table 8), but only the specific locations were used to generate the home range. All general locations fell within the bounds defined by minimum home range techniques. Calculation of home range size resulted in a minimum home range of 489 km^2. Distance between extreme points in the home range was 66 km.

Summer and fall home range of the male grizzly 680 is shown in Figure 9. Spring location data was limited due to the late capture date (19 June). Fifty-four specific and 22 general locations were obtained (Table 8). Plotting of specific locations and home range calculations produced a minimum home range of 1290 km^2. Distance between extreme points in the home range was 66 km.

Minimum home range sizes of grizzly bears from the Northern Continental Divide Ecosystem (NCDGBE) vary from 75-735 km^2 for adult females and 192-3029 km^2 for adult males (Rockwell et al. 1978, Mace and Jonkel 1980, Schallenberger and Jonkel 1980, McLellan 1982, Aune and Stivers 1982 and 1983, Servheen 1983, Aune et al 1984). Both instrumented grizzlies from the Cabinet Mountains fall within this range.

Table 8. Number and type of grizzly bear radio locations obtained by season.

	Spring		Summer		Fall	
Bear No.	Specific	General	Specific	General	Specific	General
678 (1983)	2	0	7	1	19	6
678 (1984)	13	14	7	10	14	2
680 (1984)	2	6	10	12	42	4
TOTAL	17	20	24	23	75	12

Grizzly 678 left her den site on the west side of the main Cabinets around 20 April. She remained on the west side within 3 km of her den for about 3 weeks. In mid-May she moved across the main divide to the east side. At this time 2 sets of bear tracks were noted in the snow near her 17 May location. This could have been initial mating activity for grizzly 678 during 1984. She spent the remainder of May and the first week of June on the east side. On the location flight of 11 June she was observed alone at an elevation of 1695 m on the west side of the main Cabinets. She appeared to be in good physical condition. On the location flight of 18 June, 2 sets of bear tracks in the snow were again noted near her location. On 19 June, male grizzly 680 was captured within 5 km of this location. During the following month, grizzlies 678 and 680 were located together 5 times. The last of these was on 19 July about two months after the initial indications of mating activity by grizzly 678. Much of this activity took place at moderate and upper elevations in the central portion of the main Cabinets.

Both bears remained in this same general area through the first week of August at which time they began moving south. Male grizzly 680 moved south along the

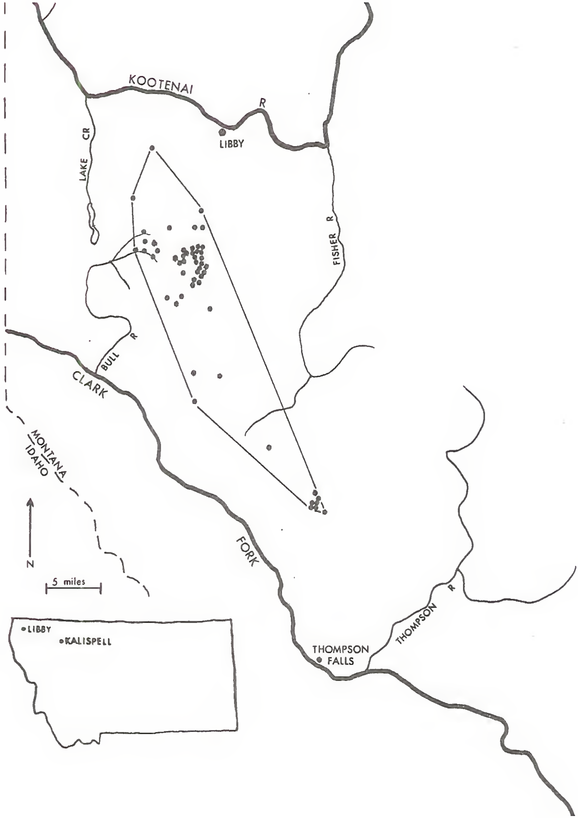

Fig. 8. Minimum home range polygon of grizzly bear 678 in the Cabinet Mountains, 1983-1984.

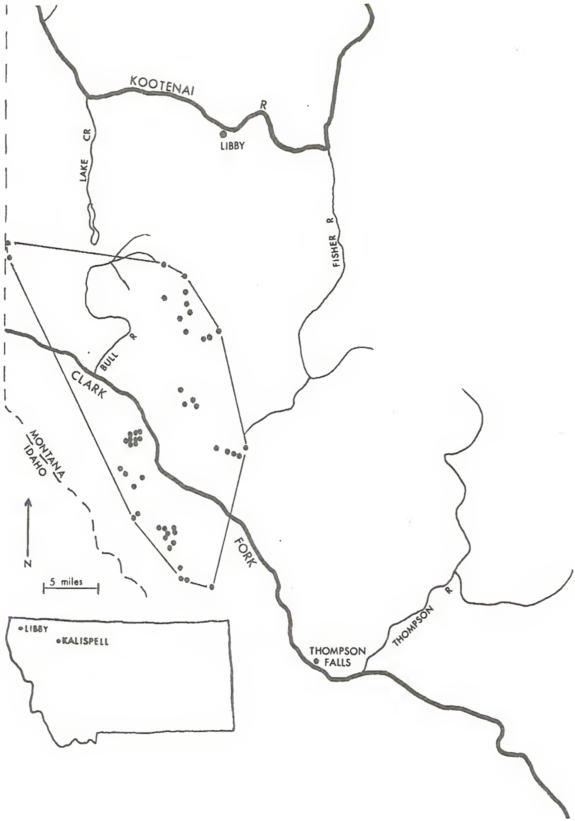

Fig. 9. Minimum home range polygon of grizzly bear 680 in the Cabinet Mountains, 1984.

west side of the main Cabinets to an area of shrubfields on the north side of the Vermilion River. Female grizzly 678 moved south on the east side of the main Cabinets to an area of extensive shrubfield cutting units south of the Vermilion River. Timing of movements and areas used by grizzly 678 during 1984 were very similar to those in 1983. Both grizzlies remained in these areas for about 3 weeks before moving north to the central part of the main Cabinet range. Female grizzly 678 moved through the central Cabinets until mid October and denned on the west side around 19 October.

Male grizzly 680 used the central portion of the main Cabinet range through September, then moved to the West Cabinet Mountains for the first two weeks of October. On 15 October, 680 was located south of the Clark Fork River. This area is outside officially delineated "occupied habitat" (USFWS 1981). The Montana general big game hunting season began 21 October and ended 25 November. The area used by grizzly 680 south of the Clark Fork lies in MDFWP hunting district 121. This district recorded 25,623 elk hunter recreation days in the 1983 season (Brown et al. 1984). Heaviest hunting pressure in this district occurs south of the Clark Fork. The area is well roaded and hunter access is good. Though grizzly 680 spent the entire hunting season in this area, USFS and MDFWP personnel received only 3 verified sightings of the animal. No bear-related conflicts around camps were reported, though elk hunting success appeared good and there was considerable meat available in camps.

On 21 November a hunter mistook a set of grizzly 680's tracks in the snow for those of a black bear. The hunter followed the tracks for about .5 km before startling the bear from it's bed. The grizzly came in the hunter's direction and the hunter fired two shots from 2.5 m and 1.5 m. The bear fell beside the hunter, then got up and stumbled off. The hunter thought the animal was probably dead or would die shortly. He notified MDFWP personnel and escorted them to the site for examination. Some blood and a quantity of foul smelling, yellow fluid was noted in the tracks of the bear after the shooting. Radio signals from the motion sensitive collar indicated the animal was still alive. On 23 September, MDFWP personnel approached the animal and forced it to move from its bed. Some blood was noted but none of the yellow fluid could be found. Tracks in the snow indicated the animal was moving well and using all its limbs. An area closure was instituted and enforced by MDFWP and USFS personnel for the final two days of the hunting season in the drainage where grizzly 680 had been wounded. Twenty-four hour monitoring and daily locations were conducted until 2 December. At that time it was established that the bear had denned. Monitoring through December, January, and February indicated the animal was still alive through periodic change in signal mode from the transmitter. In February the den was located and marked for closer inspection during the summer.

Movements by grizzly 680 demonstrate that grizzlies can move between the East and West Cabinets as well as the Cabinets and the north end of the Bitterroot range south of the Clark Fork. However, there have been few verified sightings of grizzlies south of the Clark Fork in the last 10 years. This may in part be due to a lack of active solicitation of sighting reports of grizzlies. This movement also gives credibility to the existence of a movement corridor between the Cabinets and the Yaak.

Twenty-four hour monitoring of grizzly bears provided information on times of the day that bears were active. Fourteen sessions of monitoring have been conducted. Eight of these were characterized as diurnal, 3 were nocturnal, and 3 were crepuscular. Most of the diurnal activity patterns occurred in the remote areas, while most nocturnal and crepuscular patterns were in close proximity to human activity (hunter camps, logging activity). This type of data will continue to be gathered.

Black Bear

Six additional female black bears were collared in 1984. Five black bears collared in 1983 (4 males and 1 female) were also monitored. Minimum annual home ranges of all black bears are shown in Table 9. Bear 264 (male) was killed in the 1984 spring black bear season and bear 366 (male) cast his collar during spring. One female (bear 780) was collared in October and did not provide sufficient data to plot a home range. Male minimum home ranges varied from 21.0-254.1 km^2 ($\bar{x}$ = 84.8 km^2). Female minimum home ranges varied from 8.0-66.8 km^2 ($\bar{x}$ = 19.7 km^2). On the basis of radio locations and recaptures, bears trapped on either side of the main Cabinets tended to remain on that side and not cross the main divide (Fig. 10-11). Other Montana studies have reported male home ranges of 6-82 km^2 (Aune and Stivers 1982 and 1982, Rosgaard and Simmons 1982). Amstrup and Beecham (1976) reported female home ranges of 17-130 km^2 and male home ranges of 109-115 km^2 for black bears in west-central Idaho. Female black bear home ranges in the Cabinet Mountains appeared somewhat smaller than these reports.

Table 9. Sex, age and home range size of black bears radio-tracked in the Cabinet Mountains, 1984.

Bear No.	Sex	Age	Home Range (km^2)
84	F	5	13.1
88	M	6	31.3
90	M	13	254.1
264	M	11	21.0
366	M	11	32.6
686	F	15	11.9
702	F	21	8.3
726	F	6	10.1
736	F	7	8.0
780	F	11	N/A
800	F	19	66.8

Male radio-collared black bears emerged from dens between 15 and 20 April. One female instrumented bear did not emerge from the den until about 10 May. Early spring movements of black bears appeared restricted to small areas after initial movements from den sites. Cool, wet spring weather conditions may have influenced movements.

Fall denning dates in 1984 were very similar to those recorded in 1983 (Kasworm 1984). Seven radio-collared females had denned by 19 October during 1984. Two radio-collared males had denned by 30 October 1984. Time of denning appeared earlier than dates reported in west-central Idaho (Amstrup and Beecham 1976, Reynolds and Beecham 1980) and northcentral Montana (Aune and Stivers 1983), but similar to reported dates from northwestern Montana (Jonkel and Cowan 1971).

HABITAT CHARACTERISTICS

Grizzly Bear

Habitat information from radio locations of both collared grizzlies was pooled and summarized by season. Only specific radio locations were used to generate

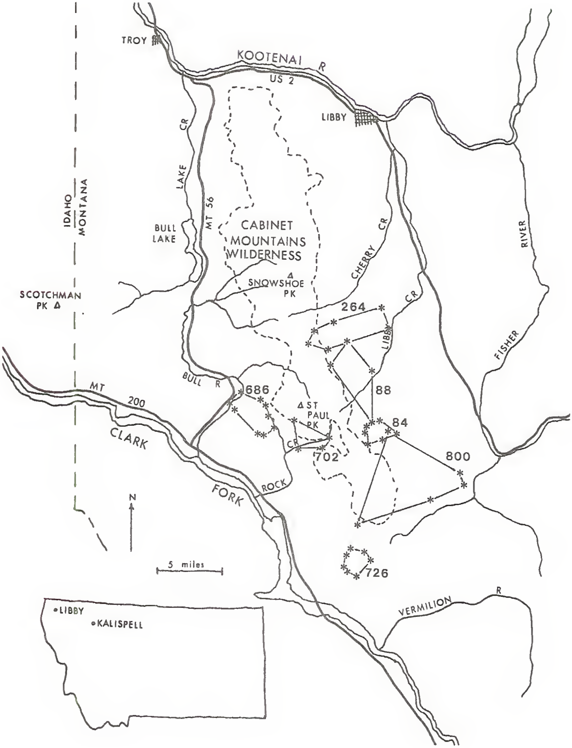

Fig. 10. Minimum home range polygons of radio-collared black bears in the Cabinet Mountains, 1983-1984.

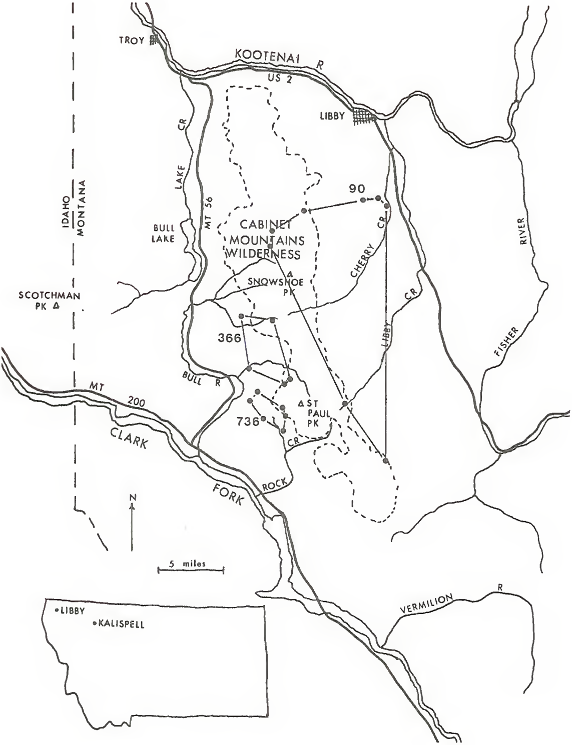

Fig. 11. Minimum home range polygons of radio-collared black bears in the Cabinet Mountains, 1983-1984.

data for characteristics of habitat used by grizzlies. Sample sizes for each season were: spring-17, summer-24, and fall-64. Locations obtained on grizzly 680 after the shooting on 21 November were not used to generate habitat use data.

Mean elevation of grizzly bear locations in spring was 1418 m (Fig. 12). Mean elevation of summer locations increased to 1552 m, then decreased to a mean of 1516 m during fall. Although means among all seasons appeared similar, examination of the standard deviations indicated more concentrated use of higher elevations during summer. This could be associated with bears following green-up to higher elevations as snow cover recedes. Several of the spring, upper elevation locations were accompanied by evidence of breeding activity. The wide range of elevation in spring locations may have been influenced by this activity. There was little variation in use of slope among seasons, except possibly a greater variability in spring (Fig. 13).

Classification of locations by aspect indicated heaviest use on south and southeast slopes during spring (Fig. 14). Southerly aspects would shed snow most rapidly in spring. Summer use appears to shift to slopes other than south aspects, while fall use appears fairly balanced among all aspects.

Grizzly bear radio locations were also classified by vegetative characteristics. Figure 15 shows grizzly use of habitat types (Pfister et al. 1977) by season. The greatest proportion of spring and fall locations was in the TSHE-CLUN habitat type (29% and 17% respectively). The greatest proportion of summer locations was in the ABLA-MEFE habitat type (38%).

Habitat types by definition do not always present a clear picture of likely habitat use. Though use may occur within a given type, radio locations were often at sites in early successional stages. Grizzly bear habitat component mapping was designed to represent more accurately the kinds of sites that are used by bears in specific areas (Servheen and Lee 1979). Habitat components identified on the KNF were described by Madel (1982). Excerpted descriptions of these components are presented in Appendix Table 12. Classifications of grizzly bear radio locations by component are shown in Figure 16. Habitat components with the greatest proportions of spring locations were mixed shrubfield snowchutes, riparian streambottom, and open timber (35%, 18%, and 18% respectively). Mixed shrubfield snowchutes also had the highest proportion of radio locations during summer (46%). During fall use appeared to shift toward more timbered types with the greatest proportions of locations in timbered shrubfields and closed timber (30% and 23% respectively).

The USFS has mapped the study area by land types (USFS 1984). This classification system integrates soil, vegetation, geology, and climate to produce mappable units. Grizzly bear radio locations were stratified by landtype (Fig. 17). Alpine landtypes (400 series) had the greatest proportion of radio locations during all seasons. Moreover, Glacially Scoured Trough Wall (landtype 401) received the most use through all seasons. This landtype has steep valley walls which typically contain numerous avalanche chutes that are often used by grizzly bears.

Under the National Forest Management Act prescriptions or allocations were developed for National Forest lands to guide multiple use planning. Grizzly

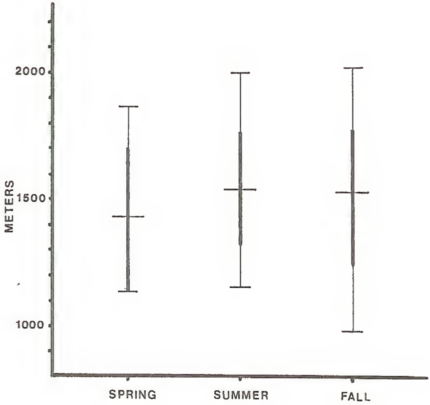

Fig. 12. Mean elevation, standard deviation, and range for radio locations of collared grizzly bears in the Cabinet Mountains, 1983-1984.

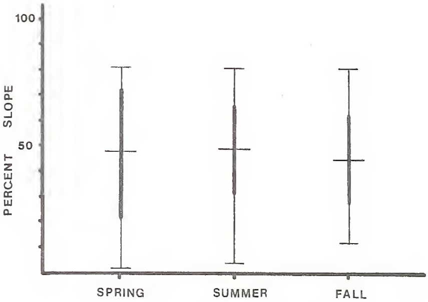

Fig. 13. Mean slope, standard deviation, and range for radio locations of collared bears in the Cabinet Mountains, 1983-1984.

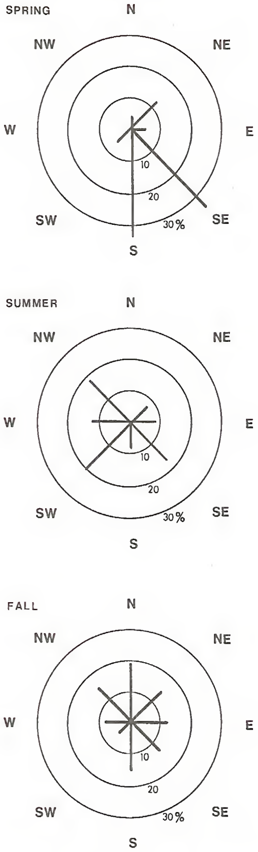

Fig. 14. Relative percentages of grizzly bear radio locations classified by aspect in the Cabinet Mountains, 1983-1984.

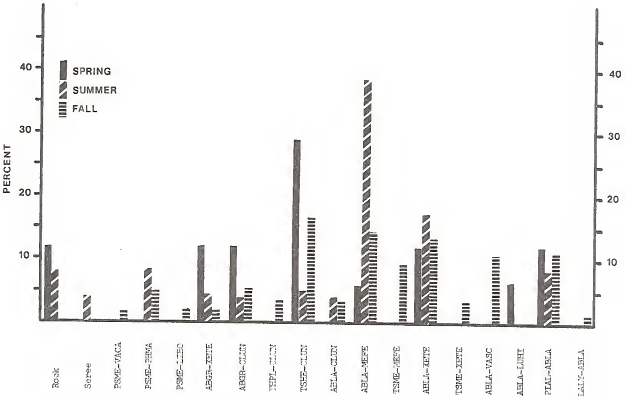

Fig. 15. Relative percentages of grizzly bear radio locations classified by habitat type in the Cabinet Mountains, 1983-1984. See Appendix Table 15 for a key to Abbreviations.

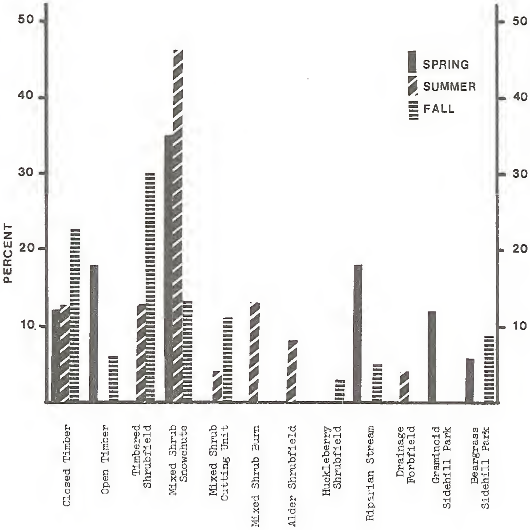

Fig. 16. Relative percentages of grizzly bear radio locations classified by habitat component in the Cabinet Mountains, 1983-1984.

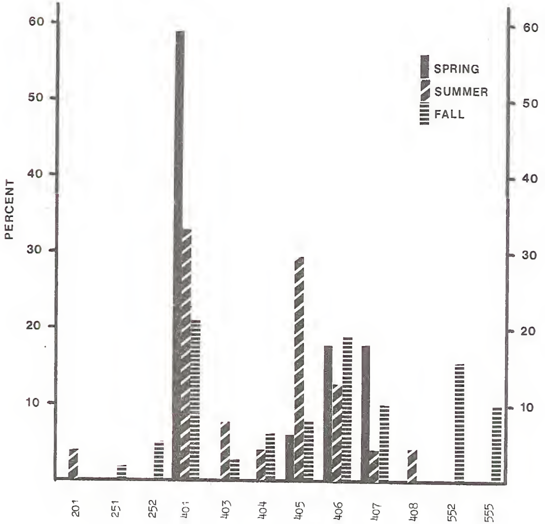

Fig. 17. Relative percentages of grizzly bear radio locations classified by landtype in the Cabinet Mountains, 1983-1984. See Appendix Table 16 for the name of coded landtypes.

bear locations were seasonally stratified by allocation (Fig. 18). Wilderness and non-motorized recreation areas had the greatest proportion of radio locations through all seasons. These allocations accounted for greater than 70% of all radio locations. Twenty-two percent of all radio locations occurred in allocations supportive of grizzlies or other wildlife (e.g. Grizzly/Timber, Big Game Winter Range, Old-growth, Big Game Summer Range/Timber).

Road management and disturbance effects on wildlife are important aspects of grizzly bear management. Distance measures from radio locations of bears to the nearest road or trail is one method of evaluating the effects of disturbance. For purposes of this evaluation, closed roads were considered the same as trails. Mean distance to radio locations from roads appeared very similar among seasons (Fig. 19). Annual mean distance between radio locations and open roads was 2467 m (N=105, S.D.=1579 m). Annual mean distance between locations and trails was 821 m (N=105, S.D.=714). The difference between annual mean distance from locations to open roads and trails was significant ($p < .001$). Closed roads were also examined as a subset of trails because of the value of a comparison between open and closed roads. Closed roads were considered the same as trails but each was accounted in analysis. Sample sizes for closed roads were: spring-10, summer-2, fall-23. Mean distance from locations to trails which were closed roads was similar between spring and fall. Small sample size for summer precluded a valid comparison. Annual mean distance from locations to closed roads was 740 m (N=35, S.D.=671 m). This difference between annual mean distance from locations to open and closed roads (1727 m) was significant ($p < .001$) and provides supportive evidence for the value of the road closure program. Mean distance from locations to perennial water showed little difference among seasons. Annual mean distance from locations to water was 594 m (N=105, S.D.=550 m).

Food habits data from scat analysis has not been summarized. Collection of scats shall continue and data will be presented in the annual report of the 1985 field season.

Collection of habitat use information will continue through the 1985 field season. When sample sizes are sufficient, habitat selection will be determined through comparison of use and availability data.

Black Bear

Black bear habitat use information was stratified by season and sex. Data from 1983 and 1984 radio locations were summarized. Radio location sample size for males was: spring-35, summer-30, and fall-62. Radio location sample size for females was: spring-53, summer-61, and fall-76.

Mean elevation of male and female black bear radio locations differed most during fall when mean elevation of males was 177 m higher than females (Fig. 20). Mean male and female radio location elevation was similar during spring and summer. Mean elevation of spring and summer locations were similar regardless of sex. Mean fall elevation was 150-350 m higher than spring or summer for male and female bears.

Most male radio locations came from black bears on the east side of the main Cabinet Range where easterly aspects dominate (Fig. 21). Most female radio locations came from black bears on the west side of the main Cabinet Range where

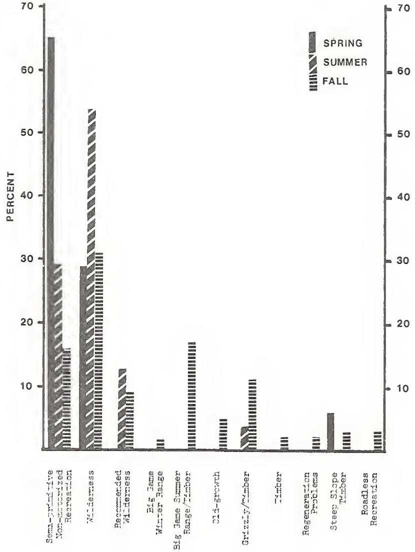

Fig. 18. Relative percentages of grizzly bear radio locations classified by USFS allocation.

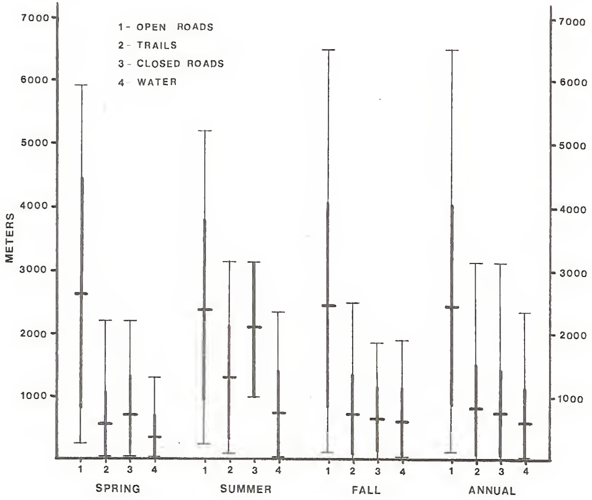

Fig. 19. Mean distance between grizzly bear radio locations and open roads, trails, closed roads, and perennial water. Standard deviation and range also indicated.

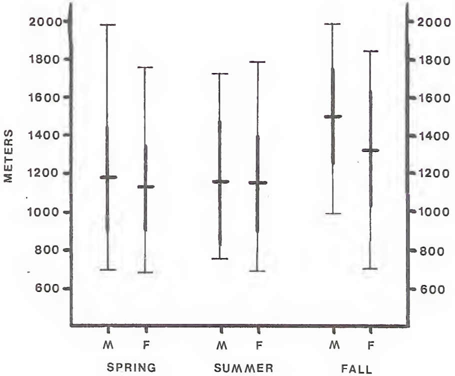

Fig. 20. Mean elevation, standard deviation, and range of male and female black bear radio locations in the Cabinet Mountains, 1983-1984.

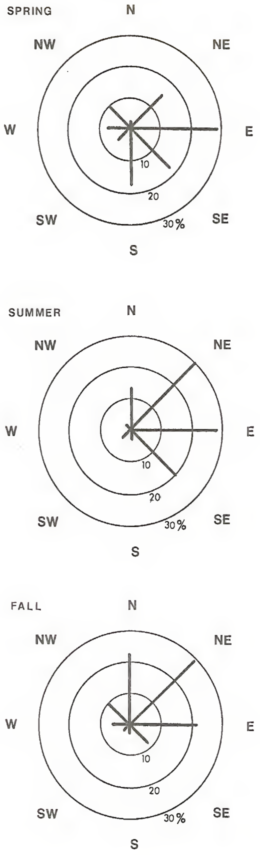

Fig. 21. Relative percentages of male black bear radio locations classified by aspect in the Cabinet Mountains, 1983-1984.

westerly and southerly aspects dominate (Fig. 22). Comparisons of aspect use between sexes may be biased. Male use of aspect in spring was characterized as southeasterly with a trend towards use of northeasterly aspects during summer and fall. Female use of aspect tended southerly during all seasons.

Classification of locations by steepness of slope (Fig. 23) indicated little change in mean slope between sexes or among seasons. However, standard deviations suggested more concentrated use of steeper slopes during fall.

Black bear locations were classified by vegetative characteristics. Greatest spring use was observed in the TSHE-CLUN habitat type for males and females. This type accounted for 55-60% of all spring locations (Figs. 24 and 25). Black bear habitat use during summer occurred mostly in ABGR-CLUN and TSHE-CLUN habitat types. These two types received 49-56% of observed summer use. Black bear use during fall appeared to be distributed through more habitat types. Use of TSHE-CLUN, ABLA-MEFE, and ABLA-CLUN habitat types accounted for 53-60% of male and female locations.

Habitat types by definition do not always present a clear picture of likely habitat use. Though use may occur within a given type, radio locations were often at sites in early successional stages. Though habitat component mapping was developed for use with grizzly bears, it may be useful in describing black bear habitat. Habitat components described by Madel (1982) are excerpted in Appendix Table 12. Closed timber, timbered shrubfields, and riparian streambottom accounted for 60% of male and female locations during spring and summer (Figs. 26 and 27). Timbered shrubfield use by females (25%) was much higher than males (3%). Males and females exhibited little difference in component use during fall. Closed timber, open timber, and timbered shrubfields accounted for 53-67% of use by males and females.

The USFS has mapped the study areas by landtype (USFS 1984). This classification system integrates soils, vegetation, and climate to produce mappable units. Male and female black bear radio locations were stratified by landtype (Fig. 28-29). Alpine landforms (400 series) were used heavily during all seasons. Continentally glaciated landforms (300 series) received most use during spring and summer, while water deposited landforms (100 series) were used most during spring.

Black bear locations were classified by USFS land-use allocation (Fig. 30-31). Sixty percent of all locations were in roadless or non-motorized recreation areas and another 26% were in areas devoted to or supportive of wildlife. Six percent were in areas for optimization of other resources and 9% were on privately owned land.

Mean distance to open roads, trails, closed roads, and perennial water appeared to increase from spring through fall for both sexes (Figs. 32 and 33). Mean distance to open and closed roads varied from a low of 500 m for males and females in spring to a high of 1300 m for males and 650 m for females in fall.

Food habits data from scat analysis has not been summarized.

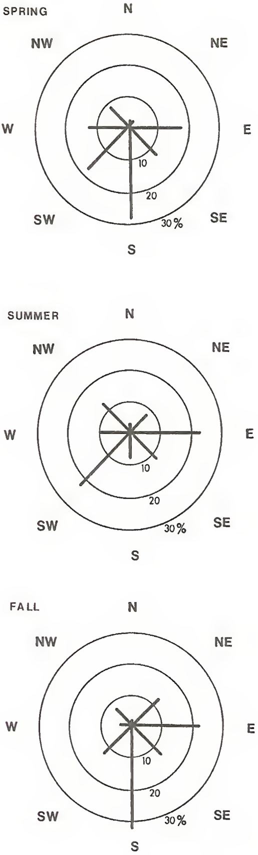

Fig. 22. Relative percentages of female black bear radio locations classified by aspect in the Cabinet Mountains, 1983-1984.

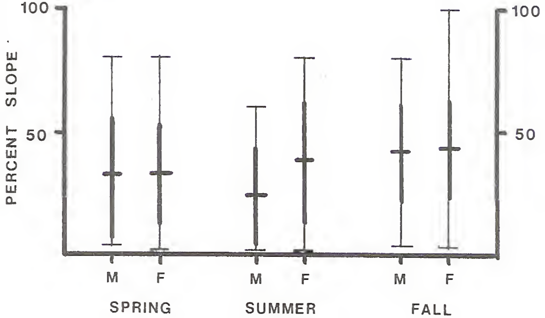

Fig. 23. Mean slope, standard deviation, and range of male and female black bear radio locations in the Cabinet Mountains, 1983-1984.

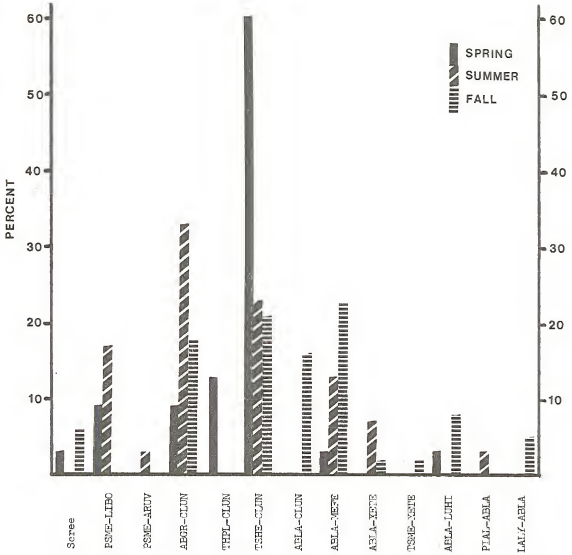

Fig. 24. Relative percentages of male black bear radio locations classified by habitat type in the Cabinet Mountains, 1983-1984. See Appendix Table 15 for a key to abbreviations.

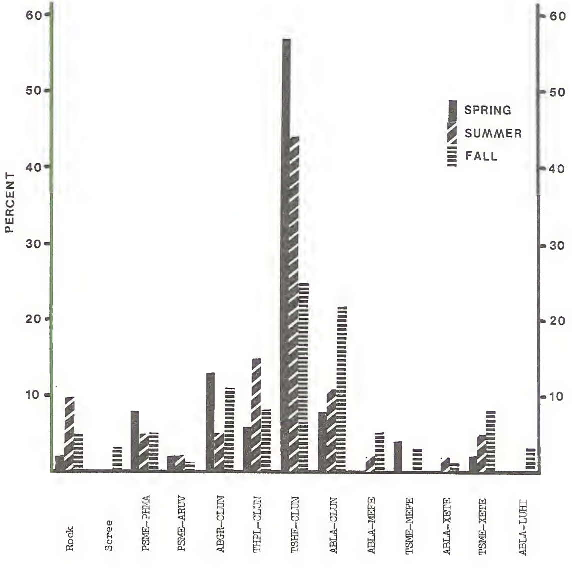

Fig. 25. Relative percentages of female black bear radio locations classified by habitat type in the Cabinet Mountains, 1983-1984. See Appendix Table 15 for a key to abbreviations.

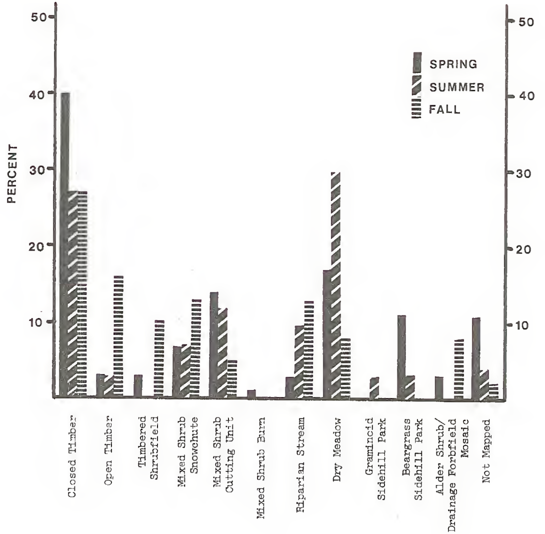

Fig. 26. Relative percentages of male black bear radio locations classified by habitat component in the Cabinet Mountains, 1983-1984.

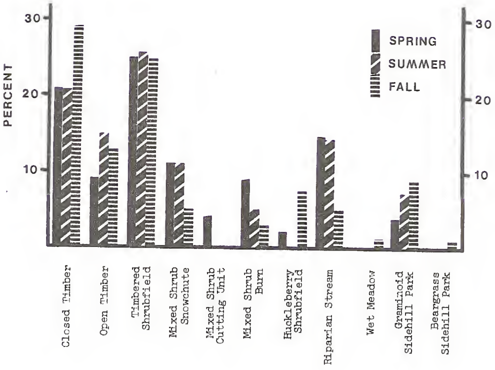

Fig. 27. Relative percentages of female black bear radio locations classified by habitat component in the Cabinet Mountains, 1983-1984.

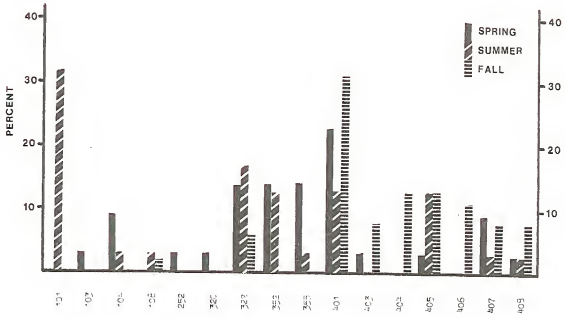

Fig. 28. Relative percentages of male black bear radio locations classified by landtype in the Cabinet Mountains, 1983-1984. See Appendix Table 16 for the name of the coded landtype.

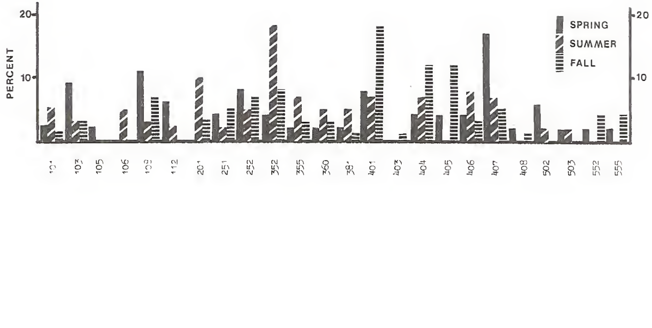

Fig. 29. Relative percentages of female black bear radio locations classified by landtype in the Cabinet Mountains, 1983-1984. See Appendix Table 16 for the name of the coded landtype.

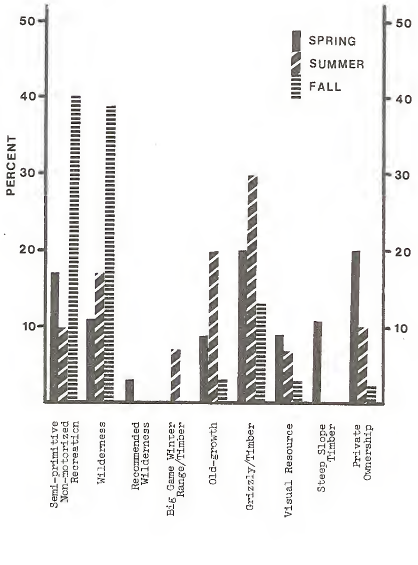

Fig. 30. Relative percentages of male black bear radio locations classified by USFS allocation.

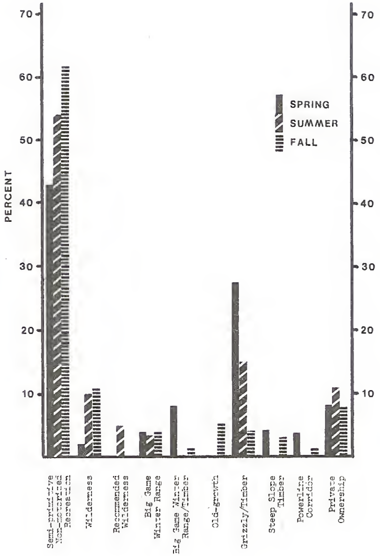

Fig. 31. Relative percentages of female black bear radio locations classified by USFS allocation.

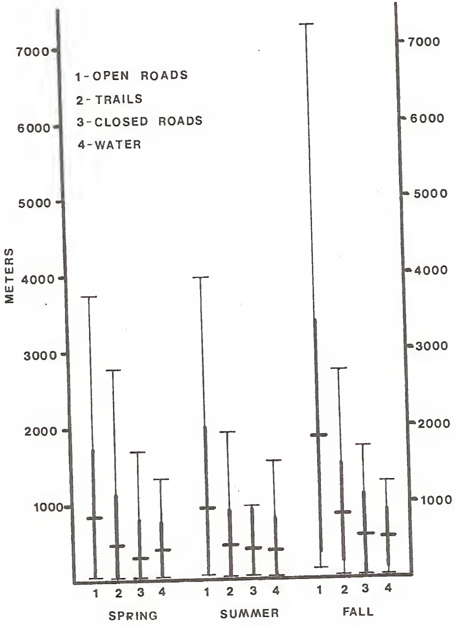

Fig. 32. Mean distance between male black bear radio locations and open roads, trails, closed roads, and perennial water in the Cabinet Mountains, 1983-1984. Standard deviation and range also indicated.

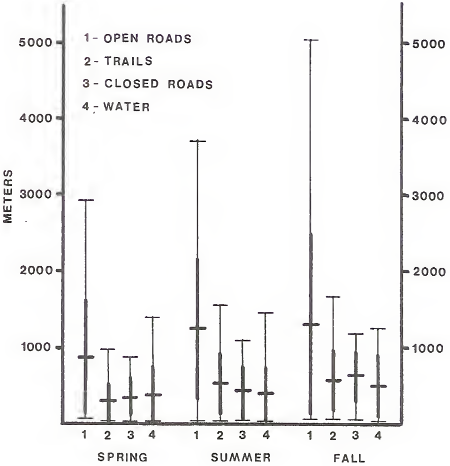

Fig. 33. Mean distance between female black bear radio locations and open roads, trails, closed roads, and perennial water in the Cabinet Mountains, 1983-1984. Standard deviation and range also indicated.

MANAGEMENT RECOMMENDATIONS

GRIZZLY BEAR

Improvement of habitat and security could give the existing population of grizzly bears a chance to recover through better reproduction and survival. However, a small population of a long-lived, slow reproducing specie such as grizzly bears would take many years to reach levels outlined by the Grizzly Bear Recovery Plan (USFWS 1981). A second alternative would be to augment existing populations through transplants of animals. Two approaches to this alternative are available. The first would involve transplanting adults or subadults from other areas of similar habitat to the Cabinet Mountains. Success rates of transplants in the past has not been high (Thier and Sizemore 1981), however most transplants have involved adult bears with a history of problems (depredation, garbage conflicts). Transplants should involve bears from remote areas with no history of conflict. Use of particular sex and age groups could provide the best chance of success. A second approach to grizzly bear augmentation has been proposed. While this approach is experimental in nature, it is based upon success with other species. The technique of cross-fostering involves placing the young of one species with the parents of another. Cross-fostering has been successful with whooping cranes (Drewien and Bizeau 1977) and peregrine falcons (Fyfe 1977). Under this approach, grizzly bear cubs would be placed in the maternal dens of black bear females during March or April. If the female black bear would accept and raise the cub, grizzly populations could be augmented in this manner. Grizzly cubs could possibly be obtained from zoos. Fostering of orphaned black bear cubs to surrogate black bear females has proved successful (Alt and Beecham 1984, Alt 1984).

BLACK BEAR

Examination of black bear population data from the Cabinet Mountains has led to the development of two ways of regulating harvest in northwest Montana. The first involves monitoring sex-specific median age of the harvest through tooth collection. Stable populations appear best maintained by keeping mean age of the harvest at least 1.0-2.0 years above the age of first estrus in females and maintaining the subadult-adult ratio of the harvest near 1.0. The second method involves allowable harvest projections. A 10% harvest rate was applied to estimated populations of black bear in several hunting districts in northwest Montana. Populations were calculated from the black bear density estimates from the Cabinet Mountains and the area of each district (Table 10). Annual variations up to 20% may be tolerable, but extended deviation from these projections may necessitate a response in harvest management. District 121 is a good example. If harvest continues at this elevated level, a change in season length may be required, integration of both of these methods may provide the best management of the black bear resource.

Table 10. Area, allowable harvest projections, and harvest for MDFWP hunting districts 100, 101, 103, 121, and 122, 1981-1983.

	Hunting District				
	100	101	103	121	122
Area (km^2)	3486	2170	4222	3155	2163
Allowable Harvest	100	62	121	90	62
1981 Harvest	26	47	44	76	84
1982 Harvest	66	27	64	82	32
1983 Harvest	118	51	82	238	55

LITERATURE CITED

Alt, G.L. 1984. Cub adoption in the black bear. J. Mammal. 65:511-512.

Alt, G.L. and J.J. Beecham. 1984. Reintroduction of orphaned black bear cubs into the wild. Wildl. Soc. Bull. 12:169-174.

Amstrup, S. C. and J. Beecham. 1976. Activity patterns of radio-collared black bears in Idaho. J. Wildl. Manage. 40:340-348.

Aune, K. and T. Stivers. 1982. Rocky Mountain Front grizzly bear monitoring and investigation. Montana Dept. Fish, Wildlife, Parks, Helena. 143 pp.

______ and M. Madel. 1984. Rocky Mountain Front grizzly bear monitoring and investigation. Montana Dept. Fish, Wildlife and Parks, Helena. 239 pp.

______ and ______. 1983. Rocky Mountain Front grizzly bear monitoring and investigation. Montana Dept. Fish, Wildlife, Parks, Helena. 180 pp.

Bannister, D. P., R. D. Weldin, N. T. Zilka, and S. W. Schmauch. 1981. Economic appraisal of the Cabinet Mountains Wilderness, Lincoln and Sanders Counties, Montana. USDI - Geol. Survey Bull. 1501. pp 54-75.

Beecham, J. 1980. Some population characteristics of two black bear populations in Idaho. Pages 201-204 in C. J. Martinka and K. L. McArthur, ed., Bears - Their Biology and Management, Bear Biol. Assoc. Conf. Ser. No. 3.

Brown, G. W., H. J. Cross, and S. Riley. 1984 P-R Job Prog. Rept. W-130-R-15, I-1. Montana Fish, Wildl. and Parks, Helena.

____________. In Prep. P-R Job Prog. Rept. W-130-R-16, I-1. Montana Dept. Fish, Wildlife and Parks, Helena.

Christensen, A.G. 1982. Cumulative effects analysis process. USFS - Kootenai Nat. For. 22 pp.

Drewien, R. and E. Bizeau. 1977. Cross-fostering shooping cranes to sandhill crane foster parents. Chapter 25 in S.A. Temple, ed., Endangered Birds - Management Techniques for Preserving Threatened Species. Univ. of Wisc. Press, Madison.

Erickson, A.W., J.E. Nellor, and G. Petrides. 1964. The black bear in Michigan. Res. Bull. No. 4. Michigan State Univ. Agr. Exp. Sta., East Lansing, 102 pp.

____________. 1965. The black bear in Alaska. Alaska Dept. Fish and Game. Juneau. 19 pp.

____________. 1976. Grizzly bear management in the Thompson Falls area and adjacent environs. USFS contract No. 26-3405, Lolo and Kootenai Nat. For. 58 pp.

____________. 1978. Grizzly bear management in the Cabinet Mountains of western Montana. USFS contract No. 262-46, Kootenai Nat. For. 82 pp.

Fyfe, R. 1977. Fostering and cross-fostering birds of prey. Chapter 23. in S.A. Temple, ed., Endangered Birds - Management Techniques for Preserving Threatened Species. Univ. of Wisc. Press, Madison.

Halvorson, G. L. 1974. Historical grizzly bear information. USFS - Lolo Nat. For. 13 pp.

Hamlin, K. L. and M. Frisina. 1975. Special grizzly bear survey. P-R Job Prog. Rept. W-130-R-6, I-1, I-4, Mont. Dept. Fish and Game, Helena. 64pp.

Hayne, D. W. 1959. Calculation of size of home range. J. Mammal. 30:1-18.

Hitchcock, C. and A. Cronquist. 1973. Flora of the Pacific Northwest. Univ. of Wash. Press, Seattle and London. 730 pp.

Hugie, R.D. 1982. Black bear ecology and management in the northern conifer-deciduous forests of Maine. Ph.D. diss., Univ. Mont. Missoula. 217 pp.

Jonkel, C. J. and I. McT. Cowan. 1971. The black bear in the spruce-fir forest. Wildl. Monogr. 27. 57 pp.

Joslin, G., J. Titus, and C. Jonkel. 1976. Past and present distribution of the border grizzly bears. Pp. 51-67 in Ann. Rept. No. 1, Border Grizzly Project., Univ. of Mont., Missoula.

______ 1980. Mountain goat habitat management plan for the Cabinet Mountains, Montana. Montana Dept. Fish, Wildlife, Parks, Helena. 122 pp.

Kasworm, W. 1984. Cabinet Mountains grizzly bear study annual report. Montana Dept. Fish, Wildlife, Parks, Helena. 50 pp.

Kohn, B.E. 1982. Status and management of black bears in Wisconsin. Tech. Bull. No. 129. Dept. Natural Resources, Madison. 31 pp.

Lund, R. E. 1983. MSUSTAT -- An interactive statistical analysis package. Mont. State Univ., Bozeman. 118 pp.

Mace, R.D. and C. Jonkel. 1980. Grizzly bear response to habitat disturbance. Pp. 70-98 in Ann. Rept. No. 5, Border Grizzly Project. Univ. of Mont., Missoula.

Madel, M.J. 1982. Grizzly bear habitat delineation and reconnaissance in the Cabinet Mountains: a procedural description. USFS - Kootenai Nat. For. 38 pp.

________, 1983. Biological assessments for the proposed Great Northern Mountain ski development. USFS - Kootenai Nat. For. 62 pp.

Martin, S.A. 1983. U.S. Borax and Chemical Corporation grizzly bear study. Proj. 323-85-A. Econ. Inc., Helena, Mont. 49 pp.

McLellan, B. N., 1981. Akamina-Kishinena grizzly project progress report, 1980. But Col. Fish and Wildlife Branch, Cranbrook. 66 pp.

Modafferi, R.D. 1982. Black bear movements and home range study. Alaska Dept. Fish and Game. Fed. Aid in Wildl. Rest. Rept. Projs. W-17-10, 11 and W-21-1, 2. Juneau. 73 pp.

Mohr, C. O. 1947. Table of equivalent populations of North American small mammals. Amer. Midl. Nat. 37:223-249.

Moore, G. and S. Gilbert. 1977. West Cabinet Mountains grizzly habitat survey. Olson-Elliot and Assoc. USFS contract No. 262-50, Kootenai Nat. For. 75 pp.

Perry, J. 1978. Handling captured bears: capture, drugging, and radio-collaring. BGTC Working paper No. 31. Border Grizzly Project. 17pp.

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. USFS Gen. Tech. Rept. INT-34. 174 pp.

Poelker, R.J. and H.D. Hartwell. 1973. Black bear of Washington. Wash. State Game Dept. Biol. Bull. 14. 180 pp.

Reynolds, D.G. and J.J. Beecham. 1980. Home range activities and reproduction of black bears in west-central Idaho. Pp 181-190 in C.J. Martinka and K.L. McArthur, eds., Bears - Their Biology and Management, Bear Biol. Assoc. Conf. Serv. No. 3.

Rockwell, S. K., J. L. Perry, M. Haroldson, and C. Jonkel. 1978. Vegetation studies of disturbed grizzly habitat. Pp. 17-68 in Ann. Rept. No. 1, Border Grizzly Project, Univ. of Mont., Missoula.

Rosgaard, A. and C. Simmons. 1982. East Boulder big game technical report. Mont. Dept. Fish, Wildl., and Parks, Helena. 58 pp.

Schallenberger, A. and C. J. Jonkel. 1980. Rocky Mountain East Front grizzly bear studies, 1979. Univ. of Mont., Missoula, Border Grizzly Project Spec. Rept. 39. 209 pp.

Servheen, C., and L.C. Lee. 1979. Mission Mountains grizzly bear studies--an interim report - 1976-78. Border Grizzly Project Spec. Rept. No. 31. Univ. of Mont., Missoula. 19 pp.

______________. 1983. Grizzly bear food habits, movements, and habitat selection in the Mission Mountains, Montana. J. Wildl. Manage. 47:1026-1035.

Stoneberg, R. and C. Jonkel. 1966. Age determination in black bears by cementum layers. J. Wildl. Manage. 30:411-414

Thier, T.J. 1981. Cabinet Mountains grizzly bear studies, 1979-1980. Border Grizzly Project Spec. Rept. No. 50. Univ. of Montana, Missoula. 64 pp.

______________ and D. Sizemore. 1981. An evaluation of grizzly bear relocations in the border grizzly project area, 1975-1980. Border Grizzly Proj. Spec. Rept. No. 47. Univ. of Mont., Missoula. 16 pp.

U.S. Dept. Of Commerce. 1985. Climatological data for Montana. National Oceanic and Atmospheric Admin. Environmental Data Service. Asheville, N. C. Vol. 87.

U.S. Fish and Wildlife Service. 1981. Grizzly bear recovery plan. U.S. Dept. Interior, Washington, D.C. 190 pp.

U.S. Forest Service. 1983. Management prescriptions for the integrated forest plan. USDA - Kootenai Nat. For.

U.S. Forest Service. 1984. Kootenai country land system inventory, northwest Montana. USDA - Kootenai Nat. For.

Waddel, T.E. and D.E. Brown. 1984. Exploitation of two subpopulations of black bears in an isolated mountain range. J. Wildl. Manage. 48: 933-938.

Appendix Table 11. Monthly average temperature, (°C), precipitation (cm), and deviation from the long term average at the Libby Ranger Station, 1984 (U.S. Dept. of Comm. 1984).

Month	Temperature (deviation)	Precipitation (deviation)
January	-2.2 (3.0)	2.67 (-3.88)
February	1.7 (2.3)	.94 (-3.05)
March	5.6 (3.3)	2.01 (-1.09)
April	7.8 (.6)	4.42 (1.70)
May	11.1 (-1.0)	5.59 (1.78)
June	15.0 (-.9)	6.71 (2.77)
July	20.0 (.7)	.23 (-1.78)
August	20.6 (2.0)	1.93 (-1.79)
September	12.2 (-1.6)	5.13 (2.11)
October	6.1 (-1.2)	5.16 (1.40)
November	1.1 (.5)	7.34 (1.83)
December	-5.0 (8.2)	6.53 (.26)
Annual	7.8 (.5)	48.64 (1.24)

Appendix Table 12. Criteria for verification of grizzly bear sightings or sign (compiled by R. Kuennen, USFS and W. Kasworm, MDFWP).

The following criteria have been established in order to ensure that there is consistency in what is reported as credible grizzly sign or observations. Sign or observations which meet these criteria should be reported each winter for placement on the forest map. Please report as much information as you have on each sighting--preferably on the attached observation card, and attach a map. The person who gets the report of the sign should sign their name under "verification by." Two types of sign make a stronger report than one.

Hair - An experienced person has looked at the hair and verified it as grizzly. Please report the name of the person doing the verification (can be sent to Bozeman lab of MDFWP).

Scats - Scats are not acceptable as verified evidence unless they contain hair verified as grizzly, or until Picton's method for identifying grizzly and black bear scats has been established. Researchers feel that scat diameter and volume are not reliable criteria unless substantiated by other sign.

Digs - A single dig or series of digs where sod is turned over in a extensive area, usually at a high elevation location. Other animals don't dig up extensive areas for bulbs, but make sure you can rule out badger digs for ground squirrels and stumps ripped up or rocks turned over by black bears. A rough rule-of-thumb is that if an area of sod greater than 4' x 4' has been dug up it should be reported as grizzly.

Tracks - The most reliable criteria is if the distance of the claws from the front toe pads is measured and reported. If the front claws are 1 5/8" or more from the pads it should be reported as grizzly. If claws are not observed, then a front pad width greater than 5½" or a back foot length greater than 9" could be grizzly. Observers should also compare the shape of the pad to that drawn on the attached identification card to see if it had the distinctive grizzly shape. Grizzlies may have smaller tracks than the limits listed above, but they will not be counted unless substantiated by hair or other sign in the area. These dimensions are based on a sample of 40 measurements of black bear feet collected by Montana Department of Fish, Wildlife and Parks in the Cabinet Mountains. The largest black bear foot measurements were:

	Pad Length	Pad Width	Foot Length	Toe-to-Claw
Front	3 1/8"	5"	5 1/8"	1 3/8"
Rear	6 1/2"	4 7/8"	8 1/4"	

Reports of "large" tracks will not be counted unless accompanied by at least a relative measure or a photograph. The substrate should also be reported. Melted out tracks in the snow may appear larger than they actually were when layed down.

Dens - Must be accompanied by hair or a good track measurement to be considered grizzly. One collared black bear in the Cabinets denned at 6500', so elevation alone is not necessarily reliable.

Observations

When verifying reports of observations it is important to consider three basic types of information; 1) amount and kind of information regarding report, 2) distance which bear was observed from, length of time, and weather, 3) subjective evaluation of interviewer about observer's reliability. Please list any information you have in these three areas when reporting observations. Things to consider when you are determining the credibility of an observation are listed below:

1. Amount and kind of information regarding report.

   Very credible = observation of long claws, grizzled coat, or silvertipping. Grizzlies may also have low or rounded ears, a hump or massive shoulders, dark legs or a saddle, or a dish-shaped face (although Thier observed a grizzly in the Cabinets which didn't have a hump or a distinctive dished face.

   Credible = the claws were not observed, but several of the other grizzly characteristics were mentioned.

   Not credible = a big bear, a brown bear mentioned but other characteristics not observed.

   When questioning people ask them to give you the best description of the bear they can and of what it was doing. Try not to lead them too much. Do not say "did it have a hump or grizzled coat," etc. If the bear was observed digging in an avalanche chute, for instance, it helps add credibility to the sighting.

2. Distance bear observed from, length of time, weather.

   Very credible = good weather or light, bear observed for more than five minutes from less than 50 yards or from farther away with binoculars, a scope, etc. Try to get the person to estimate the time and distance of the observation.

   Credible = same as above but bear observed for a shorter length of time.

   Not credible = bear observed "in a flash" -- i.e., running across a trail or road as it disappeared into the brush, or at greater than 50 yards without a scope or binoculars.

3. Subjective evaluation of interviewer about observer's reliability.

   This is a very important factor when turning in observations. Consider and report the following in determining reliability:

   - whether the person appears to be making rational judgments about what they've seen.

   - if the person has worked with grizzly bears, or hunted bears.

   - if the person has biological experience or training.

- if the person has spent a lot of time in prime grizzly bear habitat through their job or recreation.

4. Validation by reporter

Very credible (5 rating) = interviewer is convinced beyond a reasonable doubt that the sighting is credible and would be willing to stake their reputation on it.

Credible (4 rating) = interviewer feels pretty confident that the observer is reliable, but wouldn't stake their reputation on it.

Not credible (rating of 3 or less) = interviewer feels unsure of the observer's reliability.

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Appendix Table 13. Description of habitat components. Excerpted from Madel (1982).

I. Closed timber

Closed canopy timber are those sites with tree cover greater than 60 percent, and a variable but often sparce understory. Vegetation structure and composition are highly variable as influenced by environmental conditions of a site. The tree stratum consists primarily of conifers, except for occasional quaking aspen stands (Populus tremuloides). Common forest habitat types and phases that constitute closed timber specifically in the Cabinet range are included in Appendix I. Old growth forests of western red cedar and western hemlock typically occur in the valley bottoms. Various forest communities of western hemlock, grand fir, Douglas fir, larch and western white pine grow along a broad mid-elevational gradient. Subalpine fir and mountain hemlock makeup the upper elevation closed timber types.

II. Open timber

This component includes open timbered sites with tree canopy cover 30 to 60 percent, and a sparse grass-forb understory. Coniferous tree species dominate the overstory. This is a relatively uncommon forest community in the main Cabinets and often exists as habitat type inclusions in closed timber. Open timber is commonly found on dry exposures, limiting undergrowth to few rhizomatous species. Related habitat types include Douglas fir/pine grass, grand fir/beargrass, and the whitebark pine/subalpine fir.

III. Timbered shrubfield

These are open canopy timbered sites with tree cover 30 to 60 percent, and a shrub dominated understory. Vegetation composition and structure again is variable, but contingent on top-edaphic conditions of the site. The overstory consists of conifers and except for more xeric aspects, the shrub stratum is well developed. The forb layer is characteristically sparse due to limited light penetration through the tree and shrub canopies. Timbered shrubfields are extensive in the Cabinet Range and occur within the same elevational range as closed timber, although most prevalent in the subalpine zone. Component sites commonly delineated are associated with two major habitat types, subalpine fir/beargrass/huckleberry and subalpine fir/menziesia, both of which under favorable environmental conditions produce a number of key fruiting shrub species. Subalpine fir/beargrass/huckleberry generally occupies ridgetops and downslope extensions on southerly aspects. The shrub canopy is low and scattered, consisting primarily of globe huckleberry (Vaccinium globulare) and grouse whortleberry (Vaccinium scoparium). Beargrass (Xerophyllum tenax) and elk sedge (Carex geryi) compose the graminoid-forb layer as either a dense matte or sparse clumps. Subalpine fir/menziesia is an extremely widespread upper elevation habitat type in the Cabinets on all aspects, Merging with Subalpine fir/beargrass/huckleberry on warmer slopes. Huckleberry and mountain ash (Sorbus scopulina) canopy coverage is variable, but often suppressed by more vigorous shrubs, especially menziesia. Many productive timbered shrubfields at higher elevations are the result of selective regeneration cuts and occasionally shelterwood or thinning systems where solid scarification is minimal. When ground mapping, subjective decisions are made on whether or not a timbered shrubfield site classifies as a foraging component. Generally if important fruiting shrub species occupy 40 percent or more of the total shrub canopy it's identified as such and mapped. At lower elevations in the Douglas fir, grand fir, and western hemlock series, buffalo berry (Sheperdia canadensis) and serviceberry (Amelanchier alnifolia), two key bear food shrub species, occur separately in certain areas. Buffalo berry is common on the east side the the Cabinets predominating in moist timbered stands, while serviceberry occurs as a scattered shrub layer on dry benches and gradual slopes underneath a partial canopy.

VI. Shrubfields

As a general class, shrubfields are shrub dominated sites with a sparse tree cover of 30 percent or less. It's the most widespread nonforested habitat component occurring in the Cabinet Range. Species composition and vegetation structure are extremely variable, creating a number of diverse shrub communities. Shrubfields alternately produce an abundance of key bear foods throughout the growing season, which documented grizzly sign and observations have correlated. Because of its importance as a foraging component, shrubfields have been separated into three distinct shrubfield types: Mixed shrubfields, which are further identified by site history; alder (Alnus) shrubfields; huckleberry (Vaccinium shrubfields). Shrubfield types and subtypes are treated and mapped as separate habitat components.

A. Mixed Shrub-Species Shrubfields

Includes shrubfields with a co-dominant shrub stratum and graminoid-forb understory. Top-edaphic conditions and habitat disturbance patterns and site influence shrubfield composition. Mixed shrubfields are long-lived seral communities and are the result of avalanches, wildfires, slope seepage, or various timber harvest prescriptions.

1. Mixed Shrubfield/Snowchute: These are shrub dominated communities resulting from, and often maintained, by sudden snow slides on steep timbered drainages, frequently originating on open slabrock areas and running downslope to the creek bottoms. These sites exist as narrow-linear openings in the forest canopy, or as extensive, broad chutes covering an entire mid-montane slope.

   Shrubfield/snowchute communities are vertically stratified, with a tall deciduous shrub canopy (2-3 meters), an understory shrub stratum (2 meters or less), and a variable layer of forbs and perennial graminoids. Dominant woody associates in the high shrub strata include mountain maple (Acer glabrum), alder (Alnus sinuata), mountain ash, and willow (Salix spp.) each species more prevalent on certain sites than others. Lower shrubs are thimbleberry (Rubus parviflorus), elderberry (Sambucus racemosa), and snowberry (Symphoricarpos albus). The stems of maple, alder, and ash lie prostrate at the base with the lower limbs directed downslope, the tips springing erect after heavy snow cover melts in the spring (Daubenmire 1968). This morphological adaption allows tall shrubs to survive occasional heavy snow slides, while regenerating conifers are lost in avalanche paths. The herbaceous layer is often well developed and abundant in key bear foods, particularly in the lower portions of snowchutes that occur in the more mesic western hemlock/beadlily, subalpine fir/beadlily and subapline fir/menziesia habitat types. Phenological development of grasses and forbs is relatively early in south facing aspects prior to and during the leafing out of shrubs. Forbs continue to emerge and grow through the summer months on cooler slopes and in many small canopy openings. The more common forbs include lady fern (Athyrium filix-femina), bracken fern (Pteridium aquilinium), glacier lily (Erythronium grandiflorum), spring beauty (Claytonia lanceolata), starry Solomon's seal (Smilacina stellata), twisted stalk (Streptopus amplexifolius, false hellebore (Veratrum viride), meadow rue (Thalictrum occidentale), angelica (Angelica dawsonii), and cow parsnip (Heracleum lanatum).

2. Mixed Shrubfield/Cutting Unit: These are open sites which have been harvested and are currently dominated by a shrub canopy. Community structure and composition is highly variable depending on timber harvest method, site treatment, habitat type-topographic position, and time span since site disturbance. A large portion of the harvested sites along the east face of the main Cabinet Range occur in the western hemlock/beadlily habitat type, a relatively closed-timber zone low in bear foods productivity. The understory vegetation prior to tree canopy removal either has few existing bear foods or is altogether depauperate, providing only a minor rhizome-root stock from which key fruiting shrubs and forbs can resprout. Clearcuts in the western hemlock types and other sites that have been moderately scarified are quickly invaded by opportunistic species through seed dispersal or seeds retained in the soil-duff. Alder, red raspberry (Rubus idaeus), thimbleberry (Rubus parviflorus), sticky currant (Ribes viscosissimum), elderberry, and ceanothus (Ceanonthus spp.) are common shrubs growing in disturbed units. Black cottonwood seedlings (Populus trichocarpa) are common in low to mid-elevation clearcuts. Associated opportunistic forbs include fireweed (Epilobium angustifolium), pearly everlasting (Anaphalis margariticae), goldenrod (Solidago spp.), and aster (Aster spp.). On severely scarified soils, graminoids may be one of the few plant groups to occur in abundance for a number of years following disturbance.

   Harvested units not scarified and/or those that have been broadcast burned often regenerate with a more vigorous shrub canopy composed of species typically found in adjacent undisturbed timbered stands. Key fruiting shrub species that vegetatively reproduce, resprout quickly from rhizomes or root crowns and often dominate the shrub stratum for a number of years following timber harvest. Shrub response is most conspicuous in the forested subalpline fir zone. In the lower, mesic subalpine fir/beadlily and menziesia habitat types, unscarified clearcuts develop a dense mixture of shrubs including mountain ash, globe huckleberry, menziesia, thimbleberry, Utah honeysuckle (Lonicera utahensis), and willow (Salix sppl). Units that have been burned in the upper subalpine fir/beargrass h.t. on south to west aspects are dominated by Vaccinium spp., and are mapped as huckleberry shrubfields (See component definition). Zager (1980) provides an excellent correlation between various post harvest treatments and vegetation response in relationship to grizzly bear foods.

3. Mixed Shrubfield/Burn: These are mixed shrubfield communities that have developed following wildfire. Burns in general are uncommon in the Cabinet Mountains due to effective fire suppression during the past 40-70 years. Where mixed shrubfield/burns do occur they are restricted to xeric sites, especially steep southern exposures, which were originally ignited by lightning and then burned off quickly. Small spot burns are evident at the mouths of a number of drainages along the east face of the Cabinets. The entire south side of Berray Mountain, located above the East Fork Bull River exit, occupies one of the largest recent shrubfield burns. Certain sites have been noted as being environmentally positioned in fire prone areas, and the resulting seral shrubfields are maintained in a productive state.

The shrub stratum is 1.5 to 2.5 m in height and horizontally scattered, with exposed rocky shelves and a sparse bunchgrass understory. Serviceberry, willow, mountain maple, and mountain ash are the dominate shrub species on these burned sites. Unfortunately, a majority of the existing mixed shrubfield/burns are in a decadent condition, with minimal annual berry crops. Recent burns show invigorated shrub growth and produce large quantities of serviceberry, ash, and occasionally huckleberry fruit (Refer to Huckleberry shrubfield pp 10), which grizzlies feed on extensively in the late summer and fall. These shrubfields are also of high value to bears because they are often isolated from human disturbance, and provide an irregular timbered edge for efficient food/cover utilization.

B. Alder Shrubfield

This is a tall shrub community dominated by alder, almost to the exclusion of all other shrub species. It may develop as a result of snow movement, wildfire, or timber harvest but is often restricted to mesic sites, especially in seepage areas on steep slopes with shallow rocky soils. Alder shrubfields are maintained in this seral condition for many years by the repeated disturbance of snowslides and intense competition from high shrubs and forbs. This component is locally abundant in the West Cabinets in the lower subalpine fir zone, while in the East Cabinet Range its restricted to higher elevations and typically associated with drainage forbfields at the base of cirque headwalls.

The shrub stratum is composed of a dominant vertical alder layer, averaging 4 m in height, and a herbaceous understory. Individual shrubs sprout numerous stems making stands extremely dense and almost impenetrable. Utah honeysuckle, mountain ash, and thimbleberry are minor shrub species that occasionally become established in small canopy openings. Surprisingly, even under low light conditions, the water saturated soils produce large quantities of lush forbs and graminoids from late May on through the summer months depending on aspect and elevation of the site. Common species include glacier lily, spring beauty, montia (Montia spp.), sweet cicely, angelica, false hellebore, arrowleaf groundsel (Senecio triangularis), monkshood (Aconitum columbianum), and a variable fern canopy composed of bracken and lady fern.

C. Huckleberry Shrubfields

Seral shrubfields dominated by Vaccinium species are located throughout the Cabinet Range, but are normally restricted to ridgetops and mid to high elevation south/west facing slopes where subalpine fir/beargrass habitat types occur. This open, low structured shrubfield is created and at times maintained by wildfire, although timber harvest and/or snowslides may have the same developmental effect. Due to effective fire suppression in primitive areas, the majority of huckleberry fields are transitional and progressing towards timbered shrubfield communities. Old burns exist as small two to ten acre openings along ridgelines where environmental conditions are harsh, with small regenerating conifers slowly encroaching on these sites. More recent burns support extensive stands of huckleberry, which are vigorous in growth and fruit production (an excellent example being the burned over basin of the East Fork McKay Cr.).

Vegetation composition is similar to that found in the climax subalpine fir/beargrass/globe huckleberry understory, but typically more developed. The shrub canopy is low, 1 m or less, and dominated by globe huckleberry and grouse whortleberry, which grow in association with beargrass a rhizomatous forb that occurs in dense clumps underneath and around shrubs. Minor species such as mountain lover (Pachistima myrsinites), mountain ash, and menziesia are localized and scattered in the shrub canopy. The few common forbs and grasses include arnica (Arnica latifolia), yarrow (Achilles millifolium), and elk sedge, in the southern portions of the East Cabinets, grouse whortleberry forms dense low lying mats are dry, gravelly ridges.

Timber harvested units in the subalpine fir types show variable shrub-forb responses. Clearcuts not scarified, especially those broadcast burned or on southern aspects have responded favorably, resulting in a thick and productive huckleberry stratum.

V. Riparian Stream Bottom

Low to high gradient stream bottom habitat is identified by riparian plant associations which reflect the influence of increased soil moisture along hydrologically active zones. Considerable variation in vegetation composition, structure, and even between plant communities exist, with some sites being open, some timbered, and still others forming a diverse mosaic of small irregular meadows, shrubfields, and forested blocks. The development and extent of vegetatively diverse riparian habitat is strongly dependent on timber canopy closure and stream channel gradient. Creek and river bottoms of relatively level topography have high water tables, causing water backup and stream meandering. These riparian zones are broad, heterogenous, and extremely productive. The Bull River Valley, which dissects the East and West Cabinets is excellent low gradient habitat, composed of black cottonwood, spruce (Picea spp.), and cedar timber types interspersed by small wet meadow, large wet hay meadows, forb dominated streambanks, and riparian shrubfields. As discussed previously, a majority of stream bottoms occur in the western red cedar/devil's club or western hemlock/beadlily habitat types, and have a closed forest canopy with a limited understory. In this climax state, such sites are of little value as foraging habitat. Where the overstory has been removed naturally or artificially by wildfire, snow slides, or past spruce-salvage operations, the undergrowth has responded favorably and developed a lush graminoid-forb stratum. Old and recent beaver activity has also had the same type of ecological effect in many Cabinet drainages, producing hundreds of acres of high quality riparian habitat and adding diversity to already prolific low gradient stretches. Riparian zones along high gradient stream bottoms are narrowly restricted to stream banks with a visible and abrupt transition with adjacent well drained forest types. Regardless of the gradient, most open stream corridors are dominated by herbaceous meadows and riparian shrubfields. Common shrubs include alder, red-osier dogwood (Cornus stolonifera), willow, twin-berry (Lonicera involucrata), and buckthorn (Rhamnus alnifolia). Forbs and graminoids are extremely abundant, often forming a layer of 1-2 meters tall consisting of fern species (Polypodiaceae), horsetails (Equisetum spp.), licorice root (Ligusticum canbyi), angelica, cow parsnip, meadow rue, monkshood, etc.

VI. Marsh

Marshes are open sedge (Cyperaceae) dominated communities that are perennially moist, often containing standing or slow moving water, and located in slightly concave depressions along level, poorly drained valley bottoms or in u-shaped stream channels. Marshes exist as either unbroken monotypic communities or as infringing zones around open shallow lakes and ponds. Ecotone boundaries are well defined and commonly bordered by continguous western hemlock forest, occasionally having a narrow spirea shrub ring (Spiraea douglasii) on slightly better drained soils. Marsh vegetation forms a .5-1 m sedge layer composed of Carex app. and bulrushes (Scirpus). Alder may grow as scattered clumps through the community. Few forbs are found in association with marsh habitat.

VII. Wet Meadow

These are mesic graminoid dominated communities located along flat low elevation watersheds, and in slightly concave depressions of varying sizes at high elevations. Low elevation wet meadows in the Cabinets are limited to wide river and creek bottoms, and are delineated as portions of surrounding riparian habitat. Most of these sites have been cleared for haying purposes and are dominated by domestic grasses and various sedges. High elevation wet meadows are distinct physiographic climax communities that commonly occur in upper basins throughout the East and West Cabinets. Persistent snow retention and cool temperatures retard phenological development of high meadows until mid-late July, and drainage from snow fields and vertical basin headwalls tends to keep soils well saturated through the growing season.

Floristic composition varies between and within open meadows, forming distinct graminoid associations depending on slight differences in soil moisture. Sites with standing or running water typically have short uniform sedge communities composed of sedges and rushes, with horsetail shoots intermixed. On slightly drier soils dense stands of bluejoint reedgrass (Calamagrostis canadensis) occur as irregular islands between sedge groups, or as exclusive "Caca" meadows with seed stalks reaching up to 2 m in height. Forb growth is marginal, with sitka valerian (Valeriana sitchensis), arrowleaf groundsel, and licorice root commonly encountered along perimeter ecotones. Alder and willow shrub stringers occasionally grow through and around certain meadow communities, while low lying mats of alpine laurel (Kalmia polifolia) and mountain heather (Cassiope mertensiana) are associated with other sites.

VIII. Dry Meadows

These are open graminoid dominated sites with level or gradual sloping topography, most commonly occurring at low elevations. Dry meadow openings are created through timber harvest operations, livestock grazing and wildfire. Soils are ephemerally moist in the spring but dry out rapidly later on and remain in a relatively xeric condition through the summer and fall. A number of large, heavily scarified clearcuts along the east side of the East Cabinet Range and in the Bull River Valley are dominated by scattered opportunistic graminoid-forb communities. On adjacent private lands exist cleared meadow that are maintained by livestock grazing and are composed primarily of domestic perennial grasses and various forbs. Dry meadows also develop as short-lived seral communities following intensive fire on certain sites. In 1979, approximately 1700 acres of closed hemlock and Douglas fir forest was burned in the Granite-Deep Creek area, and has since then developed a robust layer of grasses and fire adapted forbs. Other disturbed sites, including roads and old skid trails that have seeded in well with introduced grasses (Timothy (Phleum pratense), orchard grass (Dactylis glomerata)) were considered as dry meadow components due to the similarity of plant associations. Dry Meadow vegetation composition is variable depending on the severity of soil disturbance and topographic position of the site, and unless maintained, most sites slowly reestablish shrub or regenerating conifer canopies.

IX. Drainage Forbfields

These are open high elevation herbaceous fields with gradual to steep topography. Forbfields exist as small irregular components where sufficient soils have accumulated at the base of rock headwalls, along moraine deposits, or near alpine ridgetops with semipermanent snowfields. Snowmelt draining off rock and percolating through shallow stony soils provides an endless supply of water through the growing season. Of the mesic components delineated, drainage fields are latest in phenological development, a number of forb species continuing to grow and flower into September and October. The forb layer may either be low, near ground level or .5 M tall and very dense. Dominant plant species growing on most sites are glacier lily, arrow leaf groundsel, angelica, sitka valerian, lousewort (Pedicularis spp.), sky-pilot (Polemonium pulcherrimum), and columbine (Aquilegia flavescens). Forbfields are often associated with alder shrubfields and talus, forming a component mosaic over upper basin slopes.

X. Snowchutes

Open forb dominated snowchutes are the result of recent massive snow slides that remove both tree and shrub cover. The majority of existing avalanche paths in the Cabinet Mountains are dominated by tall shrub communities (mixed shrubfield/snowchute and alder shrubfield) having been maintained over thousands of years. Few large slides are released in timbered zones annually, with only five snowchutes documented in the East Cabinet Range over the past five years (A. Bratkovich 1982 pers. comm.). Thus snowchutes in early successional herbaceous stages are uncommon, and govern a site for a few short growing seasons prior to shrubfield development. Where this component does exist, it commonly occurs as long narrow chutes or small 2-10 acre patches at the toe ends of shrubfield/snowchutes. The lush forb stratum is similar in composition to that growing under the shrubfield canopy, but considerably more robust and dense in structure. Succulent key bear foods are abundant and include glacier lily, spring beauty, angelica, cow parsnip and false hellabore.

XI. Sidehill Park Habitat

Sidehill parks are open graminoid and/or forb dominated communities on moderate to steep slopes from mid-montane to high elevations. They are the result of local topographic, edaphic, and climatic influences, which in combination limit tree growth and form parks of variable floristic composition. Sidehill parks are distinguished from meadow habitat by being inclined with convex topography, and having dissimilar plant communities.

Sidehill park habitat is subdivided and delineated as two component types based on differences in vegetation composition and structure.

A. Graminoid Sidehill Parks

Open graminoid parks are located throughout the Cabinet Range and are variable in structure and size depending on local environmental factors. Where shallow soil conditions exist over slabrock or in association with exposed benches of bedrock sidehill park openings are relatively small and irregularly shaped. These are found in all aspects in the Douglas fir and subalpine fir zones along high ridges and upper slopes, and may remain perennially moist, or more commonly become dry through the summer months. Ecotone boundaries on such sites are often abrupt with shrubfield or timber communities, forming a diverse mosaic of vegetation types. Xerophytic parks are dominated by bunchgrass, particularly bluebunch wheatgrass (Agropyron spicatum) and Idaho fescue (Festuca idahoensis), with a number of forb species emerging and flowering from storage organs early in the season while ample soil moisture exists. Biscuit root, glacier lily, spring beauty, buckwheat-unbrella plant (Eriogonum flavum and E. heracleodes), alumroot (Heuchera cylindrica), and indian-paintbursh (Castilleja spp.) are common sidehill park forbs. Sedges are more prevalent on sites that receive slow but continuous drainage from higher terrain and often occur as terraced benches, occasionally approaching a wet meadow condition (and should then be classified as such).

In certain drainages at somewhat lower elevations in the Douglas fir type, large graminoid parklands occur over well developed soils on south and southwestern slopes. Here the topography channels air flow so that strong winds both remove protective snowpack off southerly slopes and dry soils out deeply later in the summer months (Daubenmire 1968). Areas adjacent to the East Cabinet Range, including tributary drainages of the Fisher River such as Horse Mtn.-Miller Creek and the lower Silver Butte, but also the lower west flanks of Lake Creek exhibit these topo-edaphic climax communities. Vegetation composition is similar to that of dry graminoid-slabrock parks but more extensive and often more productive. Bunchgrasses and other grass-sedge species are vigorous in growth.

Additional forbs commonly growing in lower sidehill parks to those previously visited include balsamroot (Balsamorhiza sagittata), lupine (Lupinus spp.), yarrow, penstemen (Penstemen spp.) and pussy-toes (Antennaria racemosa). Douglas fir and ponderosa pine (Pinus ponderosa) are frequently scattered through park openings, both as large mature conifers and seedlings.

B. Beargrass Sidehill Park

Beargrass, or Indian basket-grass is a grasslike perennial forb that grows in dense rhizomatous clumps. It's found in association with a number of forest habitat communities, and at higher elevations dominates and constitutes certain sidehill park habitat. Beargrass parks are generally located on shallow, well drained soils of south to westerly aspects, existing as large homogeneous openings along upper slopes and ridges, or as small irregular patches on basin headwalls adjacent to lakes, wet meadows, and shrubfields. Ecotone edges with subalpine timber are gradual, with conifer seedlings often scattered through park components. Ground coverage exhibited by beargrass varies depending on soil development and moisture conditions of the site. Some parts may form dense fields of beargrass to the near exclusion of other vegetation. Concomitant plant species include graminoids, glacier lily, alpine knotweed (Polygonum phytolaccaefolium), penstemon, and hawkweek (Hieracium spp.). Huckleberry, grouse whortleberry, mountain lover, and mountain ash may be present on certain sites.

XII. Slabrock habitat characterizes open sites of exposed blocks of scoured-glaciated bedrock, occurring at high elevations on steep to gentle topography. As previously defined (See Graminoid Sidehill Park pp. 15) graminoid dominated communities are closely associated with slabrock where adequate soil development over and between joint blocks support vegetative growth. Other components, such as wet meadows and huckleberry shrubfields are also located as variable sized strips following soil that has accumulated in crevices and depressions. In subalpine basins and on ridgetops, slabrock community mosaics are extensive across gradual convex terrain, providing a high degree of habitat diversity, isolation, and abundance of key bear foods. The upper basins of Ross Creek in the West Cabinets and the numerous small cirques around the Chicago-St. Paul Peaks area in the East Cabinets exhibit large slabrock complexes.

Because of the difficulty in separating and mapping slabrock habitat as discrete units, sites are delineated by the associated vegetative component and secondarily identified as slabrock base (i.e., graminoid sidehill park/slabrock). Slabrock alone has little to no vegetative cover. Seasonal use and importance of slabrock mosaics are determined from the existing vegetation type and development of key bear food.

XIII. Talus/Scree/Rock

This component represents very steep to moderate slopes and benches of loose rock fragments of variable size. unstable scree and talus slopes occur over a broad elevational range with little soil development. Fields of large angular blocks of rock are common in small cirque basins on gradual slopes and benches. Vegetation is sparse, but rock fields often border and drain into wet meadows, drainage forbfields, and alder shrubfields. These and large fragment talus slopes are used as feeding and reproduction habitat by a number of small mammals that grizzly may occasionally prey upon.

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Appendix Table 14. Capture dates, sex, age, ear tag, weight, location, and color of black bears captured in the Cabinet Mtns. during 1983 and 1984.

Capture Date	Sex	Age[1]	Ear Tag[2] Color	Ear Tag[2] Number	Weight[3]	Location[4]	Hide Color
5/6/83	F	4(e)	Red	84-85	59.1 (a)	W. Fisher (E)	Brown
5/7/83	M	15	Red	86-87	104.5 (a)	W. Fisher (E)	Brown
5/11/83	M	5	Red	88-89	84.1 (a)	Ramsey Cr. (E)	Brown
5/13/83	M	12	Red	90-91	131.8 (a)	Deep Cr. (E)	Black
5/15/83	F	7	Red	92-93	54.5 (a)	Bramlet Cr. (E)	Black
5/15/83	M	7(e)	Red	94-95	104.5 (a)	W. Fisher (E)	Brown
5/16/83	M	2	Red	96-97	40.9 (a)	Ramsey Cr. (E)	Black
5/16/83	M	13	Red	98-351	104.6 (e)	Deep Cr. (E)	Black
5/18/83	F	4	Red	352-353	47.7 (a)	W. Fisher (E)	Brown
5/19/83	F	2	Red	354-355	31.8 (a)	Bramlet Cr. (E)	Black
5/19/83	F	6	Red	356-357	54.5 (a)	W. Fisher (E)	Black
5/20/83	M	6	Red	358-359	79.5 (a)	Bear Cr. (E)	Brown
5/21/83	M	2	Red	360-361	59.1 (a)	Snowshoe Cr. (E)	Black
5/23/83	M	7(e)	Red	261-262	95.8 (e)	Snowshoe Cr. (E)	Black
5/23/83	M	10	Red	263-264	113.6 (a)	Bear Cr. (E)	Brown
5/25/83	F	3	Red	362-363	40.9 (a)	Bull R. (W)	Brown
5/28/83	M	4	Red	364-365	65.9 (a)	Bull R. (W)	Brown
5/29/83	M	10	Red	366-367	104.7 (e)	Snake Cr. (W)	Black
5/29/83	M	3	Red	368-369	37.9 (e)	S.Fk. Bull R. (W)	Black
5/29/83	M	3	Red	370-371	48.3 (e)	Bull R. (W)	Brown
6/2/83	M	8	Red	265-266	100.1 (e)	Bear Cr. (E)	Brown
6/2/83	F	3	Red	372-373	50.0 (a)	S.Fk. Bull R. (W)	Brown
6/3/83	M	5	Red	374-375	56.8 (a)	S.Fk. Bull R. (W)	Black
6/4/83	F	3	Red	272-273	38.6 (a)	E.Fk. Bull R. (W)	Brown
6/4/83	M	4	Red	267-268	52.3 (a)	Libby Cr. (E)	Black
6/5/83	M	9	Red	269-270	88.8 (e)	Cable Cr. (E)	Brown
6/7/83	M	6	Red	274-275	64.7 (e)	Standard Cr. (E)	Black
6/10/83	M	5	Red	14-15	59.1 (a)	W. Fisher (E)	Black
6/15/83	M	7	Red	257-258	100.0 (a)	Libby Cr. (E)	Black
6/16/83	M	5	Red	259-260	55.6 (e)	W. Fisher (E)	Black
6/17/83	M	12	Red	253-254	100.6 (e)	Libby Cr. (E)	Black
6/17/83	F	6	Red	255-256	44.4 (e)	Libby Cr. (E)	Brown
6/21/83	M	8	Red	651-652	98.7 (e)	Bear Cr. (E)	Black
6/23/83	M	1	Red	653-654	10.5 (e)	Libby Cr. (E)	Brown
				663-664	(tag mix-up)		
6/23/83	M	4	Red	655-656	54.5 (a)	Bear Cr. (E)	Black
6/24/83	M	6	Red	657-658	94.9 (e)	Bear Cr. (E)	Black
6/27/83	M	2	Red	659-660	28.8 (e)	Libby Cr. (E)	Black
6/29/83	F	11	Red	661-662	21.1 (e)	Ramsey Cr. (E)	Black
7/4/83	F	5	Red	665-666	23.7 (e)	Ramsey Cr. (E)	Black
7/4/83	M	6	Red	667-668	70.4 (e)	Ramsey Cr. (E)	Brown
4/30/84	M	3	Red	646-647	50.0	Swamp Cr. (W)	Black
5/5/84	M	3	Red	628-629	47.7	Bull R. (W)	Black
5/9/84	F	4	Red	372-373	43.2	Bull R. (W)	Brown
5/10/84	M	3(e)	Red	626-627	43.2	S.Fk. Bull R. (W)	Black
5/10/84	M	8(e)	Red	648-649	100.0	Blue Cr. (W)	Brown
5/11/84	M	13(e)	Red	630-631	95.5	E. Fk Bull R. (W)	Brown
5/11/84	M	6	Red	650-669	81.8	Blue Cr. (W)	Brown

Appendix Table 14. Continued.

Capture Date	Sex	Age[1]	Ear Tag[2] Color	Ear Tag[2] Number	Weight[3]	Location[4]	Hide Color
5/14/84	M	7	Red	632-633	118.2	Dry Cr. (W)	Black
5/15/84	M	7	Red	672-673	77.3	Swamp Cr. (W)	Brown
5/15/84	M	6	Red	634-635	111.4	Bull R. (W)	Black
5/15/84	M	7	Red	636-637	72.7	Chippewa Cr. (W)	Black
5/17/84	M	6	Red	638-639	68.2	Bull R. (W)	Black
5/19/84	M	16	Red	640-641	94.1 (e)	E.Fk. Bull R. (W)	Black
5/20/84	M	3	Red	642-643	31.8	Gin Gulch (W)	Black
5/21/84	M	4	Red	670-671	61.4	Blue Cr. (W)	Black
5/21/84	M	5	Red	717-718	50.0	E.Fk. Bull R. (W)	Brown
5/21/84	M	3	Red	644-645	43.2	S.Fk. Bull R. (W)	Brown
5/22/84	M	8	Red	719-720	68.2	E.Fk. Bull R. (W)	Brown
5/23/84	F	2	Red	721-722	21.4	N.Fk. Bull R. (W)	Black
5/24/84	M	6	Red	676-677	100.0	Bull R. (W)	Black
5/25/84	M	9	Red	678-679	102.3	Copper Cr. (W)	Black
5/26/84	F	1	Red	723-724	19.1	Copper Cr. (W)	Brown
5/26/84	F	15(e)	Red	686-687	47.7	Copper Cr. (W)	Black
5/26/84	M	3	Red	684-685	44.1	Chippewa Cr. (W)	Brown
5/26/84	M	10	Red	682-683	109.1	S.Fk. Bull R. (W)	Brown
5/26/84	M	3	Red	680-681	35.0	N.Fk. Bull R. (W)	Black
5/27/84	M	12	Red	674-675	145.1 (e)	Blue Cr. (W)	Brown
5/28/84	F	21	Red	701-702	43.2	Rock Cr. (W)	Brown
5/28/84	F	12	Red	725-750	61.4	Dry Cr. (W)	Brown
5/29/84	F	6	Red	726-727	46.8	Swamp Cr. (W)	Brown
5/30/84	F	6	Red	728-729	45.5	E.Fk. Bull R. (W)	Brown
5/31/84	M	7	Red	705-706	84.1	Swamp Cr. (W)	Brown
5/31/84	M	3	Red	732-733	29.5	E.Fk. Bull R. (W)	Black
5/31/84	M	3	Red	730-731	34.1	S.Fk. Bull R. (W)	Brown
6/6/84	M	2	Red	703-704	27.3	Rock Cr. (W)	Black
6/7/84	M	2	Red	709-710	36.4	Swamp Cr. (W)	Brown
6/8/84(R)	M	9	Red	265-266	90.9	Beer Cr. (E)	Brown
6/10/84	M	11	Red	734-735	113.6	Libby Cr. (E)	Black
6/10/84	M	3	Red	707-708	31.8	Rock Cr. (W)	Black
6/10/84	M	3	Red	711-712	23.9 (e)	Rock Cr. (W)	Brown
6/12/84	M	1	Red	715-716	9.1	E.Fk. Bull R. (W)	Black
6/12/84	M	3	Red	713-714	29.5	Snake Cr. (W)	Black
6/12/84	F	6	Red	751-752	43.2	Trapper Cr. (E)	Black
6/13/84	F	14	Red	753-754	65.9	Libby Cr. (E)	Brown
6/14/84(R)	M	10	Red	269-270	97.7	Poorman Cr. (E)	Brown
6/15/84	M	11	Red	755-756	88.6	Trapper Cr. (E)	Black
6/18/84	F	5	Red	759-760	51.3 (e)	Trapper Cr. (E)	Black
6/18/84	F	12	Red	757-758	58.7 (e)	Poorman Cr. (E)	Black
6/18/84	F	7	Red	736-737	54.5	Rock Cr. (W)	Brown
6/19/84	F	3	Red	761-762	31.1 (e)	Poorman Cr. (E)	Brown
6/20/84	M	10	Red	738-739	97.7	Snake Cr. (W)	Black
6/21/84	F	8	Red	765-766	68.2	Bear Cr. (E)	Black
6/22/84(R)	M	6	Red	259-260	70.5	W. Fisher R. (E)	Black
6/22/84	F	15	Red	740-741	65.9	Rock Cr. (W)	Black
6/24/84	M	17	Red	763-764	102.3	Trapper Cr. (E)	Black

Appendix Table 14. Continued.

Capture Date	Sex	Age[1]	Ear Tag[2] Color	Number	Weight[3]	Location[4]	Hide Color
6/25/84	M	3	Red	795-796	25.0	Poorman (E)	Black
6/25/84(R)	M	3	Red	659-660	45.5	Rock Cr. (W)	Black
6/28/84	F	19	Red	799-800	59.1	Trapper Cr. (E)	Black
7/1/84(R)	M	6	Red	14-15	56.8	Rock Cr. (W)	Black
7/2/84	F	11	Red	767-768	52.3	Trapper Cr. (E)	Black
7/4/84	M	1	Red	742-743	11.4	Rock Cr. (W)	Brown
9/9/84	M	22	Red	769-770	138.0 (e)	Vermilion R. (W)	Black
9/27/84	F	7	Red	744-745	61.4	W. Fisher R. (E)	Brown
10/1/84	M	1	Red	746-747	50.0	W. Fisher R. (E)	Brown
10/3/84	M	3	Red	748-749	61.4	W. Fisher R. (E)	Black
10/5/84(R)	M	7	Red	274-275	100.0	W. Fisher R. (E)	Black
10/5/84	M	2	Red	771-772	47.7	W. Fisher R. (E)	Black
10/9/84	M	4	Red	777-778	65.9	Svrbtte Fshr R.(E)	Black
10/11/84	M	2	Red	775-776	50.0	W. Fisher R. (E)	Brown
10/11/84	F	11	Red	779-780	81.8	Svrbtte Fshr R.(E)	Brown
10/15/84(R)	M	8	Red	94-95	118.2	W. Fisher R. (E)	Brown

1 Age determined by lab examination of extracted tooth (e - estimate).
2 All ear tags were plastic rototags
3 Weight in kilograms (a - actual, e - estimate from regression based on chest girth and length).
4 E - East side of Cabinet Mountains, W - West side of Cabinet Mountains.

Appendix Table 15. Key to abbreviations of habitat types.

ABGR - Abies grandis
ABLA - Abies lasiocarpa
ARUV - Arctostaphylos uva-ursi
CLUN - Clintonia uniflora
LALY - Larix lyallii
LIBO - Linnaea borealis
LUHI - Luzula hitchcockii
MEFE - Menziesia ferruginea
PHMA - Physocarpus malvaceus
PIAL - Pinus albicaulis
PSME - Pseudotsuga menziesii
THPL - Thuja plicata
TSHE - Tsuga heterophylla
TSME - Tsuga mertensiana
VACA - Vaccinium caespitosum
VASC - Vaccinium scoparium
XETE - Xerophyllum fenax

Appendix Table 16. Key to codes for landtypes.

101 - Recent Alluvium
103 - Alluvial Terraces, Well-Drained
104 - Knolls and Sinkholes
105 - Alluvial Lands, Poorly Drained: Marshes, Bogs
106 - Glacial Outwash Terraces, Moist
108 - Mixed Lacustrine and Alluvial
112 - Clayey Lacustrine Terraces
201 - Rocky, Very Steep, Southerly
251 - Rocky, Very Steep, Northerly
252 - Very Steep, Northerly
322 - Clayey Glacial Till with Loess Deposit
352 - Deep Glacial Till with Loess Deposit
355 - Glacially Scoured Side Slopes
360 - Strongly Scoured Lands, 50% Rock
381 - Shallow Incised Parallel Drainages
401 - Alpine Glacial Walls
403 - Alpine Cirque Headwalls
404 - Deep Alpine Till on Mountain Slopes
405 - Strongly Frost-Churned Alpine Ridges
406 - Front-Churned Alpine Slopes
407 - Deep Alpine Valley Till, Concave
408 - Very Steep Glaciated Spurs
502 - Deep Residual Lands, Southerly
503 - Shallow Residual Lands
552 - Deep Residual Lands, Northerly
555 - Residual Ridge Tops and Noses, Northerly