

COMPARATIVE ECOLOGY OF BLACK AND GRIZZLY BEARS ON THE ROCKY MOUNTAIN FRONT, MONTANA

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Abstract: Seven black bears (*Ursus americanus*) were radiomonitored during 1981-84 in conjunction with a long-term study of grizzly bears (*Ursus arctos*). Grizzly and black bear food habits, home ranges, habitat use, and denning habits were compared within the composite home range of all radio-instrumented black bears. Trapping effort per capture for each species was compared in 6 bear management units for the period 1980-87. Differences in habitat use and denning habitat were evident. Black bears used the forested habitats more frequently than did grizzlies. Grizzly bears utilized riparian and open habitat components habitats more frequently than did black bears. Grizzly bear dens were on steeper slopes and at higher elevations than black bear dens. Subtle differences in food habits were detected. Less effort was necessary to capture black bears in bear management units with lower grizzly densities. Grizzly bears avoided habitats within 300 m of open roads while black bears avoided habitats within 100 m of open roads.

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Black bear and grizzly bear are sympatric in many areas of North America. Despite the numerous bear studies conducted throughout this continent few have empirically defined the niches of these 2 closely related species. Herrero (1978, 1979) compared the evolutionary adaptations of grizzly and black bears noting that of these 2 species the grizzly bear is better adapted to exploit more open habitats. Observation based field studies have not provided strong empirical evidence for the partitioning suggested by Hererro but do suggest some temporal or spacial division of habitat (Shaffer 1971, Lloyd and Fleck 1977).

Black bear and grizzly bear relationships have been recently studied in portions of northwestern Montana (Carriles and Jonkel 1987, Kasworm and Thier 1990). Most of these studies have occurred in heavily forested habitats quite dissimilar to the drier, more open habitats of central Montana. This paper describes how black and grizzly bears partitioned habitat along the Rocky Mountain Front in northcentral Montana. The temporal and spacial relationships of these 2 species are briefly discussed.

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STUDY AREA

The study area lies along the east face of the Continental Divide in northwestern Montana (Fig. 1).

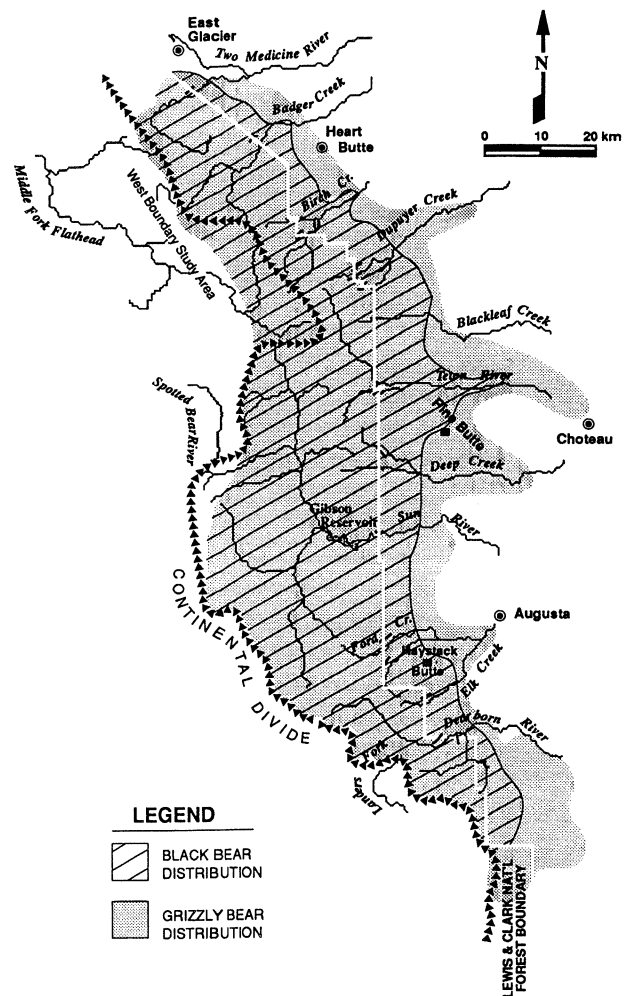


Fig. 1. Map of the study area showing overlapping distributions of black and grizzly bears.

The northern boundary is Highway 2 and the southern boundary is Highway 200. The study area is bounded on the west by the upper portions of the South Fork of the Flathead River, and the Middle Fork of the Flathead River within the Flathead, Lolo, and Helena National Forests. The eastern boundary extends to approximately Range 6 West. Bureau of Land Management lands, Montana Department of Fish, Wildlife and Parks wildlife management areas, national forest non-wilderness, and private lands were the primary focus of the research.

Briefly described, elevations on the study area range from about 1,280 m (4,200 ft.) in river valleys and plains to the east of the mountains upward to 2,863 m (9,392 ft.) on mountain tops. Sedimentary rocks of the limestone and dolomite types generally form the peaks and high ridges, while rocks of the sandstone type often underlie the valley bottoms. Alpine glaciers extensively modified landforms in the past.

Annual precipitation averages about 31 cm (12 inches) at Choteau and up to 167 cm (65 inches) near the Continental Divide. Approximately 80% of the precipitation falls as snow. Temperatures range from 32°C (90°F) to about -46°C (-50°F). The climate is characterized by long, cool winters, short, warm summers, and strong southwest winds.

The major drainage systems within the study area include the Dearborn River, Sun River, Teton River, Birch Creek, and Two Medicine River. Many of the drainages form a characteristic trellis pattern with narrow canyons joining main rivers at abrupt angles. Riparian vegetation extends into the high plains and provides food and cover for black and grizzly bears far from mountainous habitat.

Subalpine fir (*Abies lasiocarpa*) is dominant and represents climax on most of the timberline forest. Stands of spruce (*Picea* spp.), white-bark pine (*Pinus albicaulis*), lodgepole pine (*Pinus contorta*), Douglas-fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*), aspen (*Populus tremuloides*), and cottonwood (*Populus trichocarpa*) are found on select locations, depending on landform, aspect, and elevation. Natural grasslands cover the plains and foothills at lower elevations and intergrade westward into limber pine savanna.

METHODS

Bears were trapped using foot snares (Johnson and Pelton 1980). Snares were set in log cubbies, on trails, or occasionally at dip or barrel sets. Traps were checked daily by vehicle or with saddle horse and pack string.

Captured bears were anaesthetized with a 1:1 ratio of phencyclidine hydrochloride (Sernylan) and promazine hydrochloride (Sparine) or a 2:1 ratio of ketamine hydrochloride (Ketaset) and xylazine (Rompun). Bears were marked with numbered and colored plastic ear tags placed in each ear. Each bear was measured and when possible weighed with a spring scale. All grizzly bears and a select number of black bears in a portion of the study area from Sun River north to Birch Creek were radioinstrumented.

Trapping effort was recorded daily and summarized annually from 1980 to 1987. A trapnight was defined as 1 trap site open for all or part of a night period. Some trap sites had multiple snares placed around a bait. The study area was stratified into 6 bear management units (BMU) for analysis of trap effort data.

Radio-instrumented bears were relocated during weekly aerial flights from a Piper Supercub equipped with a belly mounted YAGI antenna. Radiolocations were opportunistically obtained from the ground. Black and white photographs were made of each aerial relocation to assist habitat determination and to properly locate the site on a map. Data recorded at each location included elevation, habitat type, habitat component, slope, aspect, and UTM coordinates. All grizzly and black bear radio relocations, observations, tracks, dens, kills, and depredations recorded from 1978 to 1987 were mapped to determine species distribution.

Scats were collected, frozen, and later analyzed at the MDFWP laboratory to determine contents. Grizzly and black bear scats were distinguished by monitoring radio-collared bears, collecting at capture sites, and confirming evidence at collection sites with tracks or hair. Frequency, percent frequency, volume, and percent volume were determined from the scat contents. Each food category was expressed by an importance value and percent importance using Mealey's (1980) formula where:

$$\text{Importance Value} = \frac{\text{Percent Frequency} \times \text{Percent Volume}}{100}$$

Percent importance value is defined by the following expression:

$$\text{Importance Value Percent} = \frac{\text{Importance Value of Category}}{\text{Sum of Importance Values}} \times 100$$

Differences in frequency of foods were tested by developing simultaneous confidence intervals around observed frequency of food categories in black bear diets for comparison to expected proportions. Expected proportions were derived from the observed use by

grizzly bears. The hypothesis tested was that black bear choose food categories in the same proportions as grizzly bears.

Dens were located by random chance, helicopter surveys in denning habitat, and radiotracking bears to their dens from the air or ground. Data gathered at each den site included elevation, aspect, slope, habitat type, den type, and condition of the den. Dates of den emergence and den entrance were determined by radiomonitoring bears at den sites. Differences between median dates of den entrance and emergence were tested using Chi-square analysis (Zar 1984).

Sixteen habitat components were defined according to descriptions developed by Aune et al. (1984). Availability of habitat components and distances to road categories were determined using nonmapping methods described by Marcum and Loftsgaarden (1980). Analysis of habitat preference followed Nue et al. (1974) and Byers et al. (1984). Habitat preference of grizzly and black bears was compared for the region within the total composite range of all black bears. Habitat availability was determined from 2,276 random points plotted over the 1,100 square kilometer composite home range of black bears in the study. The perimeter of the composite polygon was used to generate a subset of data from the grizzly bear radio relocation records for comparisons of habitat use. Comparisons of categorical data including slope, aspect, and elevation were tested using a Chi-square statistic. Mean values of slope and elevation by season and between species were tested using analysis of variance. Habitat use between species was compared by generating expected values from habitat use by grizzly bears and comparing these to habitat use by black bears.

The distance from bear locations to open roads was determined by measurements on a 1:24,000 USGS quadrangle. Open roads included all roads accessible by any vehicle for any or all seasons. Distance to road data were categorized into 5 distance to road categories. Relative availability of habitat within each distance to road category was determined from the random points generated within the composite home range of radio-instrumented black bears. Analysis of variance was used to compare means for distance to road by seasons and between species.

Home-range analysis was conducted using the TELDAY home-range program (MDFWP). The TELDAY program generated a minimum polygon home range (Mohr 1947). The statistical package STATGRAPHICS (STSC, Inc. 1986) was used for statistical analysis applying Chi-square, *t*-tests,

Spearman's rank correlation, regression analysis, and analysis of variance.

RESULTS

Distribution and Home Range

Distribution maps developed from 4,138 grizzly and 1,226 black bear observations illustrate the overlapping range of black and grizzly bears on the Rocky Mountain Front (Fig. 1). Each species showed a strong affinity to the forested mountain habitats near the Front Range. Black bears were more strictly confined to the forested mountain areas and less frequently observed in the plains regions of the study area. Grizzly bears were more frequently observed utilizing habitats well out onto the plains away from the mountain front. Concentration areas were similar between species with the exception of high peak areas where grizzly bears dug roots in the alpine.

Black bears were captured in each of the 5 grizzly bear management units (BMU) where grizzlies were also captured, 1980-86 (Fig. 2). The grizzly bear capture rate was 135.5 trapnites per capture and 184.0 trapnites per individual grizzly. The black bear capture rate averaged 32.8 trapnites per capture and 34.4 trapnites per individual bear. Capture effort expressed in trapnites per bear was lowest in the Sun River South BMU and highest in the Teton Birch BMU. The regression of capture effort for black bears on grizzly bears demonstrated a negative relationship; however the slope was not significant ($r^2 = 31.48$, $P = 0.33$). Convex polygon home ranges of 7 resident black bears monitored between 1981 and 1984 overlapped with 6 resident grizzly bear home ranges within the same area

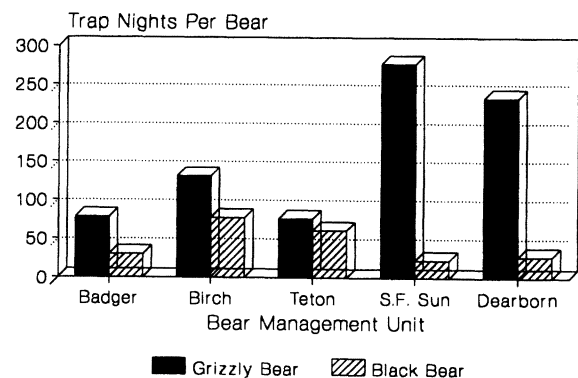


Fig. 2. Comparisons of black and grizzly bear captures per unit effort by Bear Management Units for the Rocky Mountain Front, 1980-87.

1981-84 (Fig. 3). Unmarked resident black and grizzly bears were also observed within the area. Average home-range size for resident grizzly bears was 1,185.6 km² (N = 2, SD = 740.4) for males and 642.3 km² (N = 8, SD = 265.9) for females. Resident black bear home ranges averaged 224.8 km² (N = 5, SD = 111.9) for males and 137.3 km² (N = 2, SD = 96.2) for females. Resident grizzly bear home ranges were approximately 5 times the size of resident black bear home ranges.

Comparison of Black and Grizzly Bear Food Habits

Two hundred and seventy-six black bear and 1,094 grizzly bear scats were analyzed to compare bear food habits. Bear scats contained food items from 11 major taxonomic groups including mammals, insects, birds, trees (pine nuts), sporophytes, forbs, roots, graminoids, shrubs (fruit), garbage, and other (debris). Graminoids, forbs, and insects were the most common bear foods along the East Front and these foods had high percent frequency values. In contrast, seasonally important or less common foods such as fruits, mammals, sporophytes, and pine nuts had low percent frequency values. Graminoids, forbs, and fruit had the highest percent volume of all bear food taxon.

Domestic cattle (*Bos taurus*) and deer (*Odocoileus*

ssp.) were the most common mammals eaten by black and grizzly bears. Other large herbivores in the scats of bears were domestic sheep (*Ovis aries*) and elk (*Cervus elaphus*). Insects and birds were present in bear diets also. The major insect eaten was ants. Bird parts were infrequently found in scats and then most often during nesting season. Although observations did not confirm that grizzlies killed black bears, black bear hair was found in grizzly bear scats. Grizzly bear hair was not detected in scats of black bears.

Plant parts selected from the vegetation eaten by black and grizzly bears varied with food category. Berries and leaf parts were the common plant parts found in shrub food species eaten by black and grizzly bears. Whitebark pine nuts were the major plant part found for the tree category. Graminoids were primarily composed of stem or leafy parts. The forbs in bear diets were mostly upper plant parts including leaf, stem, flowers, seeds, and fruit. Very little root matter was detected in black bear scats.

There were significant differences between species in the frequency of use for the 8 more common food categories identified in scats ($\chi^2 = 47.6$, df = 7, $P < 0.05$). The frequency of grass, forbs, shrubs, and insects was high for both species (Table 1). Grizzly bear scats contained roots, mammals, and pine nuts more frequently than did black bear scats ($P < 0.05$). Black bear scats contained insects more frequently than did grizzly bear scats ($P < 0.05$).

Comparison of the importance value percent by season indicates a similar seasonal feeding strategy with subtle differences (Fig. 4). Graminoids were important in all seasons for both species. Forbs appear to be

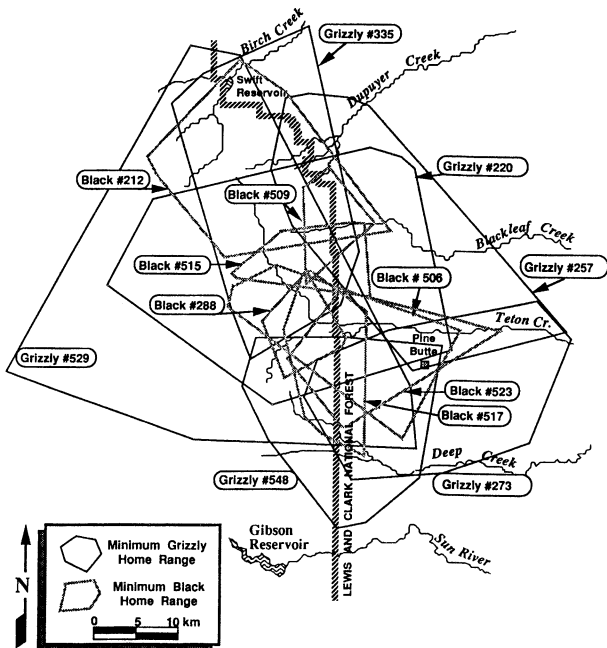


Fig. 3. Grizzly and black bear home-range overlap on the Rocky Mountain Front, 1981-84.

Table 1. Frequency, percent frequency, and percent volume of food categories found in scats from black and grizzly bears on the Rocky Mountain Front.

Food category	Grizzly bear			Black bear		
	Freq.	Percent freq.	Percent volume	Freq.	Percent freq.	Percent volume
Tree	91	5.1	5.9	12	4.3	3.7
Shrub (Fruit)	315	28.8	18.8	69	15.4	15.4
Sporophyte	100	9.1	3.5	32	11.6	6.0
Graminoid	557	50.9	23.2	142	51.5	25.0
Forb	341	31.2	16.3	106	38.4	25.0
Mammal	269	24.6	8.8	48	17.4	6.9
Insect	340	31.1	6.1	114	41.3	7.5
Root	119	10.9	7.3	3	1.1	0.9

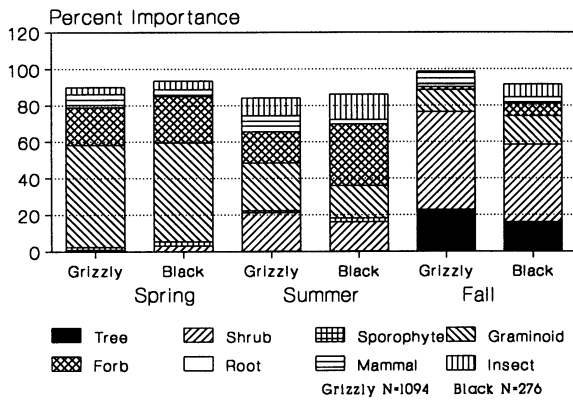


Fig. 4. Black bear and grizzly bear seasonal food habits for the Rocky Mountain Front, 1980-87.

more important throughout the summer and fall for black bears whereas importance value of forbs decreased for grizzlies after mid summer. Grizzly bears dug roots during the summer and fall while black bears did not. Berries and pine nuts were important to both species during the fall. Insects had higher importance values for black bears than for grizzly bears for all seasons. Grizzly bears had higher percent importance values for mammals in all seasons.

The species of graminoids identified in grizzly and black bear scats were similar, with *Poa* spp. and *Carex* spp. being most important. Domestic oats (*Avena sativa*) was found in scats from grizzly bears feeding in cultivated fields at low elevations. Oats were rarely found in black bear scats. Forbs utilized by both species were similar, including such moist-site species such as *Angelica* spp., *Taraxacum* spp., *Lathyrus* spp., *Osmorhiza* spp., and *Heracleum lanatum*. The fruits of shrub species utilized by both black and grizzly bears included *Prunus virginiana*, *Amelanchier alnifolia*, *Shepherdia canadensis*, and *Arctostaphylos uva-ursi*. Importance values for *Arctostaphylos uva-ursi* were higher for black bears than for grizzly bears. Importance values for *Prunus virginiana* and *Amelanchier alnifolia*, the common low-elevation shrubs, were higher for grizzly bears than for black bears.

Comparisons of Habitat Use

The mean elevation for black and grizzly bears increased from spring to fall (Table 2). Black bears were located at sites within the mid range of elevations more frequently than grizzly bears ($\chi^2 = 268.5, 10 \text{ df}, P < 0.05$) (Fig. 5). The grizzly bears ranged a

Table 2. Mean elevation for black and grizzly bear use by season on the Rocky Mountain Front

Season	Black bear		Grizzly bear	
	Mean elevation (m)	95% CI	Mean elevation (m)	95% CI
Spring	1,653.1	1,605.4-1,653.1	1,672.3	1,641.2-1,703.6
Summer	1,714.9	1,677.8-1,751.9	1,780.9	1,742.7-1,819.1
Fall	1,881.3	1,821.9-1,940.8	1,807.3	1,769.9-1,844.7

broader spectrum of elevations and used the low and upper elevational range more frequently than black bears.

Mean slope used by grizzly bears increased significantly each season from spring through fall while mean slope used by black bears did not increase until fall (Table 3). There was a significant difference in percent slope categories used by black and grizzly bears ($\chi^2 = 125.8, 7 \text{ df}, P < 0.05$). Grizzly bears used flatter slopes significantly more and steep slopes slightly more often than black bears. Black bears remained on moderately steep slopes more often than did grizzly bears (Fig. 6).

Comparisons of the aspects used by each species indicated significant differences ($\chi^2 = 136.2, 8 \text{ df}, P < 0.05$). Grizzly bears used flat terrain with little discernable aspect more frequently than did black bears (Fig. 7). Black bears used the northeast, east, and southeast slopes more than did grizzly bears.

Use/availability analysis indicated a difference in habitat preferences by these 2 species (Table 4). Black and grizzly bears preferred the closed timbered

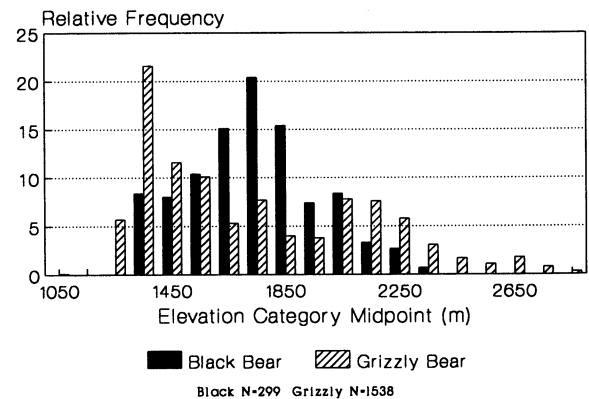


Fig. 5. Distribution of black and grizzly bear use by elevation categories for the Rocky Mountain Front.

Table 3. Mean percent slope for black and grizzly bear use by season on the Rocky Mountain Front.

Season	Black bear		Grizzly bear	
	Mean slope	95% CI	Mean slope	95% CI
Spring	24.4	21.2-27.7	17.9	16.2-19.6
Summer	24.6	21.0-28.1	21.7	19.7-23.7
Fall	36.4	31.8-40.9	27.3	25.0-29.6

component and *Populus* stands. Black bears demonstrated a preference for limber pine forests while grizzly bears did not prefer this component. Both species did not prefer the prairie grasslands, meadows, roads, and riparian complex.

Comparisons of the habitat use between species revealed that although both prefer the closed timber habitat component, black bears were using the closed timber community more than were grizzly bears ($P < 0.05$) (Table 5). Black bears used the rock/talus/scree, prairie grasslands, riparian shrub, and riparian complex habitat component significantly less than did grizzly bears ($P < 0.05$). All other components were used in the same proportions as grizzly bears.

Comparisons of Denning Habits

Fourteen black bear dens were located within the study area. Nine of these dens were examined from the ground; all were excavated. Thirty-four grizzly bear dens were located within a similar region. Grizzly and black bear dens were located on similar aspects ($\chi^2 = 2.9$, 2 df, $P < 0.05$) (Fig. 8). Grizzly bear dens were found at significantly higher elevations and

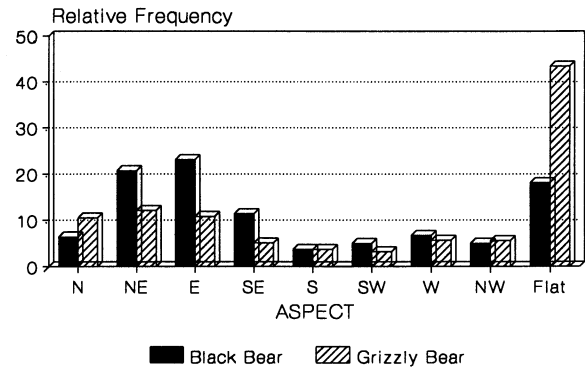


Fig. 7. Use of various aspect categories by black and grizzly bears on the Rocky Mountain Front, 1981-84.

on steeper slopes than were black bear dens ($P < 0.05$) (Table 6).

Black bears entered dens from 13 October to 30 November and emerged from dens 20 March to 5 May. Grizzly bears entered their dens from 10 October to 5 December and emerged from dens 10 March to 13 May. Median date for den entrance for black bears was 10 November ($N = 8$) which is similar to the median date of 7 November ($N = 45$) for grizzly bears ($P = 0.52$). The median date for den emergence for black bears was 4 April ($N = 8$) which is near the 7 April ($N = 43$) median date of emergence for grizzlies ($P = 0.19$).

Table 4. Use/availability of habitat components by grizzly and black bears on the core area of the Rocky Mountain Front.

Habitat component	Preference/Avoidance ^a		
	Black bear	Grizzly bear	Species preferring use
Meadow	-	-	Equal
Road	-	-	Equal
Sidehill park	0	0	Equal
Snowchute	0	0	Equal
Shrubfield	0	0	Equal
Rock/talus/scree	-	0	Grizzly
Closed timber	+	+	Equal
Limber pine	+	-	Black
Prairie grassland	-	-	Equal
Mtn. grassland	0	-	Black
Populus stand	+	+	Equal
Riparian shrub	0	+	Grizzly
Riparian complex	-	-	Equal
Open timber	0	0	Equal
Timber shrubfield	0	0	Equal
Unknown	-	-	Equal

^a(-) equals avoidance, (+) equals preference, (0) equals proportional.

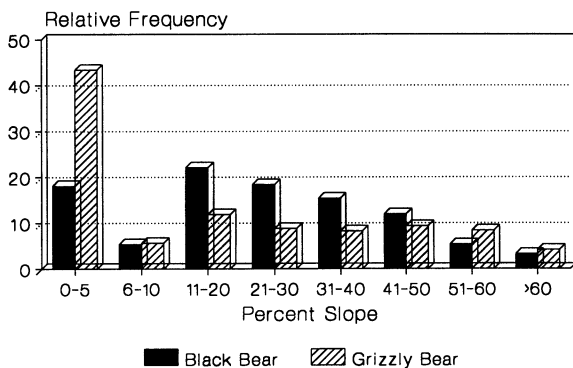


Fig. 6. The use of various slope categories by black and grizzly bears on the Rocky Mountain Front, 1981-84.

Table 5. Black bear habitat use (percent) compared with grizzly bear habitat use on the Rocky Mountain Front.

Habitat component	Observed (black)	Expected (grizzly)	Difference ($P = 0.05$)
Meadow	0.013	0.005	0
Sidehill park	0.017	0.005	0
Snowchute	0.010	0.008	0
Shrubfield	0.003	0.005	0
Rock/talus/scree	0.010	0.081	-
Closed timber	0.488	0.259	+
limber pine	0.027	0.030	0
Prairie grassland	0.003	0.031	-
Mt. grassland	0.013	0.005	0
Populus	0.231	0.241	0
Riparian shrub	0.027	0.191	-
Riparian complex	0.000	0.012	-
Open timber	0.120	0.103	0
Timber shrubfield	0.037	0.008	0
Unknown	0.000	0.017	-

Table 6. Comparisons of slope and elevation between black bear dens ($N = 14$) and grizzly bear dens ($N = 34$) in a similar portion of the Rocky Mountain Front.

Species	Mean elevation	95% CI	Mean slope	95% CI
Black	1,715.5	1,632.7-1,798.4	28.8	19.9-37.7
Grizzly	2,166.7	2,113.6-2,219.9	56.7	51.0-62.4

Road Disturbance

The mean distance to all open roads for black and grizzly bears increased significantly for each season ($P < 0.05$) (Table 7). Mean distance to roads for all seasons was significantly greater for grizzly bears than black bears ($P < 0.05$). Grizzly bears avoided the areas within 300 m of open roads ($P < 0.05$) (Table 8). Black bear were avoiding the areas within 100 m of any open roads ($P < 0.05$).

DISCUSSION

Black bears and grizzly bears share a common range along the Rocky Mountain Front. Distributions and home ranges demonstrated significant overlap in the

space occupied by these 2 closely related species. Grizzly bears have an expanded range compared to the black bears on the Rocky Mountain Front. Both species were closely associated with forest ecosystems along the Rocky Mountain Front. However, the forest/plains ecotone along the front provided extensions of cover out onto the plains, which grizzly bears frequently used.

Capture data from different regions of the Rocky Mountain Front indicate that there may be differences in the abundance of black bears relative to the abundance of grizzly bears. Aune and Kasworm (1989) reported that grizzly bear densities in southern BMUs were lower than in northern units. Density estimates are not available for black bears. It did appear that less effort was needed to capture black bears in BMUs with lower grizzly bear densities.

Differences in the relative abundance of black and grizzly bears could result from interspecific competition, varying human-caused mortality rates, or habitat differences. Habitat in the northern region of our study area was superior to that in the southern area for both black and grizzly bears (Aune and Kasworm 1989). Black bear capture rates did not conform to this gradient in habitat quality as expected. Human-caused mortality rates were not known for the southern and northern portions of the study area. Superior black bear capture rates in the southern region of the Rocky Mountain Front support a hypothesis that the observed abundance of black bears could have been induced

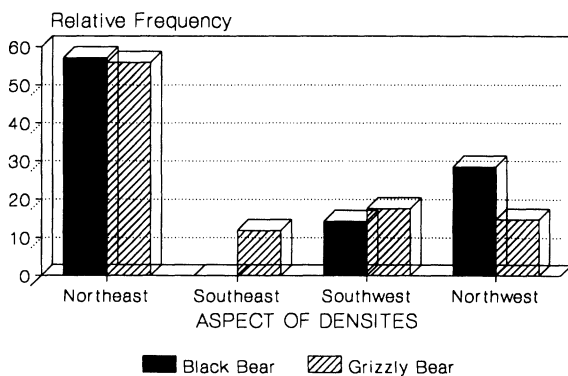


Fig. 8. Comparison of aspect of black and grizzly bear dens on the Rocky Mountain Front, 1980-87.

Table 7. Mean distance to open roads for black and grizzly bears by season on the Rocky Mountain Front.

Season	Black bear		Grizzly bear	
	Mean distance (m)	95 % C.I.	Mean distance (m)	95 % C.I.
Spring	616.3	544.0-773.8	1,434.8	1,288.3-1,581.5
Summer	982.1	787.5-1,177.2	1,917.3	1,728.0-2,106.5
Fall	1,692.5	1,360.0-2,025.0	2,900.2	2,640.7-3,159.8

Table 8. Use/availability analysis for 100 meter distance categories for black and grizzly bears on the Rocky Mountain Front.

Distance category	Black bear ^a	Grizzly bear
0-100	-	-
100-200	0	-
200-300	0	-
300-400	+	+
400-500	0	+
500+	+	+

^a (-) equals avoidance, (+) equals preference, (0) equals proportional.

by low grizzly bear densities and reduced interspecific competition.

The minimum home-range area for female and male black bears in this study was considerably larger than in other areas of Montana (Kasworm and Manley 1988, Mack 1988). Adult female home-range size was considerably larger in this study than reported for the Cabinet Mountains (22 km²) (Kasworm and Manley 1988) or the East Boulder (27-38 km²) (Mack 1988). Amstrup and Beecham (1976) suggested that the quality, quantity, and distribution of food, as influenced by climate and topography, probably determine home-range size.

Black bear habitat on the Rocky Mountain Front is similar to habitat on the East Boulder in south-central Montana but quite different than habitat in the Cabinet Mountains of northwestern Montana. Smaller female home ranges in the Cabinet Mountains are best explained by differences in habitat quality. Female home-range size on the Rocky Mountain Front was 2-3 times larger than home-range size reported for the East Boulder. This difference in home-range size may result from factors other than habitat quality.

One factor influencing home-range size of black bears could be interaction between grizzly and black bears (Jonkel 1987). Field observations from several studies indicate that black bears are displaced from feeding areas by grizzlies (Kendall 1984, Shaffer 1971). In this study observations of interspecific strife in berry fields and near carcasses indicated that grizzly bears displaced black bears. If black bear and grizzly bear interaction is frequent, avoidance behavior and displacement of black bears could result in larger home ranges. Further study is needed within similar habitats but varying densities of bears to determine the influence of grizzly bears on black bear home-range size.

Black bear and grizzly bear diets along the Rocky Mountain Front were different. The differences were probably related to the habitats each species preferred,

species-specific adaptations, and the interspecific competition between these species. Black bears seemed to rely on forbs throughout the year more than did grizzly bears, while grizzly bears shifted to other food items during the summer and fall. Grizzly bears are more capable root diggers than are black bears, and exploited sidehill parks and alpine habitat to a greater extent. The slightly higher portion of mammals found in the grizzly bear scats suggests that grizzly bears may out-compete black bears for carrion or are better predators. Shaffer (1971) and Jonkel and Cowan (1971) reported a higher proportion of mammals in the diets of grizzly bears when compared to black bears. Grizzly bears utilize a broader range of food resources available throughout a given environment while black bears concentrate on food resources within the forest (Herrero 1979).

There did appear to be some niche separation between these 2 species, indicated by preference for various habitat components, different patterns in use of elevations, and differences in food habits. Black bears were concentrating their life activities in forested habitats, which are found on north by northeast slopes at middle elevations and middle to low slopes. Grizzly bears were able to exploit a broader range of elevations and used lower elevation riparian components and the alpine environments seasonally. Herrero (1978, 1979) noted that while these 2 species coexisted in some forest ecosystems the grizzly is better adapted for exploiting more open habitat. In discussing the evolution of bears Herrero (1978) suggests that the black bear retained the forest-dwelling niche of their ancestors while the brown bear moved to exploit more open habitats as well as forests. The subtle differences in habitat selection on the Rocky Mountain Front support these postulates.

Black bears on the Rocky Mountain Front may prefer the forested habitats as a form of protection from grizzly bears. Grizzlies have been reported to kill black bears (Arnold 1930, Hornocker 1962, Jonkel and Cowan 1971, Murie 1981). Black bears are adept at climbing trees and may be able to escape predators in the forested environment (Herrero 1979). Herrero (1978) suggests that the black bear did not move out of the forested habitats since it was not large enough to protect its young, or possibly itself, on the ground from larger carnivores. Grizzly bear predation upon black bears could have important population regulation implications and could prejudice the selection of habitats by black bears.

Temporal partitioning of resources could mitigate the interspecific competition in habitats commonly selected by black and grizzly bears. Shaffer (1971) observed

that when both species were foraging in berry fields each foraged at different time periods. Jorgensen (1979) suggested that limited overlap in peak activity patterns probably reduced interspecific competition between these 2 species. Schleyer (1983) reported differences in the time of captures between the 2 species, suggesting that the species were active during different periods of the day. Aune and Kasworm (1989) reported crepuscular and nocturnal activity patterns for grizzly bears on the Rocky Mountain Front. Limited observation and activity data collected during this study yielded evidence of some temporal isolation in activities. Further investigations of activity patterns would be necessary to determine precisely how black and grizzly bears partitioned resources temporally on the Rocky Mountain Front.

Although there was some overlap, grizzly bears and black bears partitioned denning habitat along the Rocky Mountain Front. Grizzly bear dens were found on high-elevation, steep slopes along the front range while black bear dens were located in a broad zone from mid-elevation forests to the riparian areas of the prairie. Both species chose aspects that collect snow cover during the winter. Overlap of grizzly and black bear denning habitat may be more prevalent in other areas of western Montana where grizzly bears were known to den at lower elevations (Aune and Kasworm 1989).

On the Rocky Mountain Front frequent chinook winds during the winter can melt snow cover on denning slopes especially at lower elevations. Grizzly bears may claim den sites at high elevations with more consistent snow cover while black bears, to avoid grizzlies, may select the mid-lower slopes. Partitioning denning habitat on the Rocky Mountain Front may provide black bears protection from grizzly bears during the pre- and post-hibernation lethargy. There may be a selective advantage for both species by partitioning denning habitat on the Rocky Mountain Front.

Black bears on the Rocky Mountain Front exploited habitat nearer to open roads more readily than did grizzly bears. Kasworm and Manley (1990) also observed differences in displacement zones for black and grizzly bears in the Cabinet Mountains of Montana. Lloyd and Fleck (1977) reported that grizzly bears are avoiding areas frequented by humans whereas black bears are not. Black bears apparently tolerate human disturbance to a greater degree than do grizzly bears. The black bear's ability to exploit disturbed habitats may provide a survival advantage to this species in heavily roaded habitats. Nagy and Russell (1978) suggested that as human encroachment and habitat

disturbances increased in the Swan Hills region of Alberta, black bear densities increased while grizzly bear densities declined. Increased roading of the relatively unroaded Rocky Mountain Front could displace grizzly bears and bestow a competitive advantage to black bears.

Stirling and Derocher (1990) suggest that the distribution and abundance of Ursids is but an ephemeral reflection of the evolutionary path that began with the first identifiable bear. They further suggest that bears have adapted to ecological changes that affected interspecific competition and availability of food. Empirical evidence from this study demonstrate that black and grizzly bears on the Rocky Mountain Front have adapted to exploit different subniches and coexist within a common habitat because of differences in behavior, food habits, and habitat selection. These conclusions imply that ecological or human-induced change would affect the distribution and abundance of these 2 Ursids by altering habitats or providing either species a competitive advantage.

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