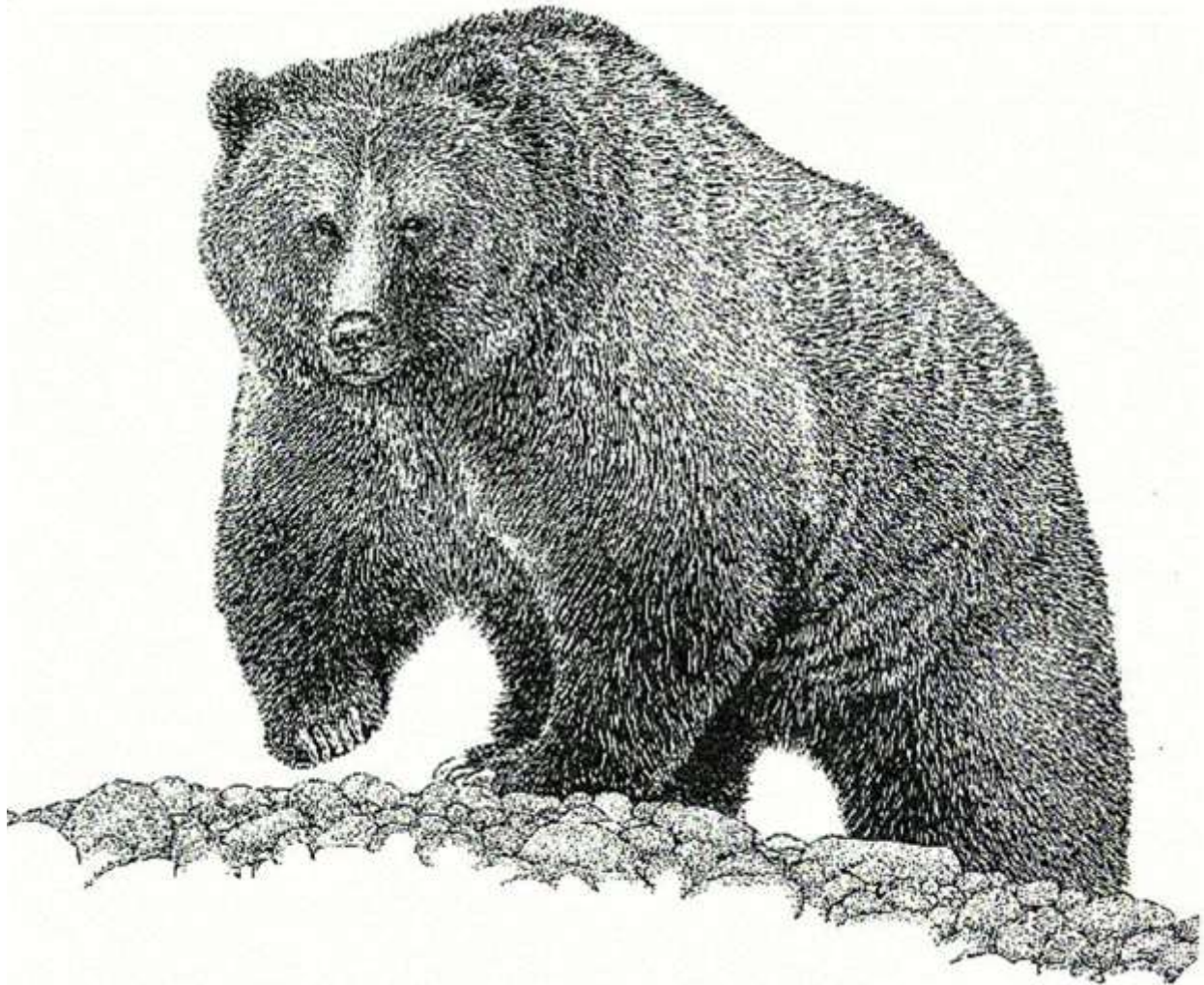


# **CABINET-YAAK GRIZZLY BEAR RECOVERY AREA 2011 RESEARCH AND MONITORING PROGRESS REPORT**



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**Abstract:**

Grizzly bear research in the Cabinet Mountains indicated that only a small population remained as of 1988. Concern over persistence of grizzly bear populations within this area resulted in a pilot program in 1990 that tested population augmentation techniques. Four subadult female bears with no history of conflicts with humans were captured in southeast British Columbia and moved to the Cabinet Mountains for release during 1990-94. Three of four transplanted bears remained within the target area for at least one year. Hair snag sampling and DNA analysis during 2002-11 identified one of the original transplanted bears. The animal was a 2 year-old female when released in 1993. Genetic analysis also identified at least 9 first generation offspring and 8 second generation offspring from this individual. The success of the augmentation test program prompted additional augmentation in cooperation with Montana Fish Wildlife and Parks. Seven female bears and 2 male bears were moved from the Flathead River to the Cabinet Mountains during 2005-11. Two of these individuals died during their first year from human related causes. One was illegally shot and one was struck by a train. Three bears moved back to near their original capture sites. Research and monitoring in the Yaak River began in 1986 with the capture and collaring of 2 grizzly bears. Including those captures, 42 bears have been captured and monitored through telemetry, 1986–2011.

Recovery plan criteria regarding numbers of females with cubs in the Cabinet-Yaak grizzly bear recovery zone (CYGBRZ) varied from 1-4 per year and averaged 2.5 per year from 2006-11. Human caused mortality averaged 1.2 bears per year and 0.3 females per year. Eight known or probable human caused mortalities have occurred in or within 10 miles of the CYGBRZ in the U.S. during 2006-11. Human caused mortalities included two adult females (both self-defense), 3 adult males (2 under investigation and a black bear mistaken identity), 2 subadult males (black bear mistaken identity and self-defense), and one subadult bear of unknown sex (under investigation). Twelve of 22 bear management units had sightings of females with young during 2006-11.

A minimum of 42 bears were identified in the CYGBRZ during 2006-11 after known mortality was subtracted. This minimum was based on captures, genetic information, mortality, and sightings of unique individuals. Sixty-one known and probable grizzly bear mortalities from all causes were documented inside or within 16 km of the CYGBRZ (including Canada) during 1982-2011. Mortality causes, timing, and locations were analyzed for 1983-11. The finite rate of increase ( $\lambda$ ) for 1983–2011 was 0.984 (95% C.I. 0.882–1.069). Finite rate of change in the population was an annual -1.6% for the period. Subadult female survival and adult female survival accounted for most of the uncertainty in  $\lambda$ . The probability that the population was declining was 64%. However data from the last 5 years indicate an improving situation. Sex and age specific survival and reproductive rates were updated and reported.

Capture, monitoring, and habitat use data was updated and reported for 1983-2011. Berry counts indicated near average production for huckleberry and serviceberry, lower than average mountain-ash production, and greater than average production of buffaloberry in 2011.

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## INTRODUCTION

Grizzly bear (*Ursus arctos*) populations south of Canada are currently listed as Threatened under the terms of the 1973 Endangered Species Act (16 U.S.C. 1531-1543). In 1993 a revised Recovery Plan for grizzly bears was adopted to aid the recovery of this species within ecosystems that they or their habitat occupy (USFWS 1993). Seven areas were identified in the Recovery Plan, one of which was the Cabinet-Yaak Grizzly Bear Recovery Zone (CYGBRZ) of extreme northwestern Montana and northeast Idaho (Fig. 1). This area lies directly south of Canada and encompasses approximately 6800 km<sup>2</sup>. The Kootenai River bisects the CYGBRZ, with grizzly bear habitat within the Cabinet Mountains to the south and the Yaak River drainage to the north (Fig. 2). The degree of grizzly bear movement between the two portions is unknown but thought to be minimal. The U.S. Fish and Wildlife Service issued a 12-month finding of warranted for endangered status but precluded by other listing actions on February 12, 1993 (58 FR 8250-8251).

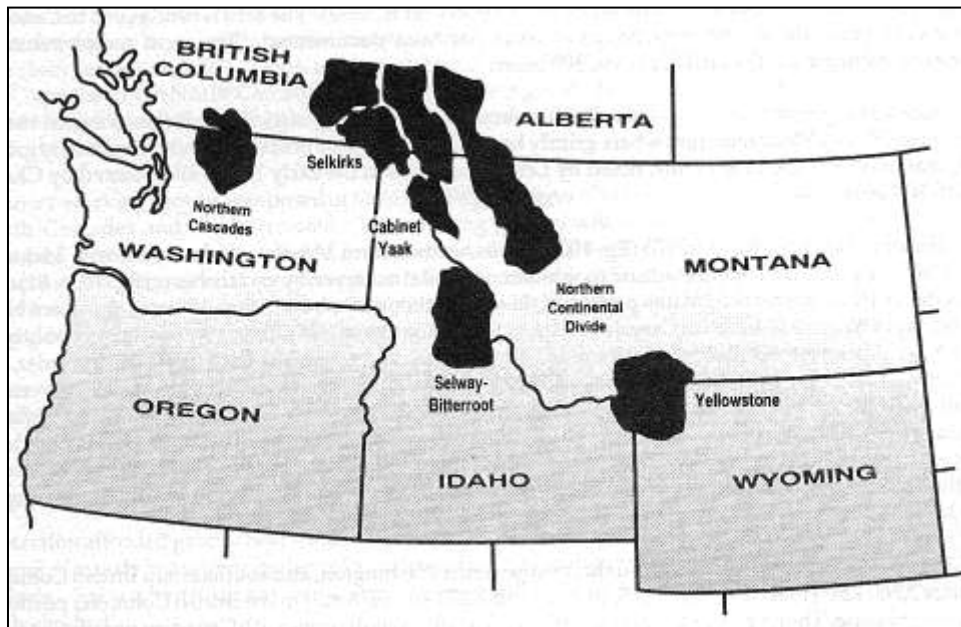


Figure 1. Grizzly bear recovery areas in the U.S., southern British Columbia, and Alberta, Canada.

Research on native grizzly bears began south of the Kootenai River during the late 1970's. Erickson (1978) reported the results of a survey he conducted for bears and their sign in the Cabinet Mountains and concluded the population consisted of approximately a dozen animals. A trapping effort in 1979 and 1980 in the same area failed to capture a grizzly bear, but a female and yearling were observed (Thier 1981). In 1983 trapping efforts were resumed and intensified (Kasworm and Manley 1988). Three individual grizzly bears were captured and radio-collared during 1983-1987. Minimal reproduction was observed during the period and the population was believed to be declining toward extinction. To reverse this trend, a formal plan was proposed in 1987 to augment the Cabinet Mountains portion of the population with subadult female bears from outside the area (USFWS 1990, Servheen et al. 1987).

Two approaches for augmenting grizzly bears were proposed. The first involved transplanting adult or subadult grizzly bears from other areas of similar habitat to the Cabinet Mountains. Transplants would involve bears from remote areas that would have no history of conflict with humans. The use of subadult females was recommended because of their smaller home ranges and potential reproductive contribution. The second approach relied on the cross fostering of grizzly bear cubs to American black bear (*Ursus americanus*) females. Under this approach, grizzly bear cubs from zoos would be placed in the maternal dens of black bear females during March or April. The fostering of orphaned black bear cubs to surrogate black bear females has been used successfully in several areas (Alt and Beecham 1984, Alt 1984).

During public review of the augmentation program, many concerns were expressed which included human safety, conflicts with other land-uses, and long-term grizzly bear population goals. A citizen's involvement committee was formed to aid information exchange between the public and the agencies. Representatives of several local organizations donated their time to further this purpose. The first product of this group was a question and answer brochure regarding grizzly bears in the CYGBRZ. This brochure was mailed to all box holders in Lincoln and Sanders counties. In response to concerns expressed by the committee, the augmentation proposal was modified to eliminate cross fostering and to reduce total numbers of transplanted bears to four individuals over five years. The beginning date of augmentation was also postponed for one year to allow additional public information and education programs.

Prior to 1986, little work was conducted on grizzly bears in the Yaak River portion of the CYGBRZ. Bears that used the area were thought to be largely transitory from Canada. However, a black bear study in the Yaak River drainage in 1986 and 1987 resulted in the capture and radio-collaring of five individual grizzly bears (Thier 1990). The Yaak River area has traditionally been an important source of timber for area mills, with timber harvesting the dominant use of the area. A pine beetle (*Dendroctonus ponderosae*) epidemic began in the mid 1970's. Large stands of lodgepole pine (*Pinus contorta*) were infected, which resulted in an accelerated timber-harvesting program with clearcutting the dominant silvicultural technique. A concern of environmental degradation, as well as the effects of timber harvesting on the local grizzly bear population, prompted a lawsuit against the Forest Service by a local citizen's group in 1983 (USFS 1989). To obtain additional information on the population status and habitat needs of grizzlies using the area, the U.S. Forest Service and Montana Department of Fish, Wildlife, and Parks cooperated with the U.S. Fish and Wildlife Service in initiating a long term study. Field work began in June of 1989.

## **OBJECTIVES**

### **A. Cabinet Mountains Population Augmentation:**

Test grizzly bear augmentation techniques in the Cabinet Mountains to determine if transplanted bears will remain in the area of release and ultimately contribute to the population through reproduction.

### **B. Recovery Zone Research and Monitoring:**

1. Document grizzly bear distribution in the Cabinet/Yaak Grizzly Bear Ecosystem.
2. Describe and monitor the grizzly bear population in terms of reproductive success, age structure, mortality causes, population trend, and population estimates.
3. Determine habitat use and movement patterns of grizzly bears. Determine habitat preference

by season and assess the relationship between habitats affected by man such as logged areas and grizzly bear habitat use. Evaluate grizzly bear movement permeability of the Kootenai River valley between the Cabinet Mountains and the Yaak River drainage and across the Moyie River Valley in British Columbia.

4. Determine the relationship between human activity and grizzly bear habitat use through the identification of areas used more or less than expected in relation to ongoing timber management activities, open and closed roads, and human residences.
5. Identify mortality sources and management techniques to limit human-caused mortality of grizzly bears.
6. Conduct black bear studies incidental to grizzly bear investigations to determine interspecific relations. Data on black bear densities, reproduction, mortality, movements, habitat-use, and food habits relative to grizzly bears will be gathered and analyzed.

## STUDY AREA

The CYGBRZ (48° N, 116° W) encompasses approximately 6,800 km<sup>2</sup> of northwest Montana and northern Idaho (Fig. 2). The Cabinet Mountains constitute about 58% of the CYGBRZ and lie south of the Kootenai River. The Yaak River portion borders Canadian grizzly populations to the north. There are two potential linkage areas between the Yaak and the Cabinets – one between Libby and Troy and one between Troy and the Idaho line. However, we have yet to document any grizzly bear movement between these areas or grizzly bear use within these linkage zones. Approximately 90% of the recovery area is on public land administered by the Kootenai, Lolo, and Panhandle National Forests. Plum Creek Timber Company Inc. and Stimson Corp. are the main corporations holding a significant amount of land in the area. Individual ownership exists primarily along major rivers, and there are numerous patented mining claims along the Cabinet Mountains Wilderness boundary. The Cabinet Mountains Wilderness encompasses 381 km<sup>2</sup> of higher elevations of the study area in the Cabinet Mountains. Bonners Ferry, Libby, Noxon, Sandpoint, Troy, Thompson Falls, and Trout Creek are the primary communities adjacent to the Cabinet Mountains.



Figure 2. Cabinet-Yaak grizzly bear recovery zone.

Elevations in the Cabinet Mountains range from 610 m along the Kootenai River to 2,664 m at Snowshoe Peak. The area has a Pacific maritime climate characterized by short, warm summers and heavy, wet winter snowfalls. Lower, drier slopes support stands of ponderosa pine (*Pinus ponderosa*) and Douglas-fir (*Pseudotsuga menziesii*), whereas grand fir (*Abies grandis*), western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*) dominate lower elevation moist sites. Subalpine fir (*Abies lasiocarpa*), spruce (*Picea spp.*), and mountain hemlock (*Tsuga mertensiana*) dominate stands between 1,500 m and timberline. Mixed coniferous and deciduous tree stands are interspersed with riparian shrubfields and wet meadows along major drainages. Huckleberry (*Vaccinium spp.*) and mixed shrubfields are partially a result of wildfires that occurred in 1910 and 1929 and more recent stand replacing fires. Fire suppression has reduced wildfires as a natural force creating or maintaining berry-producing shrubfields.

The Yaak River drainage lies in the extreme northwestern corner of Montana, northeastern Idaho, and southern British Columbia and is bounded on the east and south by Lake Koocanusa and the Kootenai River, to the west by the Moyie River, and to the north by the international boundary. Two north-south trending mountain ranges dominate the landscape - the McGillivray range in the east and the Purcell range to the west. Topography is varied, with rugged, alpine glaciated peaks present in the Northwest Peaks Scenic Area. Rounded peaks and ridges cover most of the remaining area, a result of continental glaciation. Coniferous forests dominate, with cutting units the primary source of diversity. Much of the Yaak River is low gradient and the river tends to meander, creating lush riparian zones and meadows. Elevations range from 550 m at the confluence of the Kootenai and Moyie Rivers to 2348 m atop Northwest Peak. Vegetation is diverse, with an overstory of western hemlock and western red cedar the indicated climax species on much of the study area. Ponderosa pine and Douglas-fir are common at lower elevations on south and west slopes. Subalpine fir and spruce dominate the upper elevations and cirque basins. Large stands of lodgepole pine and western larch (*Larix occidentalis*) occur at mid and upper elevations and are largely the result of extensive wildfires in the past. In recent years, several stand altering fires have occurred in the Yaak River.

Understory and non-forested habitats include graminoid parks consisting primarily of fescue (*Festuca spp.*) and bluebunch wheatgrass (*Agropyron spicatum*), which occur at moderate to high elevations. Riparian shrubfields of red-osier dogwood (*Cornus stolonifera*) and hawthorn (*Crataegus douglasii*) are prevalent along major drainages. Buffaloberry (*Shepherdia canadensis*) is common under stands of open lodgepole pine while serviceberry (*Amelanchier alnifolia*) and chokecherry (*Prunus virginiana*) prevail on drier, rockier sites. Huckleberry shrubfields are often found under open timber canopies adjacent to graminoid parks, in old burns, in cutting units, and intermixed with beargrass (*Xerophyllum tenax*).

During 1990-1994, Cabinet Mountains population augmentation trapping was conducted in the upper North Fork of the Flathead River drainage and the Wigwam River drainage in southeast British Columbia, approximately 10-40 km north of the U.S. border. During 1992 trapping was conducted south of the international border in the North Fork of the Flathead River. Subalpine fir was the indicated climax species throughout most of the area, with lodgepole pine the most prevalent. Recent wildfires at upper elevations have had more influence on habitat in the CYGBRZ. An outbreak of pine bark beetles resulted in logging large areas at lower elevations during the 1980's. Large portions of upper elevations had been logged earlier in response to a spruce bark beetle (*Dendroctonus obesus*) epidemic.

## **METHODS**

### **Grizzly Bear Observations**

All grizzly bear observations and reports of sign (tracks, digs, etc.) by study personnel and the public were recorded. Grizzly bear sighting forms were sent to a variety of field personnel from different agencies to maximize the number of reports received. Sightings of grizzly bears were rated 1–5 with 5 being the best quality and 1 being the poorest. General definitions of these categories are presented below, but it was difficult to describe all circumstances under which sightings were reported. Only sightings receiving ratings of 4 or 5 were judged credible and used in reports. Sightings that rate 1 or 2 may not always be recorded in the database.

5 - Highest quality reports typically from study personnel or highly qualified observers. Sightings not obtained by highly qualified observers must have physical evidence such as pictures, track measurements, hair, or sightings of marked bears where marks are accurately described.

4 - Good quality reports that provide credible, convincing descriptions of grizzly bears or their sign. Typically these reports include a physical description of the animal mentioning several characteristics. The observer had sufficient observation time and was close enough or had binoculars to aid in identification. Observer demonstrates sufficient knowledge of identification characteristics to be regarded as a credible observer. Background or experience of observer may influence credibility.

3 - Moderate quality reports that do not provide convincing descriptions of grizzly bears. Reports may mention 1 or 2 characteristics, but the observer does not demonstrate sufficient knowledge of characteristics to make a reliable identification. Observer may have gotten a quick glimpse of the bear or been too far away for a good quality observation.

2 - Lower quality observations that provide little description of the bear other than the observer's judgment that it was a grizzly bear.

1 - Lowest quality observations of animals that may not have been grizzly bears. This category may also involve second hand reports from other than the observer.

### **Survival and Mortality Calculations**

Survival rates for all age classes except cubs were calculated by use of the Kaplan-Meier procedure as modified for staggered entry of animals (Pollock et al. 1989, Wakkinen and Kasworm 2004). Assumptions of this method include: marked individuals were representative of the population, individuals had independent probabilities of survival, capture and radio collaring did not affect future survival, censoring mechanisms were random, a time origin could be defined, and newly collared animals had the same survival function as previously collared animals. Censoring was defined as radio-collared animals lost due to radio failure, radio loss, or emigration of the animal from the study area. Kaplan-Meier estimates may differ slightly from Booter survival estimates used in the trend calculation.

Our time origin for each bear began at capture. If a bear changed age classification while radio-collared (i.e., subadult to adult), the change occurred on the first of February (the assigned birth date of all bears). Weekly intervals were used in the Kaplan-Meier procedure



during which survival rates were assumed constant. No mortality was observed during the denning season. Animals were intermittently added to the sample over the study. Mortality dates were established based on radio telemetry, collar retrieval, and mortality site inspection. Radio failure dates were estimated using the last radiolocation date when the animal was alive.

Cub recruitment rates to 1 year of age were estimated by  $1 - (\text{cub mortalities} / \text{total cubs observed})$ , based on observations of radio-collared females (Hovey and McLellan 1996). Mortality was assumed when a cub disappeared or if the mother died. Cubs were defined as bears < 1.0 year old.

Bears captured and relocated to the Cabinet Mountains as a test of population augmentation (Kasworm et al. 1998) were not included in the analyzed sample. None of these animals had any prior history of nuisance activity. Several bears that were captured as part of a preemptive move to avoid nuisance activity were included.

Estimates of unreported mortality were based on the public reporting rate of radio collared animals >1 year of age (Cherry et al 2002). The correction factor was applied to public reported mortalities. Correction was unnecessary for known removals (management removals, capture related mortalities, or mortalities of radio-collared bears).

## Reproduction

Reproduction data was gathered through observations of radio-collared females with offspring. Because of possible undocumented neonatal loss of cubs, no determination of litter size was made if an observation was made in late summer or fall. Interbirth interval was defined as the length of time between subsequent births. Age of first parturition was determined by presence or lack of cubs from observations of aged radio collared bears (Garshelis et al. 1998).

## Population Growth Rate

We used the software program Booter 1.0 (© F. Hovey, Simon Fraser University, Burnaby, B.C.) to estimate the finite rate of increase ( $\lambda$ , or lambda) for the study area's grizzly bear populations. The estimate of  $\lambda$  was based on adult and subadult female survival, yearling and cub survival, age at first parturition, reproductive rate, and maximum age of reproduction.

Booter uses the following revised Lotka equation (Hovey and McLellan 1996), which assumes a stable age distribution:

$$(1) \quad 0 = \lambda^a - S_a \lambda^{a-1} - S_c S_y S_s^{a-2} m [1 - (S_a / \lambda)^{w-a+1}],$$

where  $S_a$ ,  $S_s$ ,  $S_y$ , and  $S_c$  are adult female, subadult female, yearling, and cub survival rates, respectively,  $a$  = age of first parturition,  $m$  = rate of reproduction, and  $w$  = maximum age. Booter calculates annual survival rates with a seasonal hazard function estimated from censored telemetry collected through all years of monitoring in calculation of  $\lambda$ . This technique was used on adults, subadults, and yearlings. Point estimates and confidence intervals may be slightly different from those produced by Kaplan-Meier techniques (differences in Tables 14 and 15). Survival rate for each class was calculated as:

$$(2) \quad S_i = \prod_{j=1}^k e^{-L_j^{(D_{ij} - T_{ij})}}$$

where  $S_i$  is survival of age class  $i$ ,  $k$  is the number of seasons,  $D_{ij}$  is the number of recorded deaths for age class  $i$  in season  $j$ ,  $T_{ij}$  is the number of days observed by radio telemetry, and  $L_j$  is the length of season  $j$  in days. Cub survival rates were estimated by  $1 - (\text{cub mortalities} / \text{total cubs born})$ , based on observations of radio-collared females. Intervals were based on the following season definitions: spring (1 April - 31 May), summer (1 June - 31 August), autumn (1 September - 30 November), and winter (1 December - 31 March). Intervals defined seasons when survival rates were assumed constant and corresponded with traditional spring and autumn hunting seasons and the denning season.

Booter provides several options to calculate a reproductive rate ( $m$ ) and we selected three to provide a range of variation (McLellan 1989). The default calculation requires a reproductive rate for each bear based upon the number of cubs produced divided by the number of years monitored. We input this number for each adult female for which we had at least one litter size and at least three successive years of radio monitoring, captures, or observations to determine reproductive data. We ran the model with this data and produced a trend calculation. Among other options, Booter allows use of paired or unpaired litter size and birth interval data with sample size restricted to the number of females. If paired data is selected, only those bears with both a known litter size and associated interbirth interval are used. The unpaired option allows the use of bears from which accurate counts of cubs were not obtained but interval was known, for instances where litter size was known but radio failure or death limited knowledge of intervals. To calculate reproductive rates under both these options, the following formula was used (from Booter 1.0):

$$(3) \quad m = \frac{\sum_{i=1}^n \frac{\sum_{j=1}^p L_{ij}}{\sum_{j=1}^k B_{ij}}}{n}$$

where  $n$  = number of females;  $j$  = observations of litter size ( $L$ ) or interbirth interval ( $B$ ) for female  $i$ ;  $p$  = number of observations of  $L$  for female  $i$ ; and  $k$  = number of observations of  $B$  for female  $i$ . Note  $k$  and  $p$  may or may not be equal. Cub sex ratio was assumed to be 50:50 and maximum age of female reproduction ( $w$ ) was set at 27 years (Schwartz et al. 2003). Average annual exponential rate of increase was calculated as  $r = \log_e \lambda$  (Caughley 1977).

### Capture and Marking

Capture and handling of bears followed the approved Animal Use Protocols University of Montana, Missoula, MT (007-009CFC-021009). Capture of black bears and grizzly bears was performed under state permits 2011-033 and 2011-064 and federal permit TE704930-0. Bears were captured with leg-hold snares following the techniques described by Johnson and Pelton (1980) and Jonkel (1993). The snares were manufactured in house following the Aldrich Snare Co. (Clallam Bay, WA) design and consist of 6.5 mm braided steel aircraft cable. All bears were immobilized with either Telazol (tiletamine hydrochloride and zolazepam hydrochloride), a

mixture of Ketaset (ketamine hydrochloride) and Rompun (xylazine hydrochloride), or a combination of Telazol and Rompun. Yohimbine and Atipamezole were the primary antagonists for Rompun. Drugs were administered intramuscularly with a syringe mounted on a pole (jab-stick), a homemade blowgun, a modified air pistol, or a cartridge powered dart gun. Immobilized bears were measured, weighed, and a first premolar tooth was extracted for age determination (Stoneberg and Jonkel 1966). Blood, tissue and/or hair samples were taken from most bears for genetic studies. Immobilized bears were given oxygen at a rate of 2-3 liters per minute. Recovering bears were dosed with Atropine and Diazepam.

Prior to 1998, each bear was marked with an individually numbered ear tag in each ear. A 4 X 13 cm streamer of rubberized fabric (Armatite or Ritcey Material) was attached to each ear tag. Ear streamer color varied by species and year to identify when the animal was captured. All grizzly bears and some adult black bears ( $\geq 4.0$  years old) were fitted with radio collars or ear tag transmitters when captured. Some bears were collared with Global Positioning System (GPS) radio collars. Collars were manufactured by Telonics (Mesa, AZ) and ear tag transmitters were manufactured by Advanced Telemetry Systems (Isanti, MN). To prevent permanent attachment, a canvas or polypropylene spacer was placed in the collars so that they would drop off in 1–3 years (Hellgren et al. 1988).

Trapping efforts were typically conducted from May through September. In 1986–87, snares were placed in areas where black bear captures were maximized on a defined study area of 214 km<sup>2</sup> (Thier 1990). Snares were placed over a broader area during 1989–94 to maximize grizzly bear captures. Trap sites were usually located within 200 m of an open road to allow vehicle access. Beginning in 1995, an effort was made to capture and re-collar known grizzly bears in the Yaak River and augmentation bears in the Cabinet Mountains. In 2003, trapping was initiated in the Salish Mountains south of Eureka, Montana to investigate bear movements in the intervening area between the Northern Continental Divide and Cabinet-Yaak recovery zones. Trapping was conducted along Highway 2 in northwest Montana and along Highway 3 in southeast British Columbia to collar bears with GPS radio collars during 2004–2010. During 2011, trapping was initiated along Highway 95 near McArthur Lake in northern Idaho and along Interstate 90 near Lookout Pass in Montana and Idaho. All 4 studies were designed to examine bear population connectivity across river valleys with highways and human habitation. Highway 2, 95, and I-90 studies utilized black bears as surrogates for grizzly bears because of the small number of grizzly bears in the valley. The Highway 3 effort in British Columbia collared grizzly bears and black bears. Much of the trapping effort in the Yaak and Cabinet Mountains areas involved the use of horses on backcountry trails and closed logging roads. Traps were checked daily. Bait consisted primarily of road-killed ungulates.

Trapping for population augmentation was conducted in the North Fork of the Flathead River in British Columbia during 1990–94. Only unmarked female grizzly bears < 6 years old (or prior to first reproduction) and > 35 kg were deemed suitable for transplant. All other captured grizzly bears were released with some collared to aid an ongoing bear study in British Columbia. Capture efforts for bears transplanted in 2005–11 occurred primarily in the North Fork and South Fork of the Flathead River in the US. No suitable bears were captured in 1992 or 2007.

### **Hair Sampling for DNA Analysis**

This project seeks evidence of grizzly bears in the Cabinet Mountains using DNA to understand the fates of 4 bears transplanted during 1990–94. The program used genetic information from a hair-snagging and remote-camera program to identify transplanted bears or their offspring living in the Cabinet Mountains. Project objectives include: a minimum estimate of the number of bears inhabiting the area, sex ratio of captured bears, and relatedness as well

as genetic diversity measures of captured bears. Population estimates utilizing capture-recapture techniques were not thought to be appropriate because expected sample sizes from the Cabinet Mountains population ( $n \leq 15$ ) would not likely provide population estimates with reasonable precision. Capture-recapture estimates would require at least 4 sessions of sampling the entire area, and sufficient funds were not available to implement this approach.

Sampling occurred from June–August of 2002–11 in the Cabinet-Yaak recovery zone in Idaho and Montana following standard hair snagging techniques (Woods *et al.* 1999). Sampling sites were established based on the location of previous sightings, sign, and radio telemetry from bears in the Cabinet Mountains. A 5 km x 5 km grid (25 km<sup>2</sup>) was used to distribute sample sites across the area in 2003 ( $n=184$ ). Each grid cell contained a single sample point near the center of the cell. Actual site location was modified on the basis of access to the site and habitat quality near the site. Sites were baited with 2 liters of a blood and fish mixture to attract bears across a barbwire perimeter placed to snag hair. Sites were deployed for 2 weeks prior to hair collection. One third of the sites were sampled during each of the months of June, July, and August. Sample sites were stratified by elevation with lowest elevation sites sampled in June and highest elevation sites sampled in August. Remote cameras were used at some sites. Hair was collected and labeled to indicate: the number and color of hairs collected, site location, date, and barb number. These data aided sorting hair to minimize lab costs. Samples collected as a part of this effort and other hair samples collected in the Cabinet Mountains in previous years that were either from known grizzly bears or samples that outwardly appeared to be grizzly bear were sent to the Wildlife Genetics International Laboratory in Nelson, British Columbia for DNA extraction and genotyping. Hairs visually identified as black bear hair by technicians at the Laboratory were not processed and hairs processed and determined to be black bear were not genotyped. Dr. Michael Proctor is a cooperator on this project and assisted with genetic interpretations. He has previously analyzed genetic samples from the Yaak portion of this recovery zone (Proctor 2003).

## **Radio Monitoring**

Attempts were made to obtain aerial radiolocations on all instrumented grizzly bears at least once each week during the 7–8 month period in which they were active. GPS collars attempted a location fix every hour and collars were retrieved in October. Augmentation bears were monitored daily following release for at least the first two weeks and usually three times per week following. In addition, efforts were made to obtain as many ground locations as possible on all bears, usually by triangulating from a vehicle. Life home ranges (minimum convex polygons; Hayne 1959) were calculated for grizzly bears during the study period. We generated home range polygons using the Hawth's Tools for ArcGIS (Beyer, H. L. 2004).

Grizzly and black bears were collared during 2004–10 with GPS collars to study movements across the Moyie River Valley and Highway 3 in British Columbia. Black bears were tested for their potential to act as surrogates that would predict grizzly bear movements. Collars attempted locations every 1–2 hours depending on configuration and data were stored within the collar. Collars were equipped with a release mechanism to allow them to be retrieved in October prior to denning. Weekly aircraft radio monitoring was conducted to check for mortality signals and approximate location. From 2004 to 2007, black bears were fitted with similar GPS radio collars to study movements across the Kootenai River Valley and Highway 2 in Montana, as part of linkage monitoring between the Yaak River and Cabinet Mountains. In 2008-2010, black bears were fitted with GPS collars in the Yaak River study area and along the Clark Fork River on the south end of the Cabinet Mountains study area.

## Berry Transects

Quantitative comparisons of annual fluctuations and site-specific influences on fruit production of huckleberry and buffaloberry were made using methods similar to those established in Glacier National Park (Kendall 1986). Transect line origins were marked by a painted tree or by surveyors' ribbon. A specific azimuth was followed from the origin through homogenous habitat. At 0.5 m intervals, a 0.04 m<sup>2</sup> frame (2 x 2 decimeter) was placed on the ground or held over shrubs and all fruits and pedicels within the perimeter of the frame were counted. If no portion of a plant was intercepted, the frame was advanced at 0.5 meter intervals and empty frames were counted. Fifty frames containing the desired species were counted on each transect. Timbered shrubfields and mixed shrub cutting units were the primary sampling areas to examine the influence of timber harvesting on berry production within a variety of aspects and elevations. Notes on berry phenology, berry size, and plant condition were recorded. Nineteen huckleberry and 5 buffaloberry transects were sampled from 1990–99, however, only 18 huckleberry transects were sampled in 2000. Two new transects were added in 2001, one was added in 2002, 2 were added in 2004, 7 were dropped in 2005, 2 were added in 2006, and 2 more were added in 2008 for a total of 18 sites. Some transects were eliminated because plant succession had affected production. Monitoring goals identified an annual trend of berry production and did not include documenting the effects of succession.

Due to the dioecious (separate male and female plants) nature of buffaloberry all frame count transects were dropped in 2007 in favor of marking 10 plants per site and counting the berries on the marked plants in order to be consistent with counts made from 1990 to 2003 on 5 plants per site. One new buffaloberry plot was established in both 2007 and 2008.

Serviceberry productivity was estimated by counting berries on 5 marked plants in 1990. In 1991 the number of marked plants sampled was increased to 10 at each site. Five serviceberry sites were sampled from 1990-96, and one site was added in 1997, and another was added in 2005. Six sites were sampled in 2007–11.

In 2001, three new plots were established to document berry production of mountain ash (*Sorbus scopulina*). Ten plants were permanently marked at each site, similar to the serviceberry plots. Counts at the same plots were recorded 2001–11.

Temperature and relative humidity data recorders (LogTag) were placed at sites in 2011. These devices record conditions at 90 minute intervals and will be retrieved, downloaded, and replaced at annual intervals.

## RESULTS AND DISCUSSION

### Grizzly Bear Observations and Recovery Plan Criteria

Grizzly bear observations and mortality from public and agency sightings or records were appended to databases. These databases include information from the U.S. and Canada. The file includes over 1,300 credible sightings, tracks, scats, digs, and hair dating from 1960 (Fig. 3) and 136 mortalities dating from 1949 (Appendix Table 1, Fig. 3). Credible sightings were those rating 4 or 5 on the 5 point scale (see page 8). Sixty-one instances of grizzly bear mortality were detected inside or within 16 km of the Cabinet-Yaak recovery zone (including Canada) during 1982-2011 (Table 1).

Fifty-four credible sightings were reported to this study that rated 4 or 5 (most credible) during 2011. Fifteen of these sightings occurred in the Yaak portion of the recovery zone and 17 sightings occurred in the Cabinet Mountains portion of the recovery zone. Twenty-two

sightings came from outside the recovery zone (Table 2 and Fig. 3).

Cubs are offspring in the first 12 months of life and yearlings are offspring in their second 12 months. The recovery plan (USFWS 1993) indicates that females with cub sightings within 10 miles of the recovery zone count toward recovery goals. One credible sighting of a female with cubs occurred during 2011 in BMU 5 (Tables 2, 3, 4, 5, Fig. 4). There appeared to be only 1 unduplicated female with cubs in the recovery area during 2011 and another female with cubs outside the recovery area. Three credible sightings of a female with yearlings or 2-year-olds occurred in BMUs 11, 13, and 17. Unduplicated sightings of females with cubs (excluding Canada) varied from 1–4 per year and averaged 2.5 per year from 2006–11 (Tables 3, 4). Recovery plan criteria require a running 6 year average of 6.0 females with cubs per year.

Twelve of 22 BMUs in the recovery zone had sightings of females with young (cubs, yearlings, or 2-year-olds) during 2006–11 (Figs. 4, 5, Table 6). Occupied BMUs were: 2, 3, 4, 5, 6, 7, 11, 13, 14, 16, 17, and 18. Recovery plan criteria indicate the need for 18 of 22 BMUs to be occupied. Sightings of females with young in BMUs 2, 3, 4, 5, 6, 7, and 18 were indicative of recent reproduction in the Cabinet Mountains.

Eight known or probable human caused mortalities of native grizzly bears have occurred in or within 10 miles of the CYGBRZ in the U.S. during 2006–11 (Table 1). Two additional mortalities of augmentation bears occurred south of the Clark Fork River. These two individuals were counted as mortalities when they were removed from the Northern Continental Divide Recovery Zone and are not counted again as mortalities in the CYGBRZ if they die. Mortalities in Canada are not counted toward recovery goals (USFWS 1993) even though bears initially marked within the recovery zone have died in Canada. Eight human caused mortalities include 2 females (BMUs 5 and 14), 5 males (BMUs 2, 10, 11, 12, 13), and one bear of unknown sex (BMU 22, to be determined by genetic analysis). Human caused mortalities during 2006–11 were one adult female (self-defense), 3 adult males (two illegal under investigation and a black bear mistaken identity), 2 subadult males (black bear mistaken identity and self-defense), and one subadult bear of unknown sex (illegal under investigation). Population levels were calculated by dividing observed females with cubs (7) minus any human-caused adult female mortality (1) from 2009–11 by 0.6 (sightability) then dividing by 0.284 (adult female proportion of population) as specified in the recovery plan (Tables 3, 4) (USFWS 1993). This resulted in a minimum population of 35 individuals. The recovery plan states; “any attempt to use this parameter to indicate trends or precise population size would be an invalid use of these data”. Applying the 4% mortality limit to the minimum calculated population resulted in a total mortality limit of 1.4 bears per year. The female limit is 0.4 females per year (30% of 1.4). Average annual human caused mortality for 2006–11 was 1.3 bears/year and 0.3 females/year (however, sex of one bear was not known at the time of this report). These preliminary mortality levels for total bears and females were within calculated limits during 2006–11, however it should be noted that the recovery plan established a goal of zero human-caused mortality for this recovery zone due to the initial low number of bears.

Table 1. Known and probable grizzly bear mortality in the Cabinet-Yaak recovery area and British Columbia, 1982–2011.

Mortality Date	Tag #	Sex	Age	Mortality Cause	Location	Open Road <500 m	Public Reported	Owner <sup>1</sup>
October, 1982	None	M	AD	Human, Poaching	Grouse Creek, ID	No	Yes	USFS
October, 1984	None	Unk	Unk	Human, Mistaken Identity, Black bear	Harvey Creek, ID	Yes	Yes	USFS
9/21/1985	14	M	AD	Human, Self Defense	Lyons Gulch, MT	No	Yes	USFS
7/14/1986	106 cub	Unk	Cub	Natural	Burnt Creek, MT	Unk	No	USFS

Mortality Date	Tag #	Sex	Age	Mortality Cause	Location	Open Road <500 m	Public Reported	Owner <sup>1</sup>
10/25/1987	None	F	Cub	Human, Mistaken Identity, Elk	Flattail Creek, MT	No	Yes	USFS
5/29/1988	134	M	AD	Human, Legal Hunter kill	Moyie River, BC	Yes	Yes	BC
10/31/1988	None	F	AD	Human, Self Defense	Seventeen Mile Creek, MT	No	Yes	USFS
7/6/1989	129	F	3	Human, Research	Burnt Creek, MT	Yes	No	USFS
1990	192	M	2	Human, Poaching	Poverty Creek, MT	Yes	Yes	USFS
1992	678	F	37	Unknown	Trail Creek, MT	No	Yes	USFS
7/22/1993	258 <sup>2</sup>	F	7	Natural	Libby Creek, MT	No	No	USFS
7/22/1993	258-cub	Unk	Cub	Natural	Libby Creek, MT	No	No	USFS
10/4/1995	None	M	AD	Human, Management	Ryan Creek, BC	Yes	Yes	PRIV
5/6/1996	302	M	3	Human, Under Investigation	Dodge Creek, MT	Yes	No	USFS
October, 1996	355	M	AD	Human, Under Investigation	Gold Creek, BC	Yes	No	BC
June? 1997	None	M	AD	Human, Poaching	Libby Creek, MT	Unk	Yes	PRIV
6/4/1999	106	F	21	Natural, Conspecific	Seventeen Mile Creek, MT	No	No	USFS
6/4/1999	106-cub	Unk	Cub	Natural, Conspecific	Seventeen Mile Creek, MT	No	No	USFS
6/4/1999	106-cub	Unk	Cub	Natural, Conspecific	Seventeen Mile Creek, MT	No	No	USFS
10/12/1999	596	F	2	Human, Self Defense	Hart Creek, BC	Yes	Yes	BC
11/15/1999	358	M	15	Human, Management	Yaak River, MT	Yes	Yes	PRIV
6/1/2000	538-cub	Unk	Cub	Natural	Hawkins Creek, BC	Unk	No	BC
6/1/2000	538-cub	Unk	Cub	Natural	Hawkins Creek, BC	Unk	No	BC
7/1/2000	303-cub	Unk	Cub	Natural	Fowler Creek, MT	Unk	No	USFS
11/15/2000	592	F	3	Human, Under Investigation	Pete Creek MT	Yes	No	USFS
5/5/2001	None	F	1	Human, Mistaken Identity, Black Bear	Spread Creek, MT	Yes	Yes	USFS
6/18/2001	538-cub	Unk	Cub	Natural	Cold Creek, BC	Unk	No	BC
6/18/2001	538-cub	Unk	Cub	Natural	Cold Creek, BC	Unk	No	BC
October, 2001	None	F	AD	Human, Train collision	Elk Creek, MT	Yes	Yes	MRL
6/24/2002	None	Unk	Unk	Human, Mistaken Identity, Hounds	Bloom Creek, BC	Yes	Yes	BC
7/1/2002	577	F	1	Natural	Marten Creek, MT	Yes	No	USFS
10/28/2002	None	F	4	Human, Under Investigation	Porcupine Creek, MT	Yes	Yes	USFS
11/18/2002	353/584	F	7	Human, Poaching	Yaak River, MT	Yes	Yes	PRIV
11/18/2002	None	F	Cub	Human, Poaching	Yaak River, MT	Yes	Yes	PRIV
11/18/2002	None	Unk	Cub	Human, Poaching	Yaak River, MT	Yes	No	PRIV
11/18/2002	None	Unk	Cub	Human, Poaching	Yaak River, MT	Yes	No	PRIV
10/15/2004	None	F	AD	Human, Management	Newgate, BC	Yes	Yes	PRIV
2005?	363	M	14	Human, Under Investigation	Curley Creek, MT	Yes	Yes	PRIV
5/15/2005	31	M	AD	Human, Legal Hunter Kill	Russell Creek, BC	Yes	Yes	BC
10/9/2005	694	F	2	Human, Under Investigation	Pipe Creek, MT	Yes	No	PCT
10/9/2005	None	F	2	Human, Train collision	Government Creek, MT	Yes	Yes	MRL
10/19/2005	668	M	3	Human, Mistaken Identity, Black bear	Yaak River, MT	Yes	Yes	PRIV
5/28/2006	None	F	4	Human, Research	Cold Creek, BC	Yes	No	BC
6/1/2006	292	F	5	Human, Management	Moyie River, BC	Yes	Yes	PRIV
9/22/2007	354	F	11	Human, Self Defense	Canuck Creek, MT	Yes	Yes	USFS
9/24/2008	?	Unk	3	Human, Under Investigation	Fishtrap Creek, MT	Yes	Yes	PCT
10/20/2008	790 <sup>2</sup>	F	3	Human, Poaching	Clark Fork River. MT	Yes	Yes	PRIV
10/20/2008	635 <sup>2</sup>	F	4	Human, Train collision	Clark Fork River. MT	Yes	Yes	MRL
11/15/2008	651	M	13	Human, Mistaken Identity, Wolf Trap	NF Yahk River, BC	Yes	Yes	BC
6/5/2009	675-cub	Unk	Cub	Natural	Copper Creek, ID	Unk	No	USFS
6/5/2009	675-cub	Unk	Cub	Natural	Copper Creek, ID	Unk	No	USFS
6/7/2009	None	M	3-4	Human, Mistaken Identity, Black bear	Bentley Creek, ID <sup>3</sup>	Yes	Yes	PRIV
11/1/2009	286	F	Adult	Human, Self Defense	EF Bull River, MT	No	Yes	USFS
6/25/2010	675-cub	Unk	Cub	Natural	American Creek, MT	Unk	No	USFS
9/6/2010	1374	M	2	Human, Under Investigation	Hawkins Creek, BC	Yes	No	BC
9/24/2010	None	M	2	Human, Wolf Trap, Selkirk Relocation	Cold Creek, BC	Yes	Yes	BC
10/11/2010	None	M	AD	Human, Under Investigation	Pine Creek, MT	No	Yes	USFS
2011?	None	Unk	Unk	Unknown	EF Rock Creek, MT	No	Yes	USFS

Mortality Date	Tag #	Sex	Age	Mortality Cause	Location	Open Road <500 m	Public Reported	Owner <sup>1</sup>
9/16/2011	None	M	AD	Human, Mistaken Identity	Faro Creek, MT	No	Yes	USFS
11/13/2011	799	M	4	Human, Mistaken Identity	Cherry Creek, MT	Yes	Yes	USFS
11/24/2011	732	M	3	Human, Defense of life	Pipe Creek, MT	Yes	Yes	PRIV
November 2011?	None	M	AD	Human, Under Investigation	Little Creek, MT	Yes	Yes	PRIV

<sup>1</sup>The recovery plan (USFWS 1993) specifies that human-caused mortality or female with young sightings from Canada will not be counted toward recovery goals in this recovery zone. BC – British Columbia, MRL – Montana Rail Link, PRIV – Individual Private, PCT – Plum Creek Timber Company, and USFS – U.S. Forest Service.

<sup>2</sup>Bears transplanted to the Cabinet Mountains under the population augmentation program were counted as mortalities in their place of origin and are not counted toward recovery goals in this recovery zone.

<sup>3</sup>Bear Killed more than 10 miles outside recovery zone in the US and not counted in recovery calculations.

Table 2. Credible grizzly bear sightings, credible female with young sightings, and known human caused mortality by bear management unit (BMU) or area, 2011.

BMU OR AREA	2011 Credible Grizzly Bear Sightings	2011 Sightings of Females with Cubs (Total)	2011 Sightings of Females with Cubs (Unduplicated)	2011 Sightings of Females with Yearlings or 2-year-olds (Total)	2011 Sightings of Females with Yearlings or 2 year-olds (unduplicated)	2011 Human Caused Mortality
1	1	0	0	0	0	0
2	4	0	0	0	0	1
3	1	0	0	0	0	0
5	7	1	1	0	0	0
6	3	0	0	0	0	0
10	1	0	0	0	0	0
11	4	0	0	1	1	1
13	3	0	0	1	0	1
14	3	0	0	0	0	0
15	1	0	0	0	0	0
16	1	0	0	0	0	0
17	2	0	0	1	0	0
18	1	0	0	0	0	0
Deer Ridge	1	0	0	0	0	0
Fisher	1	0	0	0	0	0
Tobacco	14	1	1	2	2	0
Troy	1	0	0	0	0	0
West Kootenai	5	0	0	1	0	1
2011 TOTAL	54	2	2	6	3	4

<sup>1</sup>Credible sightings are those rated 4 or 5 on a 5 point scale (see methods).

<sup>2</sup>Sightings may duplicate the same animal in different locations. Only the first sighting of a duplicated female with cubs is counted toward total females (Table 3), however subsequent sighting contribute toward occupancy (Table 8).

<sup>3</sup>Areas in Canada outside of Cabinet-Yaak recovery zone that do not count toward recovery goals.

<sup>4</sup>Areas with portions <16 km outside the Cabinet-Yaak recovery zone that count toward recovery goals.



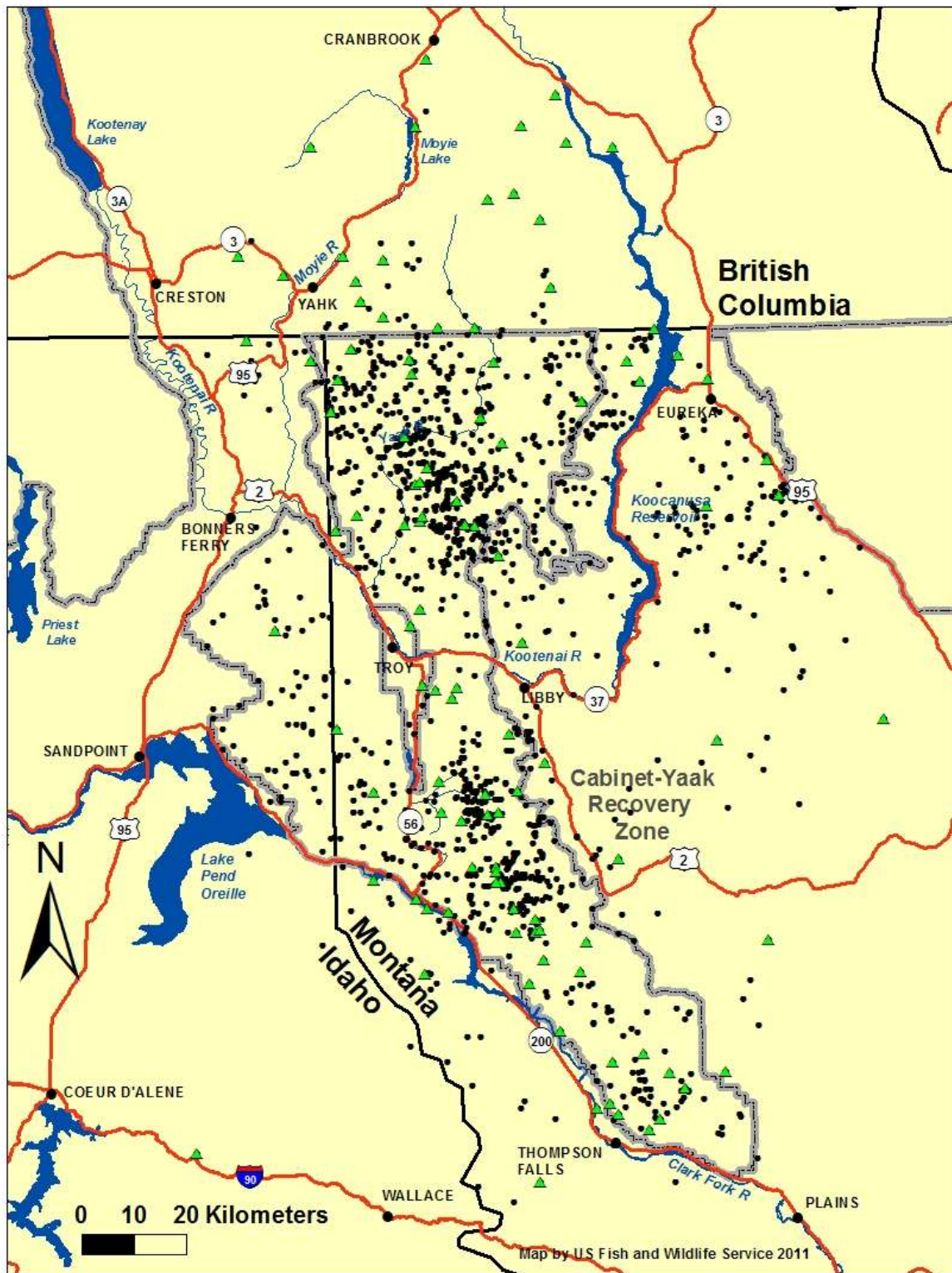


Figure 3. Grizzly bear observations (1959-2011, circles) and known or probable mortalities from all causes (1949-2011, triangles) in the Cabinet-Yaak recovery area.

Table 3. Status of the Cabinet-Yaak recovery zone during 2006-2011 in relation to the demographic recovery targets from the grizzly bear recovery plan (USFWS 1993).

Recovery Criteria	Target	2011
Females w/cubs (6-yr avg)	6	2.5 (15/6)
Human Caused Mortality limit (4% of minimum estimate)	1.4	1.3 (6 yr avg)
Female Human Caused mortality limit (30% of total mortality)	0.4	0.3 (6 yr avg)
Distribution of females w/young	18 of 22	12 of 22

Table 4. Annual Cabinet-Yaak recovery zone (excluding Canada) grizzly bear minimum unduplicated counts of females with cubs and known human-caused mortality, 1988-2011.

YEAR	ANNUAL FWC'S	ANNUAL HUMAN CAUSED ADULT FEMALE MORTALITY	ANNUAL HUMAN CAUSED ALL FEMALE MORTALITY	ANNUAL HUMAN CAUSED TOTAL MORTALITY	4% TOTAL HUMAN CAUSED MORTALITY LIMIT <sup>1</sup>	30% ALL FEMALE HUMAN CAUSED MORTALITY LIMIT <sup>1</sup>	TOTAL HUMAN CAUSED MORTALITY 6 YEAR AVERAGE	FEMALE HUMAN CAUSED MORTALITY 6 YEAR AVERAGE
1988	1	1	1	1	0	0		
1989	0	0	1	1	0	0		
1990	1	0	0	1	0	0		
1991	1	0	0	0	0	0		
1992	1	0	0	0	0	0		
1993	2	0	0	0	0.9	0.3	0.5	0.3
1994	1	0	0	0	0.9	0.3	0.3	0.2
1995	1	0	0	0	0.9	0.3	0.2	0
1996	1	0	0	1	0.7	0.2	0.2	0
1997	3	0	0	1	1.2	0.4	0.3	0
1998	0	0	0	0	0.9	0.3	0.3	0
1999	0	0	0	1	0.7	0.2	0.5	0
2000	2	0	1	1	0.5	0.1	0.7	0.2
2001	1	1	2	2	0.5	0.1	1.0	0.5
2002	4	1	4	5	1.2	0.4	1.7	1.2
2003	2	0	0	0	1.2	0.4	1.5	1.2
2004	1	0	0	0	1.4	0.4	1.5	1.2
2005	1	0	2	4	0.9	0.3	2.0	1.5
2006	1	0	0	0	0.7	0.2	1.8	1.3
2007	4	1	1	1	1.2	0.4	1.7	1.2
2008	3	0	0	1 <sup>2</sup>	1.6	0.5	1.0	0.5
2009	2	1	1	1	1.6	0.5	1.2	0.7
2010	4	0	0	1	1.9	0.6	1.3	0.7
2011	1	0	0	4	1.4	0.4	1.3	0.3

<sup>1</sup> Presently grizzly bear numbers are so small in this ecosystem that the mortality goal shall be zero known human-caused mortality.

<sup>2</sup> The sex of this mortality was not known at the time of this report.

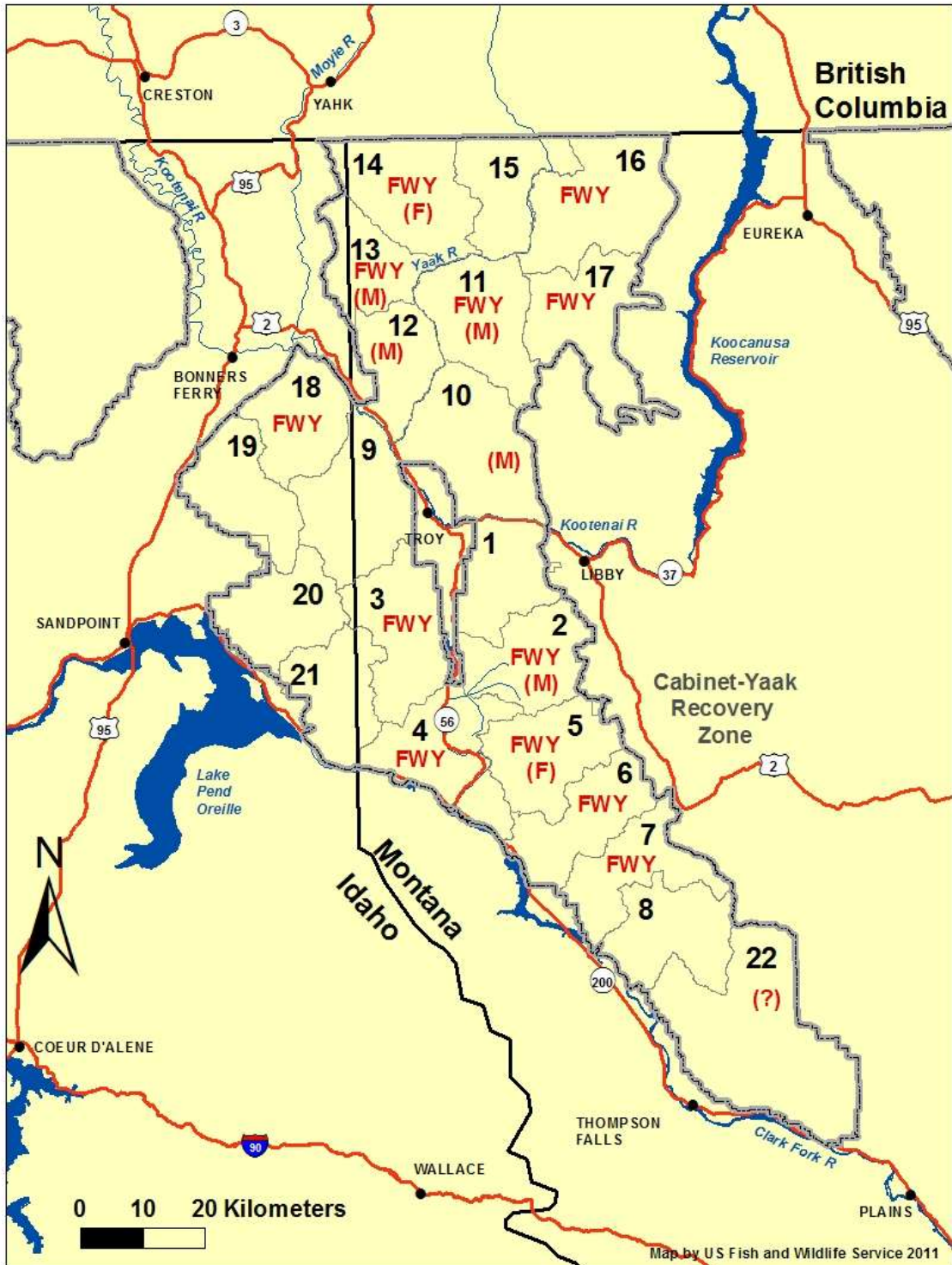


Figure 4. Female with young occupancy and known or probable mortality within Bear Management Units (BMUs) in the Cabinet-Yaak recovery zone 2006-2011. (FWY indicates occupancy of a female with young, sex of any mortality is indicated in parentheses, and “?” indicates a mortality of yet to be determined sex).

Table 5. Credible observations of females with young in or within 10 miles of the Cabinet-Yaak recovery zone, 1988-2011. Other credible observations from Canada shown in parentheses.

Year	Total credible sightings females with young	Unduplicated females with cubs	Unduplicated females with yearlings or 2-year-olds	Minimum probable adult females
1990	9	1	2	3
1991	4	1	1	2
1992	8	1	5	6
1993	6	2	1	3
1994	5	1	2	3
1995	8	1	2	3
1996	5	1	1	2
1997	14 (1)	3	4	7
1998	6 (1)	0	2 (1)	2 (1)
1999	2	0	2	2
2000	6 (1)	2 (1)	1	3 (1)
2001	5 (2)	1 (1)	3	4 (1)
2002	10 (1)	4 (1)	1	5 (1)
2003	11	2	4	6
2004	11	1	4	5
2005	10 (1)	1	4 (1)	5 (1)
2006	7 (1)	2 (1)	2	4 (1)
2007	17	4	2	6
2008	7 (1)	3 (1)	3	6 (1)
2009	5 (0)	2 (0)	2 (0)	4 (0)
2010	14 (0)	4 (0)	2 (0)	6 (0)
2011	4 (0)	1 (0)	1 (0)	2 (0)

<sup>1</sup>Credible sightings are those rated 4 or 5 on a 5 point scale (see page 8).

Table 6. Occupancy of bear management units by grizzly bear females with young in the Cabinet-Yaak recovery zone 1990-2011.

BMU	1990	1991	1992	1993	1988	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
1 CEDAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
2 SNOWSHOE	Yes	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	Yes	No	No	No	No	No
3 SPAR	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	Yes	No
4 BULL	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	Yes	No	Yes	No	No	No	No	No
5 ST. PAUL	No	No	No	Yes	No	No	No	No	No	No	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
6 WANLESS	No	No	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes	No	Yes	No	No	No	No
7 SILVER BUTTE	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No
8 VERMILION	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
9 CALLAHAN	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
10 PULPIT	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
11 RODERICK	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	No	Yes	Yes
12 NEWTON	Yes	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No
13 KENO	No	No	Yes	No	No	No	No	Yes	No	No	No	No	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes
14 NORTHWEST PEAK	Yes	No	Yes	No	No	Yes	Yes	No	Yes	No	No	No	No	Yes	No	No	No	No	Yes	No	Yes	Yes	No
15 GARVER	Yes	No	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	No	Yes	No	No	No	No	No	No	No	No	No
16 EAST FORK YAAK	No	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No
17 BIG CREEK	No	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	Yes	Yes
18 BOULDER	No	No	No	No	No	No	No	No	No	No	No	No	No	No	Yes	No	No	No	No	Yes	No	No	No
19 GROUSE	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
20 NORTH LIGHTNING	No	No	Yes	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
21 SCOTCHMAN	No	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Yes	No	No	No	No	No	No	No	No
22 MT HEADLEY	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No

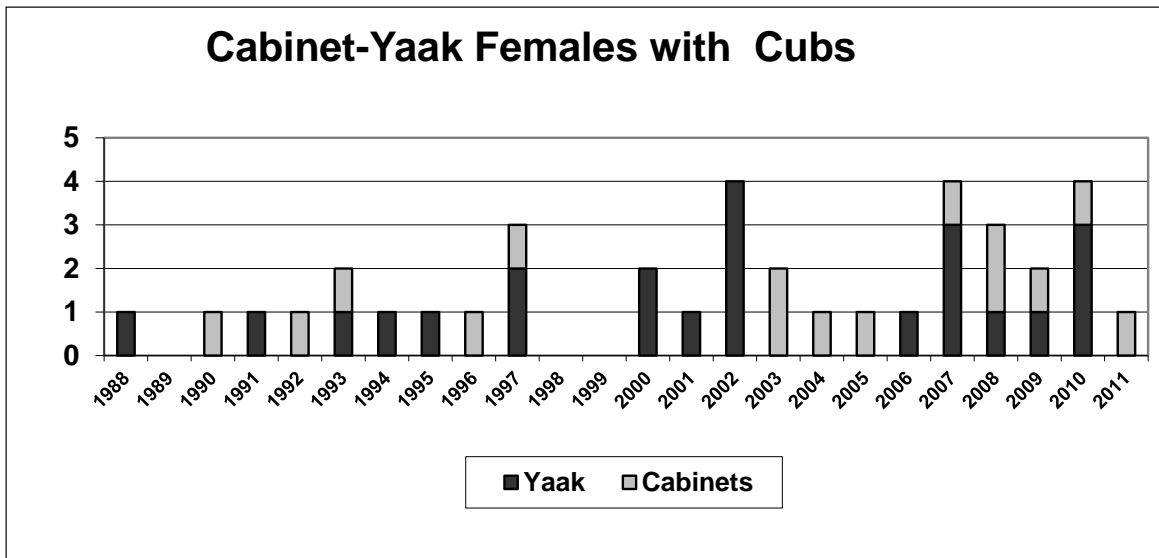


Figure 5. Credible observations of females with cubs in or within 10 miles of the Cabinet-Yaak recovery zone (excluding Canada), 1988–11. Credible sightings are those rated 4 or 5 on a 5 point scale (Methods).

### Grizzly Bear Minimum Numbers

Captures, genotypes from hair or tissue, and observations of grizzly bears by study personnel in the Yaak study area were examined to evaluate minimum population size during 1986–2011. Individuals not radio-collared or genotyped were conservatively separated by size, age, location, coloration, genetic information, or reproductive status. Conservative classification of sightings may result in unique individuals being documented as one individual. In addition, new information may result in changes in individual status or relationships.

Ninety-three individuals were identified in the Yaak River portion of the study area with 72 bears captured or genotyped and 21 unmarked individuals observed from 1986 to 2011 (Table 7). Forty-six of these animals are known or suspected to have died. Human causes were linked to 30 of these mortalities. Fourteen are believed to have died of natural causes. Seven of these 14 mortalities involved cubs. Two mortalities were from unknown causes. Two bears were known to have left the population with one going north of Highway 3 into the Purcell Mountains and one going to the Selkirk Mountains.

Total Yaak River animals identified during 1986–2011 (93 bears), less known mortality (46) and emigration (2) would leave at least 45 animals. It is unlikely that all identified animals have survived the entire 24 year period. However choosing a time period for counting the minimum number of animals may lead to biases in the estimate. A long time period may count bears that have not survived. A short time frame may miss some bears that have survived. A six year period was calculated because it is the same as that used in the Grizzly Bear Recovery Plan (USFWS 1993). Using only animals identified during 2006–2011 (35) less known mortality and emigration (14) suggests a population of at least 21. Using a 10 year calculation, animals identified during 2002–2011 (56) less known mortality (24) suggests a population of at least 32. These estimates may be liberal because they assume all other bears not known to be dead have survived the entire period. These estimates may also be conservative because study personnel observations alone would not likely sample all bears in the area, some sightings

classified as the same animal may represent different animals, and the study has received several credible public reports of additional bears not included in this analysis. Since 2002 there have been credible sightings of bears in all 8 BMUs that make up the Yaak portion of the recovery area, with sightings of females with young in 7 BMUs.

Similar observations, captures, and genetic information from the Cabinet Mountains were collected and summarized for the 1983–2011 time period (Table 8). Using the same calculations as with the Yaak study area, total animals identified between 1983 and 2011 (43), less known mortality and emigration (16) would leave at least 27 animals. Using only animals identified during the 2006-2011 time period (30) less known mortality (5) and bears that left the recovery area (4) suggest a population of at least 21. Using a 10 year calculation, animals identified during 2002-2011 (34) less known mortality (7) and bears that left the recovery area (4) suggest a population of at least 23. The same limitations identified with the Yaak study area minimum estimates also apply to these numbers. The population was augmented with 10 females since 1990, credible sightings of individual bears have occurred in 13 of 14 BMUs in the Cabinet Mountains since 2002, and sightings of females with young occurred in 8 of 14 BMUs since 2002.

The Cabinet Mountains population was estimated to be 15 bears or fewer in 1988 (Kasworm and Manley 1988). However the lack of native bears identified since 1989 suggests that the population may have been well below the level of 15 individuals. Only 7 genotyped bears not known to be augmentation bears or their offspring have been identified in the Cabinet Mountains since 1989. Of these 7, 3 are known to be dead. Twenty-six of 32 bears genotyped since 2002 are known to be augmentation bears or their offspring. The augmentation effort appears to be the primary reason that grizzly bears remain in the Cabinet Mountains.

Table 7. Grizzly bears captured, observed, photographed, or genotyped by study personnel in the Yaak study, 1986-2011.

Bear <sup>1</sup>	Sex	Years detected	Comments
?	?	1986	Born 1986. Natural mortality 1986.
?	?	1986	Born 1986. Natural mortality 1986.
Gt 106	F	1986-1999	Born 1978. Monitored 1986-99. Natural mortality 17-mile Cr. 1999.
101	M	1986-87	Born 1978. Monitored 1986-87.
Gt 129	F	1986-89,	Born 1986. Monitored 1986-89. Trap predation mortality Burnt Cr. 1989.
Gt Unk 3	F	1987,	1987 offspring 25. Cub female Mis-ID mortality 17-mile Cr. 1987
134	M	1987-88	Born 1978. Monitored 1987-88. BC hunting mortality Moyie R. 1988.
Gt 128	M	1987-92, 1997, 2001	Born 1983. Monitored 1987-92 and 1997. Natural Mortality 2001 East of Koocanusa.???
Gt 25	F	1988,	Self Defense Adult female mortality 1988. 17 mile Cr.
Gt 193	M	1988-1990	1988 offspring 106. Monitored 1988-90.
192	M	1988-1990	1988 offspring 106. Monitored 1988-90. Poaching mortality 1990.
Gt 206	F	1988-95, 1997	1988 offspring 106. Monitored 1988-95. Observed 1997.
Gt UNK 22	M	1991,	DNA 1991, 17-mile Creek.
Gt R178	M	1991-92, 2001	1991 offspring 106. Monitored 1991-92. DNA Ryan Cr., BC 2001
?	?	1991-92	1991 offspring 106. Monitored 1991-92.
Gt 244	M	1992-94, 2003-04	Born 1986. Monitored 1992-94 & 2003-04.
34	F	1993,	Transplanted to Bloom Cr. by BC 1993, captured in US 1993.
Gt 355	M	1993, 1996	Born 1990? Monitored 1996. Human, under investigation mortality 1996.
Gt 358	M	1993, 1996-99	Born 1988. Possible 1993 consort of 206. Monitored 1996-98. Management removal mortality 1999.
302	M	1993-96	Born 1993. Offspring of 106. Monitored 1993-96. Human under investigation mortality 1996.
Gt 303	F	1993-96, 1998-01, 2003, 2007, 2010-11	1993 offspring 106. Monitored 1994-96, 1998-01. Observe 2003?. 2 cubs Roderick 2007? 3 cubs EF Pipe Cr. 2010-11.

Bear <sup>1</sup>	Sex	Years detected	Comments
?	F	1994, 1998	Unmarked female consort of 244 and 363.
?	?	1994-95, 1998	1994 offspring 206, sibling of bear 505. Monitored 1994-95, Observed 1998?
505	F	1994-95, 1998	1994 offspring 206. Monitored 1994-95. Observed 1998?
Gt 353	F	1995-1999, 2002	1995 offspring 106. Monitored 1995-97, 2002. Observed 1998-99. Poaching mortality 2002.
Gt 354	F	1995-99, 2007	1995 offspring 106. Monitored 1995-99. Self-defense mortality 2007.
Gt 342	M	1996-99, 2002-04, 2011	Born 1992. Monitored 1996-99 & 2003-04. DNA 2002. DNA 2011
Gt 363	M	1996-99, 2005	Born 1992. Monitored 1996-99. DNA 2005. Human under investigation mortality Curley Cr. 2005?
?	?	1997	Born 1997. Offspring of 206.
?	?	1997	Born 1997. Offspring of 206.
Gt 68853	F	1997	1997 mortality, Wardner, BC Management removal.
Gt 72832	M	1997	1998 mortality, Mayook, BC Unknown.
Gt 384	M	1997,	Born 1990. Monitored 1997.
Gt 596	F	1997, 1999	1997 offspring of 206. Monitored 1999. Self-defense mortality 1999.
Gt 538	F	1997-02	Born 1991. Monitored 1997-02.
Gt 386	M	1997-98, 2000-01, 2005	Born 1992. Monitored 1997-98. Possibly consort of 538 in 2000, 2001. DNA 2005.
Gt 592	F	1998, 1999-00	1997 offspring of 206. Monitored 1999. DNA 1999. Human under investigation mortality 2000.
Gt UNK 55	F	1999	1997 offspring of 538. Monitored 1997-98. Found skull 1999 site of 386 lost radio collar Moyie R., BC.
Gt 106 cub 1	M	1999,	1999 offspring 106. Natural Mortality 1999.
Gt 106 cub 2	F	1999,	Born 1999. Offspring bear 106. Natural Mortality 1999.
?	?	2000,	2000 offspring 538. Natural Mortality 2000.
?	?	2000,	2000 offspring 538. Natural Mortality 2000.
?	?	2000,	2000 offspring 303. Natural Mortality 2000.
Gt 552	F	2000-01, 2011	2000 offspring 303. Monitor 2000-01. DNA 2011 Mt Henryw/young
?	?	2001,	2001 offspring 538. Natural Mortality 2001.
?	?	2001,	2001 offspring 538. Natural Mortality 2001.
Gt UNK 37	F	2001,	2000 offspring 354. Unmarked yearling mistaken identity mortality Spread Cr., 2001
Gt M-0235	F	2002	DNA 2002. NF Sullivan Cr. Human under investigation mortality Porcupine Cr. 2002.
Gt 7434	F	2002	DNA 2002. Pete Cr.
Gt 688	?	2002, 2005-06	2002 offspring 538. Crossed Highway 3 to North. Monitored 2005-06.
Gt 10165b	F	2005, 2006	2002 offspring 538, DNA 2004-05, Norge, Malpass, Spruce Cr. BC trap predation mortality 2006.
?	?	2002,	2002 offspring 353. Assumed Human mortality 2002.
?	?	2002,	2002 offspring 353. Assumed Human mortality 2002.
Gt UNK 43	F	2002,	2002 offspring 353. Poaching mortality 2002.
Gt 651	M	2002, 2005-06, 2008	Born 1995. Monitored 2002 and 2005-06. Mortality 2008.
Gt 787	M	2002-04	2000 offspring 354. DNA 2002 4th July Cr. Radio collared 2003-04.
Gt 576	M	2004-06	Born 2002. Monitored 2004-06. DNA 2005.
Gt 675	F	2004-11	Born 2002. Monitored 2004-10. Lost 2 cubs in 2009. Lost 1 cub 2010. DNA 2011 Canuck
?	F	2004	Management capture and removal 2004 Newgate Cr., BC.
Gt 10252c	F	2005	DNA 2005, Teepee Cr., BC
Gt 10252b	M	2005	DNA 2005, Teepee Cr., BC
Gt 10303g	M	2005	DNA 2005, Teepee Cr., BC
Gt M1	M	2005	2003 offspring 303. Monitored 2005 Pipe Cr. Relocated NW Peak. Lost contact.
Gt 677	M	2005,	Born 1999. Monitored 2005.
Gt 694	F	2005,	2003 offspring 303. Monitored 2005. Human under investigation mortality 2005.
Gt 17	M	2005,	Born 1997. DNA 2002 Solo Joe Cr. Monitored 2005.
Gt 668	M	2005,	Born 2002. Monitored 2005.
Gt 31	M	2005	Immigrant from Selkirk Mts. Hunter harvest 2005. Russell Cr., BC.
Gt 292	F	2005-06	Born 2001. Monitored 2005. Human Mortality 2006.
Gt 103	M	2006,	Born 2003. Monitored 2006. Went to Selkirk Mts 2006
Gt Y10165F	F	2006	Born 2002. Research mortality 2006, Cold Cr., BC.

Bear <sup>1</sup>	Sex	Years detected	Comments
5381	M	2006,2009-10	Born 2002. Monitored 2006,2009-10
Gt 200730	F	2007, 2008	Offspring 354. DNA 2007. Meadow Cr. Female with yearling track 2008.
?	?	2007,	Born 2007. Cub of 303, Roderick Mt. and EF Pipe Cr. 2007
Gt 731	F	2007, 2010, 2011	Born 2007. Cub of 303, Roderick Mt. and EF Pipe Cr. 2007. Collared 2009-11. DNA 2011-Dutch
Gt 785	F	2007-08	2006 offspring 354. Radio collared 2007-08
Gt 784	F	2007-09	2006 offspring 354. Radio collared 2007-09
?	?	2009	Born 2009. Offspring of 675. Natural mortality 2009.
?	?	2009	Born 2009. Offspring of 675. Natural mortality 2009.
Gt UNK 83	M	2009, 2011	DNA 2009 Flattail Cr, Collared 2011
Gt 737	M	2010-11	Monitored 2010-11
?	?	2010	Born 2010. Offspring of 675. Natural mortality 2010.
Gt 1374	M	2010	Monitored 2010. Human under investigation mortality Hawkins Cr. 2010
Gt Unk 107	M	2010	Human under investigation mortality Newton Mtn 2010.
?	?	2010	Born 2010. EF Pipe cubs offspring 303?. Natural mortality 2010.
Gt 729	?	2010-11	Born 2010. EF Pipe cubs offspring 303?
?	?	2010	Born 2010. EF Pipe cubs offspring 303?
Gt 732	M	2011	Born 2006. Management capture 2011. Self-defense mortality 2011 Pipe Cr.
Gt 2011038306	M	2011	DNA/Photo 2011 Copper Cr.
Gt2011038311	F	2011	Offspring 354. DNA/Photo 2011 Copper Cr.
Gt2011049118	M	2011	DNA 2011 Mt Henry offspring 552
Gt2011049122	F	2011	DNA 2011 Mt Henry offspring 552
Gt 200354a	M	2011	DNA 2011 Faro Cr mortality
Unk 123	M	2011	DNA 2011 Flagstaff

<sup>1</sup>Entires with numbers indicate bears captured and tagged. Entries with Gt signify a genotype obtained from hair.

Table 8. Grizzly bears captured, observed, photographed, or genotyped by study personnel in the Cabinet Mountains, 1983-2011.

Bear <sup>1</sup>	Sex	Years detected	Comments
Gt 678	F	1983-89, 1993	Born 1955. Collared in Cabinets 1983-89. Unknown cause mortality Barea Cr. 1993.
Gt 680	M	1984-86	Born. 1973. Collared in Cabinets 1984-85. Observed 1986.
Gt 14	M	1985,	Born 1959. Collared in Cabinets 1985. Self-defense mortality 1985.
218	F	1990-92	Born 1985. Augmentation, monitored 1990-91. Observed 1992.
Gt 258	F	1992-93	Born 1986. Augmentation, monitored 1992-93. Produced cub 1993. Natural mortality 1993.
?	?	1993	Born 1993. Offspring of 258. Probable natural mortality 1993.
Gt 286	F	1993-95, 2002, 2005, 2009	Born 1991. Augmentation, monitored 1993-95. DNA 2005. Self-defense mortality 2009.
311	F	1994-95	Born 1991. Augmentation, monitored 1994-95.
Gt UNK 39	M	1997,	Claws from Double N Lake Human under investigation mortality 1997.
Gt 770	M	2000, 2002, 2005-11	Born 1994. Photo 2002? Collared 2005-06. DNA 2000, 2005-11
Gt UNK 38	F	2001,	Adult female train mortality 2001.
Gt 2024	F	2001-02, 2007, 2011	Born 1997? Sibling 772. DNA 2001-02, 2007, 2011-W Fisher
Gt 577	F	2002,	Born 2001. Natural mortality 2002. Sibling 578 and 579.
Gt 578	M	2002,	Born 2001. Sibling 577 and 579.
Gt 579	M	2002-03	Born 2001. Sibling 577 and 578. Observed 2003.
Gt 200618415	M	2006	DNA 2006.
Gt 780	M	2002, 2006-08, 2010-11	Born 2000. Adult male collared 2006-08. DNA 2002, 2010-11
Gt 772	F	2002-03, 2007-08.	Born 1997. Sibling 2024118. DNA 2002-03, 2007. Collared 2007 with 2 cubs. Observed 2008.
Gt 403	M	2004, 2007	Born 2004. At least 1 cub photographed with adult female. Mortality 2007 in NCDE.
Gt 3119	?	2003-05	Born 2003. Train mortality 2005.
Gt A1	F	2005-08	Born 1997? Augmentation monitored 2005-07. Observe with 780 2008?
Gt 782	F	2006-08	Born 2004. Augmentation monitored 2006-08. DNA 2008.
Gt 200721009	M	2007, 2010-11	Born 2007. DNA 2007,2 011. Monitor 2010-11 as 799. Mortality 2011.



Bear <sup>1</sup>	Sex	Years detected	Comments
Gt 200721053	F	2007, 2011	Born 2007. DNA 2007, 2011
Gt 789	F	2007, 2008	Born 2007. Marked 2007. DNA 2007. Observed 2008.
Gt 791	M	2007, 2008	Born 2007. Marked 2007. DNA 2007. Observed 2008.
?	?	2008	Born 2005. Human under investigation mortality 2008. Fishtrap Cr.
Gt 790	F	2008,	Born 2005. Augmentation monitored 2008. Poaching mortality 2008 at Noxon residence.
Gt 635	F	2008,	Born 2004. Augmentation monitored 2008. Train mortality 2008 at Noxon
Gt 715	F	2009-10	Born 1998? Augmentation monitored 2009. Returned to Flathead 2010.
Gt 2009001005	F	2009-10	Born 2008. Yearling offspring of 286, DNA and Photo 2009, DNA and Photo 2010-W Fisher
Gt 2009001002	F	2009, 2011	Born 2008. Yearling offspring of 286, DNA and Photo 2009, 2011-Bear
Gt 26D02a	M	2009, 2011	Scat located by Wasser dogs DNA 2009. Possible cub photo with 286 in 2005. DNA 2011.
Gt 713	M	2010-11	Monitored 2010-11, Augmentation. DNA 2011
Gt 714	F	2010	Monitored 2010, Augmentation. Returned to Flathead 2010.
Gt 2010011328	F	2010	Born 2010, DNA and photo Rock Cr. 2010
Gt 2010011205	F	2010	Adult 2010, DNA and photo Rock Cr. 2010
Gt 2010011131	M	2010	Born 2010, DNA and photo Rock Cr. 2010
?	?	2011	Unknown cause mortality 2011. Rock Lake.
Gt 2011092001	F	2011	DNA 2011 Chippewa Cr.
GB 724	M	2011	Management 2011
GB725	F	2011	Augmentation 2011, returned to Flathead
GB 723	M	2011	Augmentation 2011

<sup>1</sup>Entires with numbers indicate bears captured and tagged. Entries with Gt signify a genotype obtained from hair.

## Cabinet Mountains Population Augmentation

From 1990-94 four female grizzly bears were captured in the Flathead River Valley of British Columbia and released in the Cabinet Mountains to augment the existing population (Table 9). Twenty-two different grizzly bears were captured during 840 trap-nights, to obtain the 4 subadult females transplanted. Capture rates were 1 grizzly bear/38 trap-nights, and 1 suitable subadult female/210 trap-nights. One of the transplanted bears and her cub died of unknown causes a year after release (Kasworm et al. 1998). The remaining three bears were monitored until their collars fell off. The program was designed to determine if transplanted bears would remain in the target area and ultimately contribute to the population through reproduction. Three of four transplanted bears remained within the target area for more than one year. Though one of the transplanted bears produced a cub, the animal had likely bred prior to translocation and did not satisfy our criteria for reproduction with native males.

In 2005 the augmentation program was reinitiated by Montana Dept. of Fish, Wildlife and Parks personnel. During 2005-11, 7 female and 2 male grizzly bears have been released in the Cabinet Mountains (Table 9). Of 13 bears released through 2011, 4 are known to have left the target area (one was recaptured and returned), two were killed within 4 months of release, and one was killed 16 years after release. One animal is known to have produced at least 9 first generation offspring 8 second generation offspring. A short history of these bears follows later in this report.

Table 9. Sex, age, capture date, capture location, release location, and fate of augmentation grizzly bears moved to the Cabinet Mountains, 1990-2011.

Bear	Sex	Age	Capture date	Capture Location	Cabinet Mtns Release Location	Fate
218	F	5	7/21/1990	NF Flathead R, BC	EF Bull River	Dennded in Cabinet Mtns 1990, Lost collar August, 1991, observed July 1992
258	F	6	7/21/1992	NF Flathead R, BC	EF Bull River	Dennded in Cabinet Mtns 1992 Produce 1 cub 1992, Natural mortality July 1993
286	F	2	7/14/1993	NF Flathead R, BC	EF Bull River	Dennded in Cabinet Mtns 1993-95, Lost collar at den April 1995, hair snag 2004-2009, self-defense mortality November 2009
311	F	3	7/12/1994	NF Flathead R, BC	EF Bull River	Lost collar July 1994, recaptured October 1995 south of Eureka, MT, released in EF Bull River, Signal lost November 1995
A1	F	7-8	9/30/2005	NF Flathead R, MT	Spar Lake	Dennded West Cabinet Mountains 2005 and 2006, Lost collar September 2007
782	F	2	8/17/2006	SF Flathead R, MT	Spar Lake	Dennded West Cabinet Mountains 2006-07, Lost collar August 2008
635	F	4	7/23/2008	Stillwater R, MT	EF Bull River	Killed by train near Heron, MT October, 2008
790	F	3	8/7/2008	Swan R, MT	EF Bull River	Illegally killed near Noxon, MT October, 2008
715	F	10	9/17/2009	NF Flathead R, MT	Spar Lake	Dennded in West Cabinet Mountains 2009-10, returned to NF Flathead R, May 2010
713	M	5	7/18/2010	NF Flathead R, MT	Spar Lake	Dennded in Cabinet Mountains 2010, Lost collar September 2011
714	F	4	7/24/2010	NF Flathead R, MT	Silverbutte Cr	Returned to NF Flathead July 2010
725	F	2	7/25/2011	MF Flathead R, MT	Spar Lake	Returned to Glacier National Park, September 2011
723	M	2	8/18/2011	Stillwater R, MT	Spar Lake	Dennded in Cabinet Mountains 2011

### Cabinet-Yaak Hair Sampling and DNA Analysis

Hair snag sampling occurred at barb wire corrals baited with a scent lure during 2000–2011 (Table 10 and Fig. 6). Sampling occurred from May through October, but varied within years. Sites were selected based on previous grizzly bear telemetry, sightings, and access. Remote cameras supplemented hair snagging at numerous sites and were useful in identifying family groupings and approximate ages of sampled bears.

In 2002 study personnel also assisted with an MDFWP black bear population hair snag estimate that sampled 285 sites in the Yaak River portion of the study area. During 2003, 184 sites on a 5 km<sup>2</sup> grid were sampled on approximately 4,300 km<sup>2</sup> in the Cabinet Mountains portion of the recovery zone. In 2009, 98 sites were sampled south of the Clark Fork River. Other years had much lower numbers of sampled sites.

Eight hundred and thirty-two sites were sampled with this technique from 2000–2011 (Table 10 and Fig. 6). These 32 sites provided grizzly bear hair from 33 individuals identified. Numerous other hair or tissue samples were collected from mortalities, captured native bears, captured bears transplanted to the Cabinet Mountains, or opportunistically collected field samples from signs, bridges, or trees during 1983-2010.

Table 10. Grizzly bear hair snagging sites and success in the Cabinet-Yaak study area, 2000–2011.

Year	Number of sites	Sites with grizzly bear pictures	Sites with grizzly bear hair	Individual grizzly bear genotypes	Locations with grizzly bear pictures or hair	Comments
2000	1	0	0	0		
2001	3	0	0	0		
2002	319	4	7	6	MF Bull R., W Fisher Cr., EF Rock Cr., NF Big Cr., NF Sullivan, Pete Cr., 4 <sup>th</sup> July Cr., Spread Cr., Solo Joe Cr.	
2003	184	1	1	1	WF Rock Cr., W Fisher Cr.	
2004	14	1	2	3	EF Bull R., EF Rock Cr.	
2005	17	2	1	1	EF Bull R., Libby Cr.	
2006	19	1	3	3	Cub Cr., Silverbutte Cr., Bear Cr., and EF Rock Cr.	
2007	36	4	4	9	Devils Club Cr., EF Rock Cr., Bear Cr., W F Rock Cr., W Fisher Cr., Pete Cr., NF Meadow Cr.	Female with young EF Rock Cr., Female with young WF Rock Cr.
2008	21	1	1	1	EF Bull R.	
2009	122	4	2	4	Bear Cr., Libby Cr., NF Callahan Cr., W Fisher Cr.	Female with young Bear Cr.
2010	24	4	3	5	EF Rock Cr., W Fisher Cr., Cub Cr., Drift Cr.	Female with young EF Rock Cr.
2011	72	8	8	13	EF Rock Cr., Bear Cr., W Fisher Cr., NF 17-mile Cr., Spruce Cr., Hensley Cr., Chippewa Cr., Solo Joe Cr.	Siblings Spruce Cr., Female with young Solo Joe Cr.
Total	832	30	32	33 <sup>1</sup>		

<sup>1</sup>Some individuals captured multiple times among years.

All samples from the Cabinet Mountains (1983-2011) were analyzed and determined to originate from 34 different grizzly bears. Three of these were from captures during 1983–1988, 9 were from augmentation bears during 1990–2010, and 22 from captures, mortalities, or hair snagging during 1997–2010. Hair snagging techniques identified 17 genotypes from 2000–2010. One of these genotypes was from grizzly bear 286. She was released in the Cabinet Mountains as part of population augmentation in 1993 (Kasworm et al. 2007). She was 2 years old at the time of her release and would have been 13 years-old when the first hair sample was obtained during 2004. Pedigree analysis indicates that bear 286 has produced at least 7 (possibly 8) first generation offspring and 8 second generation offspring. Three of those first generation offspring are adult females that have also reproduced (Fig. 7) The female grizzly bear with 2 cubs captured near Noxon in 2007 (bear 772) was determined to be the offspring of bear 286 by the genetic analysis. Bear 286 was killed in a self-defense incident with a hunter in November of 2009.

In 1993, claws from a grizzly bear were discovered in Baree Creek of the Cabinet Mountains. Analysis of DNA from these claws matched bear 678 originally captured in the Cabinet Mountains in 1983 when 28 years-old. Tissue present on the claws suggested that she died no earlier than 1992. Bear 678 would have been at least 37 years old at the estimated time of death. Pedigree analysis also indicated that the 3 bears captured in the Cabinet Mountains from 1983-1988 were a triad with bear 680 being the offspring of bears 678 and 14. All genetic samples from this study will undergo parentage analysis. We expect to be able to identify numerous additional mother – father – offspring triads with this information.

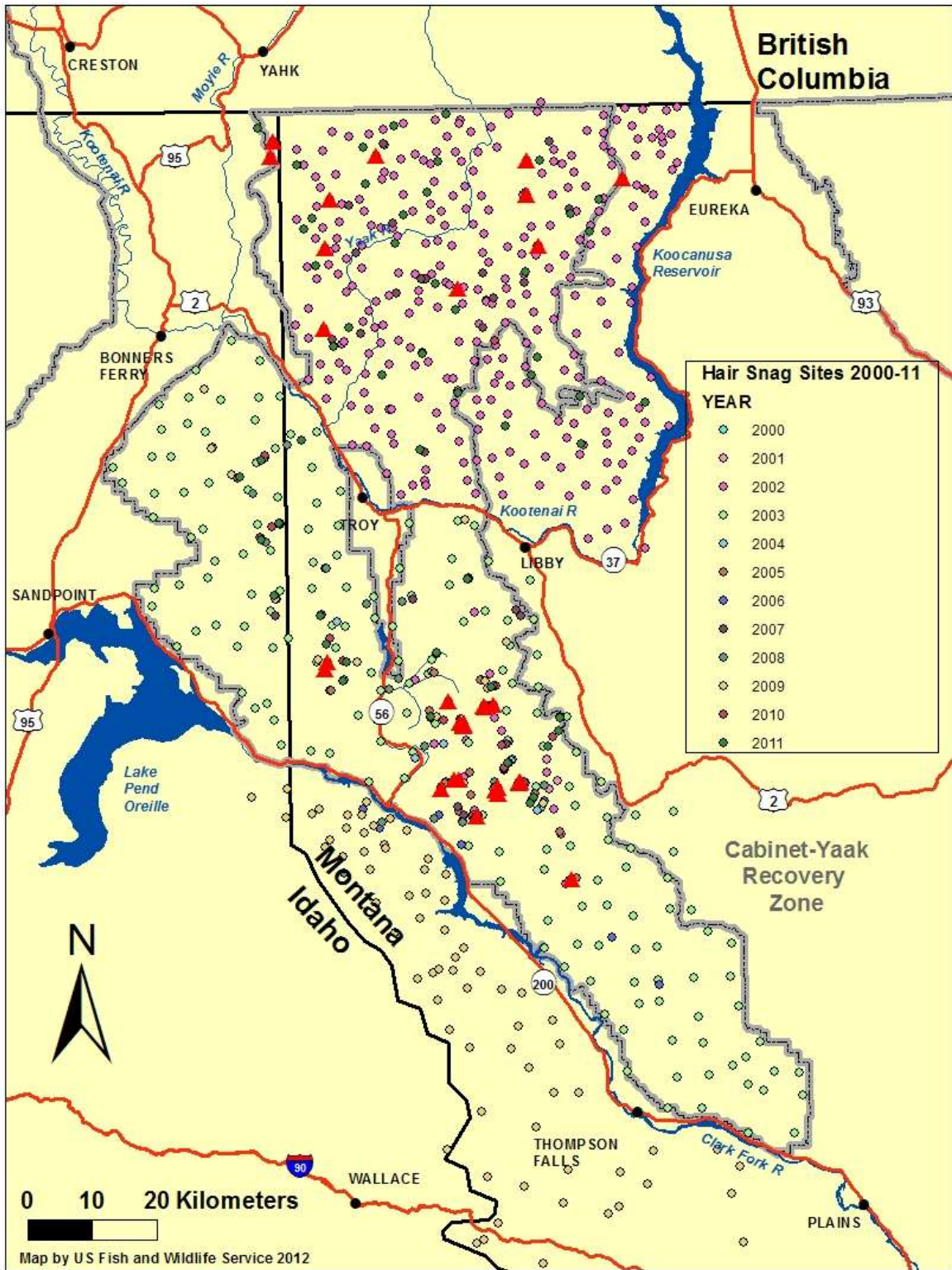


Figure 6. Location of hair snag sample sites in the Cabinet Mountains, 2000-11. Triangles denote sites that snagged grizzly bear hair.

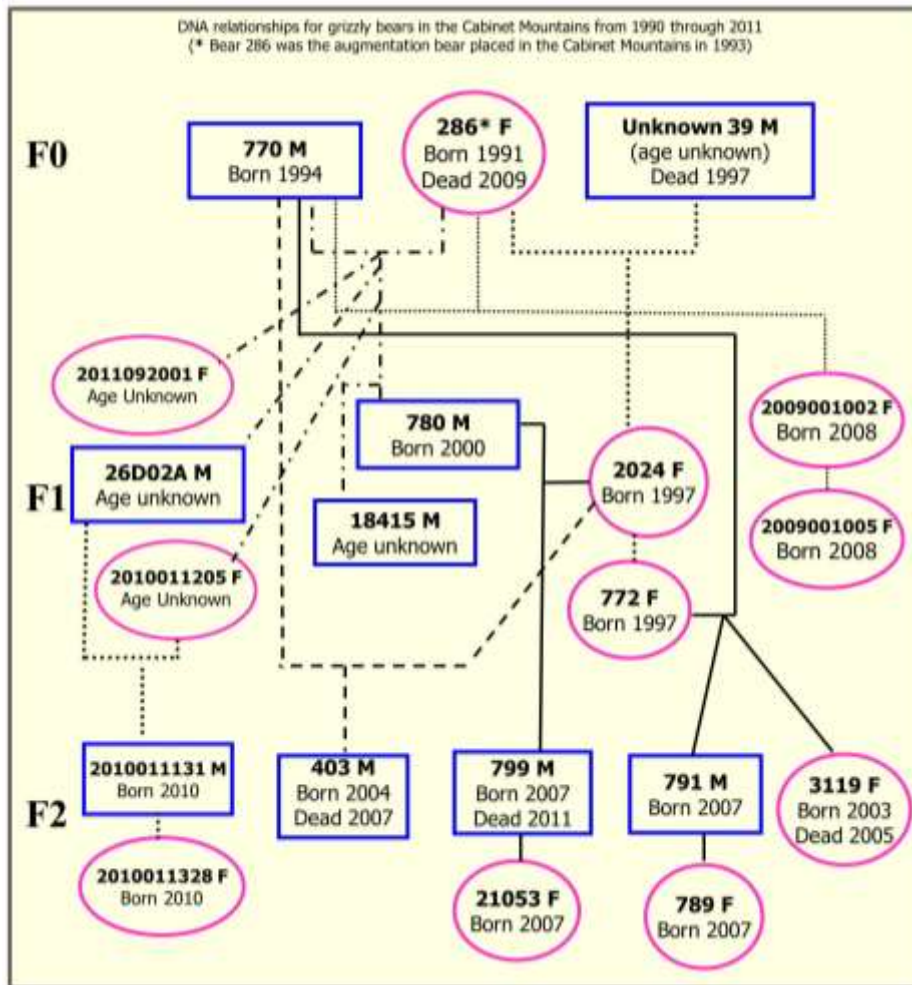


Figure 7. Most likely pedigree resulting from translocated female grizzly bear 286 into the Cabinet Mountains, USA, 1993-2010. Squares indicate males and circles represent females. Lines indicate a parent-offspring relationship. F0 is the initial generation, F1 is the first generation of offspring for translocated female 286, and F2 is the second generation.

In early August of 2010, Mines Management Inc. (operator of Montanore Mine) issued a press release.

*“Mines Management Receives Results of Groundbreaking Grizzly Bear Study - DNA Analysis of Grizzly Bear Scat Suggests a Larger Population of Bears in Cabinet/Yaak Ecosystem Than Previously Estimated. During the summer of 2009, scientists from the University of Washington and Kline Environmental Research were contracted by the Company to conduct a study in and around the Montanore Project area to assess the current condition of the grizzly bear population using DNA analysis of grizzly bear scat.*

*From the results of the study, a number of conclusions were reached, including the following:*

- -- *There are very likely significantly more grizzly bears in the Cabinet Mountains than has been previously reported.*

- -- *Either through augmentation or transient bears, the region may be at a stable condition and at its natural carrying capacity for grizzly bears.*
- -- *Current grizzly bear management activities in the recovery area should be reviewed due to recent grizzly mortalities and the increase of bears leaving the recovery area.*
- -- *DNA studies can identify individual grizzly bears from collected scat samples, which can be used to assess habitat and numbers of bears in the study area. The method proved to be an effective, non-intrusive method for monitoring grizzly bears, as compared to radio collars or hair sampling.”*

A review of that report noted errors in the use of data from this study and contacted the authors regarding these problems (Kline 2010). The authors made population estimates for the Cabinet Mountains of 37 bears based on hair snag data from this study. This study pointed out an error in their calculation which reduced their estimate to 6.5 bears. The author of the Montanore study agreed that an error was made and the calculation was actually 6.5 bears.

The University of Washington (UW) was contracted by Montanore Minerals Corporation to use scat sniffing dogs to collect scats which were later analyzed by a genetics lab for species and individual identification. The report (Wasser 2010) stated that they had collected 998 scats, identified 23 of these as grizzly bear, and genotyped 11 scats to individuals (8 in the Cabinets and 3 in the Yaak). All 11 scats that could be genotyped were reported to be from different individuals. The techniques used by UW do not allow direct comparison with our genetics database for the Cabinet-Yaak and a request was made for subsamples to be analyzed by Wildlife Genetics International (WGI) in British Columbia.

It was agreed that WGI could test the samples, but upon arrival at UW on 20 January 2011 our personnel were then told that 2 of the 23 samples previously identified as grizzly bear and genotyped to an individual were now “too weak to confirm”. We requested all 23 samples that were reported to be grizzly bear, but received only 16. These 16 samples were tested by WGI and results were returned to this study. Of the 16 samples identified by the UW as grizzly bear and provided to us, 10 were confirmed by WGI as grizzly bear, but 6 were identified as black bear. Both of the samples subsequently judged “too weak to confirm” by the UW were identified as black bear. Of the 10 sampled identified as grizzly bear by WGI, only one could be genotyped to an individual identification level. Though 11 samples were originally identified as grizzly bear and genotyped to an individual level by UW, only one was able to be genotyped by WGI. This bear was not in our database until 2011. The genetics indicate that this male is directly related as an offspring of bear 286.

### **Known Grizzly Bear Mortality**

Sixty-one instances of known and probable grizzly bear mortality from all causes were detected inside or within 16 km of the Cabinet-Yaak recovery zone (including Canada) during 1982–2011 (Tables 1 and 11, Fig. 8). This summary included radio-collared bears regardless of where they died. Seasons were defined as: spring was April 1 to May 31, summer was June 1 to August 31, and autumn was September 1 to November 30.

Ten adult females, 12 adult males, 9 subadult females, 7 subadult males, 2 yearling females, and 2 female cubs were included in the known sex and age individuals. Mortality cause frequency in descending order was natural (15), unknown but human-caused (10), poaching (8), mistaken identity (7), management removal (5), defense of life (5), train collision (3), trap predation (2), legal hunting in Canada (2), hound hunting in Canada (1), and unknown (2). Six mortalities were known to have occurred during spring, 18 during summer, 33 during autumn, and 4 unknown. All 15 natural mortalities occurred during summer. One poaching mortality occurred during spring, 6 occurred during autumn, and one was unknown. One unknown specific cause but known to be human related mortality occurred during spring, 8

occurred during autumn, and 1 was unknown. One mistaken identity mortality occurred during spring and 6 occurred in autumn. All defense of life and train collisions occurred during autumn. One management removal occurred during summer and 4 occurred during autumn. Legal hunting mortalities in Canada occurred during spring and one trap predation death occurred during spring and one occurred during summer. The black bear hound hunting mortality occurred in British Columbia and occurred during summer.

Fifty-six percent (10 of 18) of human caused mortalities occurring on the National Forests were <500m of an open road and 44% were >500m from an open road (8 of 18). Thirty-nine percent of human caused mortalities occurring on the National Forests were located within core habitat (7 of 18). Sixteen instances of known mortality occurred during the 17-year period from 1982–1998 with 12 (75%) of these mortalities being human-caused. Forty-five instances of known mortality occurred during the 13 year period from 1999–2011 with 32 (71%) of these mortalities human-caused. Rates of total human-caused mortality were 0.71 mortalities per year from 1982–1998 and 2.46 mortalities per year from 1999–2011. Thirty-one human-caused mortalities occurred within the US and 12 occurred in Canada within 16 km of the international boundary during 1982–2011. Rates of human-caused mortality in the US were 0.53 mortalities per year from 1982–1998 and 1.8 mortalities per year from 1999–2011. Rates of human caused mortality in British Columbia were 0.18 mortalities per year from 1982–1998 and 0.69 mortalities per year from 1999–2011.

Table 11. Cause, timing, and location of known and probable grizzly bear mortality in or within 16 km of the Cabinet-Yaak recovery zone (including Canada) and radio collared bears, 1982-2011.

Age / sex / season / ownership	Mortality cause											Total
	Defense of life	Legal Hunt	Hound hunting	Management removal	Mistaken identity	Natural	Poaching	Trap predation	Train Collision	Unknown, human	Unknown	
Adult female	3			2		2	1		1		1	10
Subadult female	1						1	2	2	3		9
Adult male	1	2		2	2		2			3		12
Subadult male	1			1	2		1			2		7
Yearling					1	1						2
Cub					1	12	3					16
Unknown			1		1					2	1	5
<b>Total</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>5</b>	<b>7</b>	<b>15</b>	<b>8</b>	<b>2</b>	<b>3</b>	<b>10</b>	<b>2</b>	<b>61</b>
<b>Season<sup>1</sup></b>												
Spring		2			1		1	1		1		6
Summer			1	1		15		1				18
Autumn	6			4	6		6		3	8		33
Unknown							1			1	2	4
<b>Ownership</b>												
BC Private		1		3								4
BC Public	1	1	1	1	1	4		1		2		12
US Private	1			1	1		6		3	3		15
US Public	4				5	11	2	1		5	2	30

<sup>1</sup>Spring = April 1 – May 31, Summer = June 1 – August 31, Autumn = September 1 – November 30

Use of known human-caused mortality counts probably results in under estimates of total human-caused mortality. Numerous mortalities identified by this study were reported only because animals wore a radio collar at the time of death. The public reporting rate of bears wearing radio-collars can be used to develop a correction factor to estimate unreported mortality (Cherry et al. 2002). The correction factor was not applied to natural mortality, management removals, mortality of radio collared bears or bears that died of unknown causes. All radioed bears used to develop the correction were >2 years-old and died from human related causes. Fourteen radio-collared bears died from human causes during 1982–2011. Seven of these were reported by the public and 7 were unreported. The Bayesian statistical analysis described by Cherry et al. (2002) was used to calculate unreported mortality (Table 12). The unreported estimate added 31 mortalities to the 61 known mortalities from 1982–2011.

Table 12. Annual grizzly bear mortality in or within 16 km of the Cabinet-Yaak recovery zone (including Canada) and estimates of unreported mortality, 1982-2011.

Year	Management or research	Radio monitored	Unknown cause	Public reported	Unreported estimate	Total
1982	0	0	0	1	1	2
1983	0	0	0	0	1	1
1984	0	0	0	1	1	2
1985	0	1	0	0	1	2
1986	0	1	0	0	1	2
1987	0	0	0	1	1	2
1988	0	1	0	1	1	3
1989	1	0	0	0	1	2
1990	0	0	0	1	1	2
1991	0	0	0	0	1	1
1992	0	0	1	0	1	1
1993	0	2	0	0	1	3
1994	0	0	0	0	1	1
1995	1	0	0	0	1	2
1996	0	2	0	0	1	3
1997	0	0	0	1	1	2
1998	0	0	0	0	1	1
1999	1	4	0	0	1	6
2000	0	4	0	0	1	5
2001	0	2	0	2	1	5
2002	0	5	0	2	1	8
2003	0	0	0	0	1	1
2004	1	0	0	0	1	2
2005	0	2	0	3	2	7
2006	2	0	0	0	1	3
2007	0	0	0	1	1	2
2008	0	2	0	2	1	5
2009	0	2	0	1	1	4
2010	0	2	0	2	1	5
2011	0	2	1	2	1	6
Total	6	32	2	21	31	92



The increase in total known mortality beginning in 1999 may be linked to poor food production during 1998–04 (Fig. 8). Huckleberry production during these years was about half the 20-year average (see pages 75–78). Poor berry production years can be expected at various times, but in this case there were several successive years of poor production. Huckleberries are the major source of late summer food that enables bears to accumulate sufficient fat to survive the denning period and females to produce and nurture cubs. Poor nutrition often causes females to not produce cubs in the following year. Poor food production may also cause females to travel further for food, which may expose young to greater risk of mortality from conflicts with humans, predators, or accidental deaths. Four cub mortalities were from one female bear that lost litters of 2 cubs each during spring of 2000 and 2001. Another mortality incident involved a female with 2 cubs that appeared to have been killed by another bear in 1999. The effect of cub mortality may be greatest in succeeding years when some of these animals might have been recruited to the reproductive segment of the population.

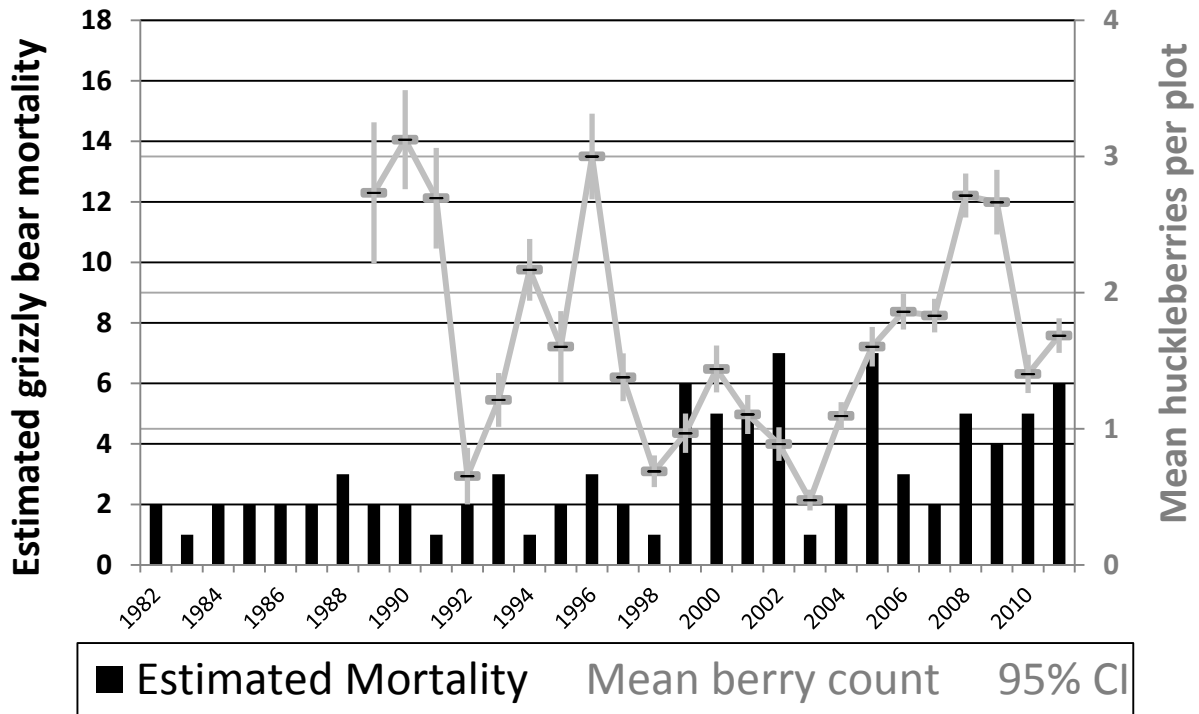


Figure 8. Known and estimated unreported grizzly bear annual mortality from all causes in or within 16 km of the Cabinet-Yaak recovery zone (including Canada) and all radio collared bears by cause, 1982-2011 and huckleberry production counts, 1989-2011.

## Grizzly Bear Mortality, Reproduction, and Population Trend

This report segment updates information on survival rates, cause-specific mortality and population trend following the methods used in a peer reviewed journal paper (Wakkinen and Kasworm 2004). These survival and reproductive estimates supercede all previous calculations and are based on the most current information.

### Native Grizzly Bear Survival and Cause-Specific Mortality

Kaplan-Meier survival and cause-specific mortality rates were calculated for 6 sex and age classes of native grizzly bears from 1983–2011 (Table 13). Adult female survival was 0.937 (95% CI 0.856–1.0, n=10) with 1 instance of natural mortality and 1 poaching among 10 radio-collared bears monitored for 31.3 bear-years. The natural mortality occurred during summer and the poaching occurred during autumn. Adult male survival was 0.887 (95% CI 0.775–1.0, n=18) with 1 legal hunting mortality in Canada, 1 defense of life, and 1 unknown but human-caused mortality among 18 radio collared bears monitored for 27.2 bear-years. The hunting mortality occurred during spring 35 km northwest of the recovery zone in British Columbia. The defense of life and the unknown but human-caused mortality occurred during autumn. Subadult female survival was 0.791 (95% CI 0.613–0.968, n=13) among 13 bears monitored for 17.7 bear-years. The trap predation mortality occurred in summer when a bear captured in a foot snare was killed by another grizzly bear. A defense of life and 2 unknown but human-caused mortalities occurred during autumn. Ten subadult males were monitored for 9.0 years and produced a survival rate of 0.762 (95% CI 0.504–1.0, n=10). There was 1 spring unknown but human-caused mortality and two mistaken identities during autumn. Yearling survival was 0.900 (95% CI 0.739–1.0, n=21) among 21 bears monitored for 11.4 bear-years. One bear died during summer from natural causes. Fourteen of 32 cubs died, resulting in a survival rate of 0.563 (95% CI 0.391–0.734, n=31). Three cubs died by poaching during autumn, and 11 cubs were believed to have died of natural causes during summer.

Table 13. Survival and cause-specific mortality rates of native grizzly bear sex and age classes based on censored telemetry data in the Cabinet–Yaak recovery zone, 1983–2011.

Parameter	Demographic parameters and mortality rates					
	Adult female	Adult male	Subadult female	Subadult male	Yearling	Cub
Individuals / bear-years	10 / 31.3	18 / 27.2	13 / 17.7	10 / 9.0	21 / 11.4	32 / 32 <sup>a</sup>
Survival <sup>b</sup> (95% CI)	0.937 (0.856–1.0)	0.887 (0.775–1.0)	0.791 (0.613–0.968)	0.762 (0.504–1.0)	0.900 (0.739–1.0)	0.563 (0.391–0.734)
Mortality rate by cause						
Legal Hunt Canada	0	0.042	0	0	0	0
Natural	0.033	0	0	0	0.100	0.344
Defense of life	0	0.036	0.047	0	0	0
Mistaken ID	0	0	0	0.095	0	0
Poaching	0.029	0	0	0	0	0.094
Trap predation	0	0	0.067	0	0	0
Unknown	0	0.036	0.096	0.143	0	0

<sup>a</sup> Cub survival based on counts of individuals alive and dead.

<sup>b</sup>Kaplan-Meier survival estimate which may differ from BOOTER survival estimate.

Mortality rates of all sex and age classes of native, non-management radio collared grizzly bears  $\geq 2$  years-old were summarized by cause and location of death (Table 14). Rates were categorized by public or private land and human or natural causes. Rates were further

stratified by death locations in British Columbia or U.S. and broken into two time periods. The two periods (1983–1998 and 1999–2011) correspond to a decline in population trend ( $\lambda$ ) beginning in 1999. Grizzly bear survival of all sex and age classes decreased from 0.899 during 1983–1998 to 0.853 during 1999–2011. Some of this decrease could be attributed to an increase in point estimates for natural mortality probably related to poor berry production during 1998–2004. A large increase in mortality occurring on private lands within the U.S. also contributed heavily to this increase in overall mortality and may also be related to poor berry production that may have caused bears to search more widely for foods that may occur on private lands. Several mortalities occurring during 1999–2011 were associated with sanitation issues on private lands. Several deaths of management bears occurred on private lands, but were not included in this calculation. Point estimates for human caused mortality occurring on public lands in the U.S. and British Columbia decreased from 1983–1998 to 1999–2011. This apparent decrease in mortality rates on public lands is particularly noteworthy given the increase in overall mortality rates. Implementation of access management on public lands could be a factor in this apparent decline.

Table 14. Survival and cause-specific survival rates of native radio collared grizzly bears  $\geq 2$  years-old by location of death based on censored telemetry data in the Cabinet–Yaak recovery zone, 1983–2011.

Parameter	1983–1998	1999–2011
Individuals / bear-years	23 / 48.9	29 / 37.0
Survival <sup>b</sup> (95% CI)	0.899 (0.819–0.979)	0.853 (0.746–0.962)
Mortality rate by location and cause		
Public / natural	0.010	0.029
U.S. public / human	0.051	0.034
B.C. public / human	0.040	0.023
U.S. private / human	0	0.062
B.C. private / human	0	0

#### Augmentation Grizzly Bear Survival and Cause-Specific Mortality

Kaplan-Meier survival and cause-specific mortality rates were calculated for 13 augmentation grizzly bears from 1990–2011. Bears that left the area, but did not die were censored. Eleven female and two male bears ranged in age from 2–10, but were pooled for this calculation because of small sample size and the lack of mortality in the adult age class. Survival for augmentation bears was 0.758 (95% CI 0.547–0.969, n=13) with 1 instance of natural mortality, 1 poaching, and 1 train collision among 13 radio-collared bears monitored for 11.0 bear-years. The natural mortality occurred during summer, the poaching and train mortality occurred during autumn. The female that died of a natural mortality produced a cub before her death, but it is believed that the cub died at the same time.

#### Native Grizzly Bear Reproduction

Mean age of first parturition among native grizzly bears was 6.5 years (95% CI; 6.0–7.0, n=4, Table 15). Three of four bears used in the calculation were radio collared from ages 2–8.

The fourth individual was captured with a cub at age 6 years-old and that was assumed to be her first reproduction, though another reproduction could have occurred earlier in her life. Sex ratio of 12 bears captured as cubs or yearlings was 8 females and 4 males. Seventeen litters comprised of 34 cubs were observed through monitoring radio-collared bears, for a mean litter size of 2.0 (95% C.I. 1.76–2.24, n=17, Table 15). Three radio-collared adult female bears provided 7 complete interbirth intervals (Table 15). Two successive instances of a female losing a complete litter of cubs prior to the end of breeding season (late July) and producing another litter the following year were observed. This scenario was treated as an interval from cub birth to cub birth of 3 years. Subsequent intervals of one year between subsequent cub births were not counted as intervals though cub mortality was counted in cub survival calculations. Mean interbirth interval would be calculated as 2.71 years (95% C.I. 2.0–3.4, n=7) using these respective calculations of birth interval. Booter software provides several options to calculate a reproductive rate (*m*) and we selected unpaired litter size and birth interval data with sample size restricted to the number of females. The unpaired option allows use of bears from which accurate counts of cubs were not obtained but interval was known, or instances where litter size was known but radio failure or death limited knowledge of birth interval. Estimated reproductive rate using the unpaired option was 0.291 female cubs/year/adult female (95% C.I. 0.198–0.459, n=17, Table 15). In all calculations the sex ratio of cubs born was assumed to be 1:1.

Table 15. Radio collared grizzly bear reproductive information from the Cabinet-Yaak 1983-2011.

Bear	Year	Cubs	Age at first reproduction	Reproductive Interval <sup>1</sup>	Cubs (relationship and fate, if known)
106	1986	2		2	1 dead in 1986, ♀ #129 dead in 1989
106	1988	3		3	♂ #192 dead in 1991, ♂ #193, ♀ #206
106	1991	2		2	2 cubs of unknown sex and fate
106	1993	2		2	♂ #302 dead in 1996, ♀ #303
106	1995	2		4	♀ #353 dead in 2002, ♀ #354 dead in 2007
106	1999	2		-	♀ #106 and 2 cubs dead in 1999
206	1994	2	6	3	♀ #505
206	1997	2		-	♀ #596 dead in 1999, ♀ #592 dead in 2000
538	1997	1	6	3	1 cub separated from ♀ #538 in 1998
538	2000	2		1	2 cubs dead in 2000
538	2001	2		1	2 cubs dead in 2001
538	2002	2		-	2 cubs of unknown sex and fate
303	2000	2	7	-	1 cub dead in 2000, ♀ #552
353	2002	3		-	♀ #353 dead in 2002, 3 cubs (1 female) all assumed dead in 2002
772	2007	2		-	♀ #789, ♂ #791
675	2009	2	7	-	2 cubs dead in 2009
675	2010	1		-	1 cub dead in 2010

<sup>1</sup>Number of years from birth to subsequent birth.

## Population Trend

Approximately 90% of the data used in population trend calculations came from bears monitored in the Yaak River portion of this population, hence this result is most indicative of that portion of the recovery area. The estimated finite rate of increase ( $\lambda$ ) for 1983–2011 using Booter software with the unpaired litter size and birth interval data option was 0.984 (95% C.I.

0.882–1.069, Table 16). Finite rate of change in the population was an annual -1.6% for the period. Subadult female survival and adult female survival accounted for most of the uncertainty in  $\lambda$ , with reproductive rate, yearling survival, cub survival, and age at first parturition contributing much smaller amounts. The sample sizes available to calculate population trend are small and small sample sizes yield wide confidence intervals around any calculated estimate of trend (i.e.,  $\lambda$ ). The probability that the population was declining was 64%.

Sample size concerns limited calculation of point estimates of cumulative annual rate of change until 1998 (Fig. 9). Finite rates of increase calculated for the period 1983–1998 ( $\lambda = 1.067$ ) suggested an increasing population (Wakkinen and Kasworm 2004). Survival rates for adult and subadult females were 0.948 and 0.901 respectively, at that time. Adult and subadult female survival rates declined to 0.926 and 0.740 respectively in 2006. Human-caused mortality has accounted for much of this decline and appears to be largely responsible for the decline in the rate of increase. During 2011, adult female survival and subadult female survival had increased to 0.936 and 0.794 respectively and resulted in an improving population trend estimate since 2006. Improving survival by reducing human-caused mortality is crucial for recovery of this population (Proctor et al 2004).

Table 16. Booter unpaired method estimated annual survival rates, age at first parturition, reproductive rates, and population trend of native grizzly bears in the Cabinet–Yaak recovery zone, 1983–2011.

Parameter	Sample size	Estimate (95% CI)	SE	Variance (%) <sup>a</sup>
Adult female survival <sup>b</sup> ( $S_a$ )	8 / 31.3 <sup>c</sup>	0.936 (0.827–1.0)	0.046	32.4
Subadult female survival <sup>b</sup> ( $S_s$ )	13 / 17.6 <sup>c</sup>	0.794 (0.590–0.953)	0.094	54.9
Yearling survival <sup>b</sup> ( $S_y$ )	19 / 11.2 <sup>c</sup>	0.880 (0.627–1.0)	0.114	3.3
Cub survival <sup>b</sup> ( $S_c$ ) <sup>d</sup>	32/32	0.562 (0.406–0.750)	0.088	4.8
Age first parturition ( $a$ )	4	6.5 (6.0–7.0)	0.249	0.7
Maximum age ( $w$ )	Fixed	27		
Unpaired Reproductive rate ( $m$ ) <sup>e</sup>	7/7/17 <sup>f</sup>	0.380 (0.292–0.509)	0.054	4.0
Unpaired Lambda ( $\lambda$ )	5000 bootstrap runs	0.984 (0.882–1.069)	0.047	

<sup>a</sup> Percent of lambda explained by each parameter

<sup>b</sup>Booter survival calculation which may differ from Kaplan-Meier estimates

<sup>c</sup>individuals / bear-years

<sup>d</sup>Cub survival based on counts of individuals alive and dead

<sup>e</sup>Number of female cubs produced/year/adult female. Sex ratio assumed to be 1:1.

<sup>f</sup>Sample size for individual adult females / sample size for birth interval / sample size for litter size

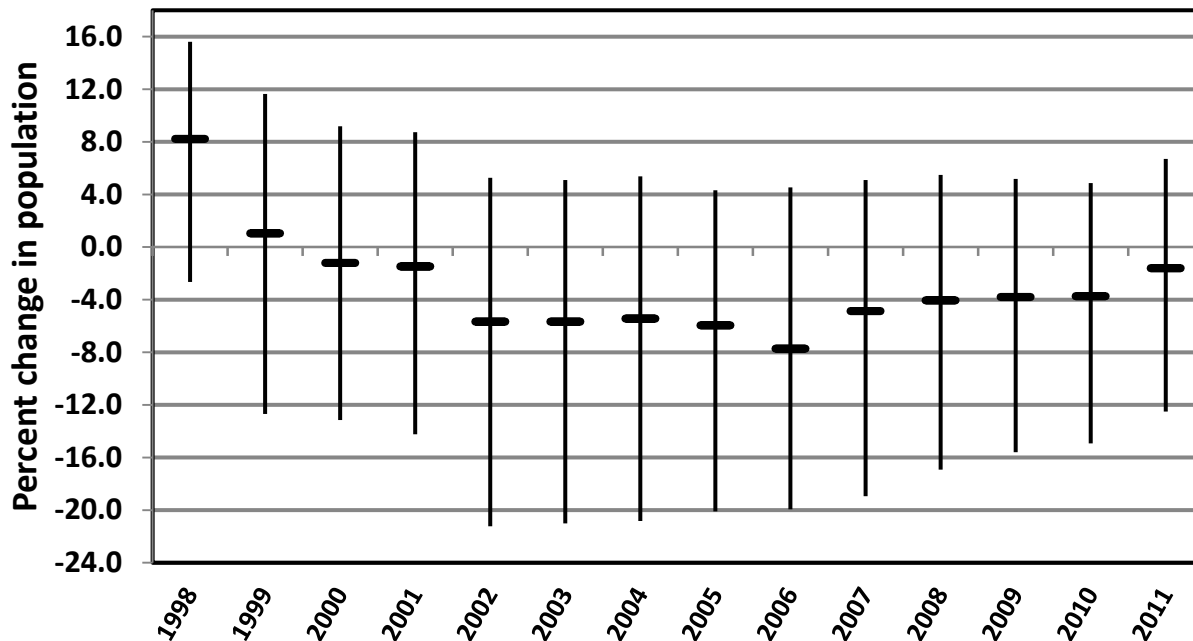


Figure 9. Point estimate and 95% confidence intervals for cumulative annual calculation of population rate of change for native grizzly bears in the Cabinet-Yaak recovery area, 1983–2011. Each entry represents the annual rate of change from 1983 to that date.

## Capture and Marking

### Cabinet Mountains

Research trapping was conducted in the Cabinet Mountains portion of the CYGBRZ from 1983–87. Three adult grizzly bears were captured during this effort (1 female and 2 males). No trapping efforts occurred from 1988–1994. In 1995 an effort was begun to recapture relocated bears in order to determine success of the population augmentation program and capture any native bears in the Cabinet Mountains. During 1983–2011, 7,336 trap nights were expended to capture 9 individual grizzly bears and 301 individual black bears (Table 17 and 18, Fig. 10). Rates of capture by individual were 1 grizzly bear/815 trap-nights and 1 black bear/24 trap-nights. A trap night was defined as one site with one or more snares set for one night. None of the augmentation bears were captured during subsequent trapping efforts. Much of the trapping effort before 2002 involved use of horses on backcountry trails and closed roads. In 2003, two culvert traps were airlifted to the East Fork of Rock Creek by helicopter. Traps were operated during the last week of August and first week of September. Three black bears were captured. No grizzly bears were captured, though one was observed near the traps. In 2005 one adult male grizzly bear (770) was captured in the Cabinet Mountains. In 2006 an adult male grizzly bear (780) was captured in the West Cabinet Mountains. Three yearling grizzly bears (1 female and 2 males) were captured in May 2002 south of the Clark Fork River. These siblings weighed 50–65 pounds and were fitted with ear tag transmitters. The yearlings were preemptively moved away from humans. There were no indications that these bears had received human foods, but the agencies were concerned that they may become conditioned to

human foods if they remained in that area. The yearling female died of natural causes in June 2002, but fates of the males are unknown. A grizzly bear that died in 2001 was found along the railroad tracks in May 2002 and was presumed to be their mother. One grizzly bear and 8 black bears were captured in 2010. Four black bears were captured and 1 was collared in 2011.

#### Yaak River

Trapping was conducted in the Yaak portion of the CYGBRZ during 1986-87 as part of a black bear graduate research study (Thier 1990), and from 1989–11 by the U.S. Fish and Wildlife Service. Seventy eight captures of 42 individual grizzly bears and 463 captures of 390 individual black bears were made during 8,545 trap nights during 1986–11 (Tables 17 and 18, Fig. 10). Rates of capture by individual were 1 grizzly bear/204 trap-nights and 1 black bear/22 trap-nights. A trap night was defined as one site with one or more snares set for one night.

Trapping effort was concentrated in home ranges of known bears during 1995–2011 to recapture adult females with known life histories. Much of the effort involved using horses in areas inaccessible to vehicles, such as backcountry trails and closed roads.

#### Salish Mountains

Trapping occurred in the Salish Mountains, south of Eureka, Montana, in 2003. An adult female grizzly bear (5 years old), and 5 black bears were captured during 63 trap nights of effort (Tables 17, 18).

Table 17. Capture effort and success for grizzly bears and black bears in the Yaak, Cabinet Mountains, Salish Mountains, North of Highway 3, British Columbia, Interstate 90, and Highway 95, Idaho study areas, 1983–11.

Area / Year	Trap Nights	Grizzly Bear Captures	Black Bear Captures	Trap Nights / Grizzly Bear	Trap Nights / Black Bear
Cabinet Mountains, 1983–11					
Total Captures	7336	12	418	611	18
Individuals <sup>1</sup>	7336	9	301	815	24
Salish Mountains, 2003 <sup>1</sup>	63	1	5	63	13
Yaak River South Hwy 3, 1986-11					
Total Captures	8545	78	463	110	19
Individuals <sup>1</sup>	8545	42	390	204	22
N. Hwy 3, BC, 2004–08					
Total Captures	259	9	37	29	7
Individuals <sup>1</sup>	259	8	32	32	8
Interstate 90, 2011					
Total Captures	210	0	20	0	11
Individuals <sup>1</sup>	210	0	18	0	12
Hwy 95, ID, 2011					
Total Captures	413	0	19	0	22
Individuals <sup>1</sup>	413	0	19	0	22

<sup>1</sup>Individual new bears captured during the indicated time.

Table 18. Grizzly bear capture information from the Cabinet-Yaak recovery area, 1983–11. Multiple captures of a single bear during a given year are not included.

Bear	Capture	Sex	Age	Weight kg	Location	Capture reason
678	6/29/83	F	28	86	Bear Cr.	Research
680	6/19/84	M	11	(181)	Libby Cr.	Research
680	5/12/85	M	12	(181)	Bear Cr.	Research
678	6/01/85	F	30	79	Cherry Cr.	Research
14	6/19/85	M	27	(159)	Cherry Cr.	Research
101	4/30/86	M	(8)	(171)	N Fk 17Mile Cr.	Research
678	5/21/86	F	31	65	Cherry Cr.	Research
106	5/23/86	F	8	92	Otis Cr.	Research
128	5/10/87	M	4	(114)	Lang Cr.	Research
129	5/20/87	F	1	32	Pheasant Cr.	Research
106	6/20/87	F	9	(91)	Grizzly Cr.	Research
134	6/24/87	M	8	(181)	Otis Cr.	Research
129	7/06/89	F	3	(80)	Grizzly Cr.	Research
192	10/14/89	M	1	90	Large Cr.	Research
193	10/14/89	M	1	79	Large Cr.	Research
193	6/03/90	M	2	77	Burnt Cr.	Research
206	6/03/90	F	2	70	Burnt Cr.	Research
106	9/25/90	F	12	(136)	Burnt Cr.	Research
206	5/24/91	F	3	77	Burnt Cr.	Research
244	6/17/92	M	6	140	Yaak R.	Research
106	9/04/92	F	14	144	Burnt Cr.	Research
34	6/26/93	F	(15)	158	Spread Cr.	Research
206	10/06/93	F	5	(159)	Pete Cr.	Research
505	9/14/94	F	Cub	45	Jungle Cr.	Research
302	10/07/94	M	1	95	Cool Cr.	Research
303	10/07/94	F	1	113	Cool Cr.	Research
106	9/20/95	F	17	(169)	Cool Cr.	Research
353	9/20/95	F	Cub	43	Cool Cr.	Research
354	9/20/95	F	Cub	47	Cool Cr.	Research
302	9/24/95	M	2	113	Cool Cr.	Research
342	5/22/96	M	4	(146)	Zulu Cr.	Research
363	5/27/96	M	4	(158)	Zulu Cr.	Research
303	5/27/96	F	3	(113)	Zulu Cr.	Research
355	9/12/96	M	(6)	(203)	Rampike Cr.	Research
358	9/22/96	M	8	(225)	Pete Cr.	Research
353	9/23/96	F	1	83	Cool Cr.	Research
354	9/23/96	F	1	88	Cool Cr.	Research
384	6/12/97	M	7	(248)	Zulu Cr.	Research
128	6/15/97	M	14	(270)	Cool Cr.	Research
386	6/20/97	M	5	(180)	Zulu Cr.	Research
363	6/26/97	M	5	(180)	Cool Cr.	Research
538	9/25/97	F	6	(135)	Rampike Cr.	Research
354	9/27/97	F	2	99	Burnt Cr.	Research
354	8/20/98	F	3	(90)	Cool Cr.	Research
106	8/29/98	F	20	(146)	Burnt Cr.	Research
363	8/30/98	M	6	(203)	Burnt Cr.	Research
342	9/17/98	M	6	(203)	Clay Cr.	Research
303	9/21/98	F	5	(113)	Clay Cr.	Research
592	8/17/99	F	2	(91)	Pete Cr.	Research
596	8/23/99	F	2	(91)	French Cr.	Research
358	11/15/99	M	11	279	Yaak R.	Management, open freezer, killed goats
538	7/16/00	F	9	(171)	Moyie River, BC	Research
552	7/16/01	F	1	(36)	Copeland Cr.	Research



Bear	Capture	Sex	Age	Weight kg	Location	Capture reason
577	5/22/02	F	1	23	Elk Cr.	Management, pre-emptive move
578	5/22/02	M	1	23	Elk Cr.	Management, pre-emptive move
579	5/22/02	M	1	30	Elk Cr.	Management, pre-emptive move
353	6/15/02	F	7	(136)	Burnt Cr.	Research
651	9/25/02	M	7	(227)	Spread Cr.	Research
787	5/17/03	M	3	71	Deer Cr. ID	Management, garbage feeding
342	5/23/03	M	11	(227)	Burnt Cr.	Research
648	8/18/03	F	5	(159)	McGuire Cr., Salish Mtns.	Research
244	9/25/03	M	17	(205)	N Fk Hellroaring Cr.	Research
576	10/21/04	M	2	(114)	Young Cr.	Management, garbage feeding
675	10/22/04	F	2	100	Young Cr.	Management, pre-emptive move
677	5/13/05	M	6	105	Canuck Cr., BC	Research
576	6/17/05	M	3	133	Teepee Cr., BC	Research
17	6/18/05	M	8	175	Norge Pass, BC	Research
292	7/6/05	F	4	(114)	Mission Cr., ID	Research
694	7/15/05	F	2	73	Kelsey Cr.	Research
770	9/20/05	M	11	(250)	Chippewa Cr.	Research
M1	10/4/05	M	(2)	(80)	Pipe Cr.	Management, garbage feeding
668	10/11/05	M	3	120	Yaak R.	Management, garbage feeding
103	5/23/06	M	3	125	Canuck Cr., BC	Research
---	5/28/06	F	4	(125)	Cold Cr., BC (Trap)	Research
5381	6/6/08	M	4	(200)	Hellroaring Cr., ID	Research
651	6/28/06	M	11	198	Cold Cr., BC	Research
780	9/22/06	M	6	(250)	S Fk Callahan Cr.	Research
784	9/23/07	F	2	(175)	Spread Cr.	Research
772	9/18/2007	F	10	255	Pilgrim Cr.	Management, fruit trees
789	9/18/2007	F	Cub	80	Pilgrim Cr.	Management, fruit trees
791	9/18/2007	M	Cub	85	Pilgrim Cr.	Management, fruit trees
785	10/15/07	F	2	165	Pete Cr.	Research
675	5/23/09	F	7	195	Elmer Cr. BC	Research
784	7/24/09	F	4	(300)	Hensley Cr.	Research
731	9/17/09	F	2	(275)	Fowler Cr.	Research
799	5/21/10	M	3	(102)	Rock Cr.	Research
737	7/21/10	M	4	129	Messler Cr.	Research
1374	8/30/10	M	2	98	Young Cr.	Management, garbage feeding
726	5/24/11	M	(2)	77	Meadow Cr.	Research
722	5/31/11	M	12	261	Otis Cr.	Research
729	6/18/11	F	1	33	Beulah Cr.	Research
724	7/13/11	M	2	159	Graves Cr.	Management, killed pigs
732	10/27/11	M	5	139	Otis Cr.	Management, killed chickens

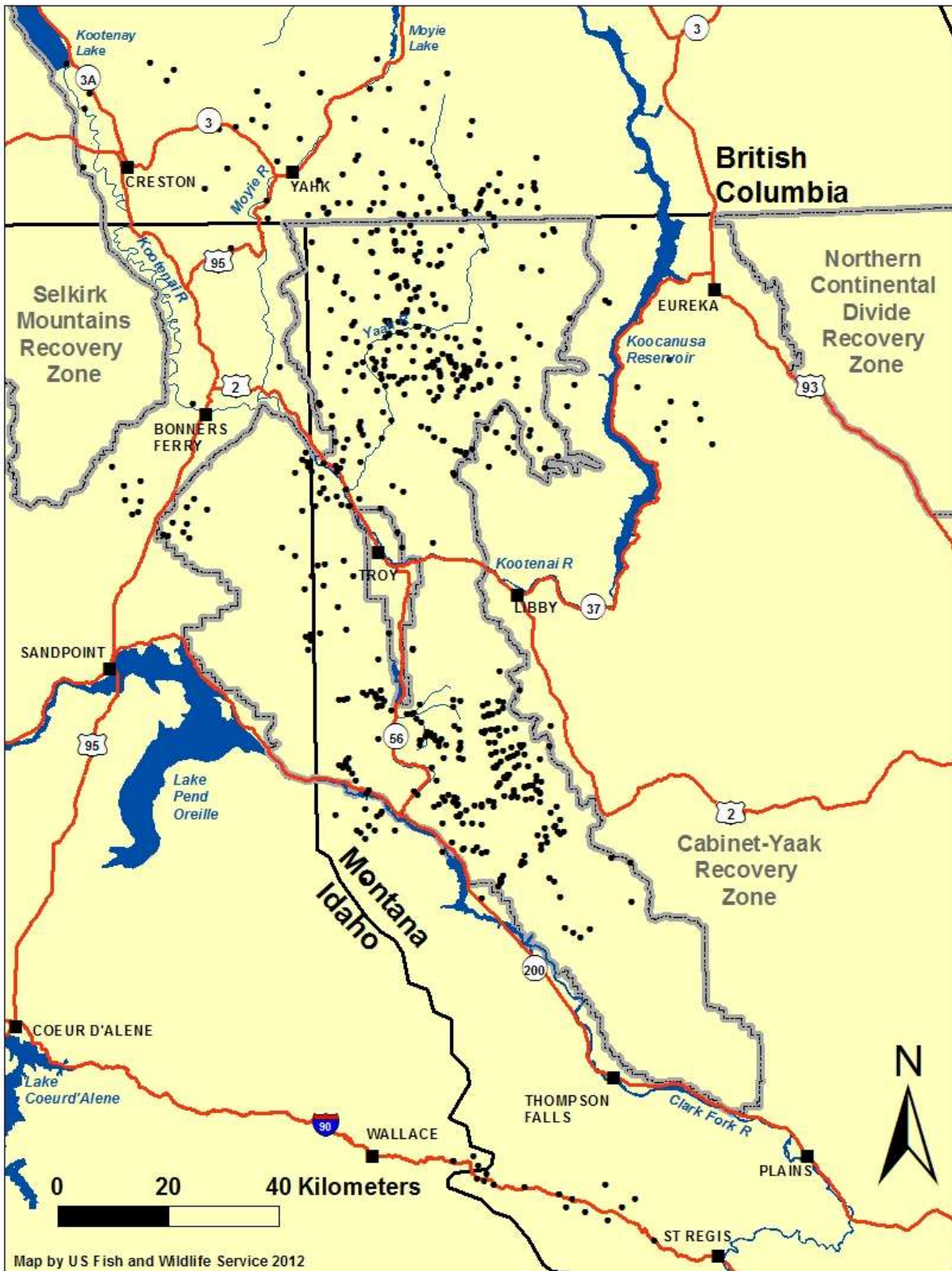


Figure 10. Trap site locations in the Cabinet-Yaak study area 1983–2011.

## Moyie River and Kootenay River Valleys, British Columbia

Three grizzly bears and 19 black bears were captured in the Moyie River valley near Highway 3 in BC in 2004. Grizzly bears (2 females and 1 male) were fitted with GPS radio collars and were captured north of Highway 3. Six grizzly bears and 18 black bears were captured during 2005. Three grizzly bears (1 female and 2 males) were captured north of Highway 3, and 3 males were captured south of Highway 3. Five bears were collared; however the female was too small. In 2006, four grizzly bears and 20 black bears were captured. A yearling female was released without collaring due to its small size. South of Highway 3, a female and two males were captured. The males were collared but the female was found dead in the snare. She was killed by another grizzly bear. Seven black bears (6 males and 1 female) were collared in 2006. One grizzly bear (captured twice north of Highway 3) and 10 black bears were caught in 2007. The grizzly bear and 7 black bears were fitted with GPS collars. Three black bears, 2 of which were collared, were captured in the Selkirk Mountains to examine linkage across the Kootenay River Valley. During 2008, 5 grizzly bears and 8 black bears were captured and in 2009 1 grizzly bear and 3 out of 11 captured black bears were collared.

## Selkirk Mountains

Trapping occurred in the Selkirk Mountains, west of Creston, British Columbia, in 2007-11 under a cooperative study with Dr. Michael Proctor (Birchdale Ecological Consultants), and the BC Ministry of Environment. The primary objective of the project is to examine linkage and population connectivity among the Selkirk and Purcell Mountains in BC and the US. Twenty-one grizzly bears have been captured and radio collared during this effort.

## Cabinet Mountains Augmentation Captures Flathead River, Montana and British Columbia

From 1990-94 four female grizzly bears were captured in the Flathead River Valley of British Columbia and released in the Cabinet Mountains to augment the existing population. Twenty-two different grizzly bears were captured during 840 trap-nights, to obtain the 4 subadult females transplanted. Capture rates were 1 grizzly bear/38 trap-nights, and 1 suitable subadult female/210 trap-nights. A transplanted bear and her cub died of unknown causes a year after release (Kasworm et al. 1998). The remaining three bears were monitored until their collars fell off. The program was designed to determine if transplanted bears would remain in the target area and ultimately contribute to the population through reproduction. Three of four transplanted bears remained within the target area for more than one year. Though one of the transplanted bears produced a cub, the animal had likely bred prior to translocation and did not satisfy our criteria for reproduction with native males.

In 2005 an adult female grizzly bear (A1) was captured in the North Fork of the Flathead River drainage by Montana Dept. of Fish, Wildlife and Parks personnel and relocated to the West Cabinet Mountains near Spar Lake. In 2006 a subadult female (782) was captured in the South Fork of the Flathead River drainage by state personnel and released in the same area near Spar Lake with a GPS radio collar. No bears were transplanted in 2007 as no suitable females were captured. Two female grizzly bears were released in the East Fork of the Bull River during 2008 during late July and early August, respectively. The first (4 year-old) came from the upper Stillwater drainage of the Whitefish Range and the second (3 year-old) came from Swan River. Both bears were equipped with GPS radio collars. In October 2008 both of these bears were killed. In September 2009 an adult female from Big Creek in the North Fork of the Flathead River drainage was released in the Spar Lake area. In July 2010, two subadult

bears, a male (5 year-old) and a female (4 year-old), were transplanted to the Cabinet Mountains. A male from Dead Horse Creek was released near Spar Lake and a female from Spruce Creek was released at Silverbutte Creek. Two, 2 year old bears were released in 2011. A female (725) from Puzzle Creek in the Middle Fork of the Flathead River drainage was released near Spar Lake and a male (723) from Stryker Ridge, near Antice Creek was also released near Spar Lake. A short history of these bears follows later in this report.

#### Population Linkage Kootenai River Valley, Montana

Eight black bears were captured in 2004 to determine bear crossing patterns of the Kootenai River valley near the junction of Highway 2 and 508. Seven of these bears were fitted with GPS radio collars that store location data and detach in early October. These captures were distributed north (2 females and 2 males) and south of the Kootenai River (1 female and 2 males). Three black bears were captured and collared in 2005. All three bears (2 females and 1 male) were captured north of the river. During July 2006 2 female black bears were collared north of the river. In 2007, no bears were captured during 183 trap nights of effort.

#### Population Linkage Clark Fork River Valley, Montana

Six black bears were captured in 2008 in the Clark Fork River Valley to examine bear crossing opportunities of the valley near the junction of Highways 200 and 56. Four of these bears (2 females and 2 males) were fitted with GPS radio collars. All collars were placed on bears north of the Clark Fork River. In 2009 three black bears were captured and collared; 2 north and 1 south of the river. During 2010, collars were placed on 1 grizzly bear and 4 black bears north of the river and one black bear south of the river. One black bear was collared north of the river and 4 were collared south of the river in 2011.

#### Population Linkage Interstate 90 Corridor, Montana and Idaho

An effort to trap and collar black bears with GPS radio collars, along I-90 near Lookout Pass, was initiated in 2011. Eighteen bears were captured 20 times during 210 trap nights of effort, resulting in 11 trap nights/capture (Table 17). Fourteen bears were collared, 13 in Montana and 1 in Idaho. Eight of the bears were collared north of the interstate highway and 6 were collared south of the highway.

#### Population Linkage Highway 95 Corridor, Idaho

An effort was begun in 2011 to collar black bears with GPS radio collars along Highway 95 between Bonners Ferry and Sandpoint, Idaho. The effort centered on the McArthur Lake State Wildlife Management Area. Nineteen black bears were captured during 413 trap nights of effort, or 22 trap nights/capture (Table 17). Fourteen bears were collared. Nine of those bears were collared west of the highway, and 5 were east of the highway.

### **Radio Telemetry Monitoring**

#### Grizzly Bears – Survival and Trend Estimates

Eleven grizzly bears were monitored by GPS radio collars during portions of 2011.

Research captures and monitoring included two females (subadults) and three males (2 subadults and an adult) in the Yaak River and one male (subadult) in the Cabinet Mountains. Three bears from the Cabinet Mountains (2 subadult males and 1 subadult female) were part of the augmentation program. Two bears (subadult males) were captured as management actions

### Black Bear – Linkage Research

Thirty-three black bears were monitored with GPS collars for portions of 2011 (14 at McArthur Lake, 14 at Lookout Pass, and 5 in the Clark Fork River). Black bears may prove useful surrogates for grizzly bears when evaluating linkage areas across valleys with highways and human habitation. Monitoring of black bears along Highway 2 near the confluence of the Kootenai and Yaak Rivers was conducted from 2004-06. Eleven black bears were monitored with GPS radio collars. Locations from these animals did not detect any crossing of the valley, but the data will be modeled with several habitat variables to predict areas of probable use with logistic regression (Fig. 11).

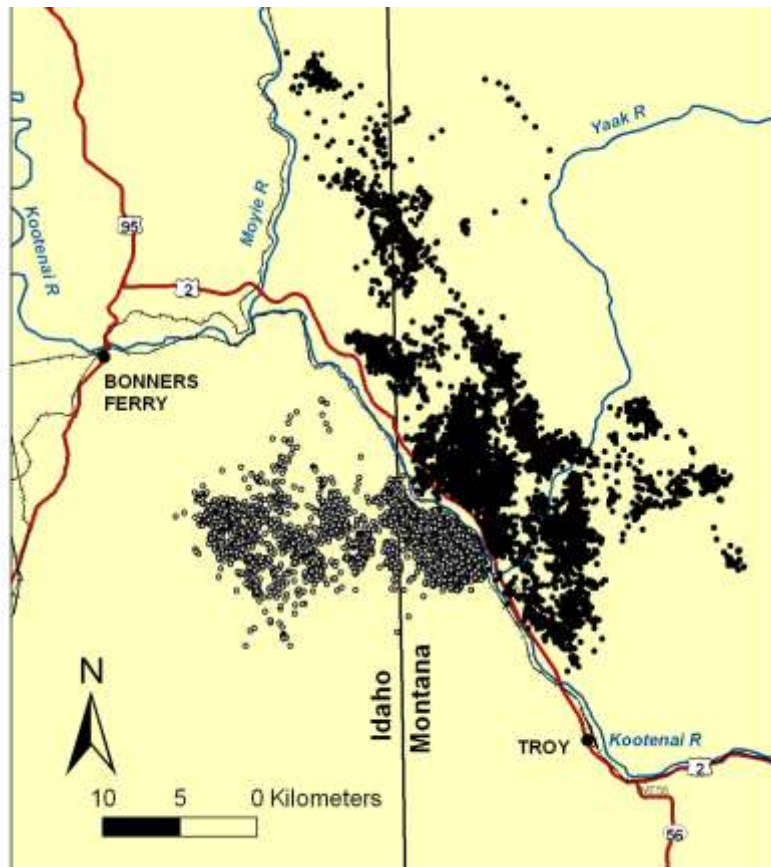


Figure 11. Black bear GPS radio locations along the Kootenai River, northwest Montana, 2004-06. Black dot are bears captured north of the Kootenai River and gray dots are bears captured south of the Kootenai River.

## Monitoring Summary of Each Adult Female Grizzly Bear

### Cabinet Mountains Native Adult Female Bears

Grizzly 678—This adult female was first captured in Bear Creek on 30 June 1983. She weighed 87 kg at capture and was 28 years old. Bear 678 was monitored until spring of 1989 when she lost her collar. During 1983-89 she was recaptured twice for collar replacement. She was not accompanied by cubs at capture and was never seen with cubs during monitoring though both radio collared males spent time with her during the spring breeding seasons of 1984 and 1985. She may have come into estrous, but could not complete a pregnancy. During 1983 and 1984 her home range extended south to the Vermilion River, but during subsequent years she remained further north of that area with the core of her range within or near the Cabinet Mountains Wilderness. When she lost her collar during the spring of 1989, but was still alive. In 1993 several claws were discovered in the Cabinet Mountains in Baree Creek. Analysis of the DNA in these claws indicated that they were from bear 678. The presence of dried tissue on the claws suggested that the bear had died during 1993 or the previous year. If bear 678 died during 1992 she would have been 37 years old and one of the oldest known grizzly bears recorded in the wild.

Grizzly 772—This female was captured on 18 September 2007 at Pilgrim Creek, south of the Clark Fork River with 2 cubs. They were released the next day at Marten Creek. Before denning she moved north across the river into the Cabinet Mountains. Her collar malfunctioned prior to getting a den location. A Bull River resident reported seeing a collared grizzly bear with 2 young near his home in 2008.

### Cabinet Mountains Augmentation Bears

Grizzly 218—This animal was captured in the North Fork of the Flathead River in British Columbia on 21 July 1990 as a 5-year-old and released near the west edge of the Cabinet Mountains Wilderness in Lost Girl Creek the following day. Bear 218 weighed 71 kg when captured. She was monitored for remainder of 1990 and denned in the upper reaches of Big Cherry Creek at an elevation of about 2100 m. Contact with bear 218 was lost in August of 1991 when the canvas spacer on her collar separated. On 2 July 1992, she was observed crossing a road in Midas Creek. Although she was of potential reproductive age, she was not observed with cubs. She has not been observed since and her fate at this time is unknown.

Grizzly 258—This animal was captured in the North Fork of the Flathead in British Columbia on 21 July 1992 as a 6-year-old and released near the west edge of the Cabinet Mountains Wilderness in Lost Girl Creek the following day. Bear 258 weighed 70 kg at capture. She was monitored from release through denning in the East Fork of Rock Creek during early November of 1992. She emerged from her den between 12 and 19 May. Small tracks were later observed in the snow from the air, indicating young accompanied her. The presence of one cub was confirmed on 17 June when she and a cub were observed on a radio monitoring flight. Bear 258 was seven years old in 1993 and had apparently bred in British Columbia prior to being moved the previous year. Bear 258 traveled fairly extensively in 1993 (considering the age of her cub) and utilized upper elevations in the East Fork of Rock Creek, Swamp Creek, Libby Creek, and East Fork of the Bull River. In mid-July her movements ceased near the vicinity of Libby Lakes (in upper Libby Creek drainage) and it was assumed she had cast her collar. An examination of the site was made on 22 July. Bear 258 was found dead, lying on her stomach

in a daybed she had made in a small patch of trees at 2000 m elevation on an otherwise open slope. It was estimated she had been dead for 8-10 days. There was no evidence of a traumatic death at the site, nor was there any evidence of her cub. The carcass was removed the following day via helicopter and sent to the Montana Department of Fish, Wildlife and Parks Wildlife Laboratory in Bozeman for analysis. Laboratory personnel were unable to determine a cause of death, though several factors such as parasites, physical trauma, physical abnormalities, fast acting poisons, and starvation were ruled out.

Grizzly 286—This animal was 2 years old when captured in the North Fork of the Flathead River on 14 July 1993. She was released in Lost Girl Creek in the Cabinet Mountains on 15 July. She weighed 36 kg at capture. Bear 286 stayed in the vicinity of the release site for 10 days before moving south. She spent the remainder of the summer and fall at higher elevations in the Cabinet Mountains with most of her movements centered within 10 km of the release site. The one long movement she made occurred in late August north along the crest of the Cabinet Mountains about 25 km and then returned to the release site vicinity. These movements occurred over 7-8 days. Bear 286 denned during early November of 1993 in Snowshoe Creek at 2100 m elevation. Bear 286 emerged from her den during late April of 1994. She remained at higher elevations during most of the year. Her home range was similar to that of 1993. Bear 286 denned in Granite Creek during early November and lost her radio collar during late April of 1995 shortly after den emergence. During 2004, 2005, 2007, and 2009 hair from this bear was collected in the Cabinet Mountains at hair snag sites and identified by DNA analysis. This analysis also identified at least 9 offspring. In 2009, she was shot by an elk hunter in a reported case of self defense.

Grizzly 311—This 3-year-old female was captured on 12 July 1994 in the North Fork of the Flathead River. She weighed 75 kg and was released at the Lost Girl site on 13 July. She remained near the release site for 4 days before moving east about 15 km to an area near Horse Mountain. On 25 July she lost her radio collar in the vicinity of Standard Lake. Bear 311 was sighted again on 7 September in the East Fork of Rock Creek. There were no additional sightings reported after that date. On 2 October 1995 this bear was captured at Lydia Creek approximately 80 km northeast of her last known sighting in the Cabinet Mountains. She was moved back to the Cabinet Mountains and released in Lost Girl Creek with a new radio collar. She was monitored for approximately one month, after which the signal was lost.

Grizzly A1—This adult female (approximately 7-8 years old) was captured at Spruce Creek in the North Fork of the Flathead River on 30 Sept. 2005 by Montana Dept of Fish, Wildlife and Parks personnel. She was released near Spar Lake in the West Cabinet Mountains and was monitored within an 8 km radius of the release site until late November when she moved north to within 3 km of the Kootenai River along the Idaho-Montana border before denning in Goat Creek in mid December. In October 2006 she was observed from the aircraft in the North Fork of Lightning Creek chasing a wolf away from an apparent kill. She denned near Katka Peak. She was monitored in 2007 until September when she lost her collar.

Grizzly 782—This subadult female (2 years old) was captured at Ball Creek in the South Fork of the Flathead River on 17 August 2006 by Montana Dept. of Fish, Wildlife and Parks personnel. She was released near Spar Lake in the West Cabinet Mountains. Since her release she has stayed fairly close (8-10 km) to the release site despite a move east to the main Cabinet Mountains and near Highway 2 during 14-20 September, 2006. She denned near Spar Lake. She was monitored throughout 2007 to her den. She lost her radio collar in August of 2008.

Grizzly 635—This subadult female (4 years old) was captured in Fitzsimmons Creek in the Stillwater drainage of the Whitefish Range on 23 July 2008 by Montana Dept of Fish, Wildlife and Parks personnel. She was released in the East Fork of the Bull River near the Cabinet Mountains Wilderness on 24 July 2008. She was monitored in the Cabinet Mountains until October 15 when she and bear 790 began traveling together. They moved down the Bull River from Bull Lake and on October 21 approached the Clark Fork River west of Noxon, MT. At this point the animals split up and bear 635 moved downstream on the south side of the Clark Fork River along the Montana Rail Link tracks. At approximately 8 PM on the evening of 21 October Montana Rail Link officials reported striking a bear on the tracks. Flights on 22 October located the transmitter on the north shore of the Clark Fork River about 10 km west of the reported strike. Ground investigation located and recovered the body of bear 635. Necropsy and x-rays reported heavy bruising on the carcass in the head and rear legs of the bear, but no significant broken bones. Water was located in the lungs and it was suggested that the animal died from drowning after blunt force trauma possibly rendering her unconscious.

Grizzly 790—This subadult female (3 years old) was captured in Swan River on 7 August 2008 by Montana Dept of Fish, Wildlife and Parks personnel. She was released in the East Fork of the Bull River near the Cabinet Mountains Wilderness on 8 August 2008. She was monitored in the Cabinet Mountains until October 15 when she and bear 635 began traveling together. They moved down the Bull River from Bull Lake and on October 21 approached the Clark Fork River west of Noxon, MT. At this point the animals split up and bear 790 moved south of the Clark Fork River. At approximately 6 PM on the evening of 21 October a Noxon resident reported killing a radio collared bear that was getting garbage in his yard. The individual said he thought the animal was a black bear. Wardens from MDFWP investigated the incident. GPS radio telemetry did not show complete agreement with the animal location and reported timing of the garbage incident. Furthermore, no garbage was found in the stomach of the bear during necropsy. The individual did not possess a valid black bear tag and was cited and convicted of illegally killing a grizzly bear.

Grizzly 715—This adult female (~10 years old) was captured on 17 September 2009 in the Big Cr. drainage of the North Fork of the Flathead River by MDFWP personnel. She was released on 18 September near Spar Lake. She was monitored until she denned in the West Cabinet Mountains in late November. She emerged in late April and her signal was lost in late May 2010. On 5 August she was located northeast of Big Mountain ski area near where she was originally captured in 2009.

Grizzly 713—This subadult male (5 years old) was captured on 18 July 2010 in the Dead Horse Cr. drainage of the North Fork of the Flathead River by MDFWP personnel. He was released on 18 July near Spar Lake. He moved extensively through the Cabinet Mountains, crossed the Kootenai River moving north, and used the Fisher River drainage during 2010 and prior to denning in November of 2010 on the east side of the Cabinet Mountains. He made extensive movements east during 2011 into the Fisher River before returning to the Cabinet Mountains in August and lost his radio collar on the east side of the Cabinet Mountains in

Grizzly 714—This subadult female (4 years old) was captured on 24 July 2010 in the Spruce Cr. drainage of the North Fork of the Flathead River by MDFWP personnel. She was released on



25 July at Silverbutte Creek. On 5 August she was located back in the North Fork near her original capture location.

Grizzly 725—This subadult female (2 years old) was captured on 25 July 2011 in the Puzzle Cr. Drainage of the Middle Fork of the Flathead River By MDFWP personnel. She was released on 26 July near Spar Lake. In August she moved north of the Kootenai River and in September she crossed Kooconusa Reservoir moving first to the Whitefish Range and then into Glacier National Park. She was last monitored near upper Quartz Lake within Glacier National Park.

Grizzly 723—This subadult male (2 years old) was captured on 18 August 2011 on Stryker Ridge in the Antice Creek drainage of the Whitefish River by MDFWP personnel. He was released on 19 August 2011 near Spar Lake. In late September he moved into the east Cabinet Mountains and denned in November.

#### Yaak Drainage Adult Female Bears

Grizzly 106—An adult female bear was captured on 23 May 1986 in the Yaak River near the confluence with Pheasant Creek. Two 5-month-old cubs accompanied the 8-year-old female, although the cubs were not captured. She weighed 92 kg and her body condition was judged to be good. She was recaptured in 1986, 1987, 1990, 1992, 1995, and 1998. She was accompanied by only 1 cub when captured in the fall of 1986. A sibling cub apparently died in early July. Bear 106 produced 3 cubs in 1988 (bears 192, 193, and 206). These cubs remained with her until the spring of 1990. She was recaptured in the fall of 1990 and her collar was replaced. In 1991, bear 106 was accompanied by 2 cubs, from which she separated during June of 1992 during the breeding season. She was observed consorting with male bear 128 during 1992. She was recaptured on 4 September and weighed 144 kg. Bear 106 produced two cubs again in 1993. Those cubs remained with her until June of 1994 when she was observed in the company of an unmarked adult male and at a later time, grizzly 244. She lost her collar during July of 1994. Bears 302 and 303 were believed to be her 1993 offspring. On 20 September 1995 she was recaptured and collared. Two female cubs (bears 353 and 354) were captured with her. These two cubs remained with her until 1997. She was captured and re-collared on 29 August 1998. She was alone and was not lactating at the time of capture. She was monitored until June 1999 at which time the radio signal came from the same location on two consecutive flights. Upon examination of the site, bear 106 was found dead along with two cubs of unknown sex. Evidence at the site indicated that she had likely been killed by an adult male grizzly bear while defending an elk carcass and/or her cubs.

Grizzly 206—Female 206 was the offspring of bear 106 and had 2 litter mates (Bears 192 and 193). Sibling grizzly bears 206 and 192 were captured on 3 June 1990 in Burnt Creek. She was in good condition and weighed 70 kg. Bear 206 was monitored throughout 1991 and 1992. During 1992 she was observed consorting with male bear 128 during breeding season. Bear 206 was 4 years-old at that time. She did not emerge with cubs in 1993 and was seen consorting with at least 2 male grizzly bears during breeding season. She was recaptured in October 1993 and was in excellent condition weighing in excess of 150 kg. Since separating from her mother bear 206 has centered her home range in the West Fork of the Yaak River and Pete Creek. She lost her radio collar at the den during April of 1994. On 14 September 1994 a female cub (505) was captured in Jungle Creek. Bear 206 and another cub were present at the trap site. In 1997, she was observed with two cubs and was identified by her ear streamers.

Grizzly 34—On 26 June 1993 this female bear was captured in Spread Creek. She was approximately 15 years old and weighed 158 kg. She had yellow tags in her ears from British Columbia Wildlife Branch. She had been moved from a garbage dump to Bloom Creek north of the border in British Columbia with 2 yearlings. There were no young with her at capture and due to her large neck, the collar dropped off within a week.

Grizzly 538—This female bear was captured on 25 September 1997 in Rampike Creek. A single cub was with her at the trap site but was not captured. She was estimated to be 6 years old and weighed approximately 135 kg. She separated from the yearling in May of 1998 and was observed with male bear 358. She did not produce cubs in spring 1999, possibly due to the very poor berry crop in 1998. She was seen with an adult male in June of 1999. In late May of 2000 she emerged from the den with two cubs, however, both cubs were not seen with her after June 2000 and were presumed dead. She was captured on 16 July 2000 in the Moyie River drainage in British Columbia. She emerged from her den with 2 cubs in May of 2001, but they were not seen with her after June 2001 and are also presumed to be dead. In May of 2002 she emerged from her den with 2 cubs, which survived to den with her in the fall. Her collar ceased transmitting during the denning period of 2002-2003.

Grizzly 303—This female is the offspring of bear 106. She was captured on 27 May 1996 in Zulu Creek and recaptured on 21 September 1998 in Clay Creek. Her home range is centered on the South Fork of the Yaak River. As a 5 year old she was seen with an adult male during breeding season in 1998. She did not have cubs in the spring of 1999, but was seen with an adult male during breeding season. In May 2000 she emerged from the den with two cubs however, after June 2000 one of the cubs was no longer observed with her and was presumed dead. The remaining cub survived and entered the den with her mother in November 2000. She emerged from the den in April 2001, with her yearling. She was monitored until July 2001 when her collar ceased transmitting.

Grizzly 353—This female is the offspring of bear 106. She was captured on 20 September 1995 as a yearling, and on 23 September 1996 as a 2 year old. She wore a transmitter from 1995-97. On 15 June 2002 she was recaptured. She was seen with 3 cubs shortly after capture. She was killed in November of 2002 and the remains of 1 cub were also found. The other 2 cubs are assumed to be dead.

Grizzly 675—This female was captured on 10 October 2004 at Young Creek, as a two year old as part of a management action though she was not believed to be the conflict animal. She was released in the Northwest Peaks area as a preemptive move and has established her home range there in the US and Canada. She did not produce cubs during 2008 as a 6 year old. In 2009 she had two cubs with her at den emergence, but both died in June of 2009. In 2010 she produced one cub, but lost it in early June.

#### Salish Mountains Adult Female Bears

Grizzly 648—This female bear was captured on 18 August 2003 in the McGuire Creek drainage of the Salish Mountains. She was followed until 13 November 2003. She was located in a den in spring of 2004 in the Williams Creek drainage, east of Highway 93, in the Whitefish Range. She emerged from the den in May 2004 with one cub. They were monitored throughout the field season until they denned in Deep Creek in the Whitefish Range again in November 2004. She was located in both the Salish Mountains and the Whitefish Range in 2004. She emerged from

the den with the yearling in the spring of 2005 and was monitored until she denned in Williams Creek. She dropped her collar in May 2006.

### **Grizzly Bear Home Ranges**

Specific and general locations were obtained on collared bears, but only aerial, specific locations were used to calculate home ranges. The convex polygon for life ranges were computed for bears monitored during 1983-2011 (Table 19 and Figs. 12-78).

Native CYGBRZ adult male life range averaged 1,390 km<sup>2</sup> (95% CI ± 446) using the minimum convex polygon estimator ( $n = 14$ , bears 14, 680, 101, 128, 134, 244, 342, 358, 363, 386, 651, 17, 770, and 780). Native adult female life range averaged 692 km<sup>2</sup> (95% CI ± 289) using the minimum convex polygon estimator ( $n = 7$ , bears 678, 106, 206, 303, 353, 538, and 675). The minimum convex polygon estimator for bear 106 was 852 km<sup>2</sup> during her 1986-99 life time. Her home range was smallest during 1986, 1988, 1991, 1993, and 1995 when she had cubs. The minimum convex polygon home range of native adult female bear 678 in the Cabinet Mountains from 1983-88 was 658 km<sup>2</sup>. The 2003-2005 range for female bear 648, in the Salish Mountains, was 948 km<sup>2</sup> (minimum convex polygon).

Four known female offspring of bear 106 established home ranges around their maternal range. Female offspring 206 has established a home range adjacent to and north of her mother's home range. Bear 303 has established a home range east of her mother's old home range and female 354 may have established her home range west of her mothers. Bear 353 lived within her mother's old range, before her death.

Home ranges of collared grizzly bears overlap extensively on a yearly and lifetime basis. However, bears typically utilize the same space at different times. Male home ranges overlap several females to increase breeding potential, but males and females consort only during the brief period of courtship and breeding. Adult male bears whose home ranges overlap seldom use the same habitat at the same time to avoid conflict. For example, bear 128 was captured in the central part of the study area in 1987, but has used this area on a limited basis since capture. He was recaptured in this area in 1997 but promptly moved north into British Columbia. Adult male bears 101, 134, 244, 342, and 363 used a large portion of the study area from 1986 to 1998, but were not consistently located in close proximity except for bears 342 and 363. These two animals were located together on 4 occasions between 1996 and 1998 and were in close proximity on other occasions. Bears 342 and 363 are believed to be siblings, and were 4-7 years old during 1996-99.

Thirteen of thirty bears (43 percent) captured south of the international boundary in the Yaak study area of northwest Montana and northern Idaho were monitored crossing into Canada between 1987 and 2010. Six of these animals were adult males that spent portions of spring breeding season in Canada during various years between 1987 and 2010 (128, 134, 355, 358, 386, and 651). One of these males (358) was observed courting an adult female (538) whose home range occurs largely in Canada, but was initially captured in the United States. Another adult female (206) whose home range occurs largely in the United States was observed in association with 2 different unmarked adult males in Canada and subsequently produced a litter of cubs. Furthermore, 3 adult males (128, 134, and 651) originally captured in the United States were monitored up to 32 km north of the border and north of the Moyie River in the Purcell Mountains during breeding season of 1987, 1992, and 2006.

Table 19. Home range sizes of native and transplanted grizzly bears in the Cabinet-Yaak recovery zone, and the Salish Mountains, 1983-11.

Bear # and Sex	Years	Age (Est.)	Area of use	Collar Type	Radio Locations	100% Convex Polygon (km <sup>2</sup> )
678 ♀	1983-1989	28-34	Cabinet Mts, MT	VHF	173	658
680 ♂	1984-1985	11-12	Cabinet Mts, MT	VHF	75	1,947
14 ♂	1985	27	Cabinet Mts, MT	VHF	23	589
101 ♂	1986	8	Yaak River, MT	VHF	38	787
106 ♀	1986-1999	8-20	Yaak River, MT	VHF	379	852
128 ♂	1987-1997	4-14	Yaak River, MT	VHF	204	2,895
129 ♀	1987-1989	1-3	Yaak River, MT	VHF	42	60
134 ♂	1987-1988	8-9	Yaak River, MT	VHF	20	594
192 ♂	1990	2	Yaak River, MT	VHF	10	574
193 ♂	1990	2	Yaak River, MT	VHF	34	642
206 ♀	1990-1995	2-7	Yaak River, MT	VHF	208	1,332
218 <sup>1</sup> ♀	1990-1991	5-6	Cabinet Mts, MT	VHF	95	541
244 ♂	1992-2004	6-18	Yaak River, MT	VHF	158	1,406
258 <sup>1</sup> ♀	1992-1993	6-7	Cabinet Mts, MT	VHF	54	400
286 <sup>1</sup> ♀	1993-1994	2-3	Cabinet Mts, MT	VHF	82	266
311 <sup>1</sup> ♀	1994-1995	3-4	Cabinet Mts, MT	VHF	16	209
302 ♂	1994-1996	1-3	Yaak River, MT	VHF	60	514
303 ♀	1994-2001	1-8	Yaak River, MT	VHF	237	337
342 ♂	1996-2004	4-12	Yaak River, MT	VHF	134	1,653
355 ♂	1996	(6)	Yaak River, MT & BC	VHF	5	N/A
358 ♂	1996-1998	8-10	Yaak River, MT & BC	VHF	55	1,442
363 ♂	1996-1999	4-7	Yaak River, MT	VHF	120	538
386 ♂	1997-1998	5-6	Yaak River, MT	VHF	29	1,895
354 ♀	1997-1999	2-4	Yaak River, MT	VHF	70	537
538 ♀	1997-2002	6-11	Yaak River, MT & BC	VHF	232	835
592 ♀	1999-2000	2-3	Yaak River, MT & BC	VHF	59	471
596 ♀	1999	2	Yaak River, MT & BC	VHF	10	283
552 ♀	2001	1	Yaak River, MT	VHF	6	N/A
577 ♀	2002	1	Cabinet Mts, MT	VHF	11	2
578 ♂	2002	1	Cabinet Mts, MT	VHF	3	N/A
579 ♂	2002	1	Cabinet Mts, MT	VHF	10	5
353 ♀	2002	7	Yaak River, MT	VHF	37	119
651 ♂	2002-03,06	7-11	Yaak River, MT & BC	VHF	1,723	934
787 ♂	2003-2004	3-4	Yaak River, MT	VHF	84	1,862
648 ♀	2003-2005	5-7	Salish Mts, MT	VHF	85	948
576 ♂	2005-2006	3-4	Yaak River, MT & BC	GPS	2,310	1,381
675 ♀	2004-2010	2-8	Yaak River, MT & BC	VHF	1,682	712
10 ♀	2004	11	Moyie River, BC	GPS	1,977	176
11 ♂	2004	7	Moyie River, BC	GPS	894	1,453
12 ♀	2004	11	Moyie River, BC	GPS	1,612	333
17 ♂	2005	8	Yaak River, MT & BC	GPS	1,903	3,074
677 ♂	2005	6	Yaak River, MT & BC	GPS	519	3,361
688 ♂	2005-2006	3-4	Moyie & Goat River, BC	GPS	3,421	1,544

<b>Bear # and Sex</b>	<b>Years</b>	<b>Age (Est.)</b>	<b>Area of use</b>	<b>Collar Type</b>	<b>Radio Locations</b>	<b>100% Convex Polygon (km<sup>2</sup>)</b>
694 ♀	2005	2	Yaak River, MT	VHF	11	89
292 ♀	2005	4	Moyie & Goat River, BC & ID	GPS	7,062	253
770 ♂	2005-2006	11-12	Cabinet Mts, MT	VHF	20	326
2 ♂	2005-2006	(7-9)	Moyie / Yahk, BC	GPS	1,337	2,860
A1 <sup>1</sup> ♀	2005-2007	(8-10)	Cabinet Mts, MT	VHF	73	725
782 <sup>1</sup> ♀	2006-2008	2-5	Cabinet Mts, MT	GPS	1,126	1,932
780 ♂	2006-2008	6-8	Cabinet Mts, MT	VHF	56	1,374
103 ♂	2006-2007	3-4	Kootenai, & Pend Oreille River, BC, ID, & WA	GPS	4,872	6,545
5381 ♂	2006-2007	4-5	Moyie & Goat River, BC & ID	GPS	11,491	1,949
130 ♀	2007-2008	26-27	Goat River, BC	GPS	3,986	281
131 ♀	2007-2008	(5)	Goat River, BC	GPS	3,270	276
784 ♀	2007-2009	1-3	Yaak River, MT	GPS	2,606	524
785 ♀	2007-2008	1-2	Yaak River, MT	GPS	362	207
772 ♀	2007	10	Cabinet Mts, MT	VHF	14	446
138 ♀	2008-2009	2-3	Kootenay River, BC	GPS	3,232	750
635 <sup>1</sup> ♀	2008	4	Cabinet Mts, MT	GPS	285	451
790 <sup>1</sup> ♀	2008	3	Cabinet Mts, MT	GPS	227	423
715 <sup>1</sup> ♀	2009-2010	(10-11)	Cabinet Mts, MT	GPS	437	6,666
731 ♀	2009-2011	2-4	Yaak River, MT	GPS	1,652	852
1374 ♂	2010	2	Yaak River, MT & BC	GPS	14	381
713 <sup>1</sup> ♂	2010-2011	5	Cabinet Mts, MT	GPS	521	6,628
714 <sup>1</sup> ♀	2010-2011	4-5	Cabinet Mts & Flathead, MT	GPS	1,138	2,904
799 ♂	2010-2011	3-4	Cabinet Mts, MT	GPS	1,422	805
722 <sup>1</sup> ♂	2011	12	Yaak River, MT & BC	GPS	1,045	3,350
723 <sup>1</sup> ♂	2011	2	Cabinet Mts, MT	GPS	243	990
725 <sup>1</sup> ♀	2011	2	Cabinet Mts & Flathead, MT	GPS	282	4,233
732 <sup>1</sup> ♂	2011	5	Yaak River, MT	GPS	875	458

<sup>1</sup> Bear transplanted to Cabinet Mountains from North Fork of the Flathead River, British Columbia or Flathead River, Montana.

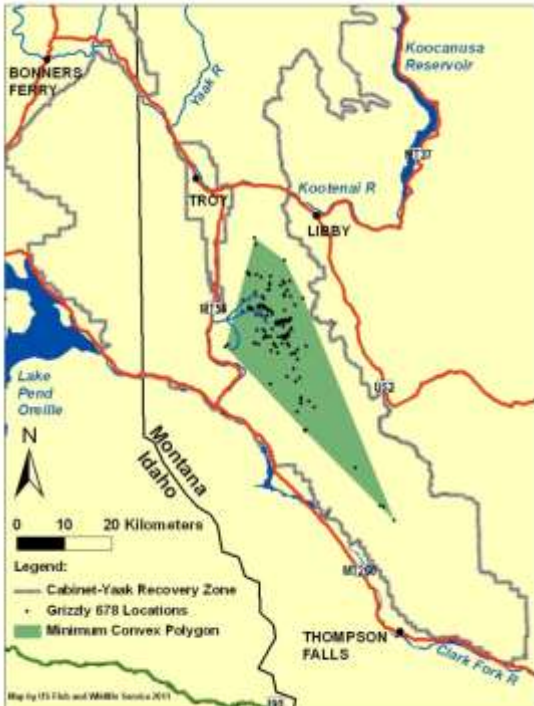


Figure 12. Radio locations and minimum convex (shaded) life range of female grizzly bear 678 in the Cabinet Mountains, 1983-89.

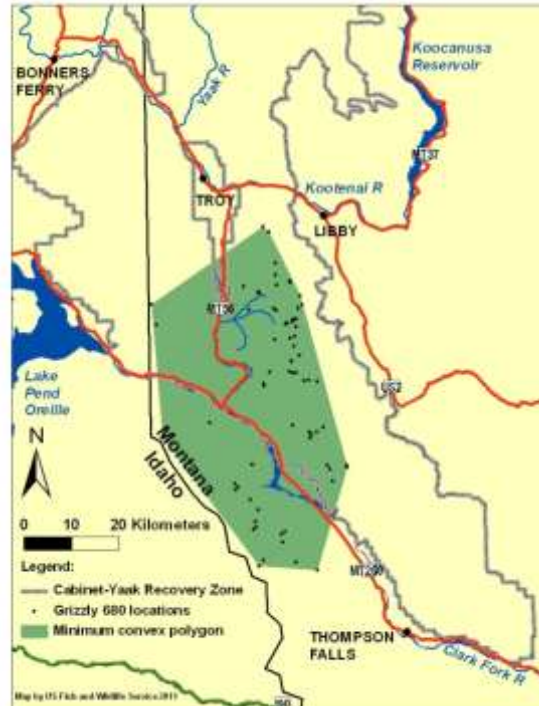


Figure 13. Radio locations and minimum convex (shaded) life range of male grizzly bear 680 in the Cabinet Mountains, 1984-85.



Figure 14. Radio locations and minimum convex (shaded) life range of male grizzly bear 14 in the Cabinet Mountains, 1985.



Figure 15. Radio locations and minimum convex (shaded) life range of male grizzly bear 101 in the Yaak River, 1986-87.

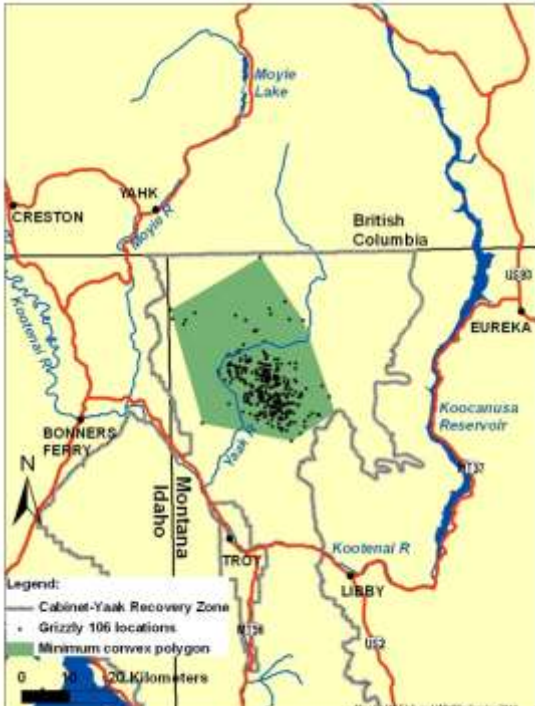


Figure 16. Radio locations and minimum convex (shaded) life range of female grizzly bear 106 in the Yaak River, 1986-99.

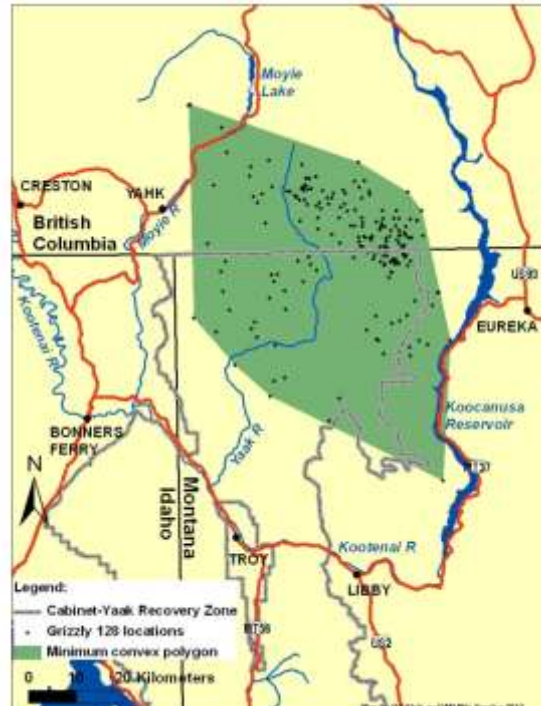


Figure 17. Radio locations and minimum convex (shaded) life range of male grizzly bear 128 in the Yaak River, 1987-97.

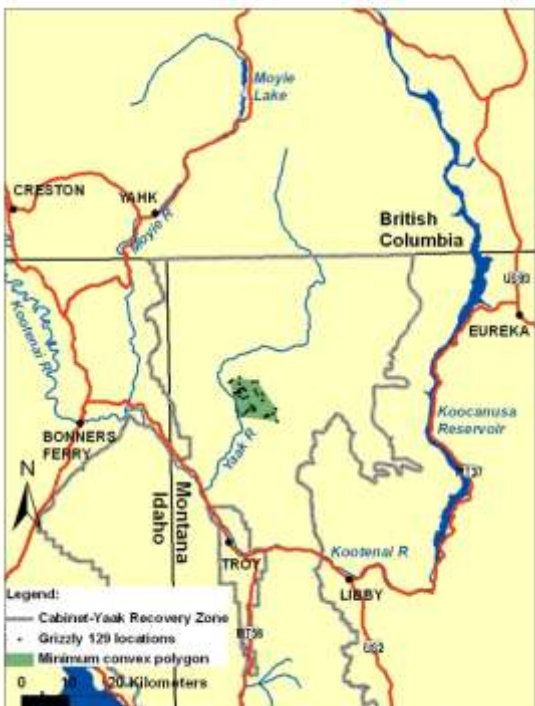


Figure 18. Radio locations and minimum convex (shaded) life range of female grizzly bear 129 in the Yaak River, 1987-89.

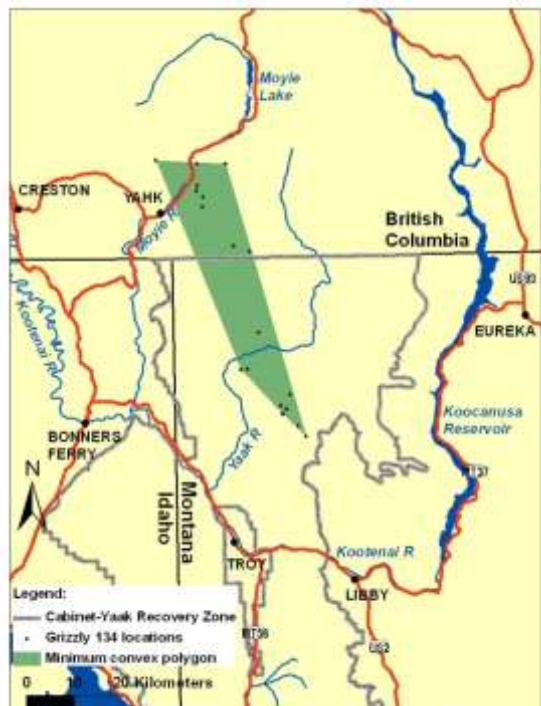


Figure 19. Radio locations and minimum convex (shaded) life range of male grizzly bear 134 in the Yaak River, 1987-88.

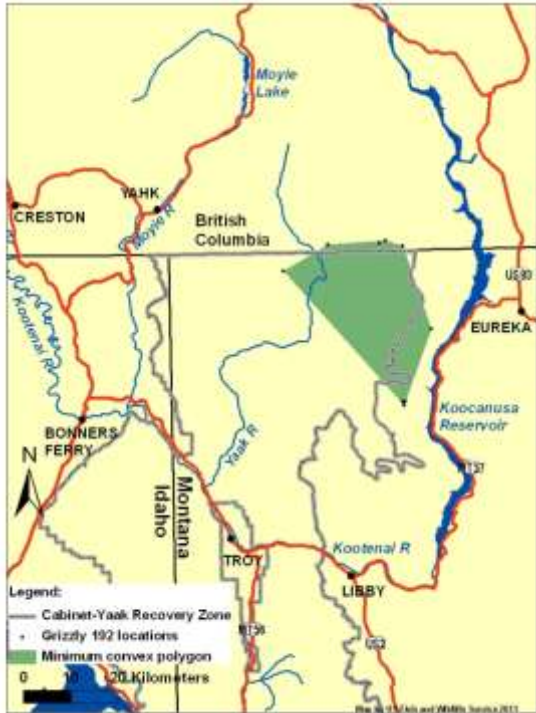


Figure 20. Radio locations and minimum convex (shaded) life range of male grizzly bear 192 in the Yaak River, 1990.

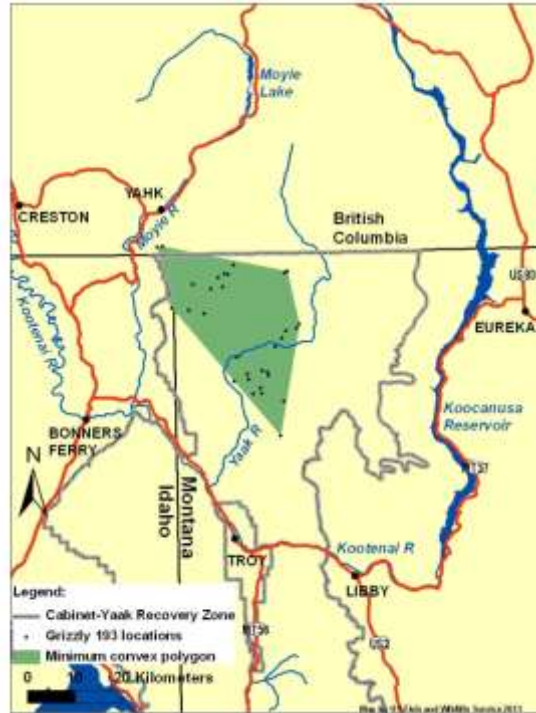


Figure 21. Radio locations and minimum convex (shaded) life range of male grizzly bear 193 in the Yaak River, 1990.

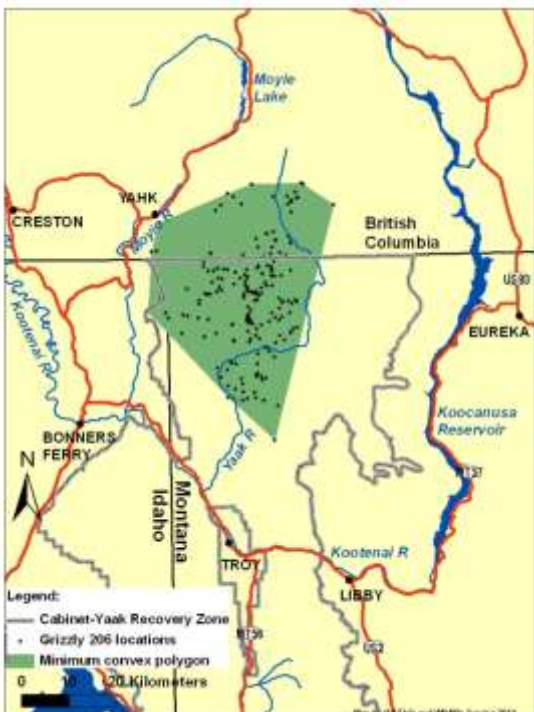


Figure 22. Radio locations and minimum convex (shaded) life range of female grizzly bear 206 in the Yaak River, 1991-94.

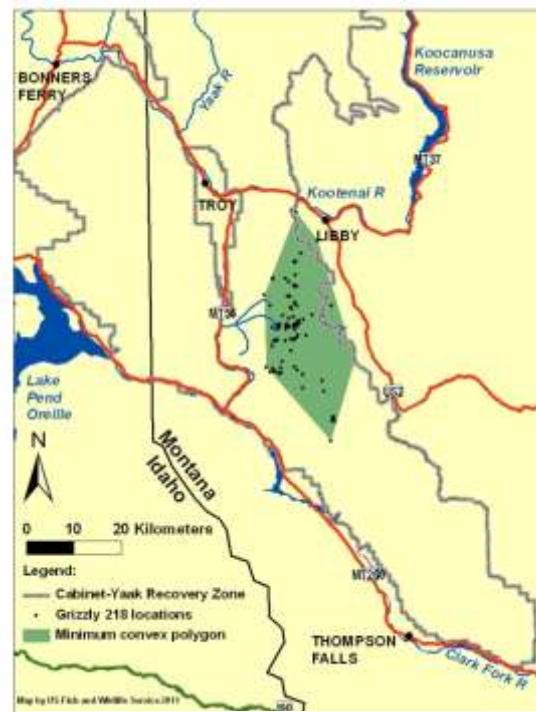


Figure 23. Radio locations and minimum convex (shaded) life range of female augmentation grizzly bear 218 in the Cabinet Mountains, 1990-91.



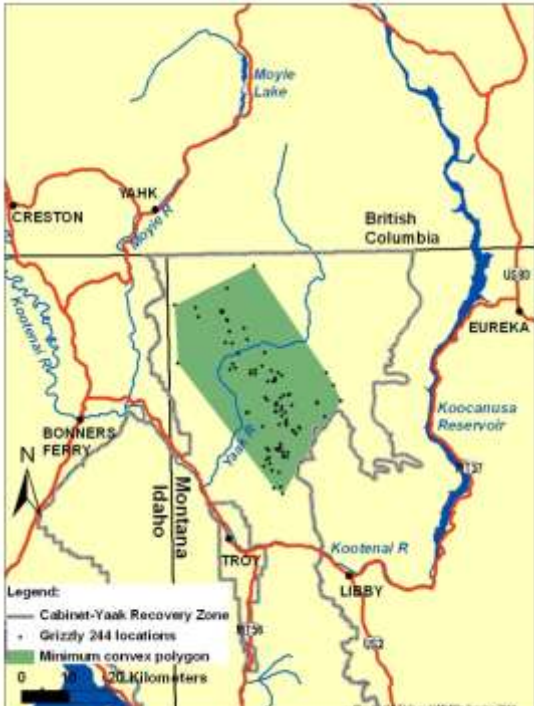


Figure 24. Radio locations and minimum convex (shaded) life range of male grizzly bear 244 in the Yaak River, 1992-03.



Figure 25. Radio locations and minimum convex (shaded) life range of female augmentation grizzly bear 258 in the Cabinet Mountains, 1992-93.



Figure 26. Radio locations and minimum convex (shaded) life range of female augmentation grizzly bear 286 in the Cabinet Mountains, 1993-95.



Figure 27. Radio locations and minimum convex (shaded) life range of female augmentation grizzly bear 311 in the Cabinet Mountains, 1994-95.



Figure 28. Radio locations and minimum convex (shaded) life range of male grizzly bear 302 in the Yaak River, 1994-96.



Figure 29. Radio locations and minimum convex (shaded) life range of female grizzly bear 303 in the Yaak River, 1994-01.

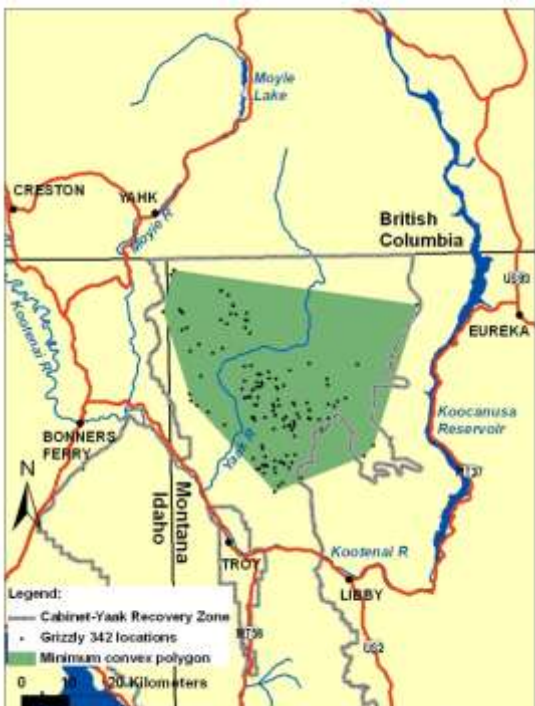


Figure 30. Radio locations and minimum convex (shaded) life range of male grizzly bear 342 in the Yaak River, 1995-01.

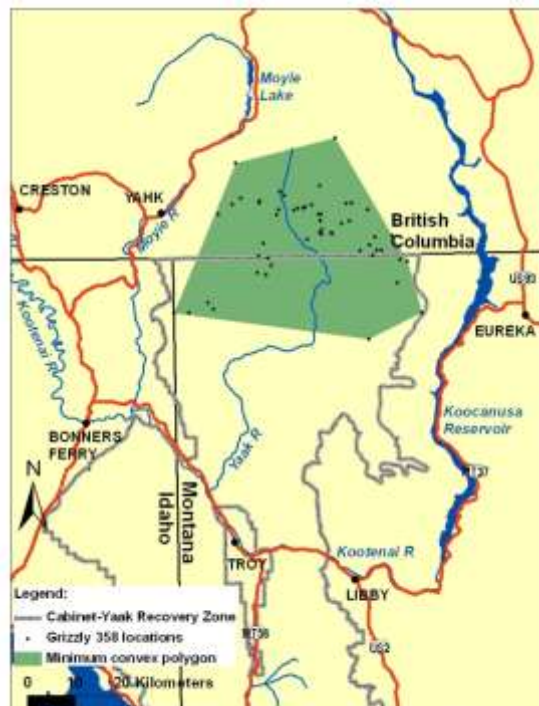


Figure 31. Radio locations and minimum convex (shaded) life range of male grizzly bear 358 in the Yaak River, 1996-98.

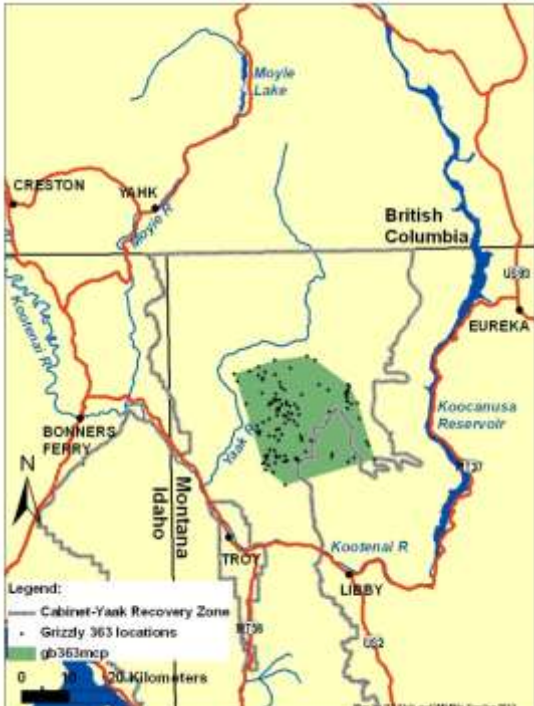


Figure 32. Radio locations and minimum convex (shaded) life range of male grizzly bear 363 in the Yaak River, 1996-99.



Figure 33. Radio locations and minimum convex (shaded) life range of male grizzly bear 386 in the Yaak River, 1997-99.

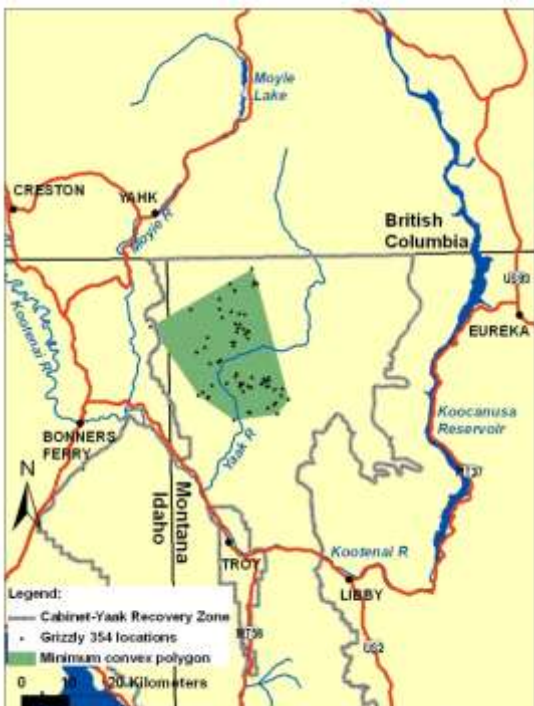


Figure 34. Radio locations and minimum convex (shaded) life range of female grizzly bear 354 in the Yaak River, 1997-99.

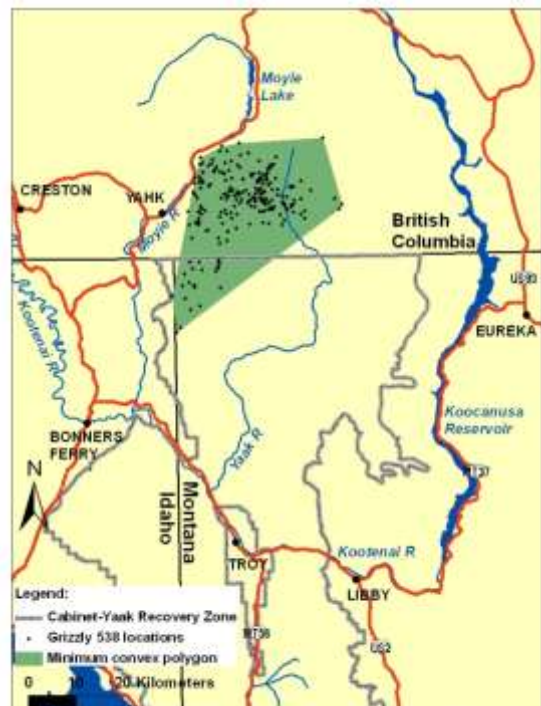


Figure 35. Radio locations and minimum convex (shaded) life range of female grizzly bear 538 in the Yaak River, 1997-02.

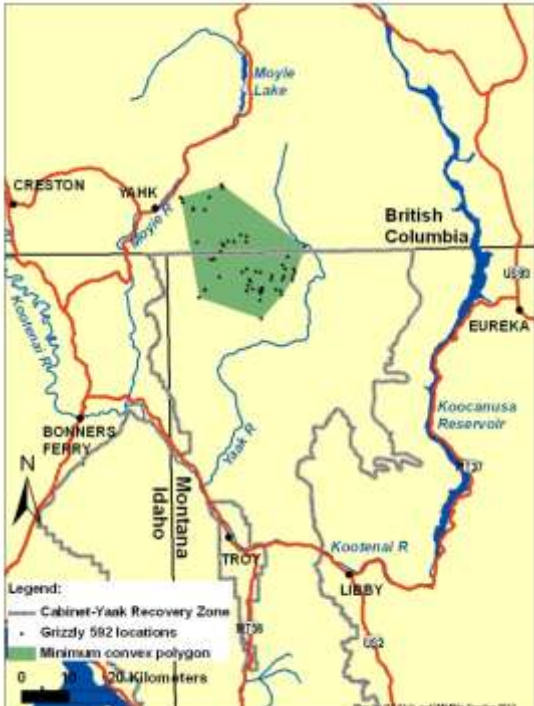


Figure 36. Radio locations and minimum convex (shaded) life range of female grizzly bear 592 in the Yaak River, 1999-00.



Figure 37. Radio locations and minimum convex (shaded) life range of female grizzly bear 596 in the Yaak River, 1999.



Figure 38. Radio locations and minimum convex (shaded) life range of female grizzly bear 577 in the Cabinet Mountains, 2002.



Figure 39. Radio locations and minimum convex (shaded) life range of male grizzly bear 579 in the Cabinet Mountains, 2002.

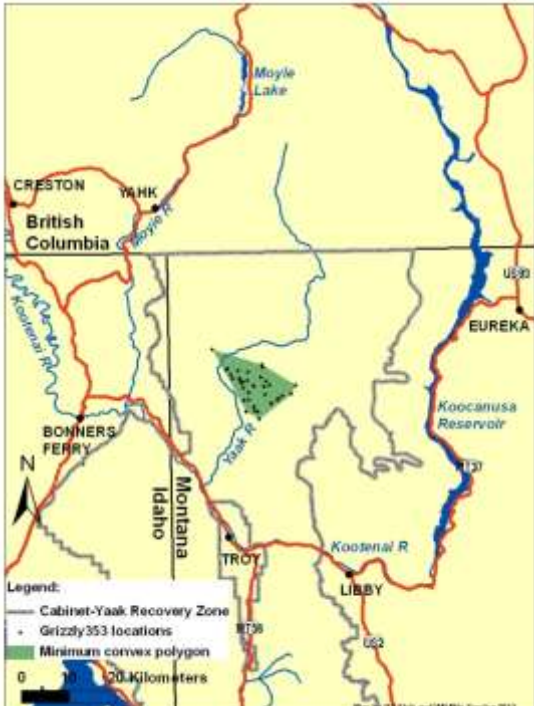


Figure 40. Radio locations and minimum convex (shaded) life range of female grizzly bear 353 in the Yaak River, 2002.

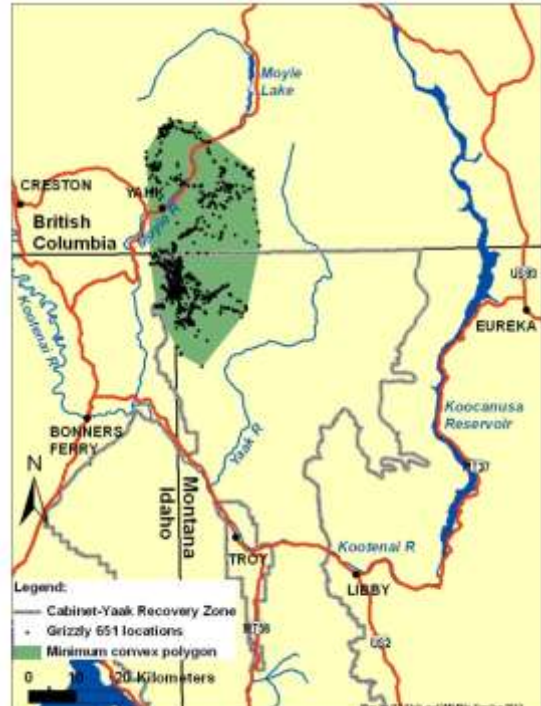


Figure 41. Radio locations and minimum convex (shaded) life range of male grizzly bear 651 in the Yaak River, 2002-06.

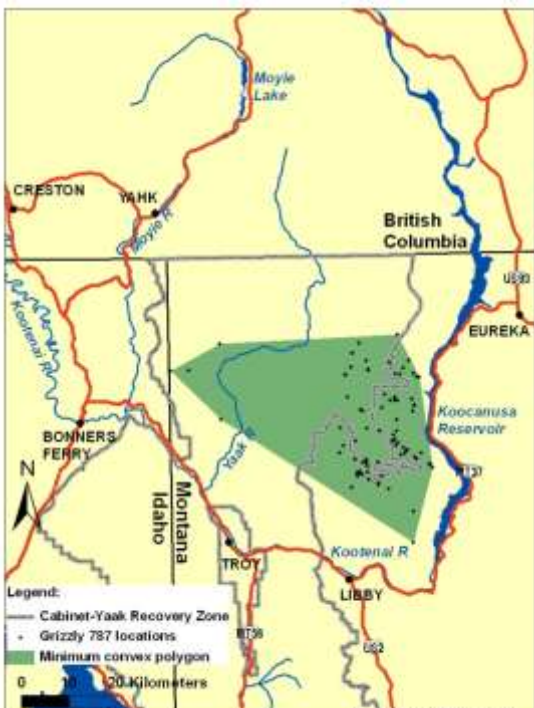


Figure 42. Radio locations and minimum convex (shaded) life range of male grizzly bear 787 in the Yaak River, 2003-04.



Figure 43. Radio locations and minimum convex (shaded) life range of female grizzly bear 648 in the Yaak River, 2003-05.

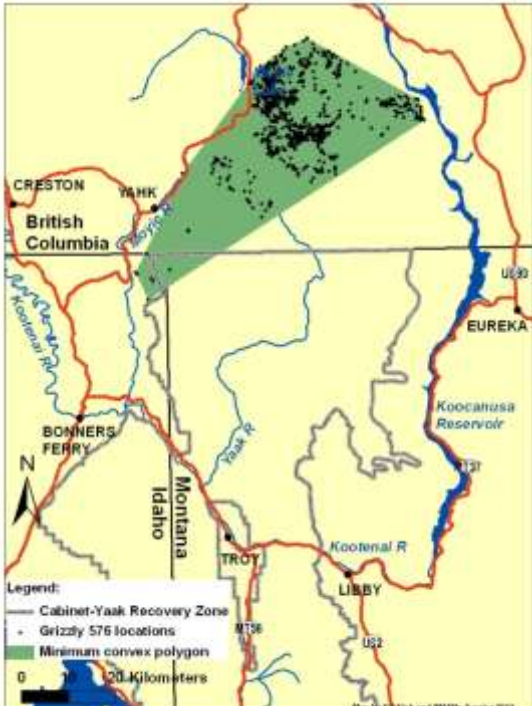


Figure 44. Radio locations and minimum convex (shaded) life range of male grizzly bear 576 in the Yaak River, 2004-06.

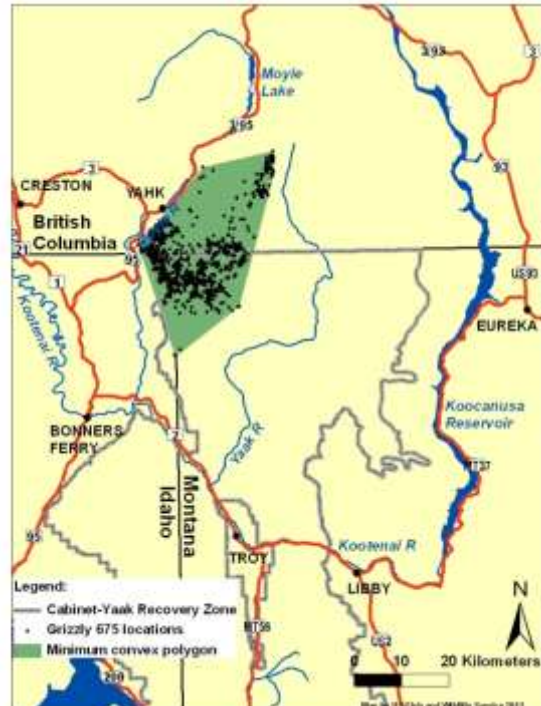


Figure 45. Radio locations and minimum convex (shaded) life range of female grizzly bear 675 in the Yaak River, 2004-10.



Figure 46. Radio locations and minimum convex (shaded) life range of female grizzly bear 10 in the Purcell Mountains, 2004.



Figure 47. Radio locations and minimum convex (shaded) life range of male grizzly bear 11 in the Purcell Mountains, 2004.

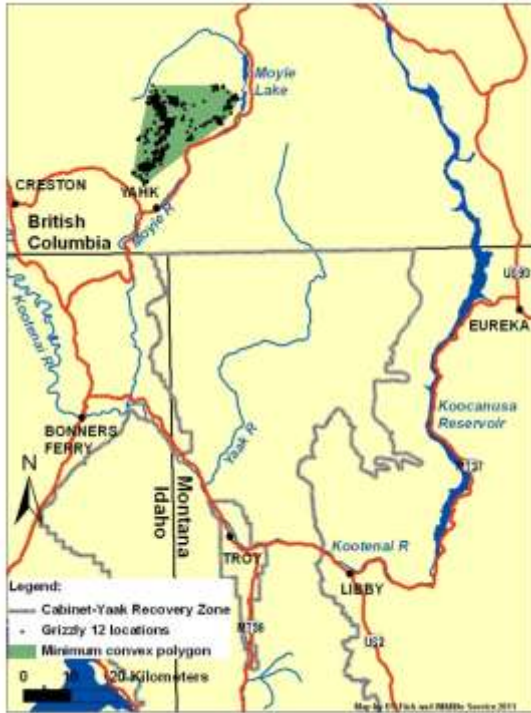


Figure 48. Radio locations and minimum convex (shaded) life range of female grizzly bear 12 in the Purcell Mountains, 2004.

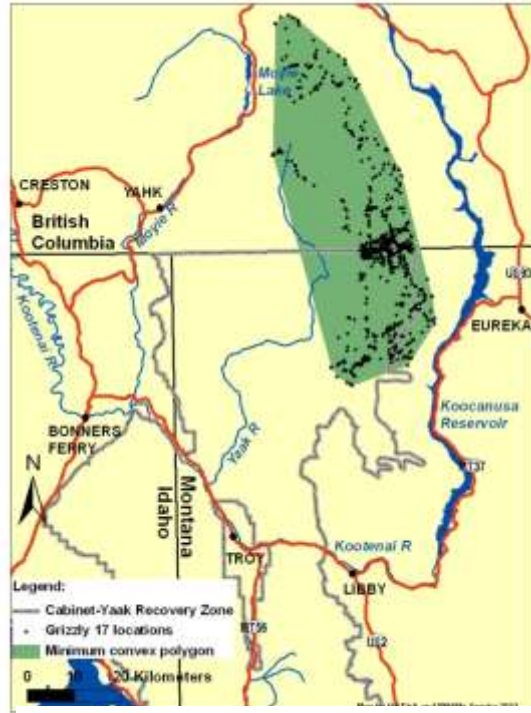


Figure 49. Radio locations and minimum convex (shaded) life range of male grizzly bear 17 in the Purcell Mountains, 2004.

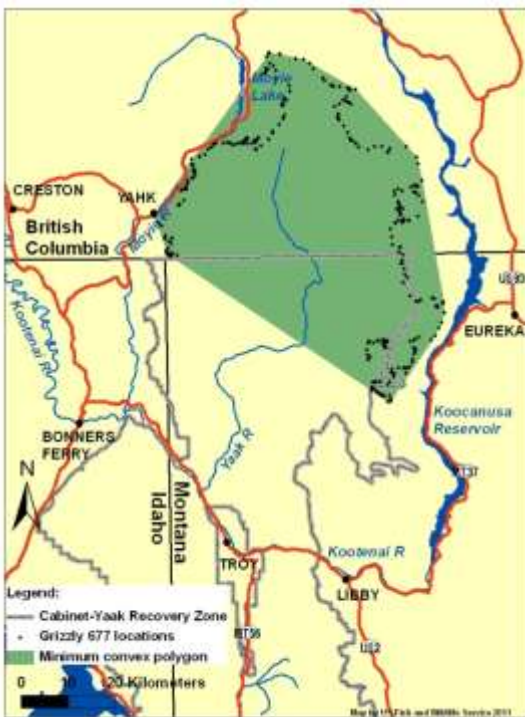


Figure 50. Radio locations and minimum convex (shaded) life range of male grizzly bear 677 in the Purcell Mountains, 2005.



Figure 51. Radio locations and minimum convex (shaded) life range of male grizzly bear 688 in the Purcell Mountains, 2005-06.

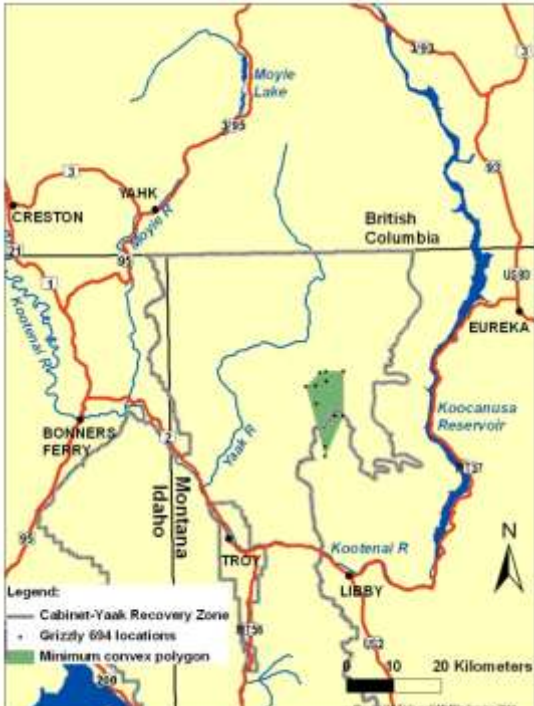


Figure 52. Radio locations and minimum convex (shaded) life range of female grizzly bear 694 in the Yaak River, 2005.



Figure 53. Radio locations and minimum convex (shaded) life range of female grizzly bear 292 in the Purcell Mountains, 2005.



Figure 54. Radio locations and minimum convex (shaded) life range of male grizzly bear 770 in the Cabinet Mountains, 2005-06.



Figure 55. Radio locations and minimum convex (shaded) life ranges of male grizzly bear 2 in the Purcell Mountains, 2005.



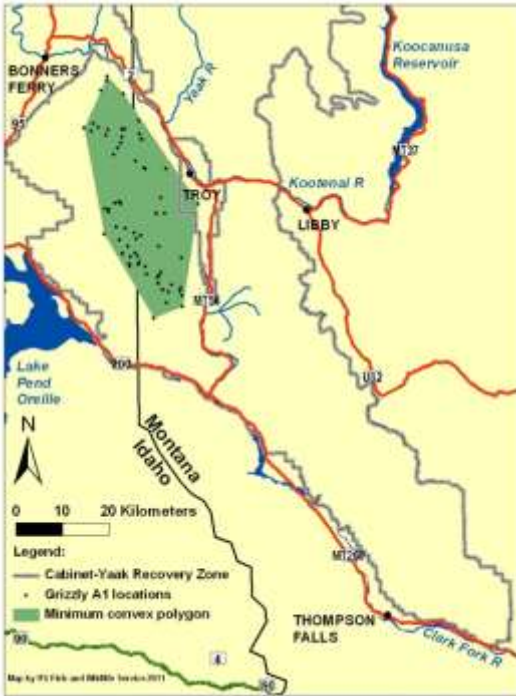


Figure 56. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear A1 in the Cabinet Mountains, 2005-07.

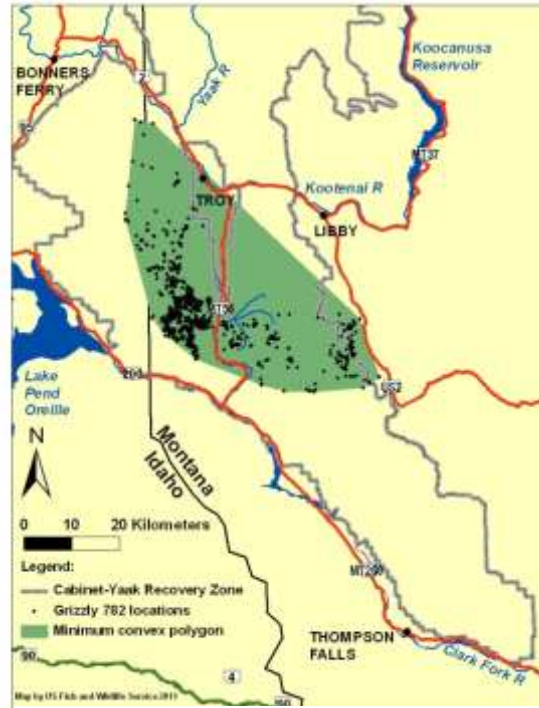


Figure 57. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear 782 in the Cabinet Mountains, 2006-07.

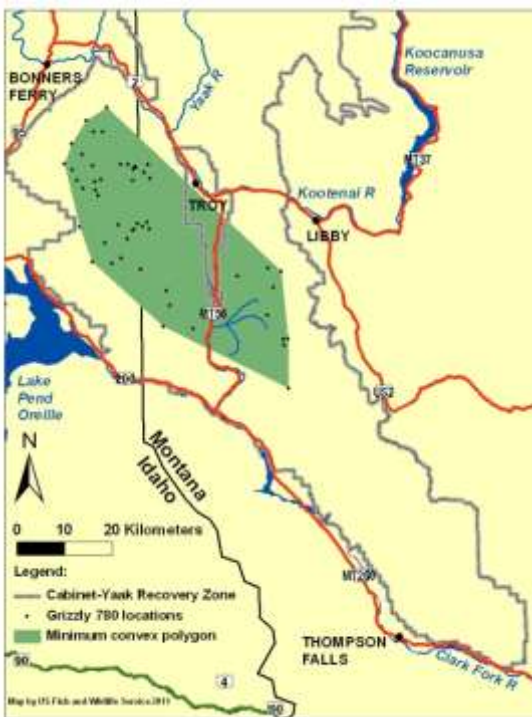


Figure 58. Radio locations and minimum convex (shaded) life range of male grizzly bear 780 in the Cabinet Mountains, 2006-08.

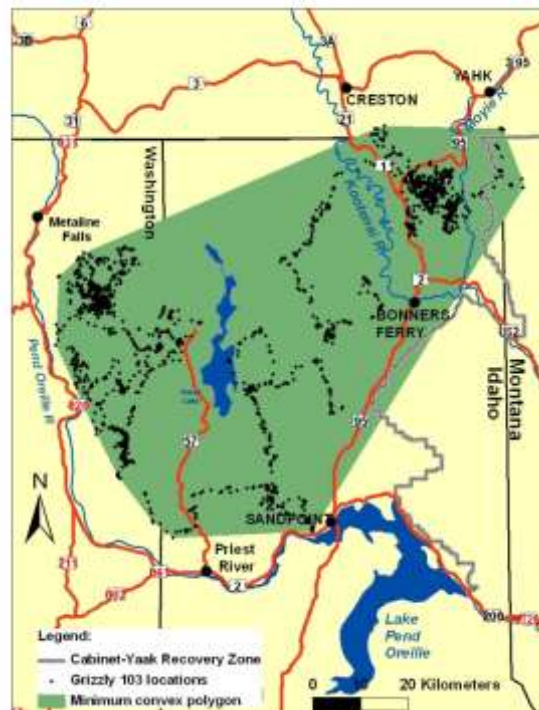


Figure 59. Radio locations and minimum convex (shaded) life range of male grizzly bear 103 in the Yaak River, 2006-07.



Figure 60. Radio locations and minimum convex (shaded) life range of male grizzly bear 5381 in the Purcell Mountains, 2006-07.



Figure 61. Radio locations and minimum convex (shaded) life range of female grizzly bear 130 in the Purcell Mountains, 2007-08.



Figure 62. Radio locations and minimum convex (shaded) life range of female grizzly bear 131 in the Purcell Mountains, 2007-08.



Figure 63. Radio locations and minimum convex (shaded) life range of female grizzly bear 784 in the Yaak River, 2007-09.

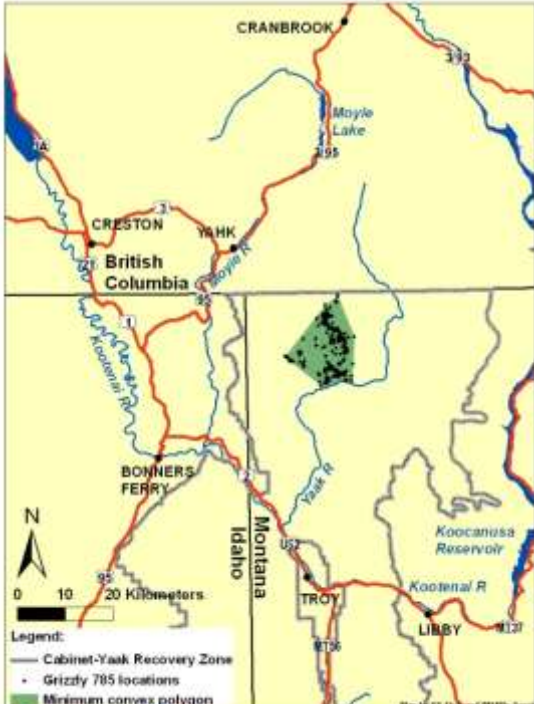


Figure 64. Radio locations and minimum convex (shaded) life range of female grizzly bear 785 in the Yaak River, 2007-08.



Figure 65. Radio locations and minimum convex (shaded) life range of female grizzly bear 772 in the Cabinet Mountains, 2007.



Figure 66. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear 635 in the Cabinet Mountains, 2008.

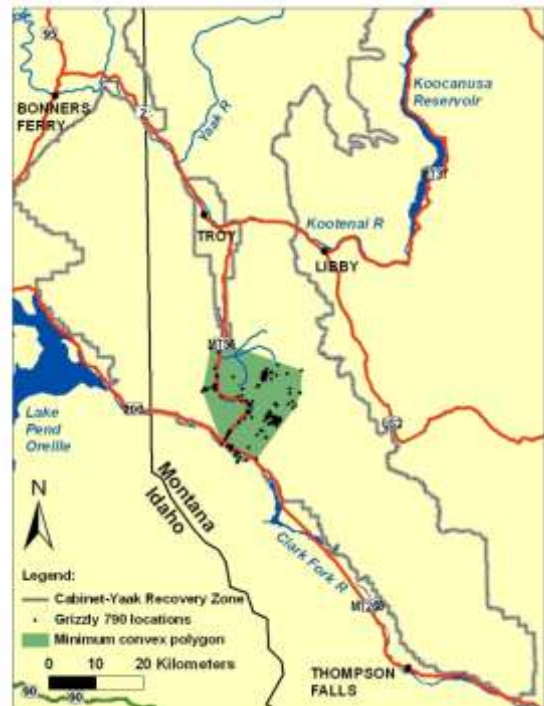


Figure 67. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear 790 in the Cabinet Mountains, 2008.

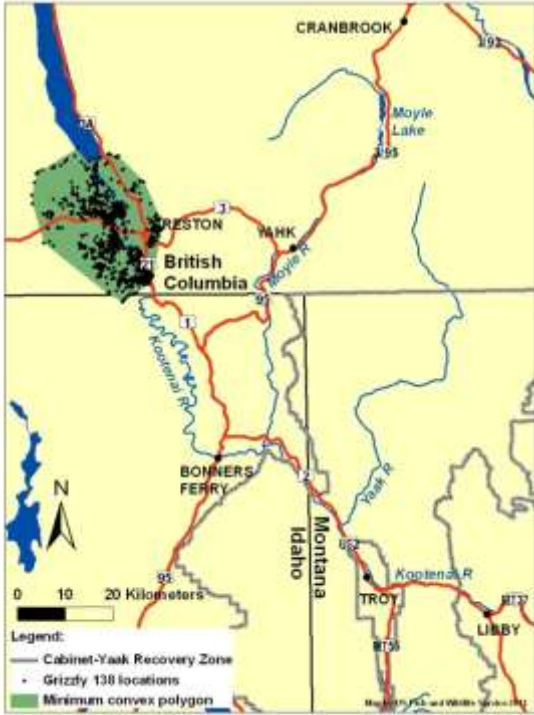


Figure 68. Radio locations and minimum convex (shaded) life range of female grizzly bear 138 in the Purcell and Selkirk Mountains, 2008-09.



Figure 69. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear 715 in the Cabinet Mountains, 2009-10.

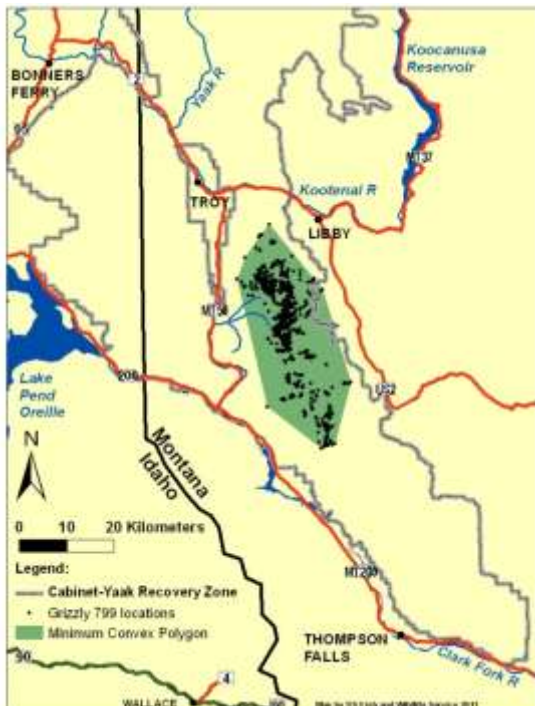


Figure 70. Radio locations and minimum convex (shaded) life range of male grizzly bear 799 in the Cabinet Mountains, 2010-11.



Figure 71. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear 714 in the Cabinet Mountains, 2010-11.

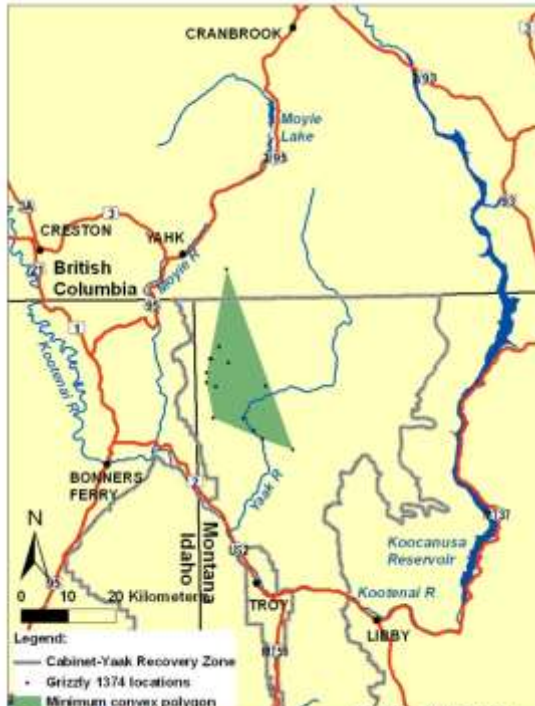


Figure 72. Radio locations and minimum convex (shaded) life range of male grizzly bear 1374 in the Yaak River, 2010.

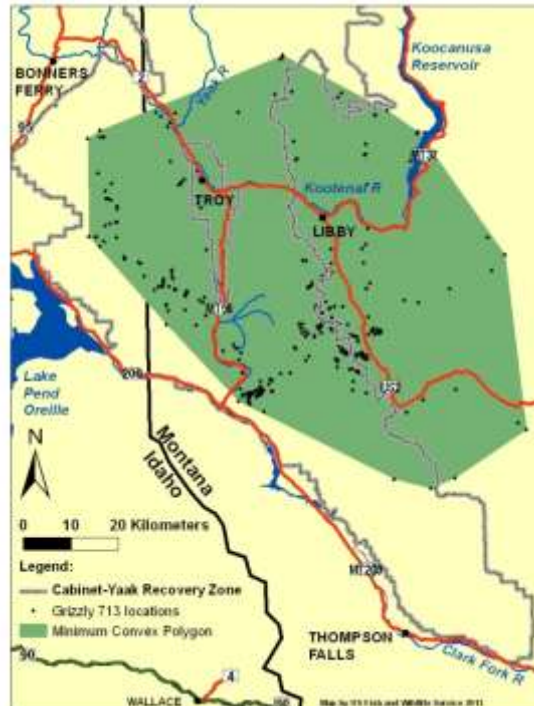


Figure 73. Radio locations and minimum convex (shaded) life range of augmentation male grizzly bear 713 in the Cabinet Mountains, 2010-11.

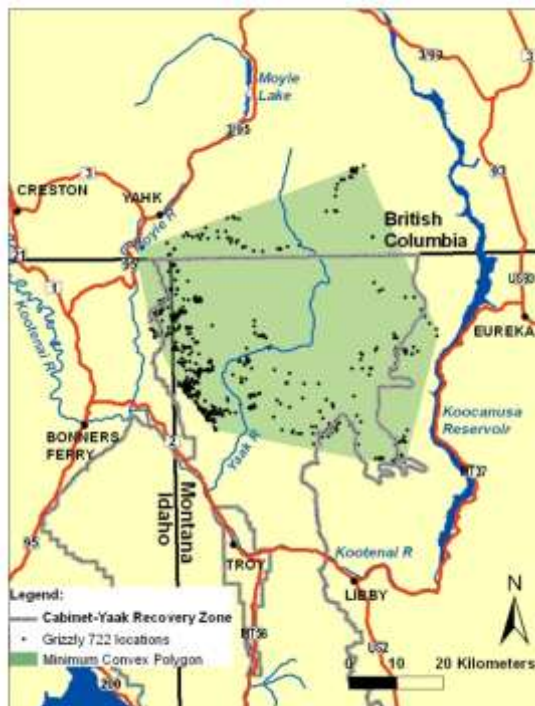


Figure 74. Radio locations and minimum convex (shaded) life range of male grizzly bear 722 in the Yaak River, 2011.



Figure 75. Radio locations and minimum convex (shaded) life range of augmentation male grizzly bear 723 in the Cabinet Mountains, 2010.



Figure 76. Radio locations and minimum convex (shaded) life range of augmentation female grizzly bear 725 in the Cabinet Mountains, 2011.

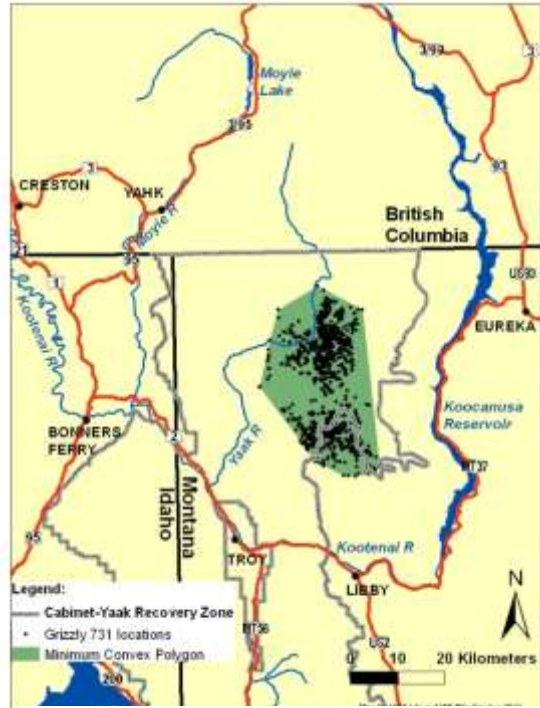


Figure 77. Radio locations and minimum convex (shaded) life range of female grizzly bear 731 in the Yaak River, 2009-11.

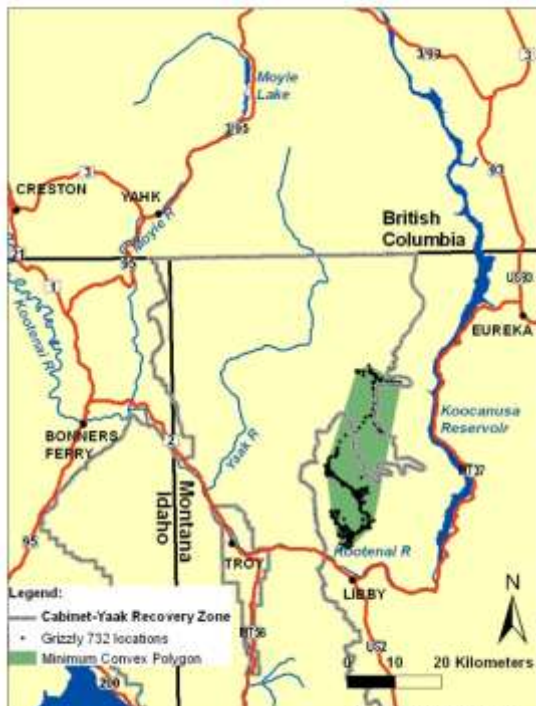


Figure 78. Radio locations and minimum convex (shaded) life range of male grizzly bear 732 in the Yaak River, 2011.

### Grizzly Bear Denning Chronology

Den entry and exit dates were summarized by week during 1983–2011. Sixty-six den exit dates ranged from the third week of March to the third week of May (Figure 73). Fifty-four (82%) exit dates occurred from the first through fourth weeks of April. Grizzly bears in the Cabinet Mountains generally exited dens at least one week later than bears in the Yaak river drainage. Males generally exited dens earlier than females. Females with cubs appear to exit dens later than other females.

Seventy-two den entry dates ranged from the third week of October to the last week of December. Sixty (83%) of these entry dates occurred from the first week of November to the second week of December (Figure 74). Grizzly bears in the Cabinet Mountains generally entered dens at least 2 to 3 weeks earlier than bears in the Yaak river drainage. Males generally entered dens later than females.

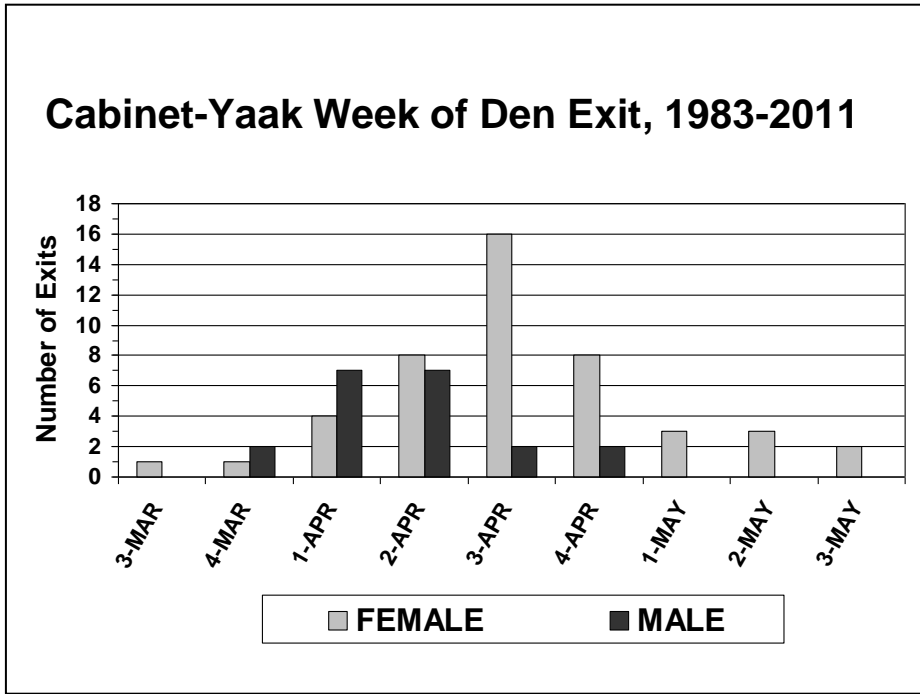


Figure 79. Week of indicated month for den exit of radio collared grizzly bears in the Cabinet-Yaak recovery zone 1983-2011.

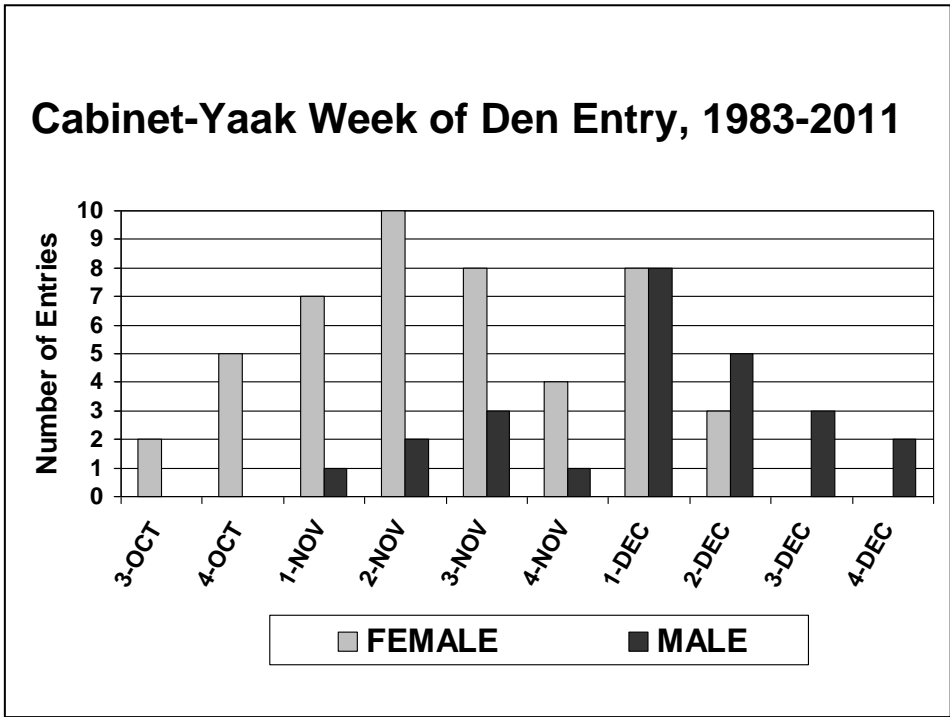


Figure 80. Week of indicated month for den entry of radio collared grizzly bears in the Cabinet-Yaak recovery zone 1983-2011.

## Grizzly Bear Use of Habitat Components

Grizzly bear use of habitat components was summarized on a seasonal basis during 1983–2009. Only VHF radio locations (1983–2009) were used in this analysis. Radio locations derived from GPS radio collars will be analyzed separately through resource selection function techniques in the future. Spring was defined as den exit through 15 June, summer was 16 June through 15 September, and autumn was 16 September through den entry. VHF radiolocation sample sizes for the Cabinet Mountains were: 152 in spring, 379 in summer, and 130 in autumn. Radiolocation sample sizes for the Yaak River were: 480 in spring, 1061 in summer, and 713 in autumn. Den site sample sizes were 17 in the Cabinet Mountains and 54 in the Yaak River.

Radio collared grizzly bears in the Cabinet Mountains and Yaak River made greatest annual use of closed timber, timbered shrubfields, mixed shrub snowchutes, mixed shrub/cutting units, alder shrubfields, huckleberry shrubfields, and graminoid and beargrass sidehill parks (Fig. 81). Primary differences in annual use of habitat components include greater use of mixed shrub snowchutes, alder shrubfields, huckleberry shrubfields, and beargrass sidehill parks in the Cabinet Mountains and greater use of closed timber, timbered shrubfields, mixed shrub/cutting units, and graminoid sidehill parks in the Yaak River. A brief description of all 19 habitat components is provided in Appendix 2.

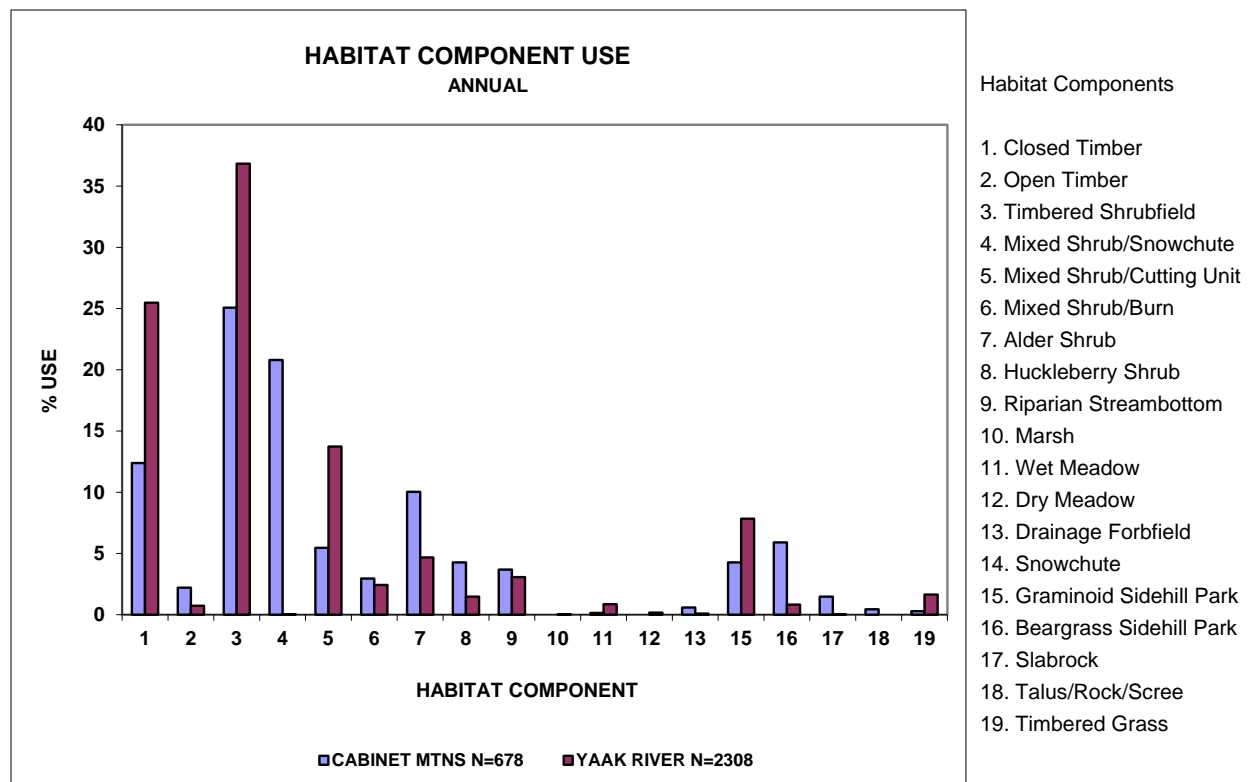


Figure 81. Annual habitat component use in the Cabinet Mountains and Yaak River, 1983-2009.



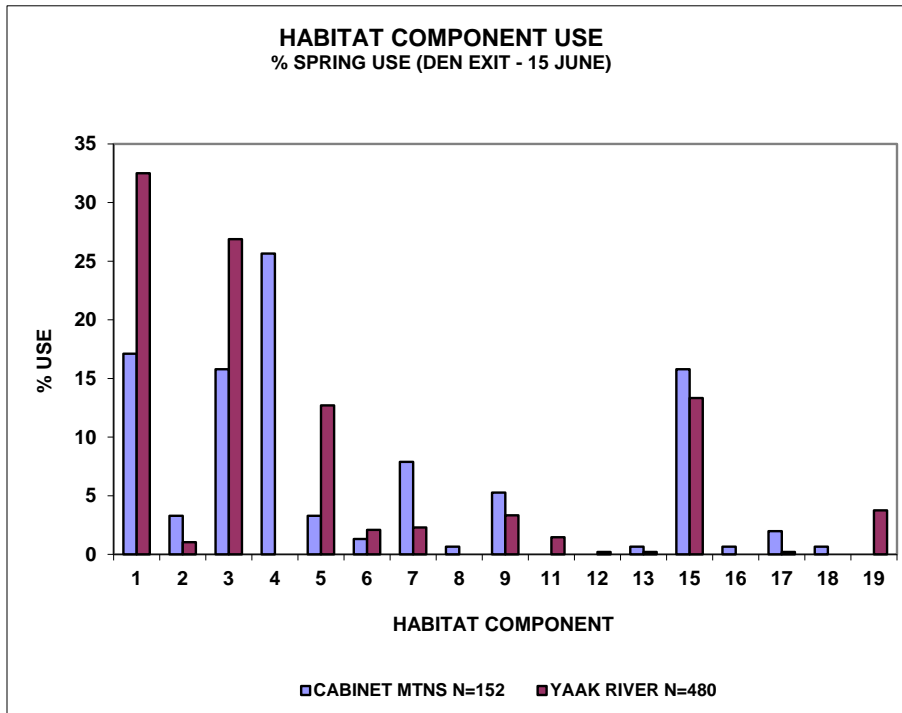
Spring use of habitat components by radio-collared grizzly bears in the Cabinet Mountains and the Yaak River drainage was dominated by closed timber, timbered shrubfields, mixed shrub snowchutes, mixed shrub cutting units, alder shrubfields, and graminoid sidehill parks (Fig. 82). Notable differences between the two study areas include heavier use of snowchutes, alder, and graminoid parks in the Cabinet Mountains and heavier use of closed timber, timbered shrubfields, and cutting units in the Yaak River. Food habits indicate that bears are utilizing grasses, sedges, succulent forbs, and the corms of glacier lily and biscuitroot at this time of the year (Kasworm and Thier 1993). Snowchutes, cutting units, alder, and graminoid parks provide many of these items at this time.

Summer use of habitat components by radio-collared grizzly bears in the Cabinet Mountains and the Yaak River drainage was dominated by closed timber, timbered shrubfields, mixed shrub snowchutes, mixed shrub cutting units, mixed shrub burns, alder shrubfields, huckleberry shrubfields, graminoid sidehill parks, and beargrass sidehill parks (Fig. 83). Differences between the two study areas include heavier use of snowchutes, huckleberry shrubfields, and beargrass parks in the Cabinet Mountains and heavier use of closed timber, timbered shrubfields, cutting units, and graminoid parks in the Yaak River. Food habits indicate heavy use of succulent forbs, insects, and berries (mostly huckleberries) (Kasworm and Thier 1993).

Autumn use of habitat components by radio-collared grizzly bears in the Cabinet Mountains and the Yaak River drainage was dominated by closed timber, timbered shrubfields, mixed shrub snowchutes, mixed shrub cutting units, mixed shrub burns, alder shrubfields, huckleberry shrubfields, graminoid sidehill parks, and beargrass sidehill parks (Fig. 84). Differences between the two study areas include heavier use of snowchutes, huckleberry shrubfields, and beargrass parks in the Cabinet Mountains and heavier use of closed timber, timbered shrubfields, cutting units, and graminoid parks in the Yaak River. Autumn bear diets reverted back to grasses and sedges during late rains and subsequent green-up. Berries can still be important at this time of year when huckleberries are still available at higher elevations or mountain ash berries which persist on plants beyond first snowfall. Bears also utilize carrion and gut piles from hunter harvested or wounded deer and elk.

Many of the differences in use between the Cabinet Mountains and the Yaak River study areas appear related to amounts or availability of these components in each study area. Much of the use of closed timber and timbered shrubfields occurred adjacent to other components that provided food and may have been used for cover or bedding areas.

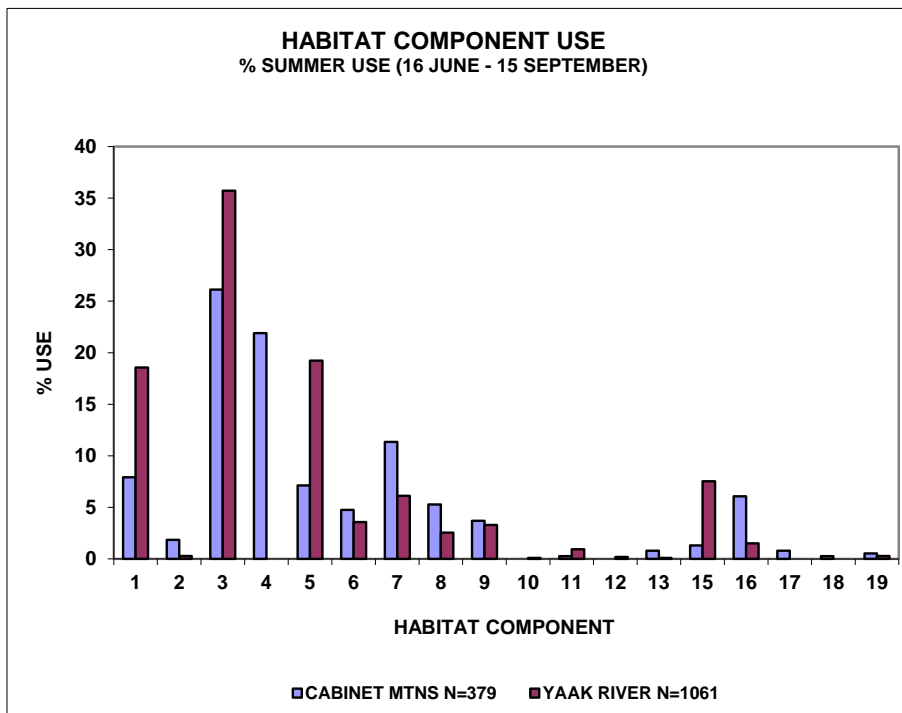
Den use of habitat components by radio collared grizzly bears in the Cabinet Mountains and the Yaak River drainage was dominated by closed timber, timbered shrubfields, graminoid sidehill parks, and beargrass sidehill parks (Fig. 85). Differences between the two study areas include heavier use of beargrass parks in the Cabinet Mountains and heavier use of closed timber, timbered shrubfields, and graminoid parks in the Yaak River.



Habitat Components

1. Closed Timber
2. Open Timber
3. Timbered Shrubfield
4. Mixed Shrub/Snowchute
5. Mixed Shrub/Cutting Unit
6. Mixed Shrub/Burn
7. Alder Shrub
8. Huckleberry Shrub
9. Riparian Streambottom
10. Marsh
11. Wet Meadow
12. Dry Meadow
13. Drainage Forbfield
14. Snowchute
15. Graminoid Sidehill Park
16. Beargrass Sidehill Park
17. Slabrock
18. Talus/Rock/Scree
19. Timbered Grass

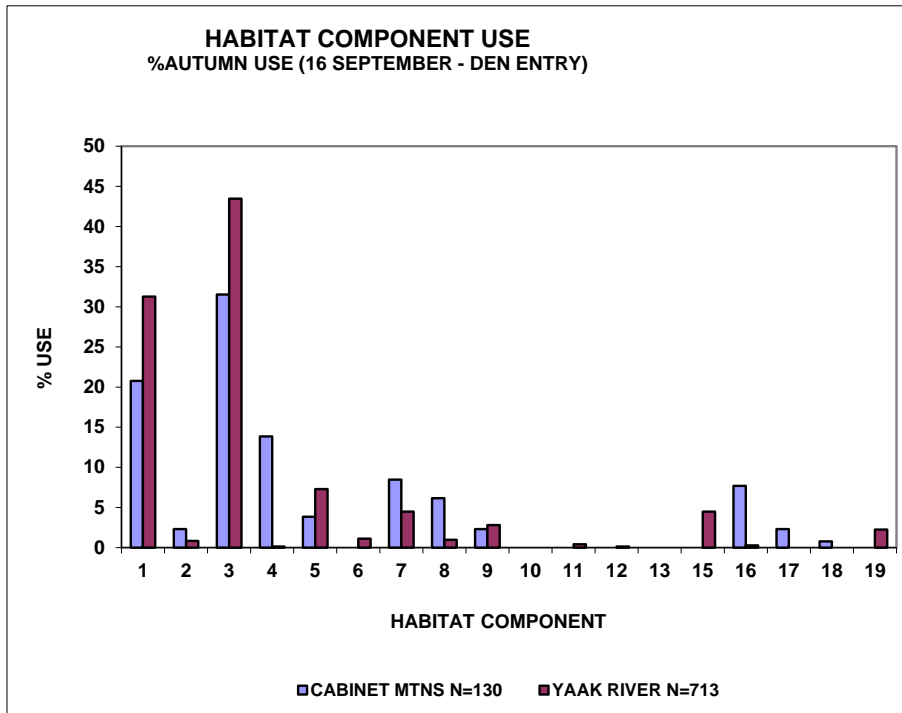
Figure 82. Spring habitat component use in the Cabinet Mountains and Yaak River, 1983-2009.



Habitat Components

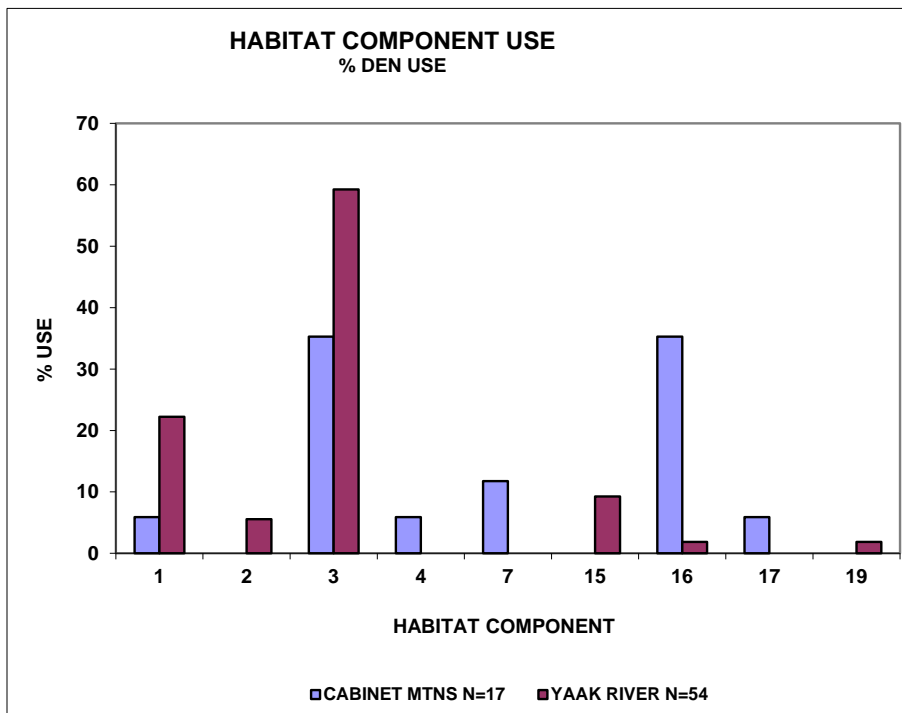
1. Closed Timber
2. Open Timber
3. Timbered Shrubfield
4. Mixed Shrub/Snowchute
5. Mixed Shrub/Cutting Unit
6. Mixed Shrub/Burn
7. Alder Shrub
8. Huckleberry Shrub
9. Riparian Streambottom
10. Marsh
11. Wet Meadow
12. Dry Meadow
13. Drainage Forbfield
14. Snowchute
15. Graminoid Sidehill Park
16. Beargrass Sidehill Park
17. Slabrock
18. Talus/Rock/Scree
19. Timbered Grass

Figure 83. Summer habitat component use in the Cabinet Mountains and Yaak River, 1983-2009.



- Habitat Components
1. Closed Timber
  2. Open Timber
  3. Timbered Shrubfield
  4. Mixed Shrub/Snowchute
  5. Mixed Shrub/Cutting Unit
  6. Mixed Shrub/Burn
  7. Alder Shrub
  8. Huckleberry Shrub
  9. Riparian Streambottom
  10. Marsh
  11. Wet Meadow
  12. Dry Meadow
  13. Drainage Forbfield
  14. Snowchute
  15. Graminoid Sidehill Park
  16. Beargrass Sidehill Park
  17. Slabrock
  18. Talus/Rock/Scree
  19. Timbered Grass

Figure 84. Autumn habitat component use in the Cabinet Mountains and Yaak River, 1983-2009.



- Habitat Components
1. Closed Timber
  2. Open Timber
  3. Timbered Shrubfield
  4. Mixed Shrub/Snowchute
  5. Mixed Shrub/Cutting Unit
  6. Mixed Shrub/Burn
  7. Alder Shrub
  8. Huckleberry Shrub
  9. Riparian Streambottom
  10. Marsh
  11. Wet Meadow
  12. Dry Meadow
  13. Drainage Forbfield
  14. Snowchute
  15. Graminoid Sidehill Park
  16. Beargrass Sidehill Park
  17. Slabrock
  18. Talus/Rock/Scree
  19. Timbered Grass

Figure 85. Den habitat component use in the Cabinet Mountains and Yaak River, 1983-2009.

## Grizzly Bear Use by Elevation

Differences in elevation between the Cabinet Mountains and the Yaak River study areas are reflected in the bear location data from both areas (Fig. 86-87). Annual mean elevation used by grizzly bears in the Cabinets Mountains was 1,575 meters compared to 1,497 meters for the Yaak River. Monthly mean elevation followed similar patterns with Cabinet Mountain grizzly bears utilizing higher elevations during most months except November. Sample size in the Cabinet Mountains during November was small, but bears were generally forced into lower elevations by snowfall prior to den entry and may have been responding to increased amount of carrion in the form of gut piles and wounded animals from ungulate hunters. Mean den elevation in the Cabinet Mountains was 1,875 meters and 1,698 meters in the Yaak River.

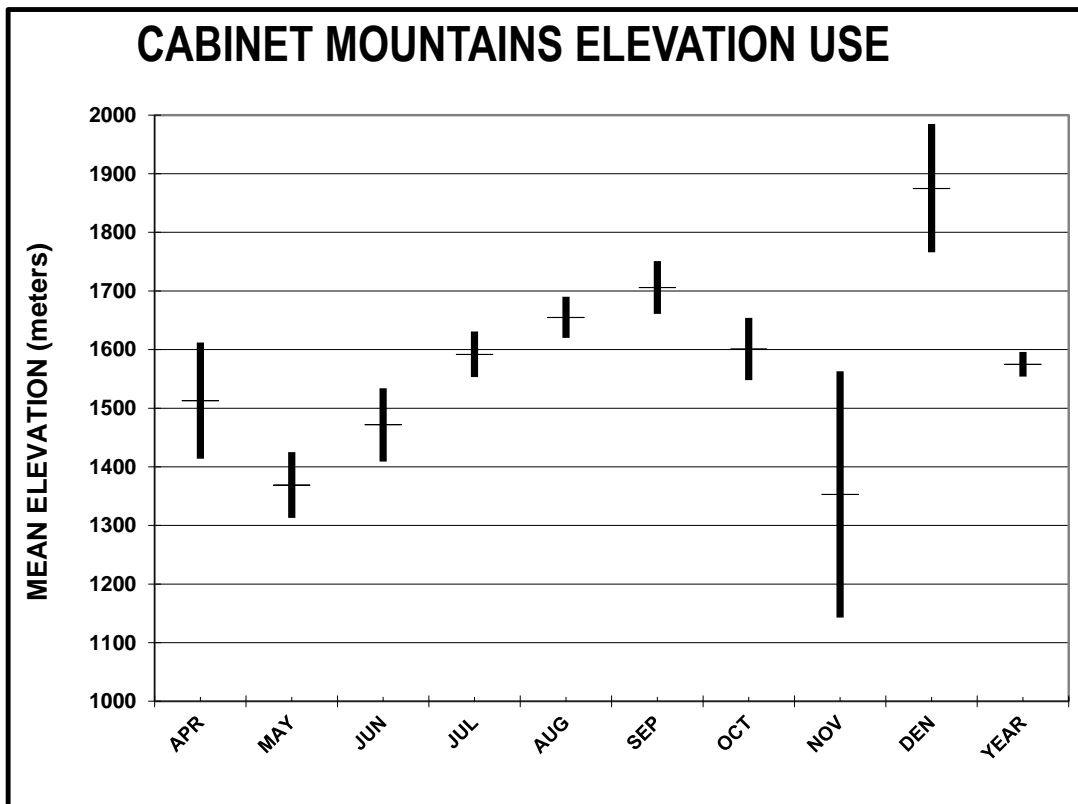


Figure 86. Mean elevation and 95% confidence intervals of radiolocations in the Cabinet Mountains, 1983-2009.

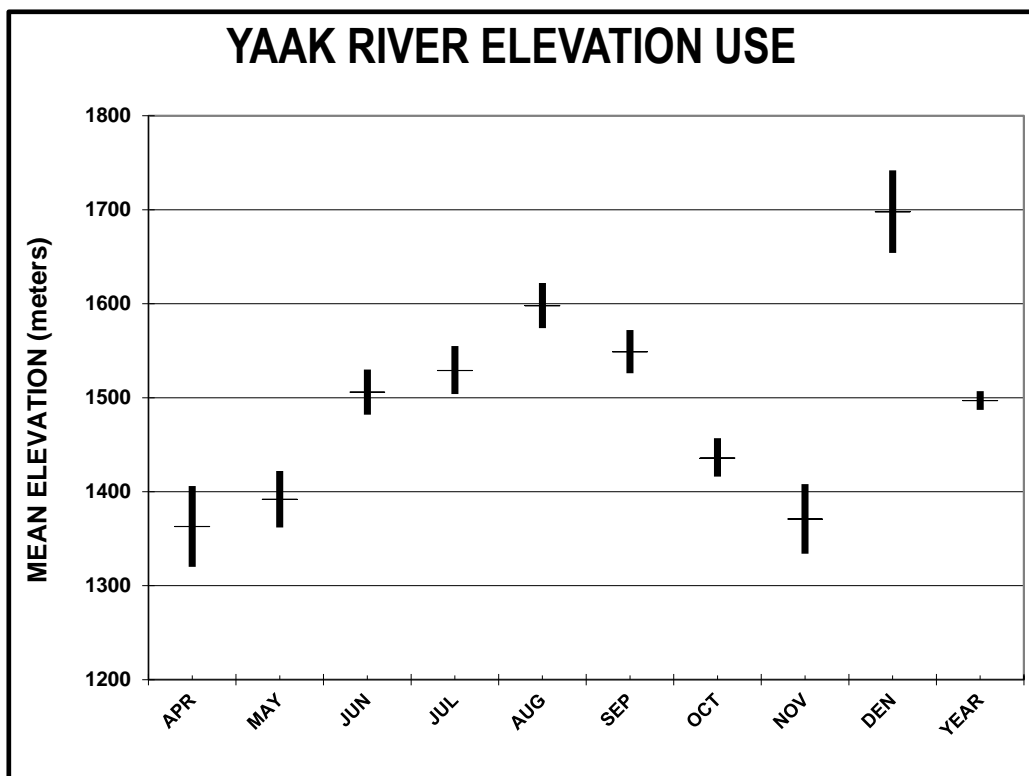


Figure 87. Mean elevation and 95% confidence intervals of radiolocations in the Yaak River, 1986-2009.

### Grizzly Bear Use by Aspect

Use of aspect by grizzly bears varied between the Cabinet Mountains and Yaak River study areas, particularly during early spring (Figs. 88-89). South aspects received greatest use by grizzly bears in the Cabinet Mountains during April and May. However, grizzly bears in the Yaak area showed more balanced use of all aspects during that time. Generally grizzly bears in the Cabinet Mountains made greater use of southerly slopes during all months than grizzly bears in the Yaak River. South aspects were most heavily used by grizzly bears in the Cabinet Mountains for den sites, but used least in the Yaak River. Elevation, slope, and the resultant vegetation in addition to snow melt likely interacted to produce the observed patterns of use.

### Grizzly Bear Spring Habitat Description

After den emergence in spring, bears seek sites that melt snow early and produce green vegetation. These sites can often overlap with ungulate winter range and provide winterkill carrion. Spring habitat use in both study areas (April and May) indicated use of low elevation sites. Cabinet Mountain radio locations indicated most use below 1,600 m with primary use of southerly facing snowchutes, alder shrubfields, grassy sidehill parks, and closed timber. Yaak River radio locations indicated most use below 1,400 m with primary use of closed timber, timbered shrubfields, cutting units, and grassy sidehill parks on virtually all aspects. Lower elevation of the Yaak River area may allow snow to melt and vegetation to green-up earlier.

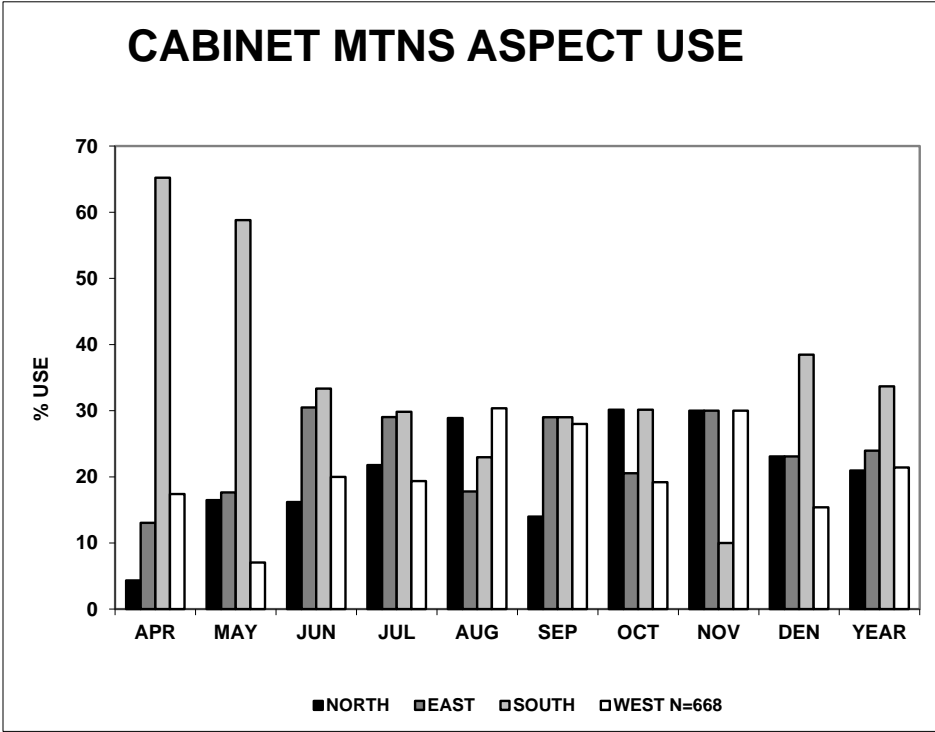


Figure 88. Aspect of radiolocations in the Cabinet Mountains, 1983-2009.

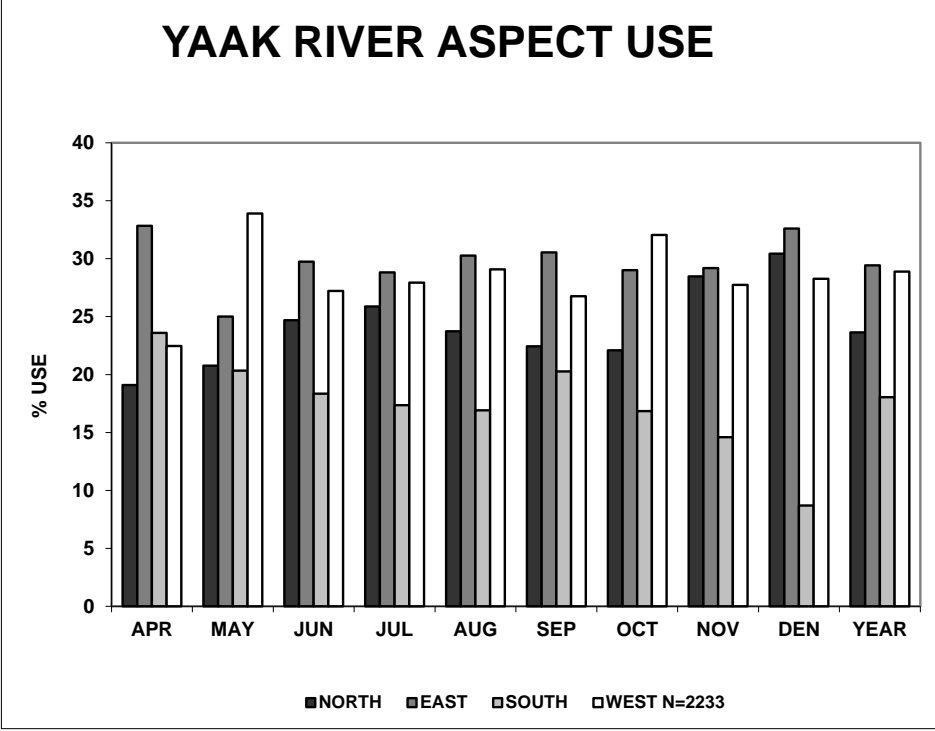


Figure 89. Aspect of radiolocations in the Yaak River, 1986-2009.

## Berry Production

### Huckleberry

Eleven huckleberry transects were evaluated during 1989, 19 during 1990–99, 18 in 2000, 20 in 2001, 21 in 2002–03, 23 in 2004, 16 in 2005, 18 in 2006, 16 in 2007, 18 in 2008–09, 17 in 2010 and 15 in 2011. Mean berry count per plot for all transects was 1.66 (95% CI  $\pm$  0.045) during the study period. Mean annual berry counts during 1989–2011 ranged from 0.5–3.1 (Fig. 90). Low berry counts occurred in 1992, 1998–99, and 2002–03. High counts occurred in 1989–91, 1996, 2008, and 2009.

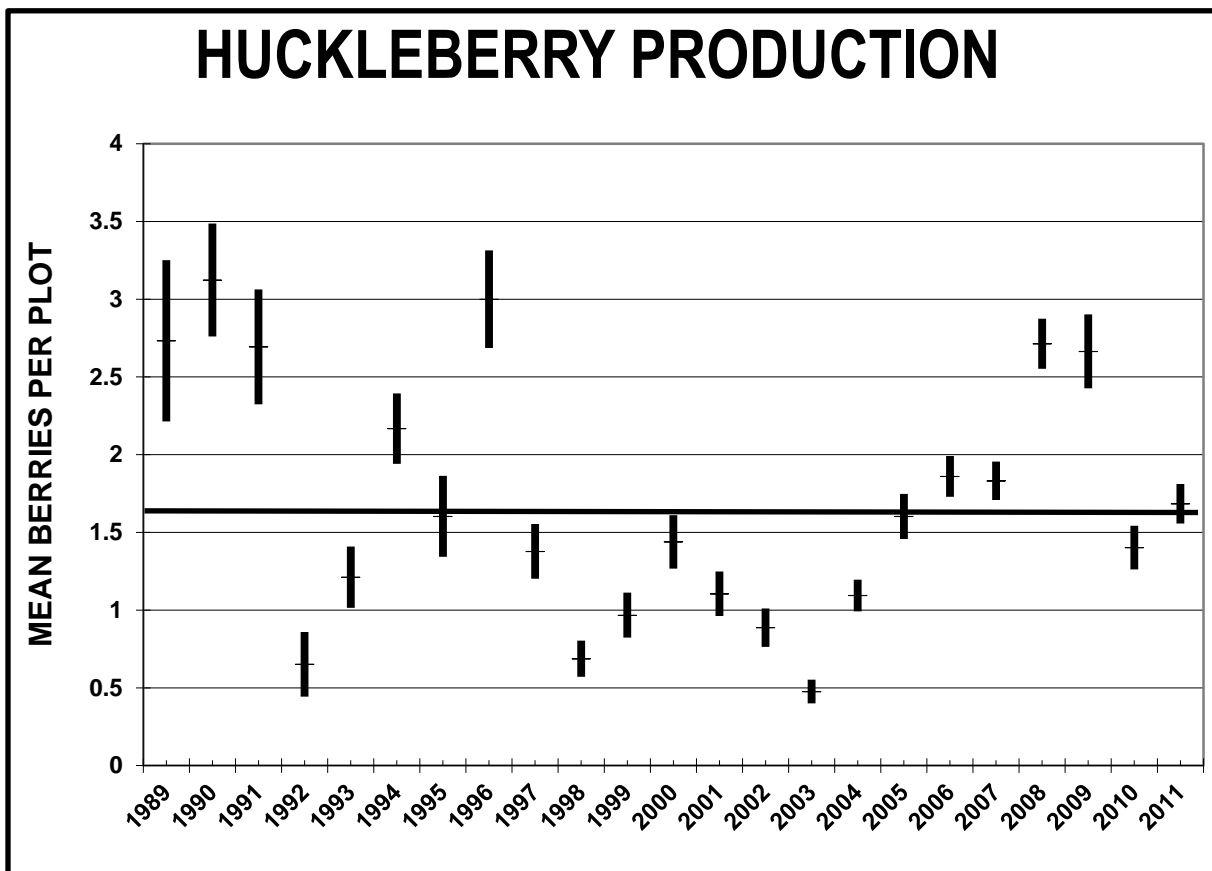


Figure 90. Mean berries per plot and 95% confidence intervals for huckleberry transects in the Cabinet-Yaak, 1989–2011. Horizontal line indicates mean production during study.

## Buffaloberry

Five buffaloberry plots were evaluated during 1990–99, and 2002–03 with 5 plants marked at each site. One plot was set up in 2007 and 2008 with 10 marked plants and these 2 plots were counted in 2009–11. Mean berry counts per plant from all plots was 205 (95% CI  $\pm$  33) during the study period. Mean berry counts ranged from 15 to 627 berries per plot from 1990 to 2011 (Fig. 91) with low counts occurring in 1998, 1999, 2003, and 2007. High counts occurred in 1990, 1993, 2009, and 2011.

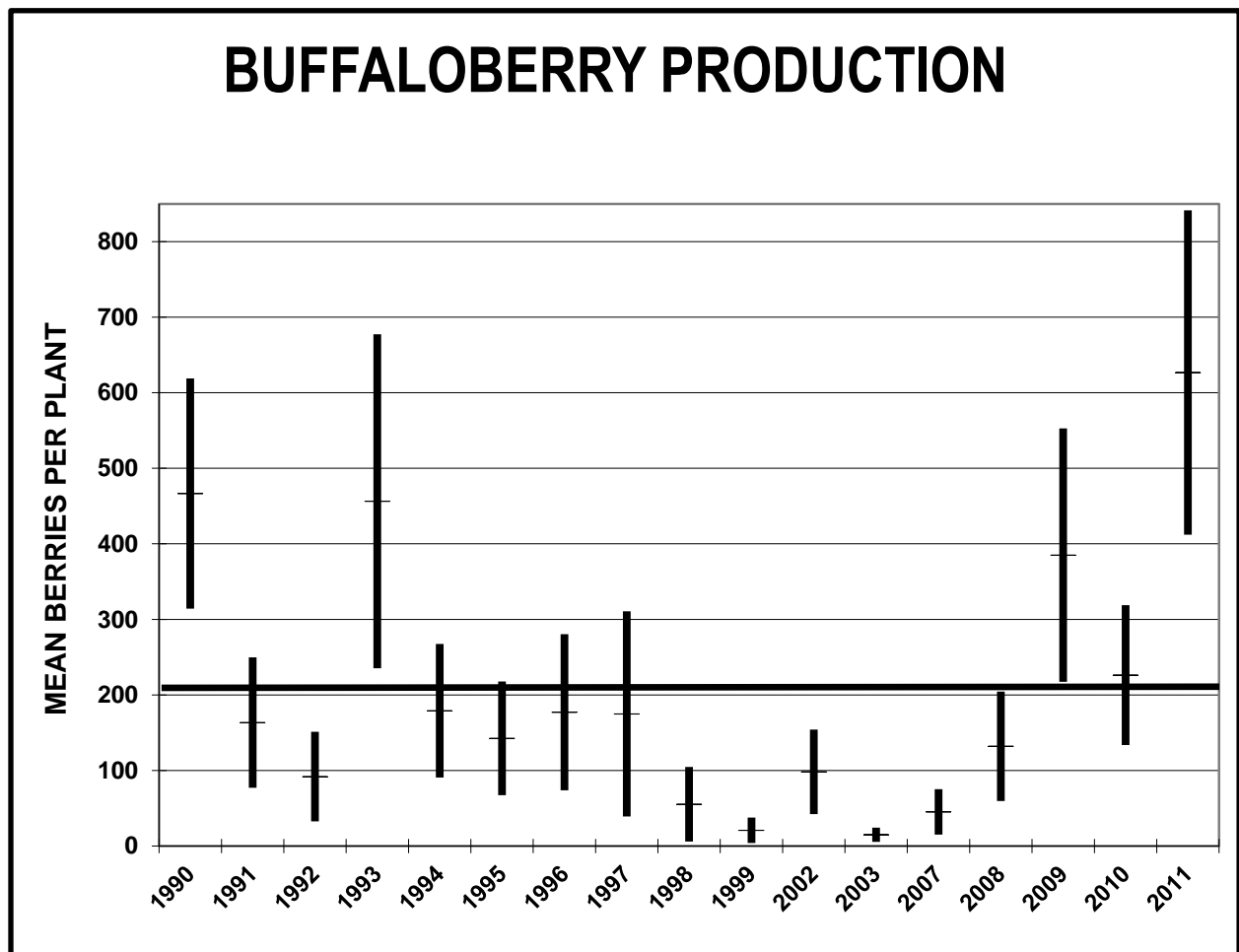


Figure 91. Mean berries per plot and 95% confidence intervals for buffaloberry transects in the Cabinet-Yaak, 1989-2011. Horizontal line indicates mean production during study.



## Serviceberry

Five sites were evaluated for serviceberry production during 1990–96. One more site was added in 1997 and 2005, and one site was dropped in 2007. Mean berry count per plant was 118 (95% CI  $\pm 14$ ) during the study. Mean berry counts per plant varied from 12 to 355 during the years 1990 to 2011 (Fig. 92). Low counts occurred during 1992, 1994, 1998–99, 2002, 2004–08 and 2010. High counts occurred during 1990 and 1995.

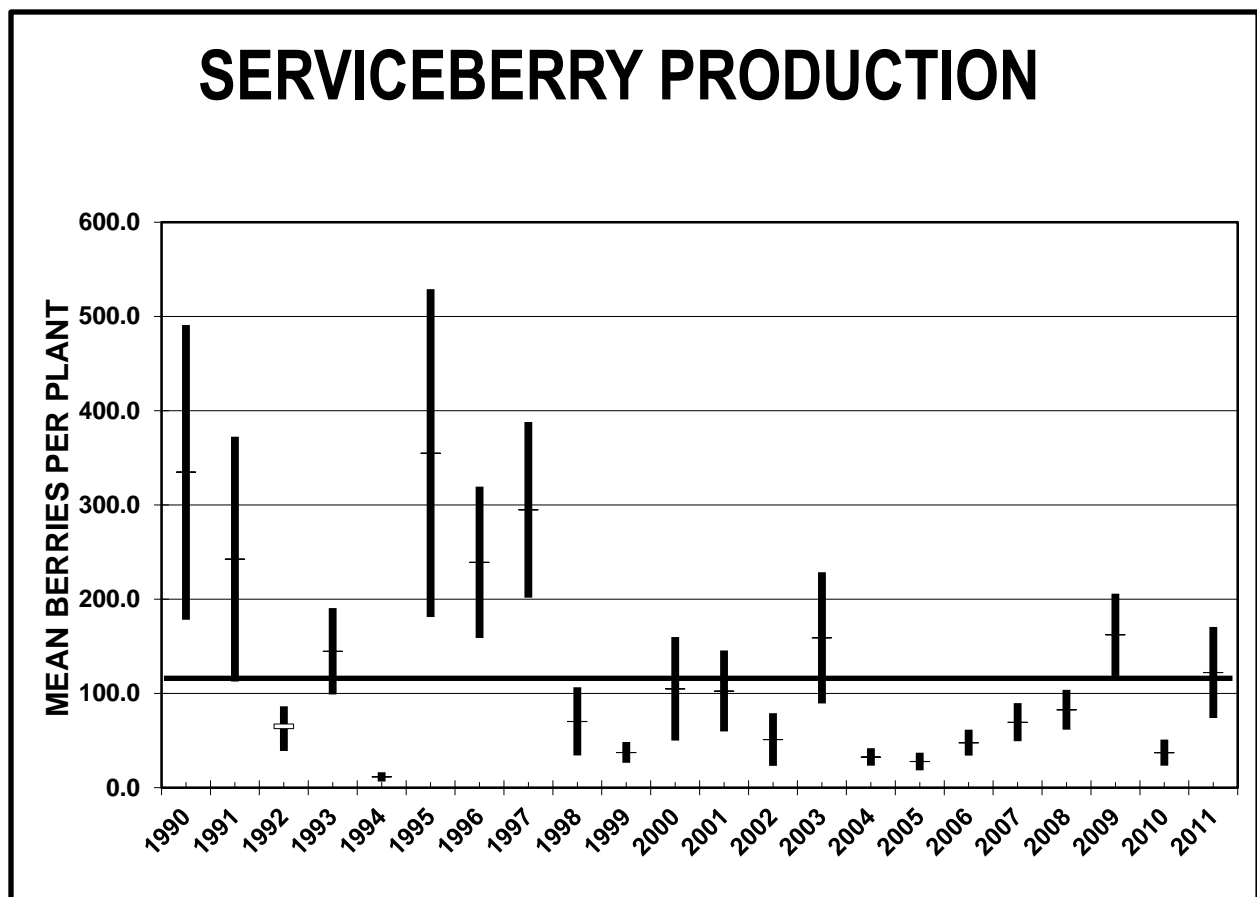


Figure 92. Mean berries per plot and 95% confidence intervals for serviceberry transects in the Cabinet-Yaak, 1989-2011. Horizontal line indicates mean production during study.

## Mountain Ash

Three sites were evaluated for mountain ash production in 2001–11 (Fig. 93). Total mean berry counts for each year were 392, 147, 66, 141, 226, 59, 105, 205, 180, 92, and 97 respectively, with the lowest elevation site producing the most berries. The mean berry count for 11 years combined was 155 (95% CI  $\pm$  24).

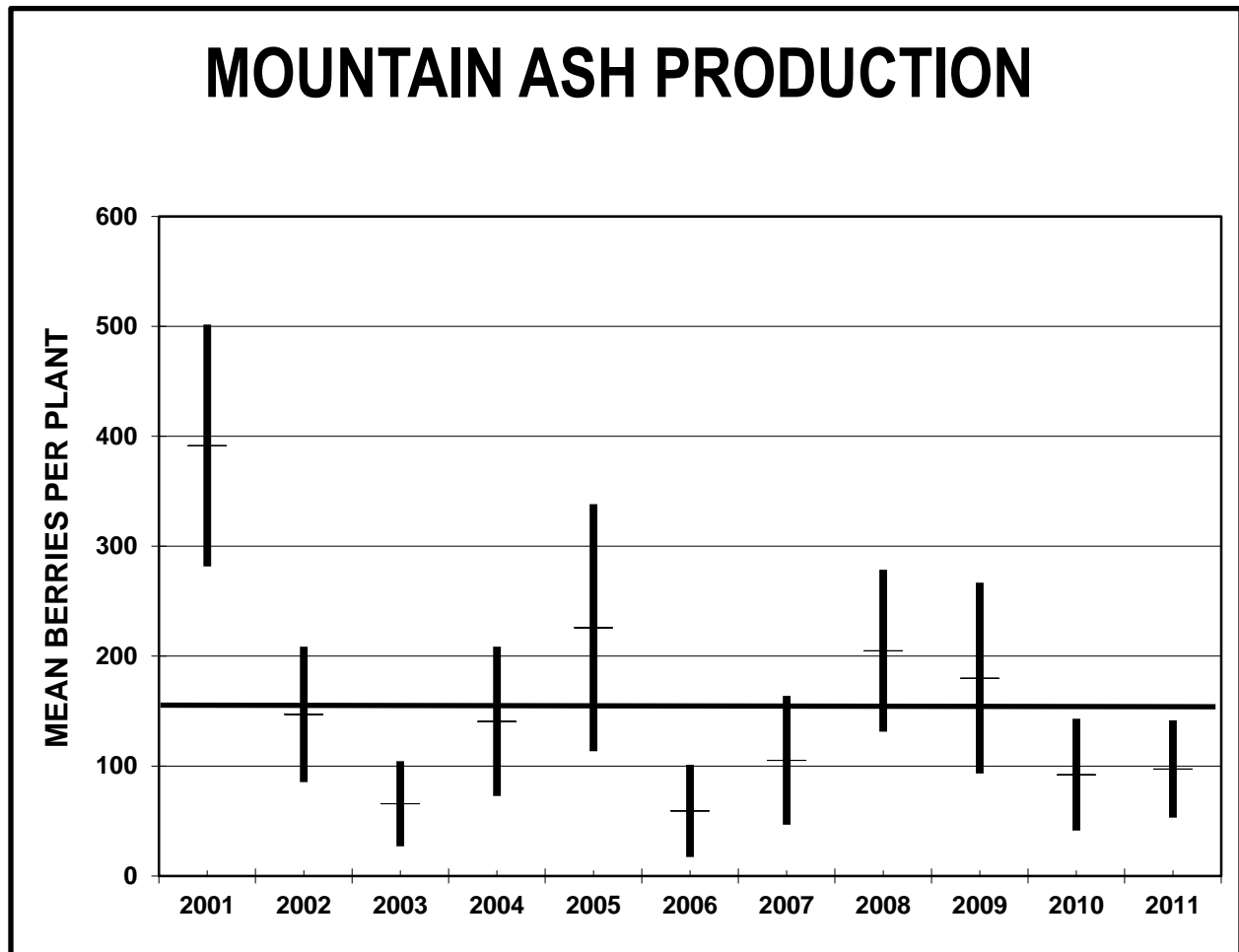


Figure 93. Mean berries per plot and 95% confidence intervals for mountain ash transects in the Cabinet-Yaak, 1989-2011. Horizontal line indicates mean production during study.

Huckleberries appear to provide the most prevalent food for bears and excellent production occurred in 1989–91, 1996, 2008, and 2009. However Serviceberries and Mountain Ash can provide a significant food source in some years. Mountain Ash may be particularly valuable to bears in years of low food production because the berries are persistent and remain on the plants until after frost and leaf drop. Low berry counts for all three of these species would appear most detrimental for bears attempting to store fat for winter denning. Low production among all species occurred in 1992, 1998, and 2003.

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Appendix Table 1. Known grizzly bear mortality in or near the Cabinet-Yaak recovery zone and the Yahk grizzly bear population unit in British Columbia, 1949-11.

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1949	COPPER CR, MT	1	ADULT FEMALE	HUMAN, LEGAL HUNTER KILL
1950	SQUAW CR, MT	1	SUBADULT	UNKNOWN
1951	PETE CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1951	PAPOOSE CR, MT	2	SUBADULTS	UNKNOWN
1951	GOAT CR, MT	1	SUBADULT MALE	UNKNOWN
1952	FELIX CR, MT	6	2 ADULT FEMALES, 4 YEARLINGS	HUMAN, MANAGEMENT REMOVAL
1953	OBRIEN CR, MT	1	SUBADULT MALE	HUMAN, LEGAL HUNTER KILL
1953	KENELTY MT, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1953	20-ODD MT, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1953	BURNT CR, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1953	17-MILE CR, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	N F BULL R, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	S F BULL R, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	CEDAR LK, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	TAYLOR PK, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	SILVERBUTTE CR, MT	1	UNKNOWN	HUMAN, LEGAL HUNTER KILL
1954	SILVERBOW CR, MT	1	ADULT FEMALE	HUMAN, LEGAL HUNTER KILL
1955	WOLF CR, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1955	MT HEADLEY, MT	1	SUBADULT	HUMAN, MANAGEMENT REMOVAL
1955	BAREE LK, MT	1	ADULT MALE	UNKNOWN
1955	BAREE LK, MT	1	ADULT FEMALE	UNKNOWN
1955	BEAR CR, MT	1	SUBADULT MALE	HUMAN, LEGAL HUNTER KILL
1958	SQUAW CR, MT	1	ADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1959	E F ROCK CR, MT	2	ADULT FEMALE, 1 CUB	HUMAN, LEGAL HUNTER KILL
1959	W F THOMPSON R, MT	4	ADULT FEMALE, 3 CUBS	UNKNOWN
1959	CLIFF CR, MT	1	UNKNOWN	UNKNOWN
1960	PROSPECT CR, MT	2	ADULT FEMALE, 1 CUB	UNKNOWN
1964	GRAVES CR, MT	2	SUBADULTS	UNKNOWN
1964	WANLESS LK, MT	3	SUBADULTS (ADULT WOUNDED)	UNKNOWN
1965	SNOWSHOE CR, MT	2	SUBADULTS	UNKNOWN
1965	PINKHAM CR, MT	1	UNKNOWN	UNKNOWN
1967	SOPHIE LK, MT	1	UNKNOWN	UNKNOWN
1968	BEAR CR, MT	1	ADULT FEMALE	HUMAN, ILLEGAL KILL
1968	GRANITE CR, MT	1	SUBADULT MALE	HUMAN, MANAGEMENT REMOVAL
1969	PRISCILLA PK, MT	1	ADULT FEMALE	UNKNOWN
1970	THOMPSON R, MT	1	UNKNOWN	UNKNOWN
1970	CAMERON CR, MT	1	SUBADULT MALE	UNKNOWN
1970	SQUAW CR, MT	2	ADULT FEMALE, SUBADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
1971	MURR CR, MT	1	ADULT FEMALE	UNKNOWN
1972	ROCK CR, MT	1	SUBADULT	HUMAN, MISTAKEN IDENTITY (Black Bear)
1974	SWAMP CR, MT	1	ADULT MALE	HUMAN, LEGAL HUNTER KILL
1977	RABBIT CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1978	MOYIE LAKE, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1982	GROUSE, ID	1	ADULT MALE	HUMAN, ILLEGAL KILL
1984	HARVEY CR, ID	1	UNKNOWN	HUMAN, MISTAKEN IDENTITY (Black Bear)
1985	LYONS CR, MT	1	ADULT MALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1986	BURNT CR, MT	1	CUB	UNKNOWN (NATURAL)
1987	FLATTAIL CR, MT	1	FEMALE CUB	HUMAN, MISTAKEN IDENTITY (Elk)

YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
1988	LEWISBY CR, BC	1	ADULT MALE	HUMAN, LEGAL HUNTER KILL (BC)
1988	N F 17-MILE CR, MT	1	ADULT FEMALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1989	BURNT CR, MT	1	SUBADULT FEMALE	HUMAN, RESEARCH TRAP (Predation)
1990	POVERTY CR, MT	1	SUBADULT MALE	HUMAN, ILLEGAL
1992	TRAIL CR, MT	1	ADULT FEMALE	UNKNOWN
1993	LIBBY CR, MT	2	ADULT FEMALE AND CUB	UNKNOWN (NATURAL)
1994	JIM CR, BC	1	SUBADULT MALE	HUMAN, MANAGEMENT
1994	SOUTHWEST CRANBROOK, BC	3	2 FEMALES AND 1 MALE	HUMAN, MANAGEMENT
1995	RYAN CR, BC	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
1996	DODGE CR, MT	1	SUBADULT MALE	HUMAN, UNDER INVESTIGATION
1996	GOLD CR, BC	1	ADULT MALE	HUMAN, UNDER INVESTIGATION
1997	LIBBY CR, MT	1	ADULT MALE	HUMAN, ILLEGAL
1997	PLUMBOB CR, BC	1	MALE	HUMAN, MANAGEMENT
1997	WARDNER, BC	1	ADULT FEMALE	HUMAN, MANAGEMENT
1997	MAYOOK, CR,BC	1	SUBADULT MALE	HUMAN, ILLEGAL KILL
1999	17 MILE CR, MT	3	ADULT FEMALE, 2 CUBS	NATURAL MORTALITY (Predation)
1999	W FK YAHK R, BC	1	SUBADULT FEMALE	HUMAN, DEFENSE OF LIFE BY HUNTER
1999	E FK YAAK R, MT	1	ADULT MALE	HUMAN, MANAGEMENT REMOVAL
2000	HAWKINS CR, BC	2	2 CUBS	UNKNOWN (NATURAL)
2000	FOWLER CR, MT	1	1 CUB	UNKNOWN (NATURAL)
2000	PETE CR, MT	1	SUBADULT FEMALE	HUMAN, UNDER INVESTIGATION
2001	COLD CR, BC	2	2 CUBS	UNKNOWN (NATURAL)
2001	SPREAD CR, MT	1	SUBADULT FEMALE	HUMAN, MISTAKEN IDENTITY (Black Bear)
2001	ELK CR, MT	1	ADULT FEMALE	HUMAN, TRAIN COLLISION
2002	MARTEN CR, MT	1	SUBADULT FEMALE	NATURAL
2002	PORCUPINE CR, MT	1	SUBADULT FEMALE	HUMAN, UNDER INVESTIGATION (Illegal)
2002	YAAK R, MT	4	ADULT FEMALE, 3 CUBS	HUMAN, ILLEGAL
2002	BLOOM CR, BC	1	UNKNOWN	HUMAN, BLACK BEAR HOUND HUNTERS
2002	KOOTENAY R, BC	1	FEMALE	HUMAN, DEFENSE OF LIFE
2004	WEST FORT STEELE, BC	1	MALE	HUMAN, DEFENSE OF LIFE AT DUMP
2004	JIM CR, BC	1	ADULT MALE	HUMAN, MISTAKEN IDENTITY
2004	NEWGATE,BC	1	ADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
2005	RUSSELL CR, BC	1	ADULT MALE	HUMAN, LEGAL HUNTER KILL (BC)
2005	GOVERNMENT CR, MT	1	SUBADULT FEMALE	HUMAN, TRAIN COLLISION
2005	PIPE CR, MT	1	SUBADULT FEMALE	HUMAN, ILLEGAL
2005	YAAK R, MT	1	SUBADULT MALE	HUMAN, ILLEGAL
2005?	CURLEY CR, MT	1	ADULT	HUMAN, UNDER INVESTIGATION
2006	COLD CR, BC	1	ADULT FEMALE	HUMAN, RESEARCH TRAP (Predation)
2006	RAINY CR, BC	1	ADULT FEMALE	HUMAN, MANAGEMENT REMOVAL
2007	SPREAD CR, MT	1	ADULT FEMALE	HUMAN, DEFENSE OF LIFE
2008	FISTRAP CR, MT	1	UNKNOWN SUBADULT	HUMAN, UNDER INVESTIGATION
2008	CLARK FORK RIVER, MT	1	SUBADULT FEMALE	HUMAN, TRAIN COLLISION
2008	CLARK FORK RIVER, MT	1	SUBADULT FEMALE	HUMAN, POACHING
2008	NF YAHK RIVER, BC	1	ADULT MALE	HUMAN.MISTAKEN IDENTITY, WOLF TRAP
2009	COPPER CR, ID	2	2 CUBS	UNKNOWN (NATURAL)
2009	BENTLEY CR, ID	1	SUBADULT MALE	HUMAN, MISTAKEN IDENTITY (Black Bear)
2009	EF BULL R, MT	1	ADULT FEMALE	HUMAN, DEFENSE OF LIFE
2010	AMERICAN CREEK, MT	1	CUB	NATURAL
2010	HAWKINS CREEK, BC	1	SUBADULT MALE	HUMAN, UNDER INVESTIGATION
2010	COLD CR, BC	1	SUBADULT MALE	HUMAN, WOLF TRAP, SELKIRK RELOCATION
2010	PINE CR, MT	1	ADULT MALE	HUMAN, POACHING
2011	EF ROCK CR, MT	1	SUBADULT	UNKNOWN



YEAR	LOCATION	TOTAL	SEX / AGE	MORTALITY CAUSE
2011	FARO CR, MT	1	ADULT MALE	HUMAN, MISTAKEN IDENTITY (Black Bear)
2011	CHERRY CR, MT	1	SUBADULT MALE	HUMAN, MISTAKEN IDENTITY (Black Bear)
2011	PIPE CR, MT	1	SUBADULT MALE	HUMAN, DEFENSE OF LIFE
2011	LITTLE CR, MT	1	ADULT MALE	HUMAN, UNDER INVESTIGATION

## Appendix 2. Description of Habitat Components.

1. Closed Timber - Timber stands with tree cover greater than 60%, and a variable but often sparse understory.
2. Open Timber - Timbered sites with tree canopy cover of from 30 to 60%, and a sparse grass - forb understory. Commonly found on dry exposures, limiting undergrowth to a few rhizomatous species.
3. Timbered Shrubfield - Open timbered sites with tree cover of 30 to 60%, and a shrub dominated understory. Except for more xeric aspects, the shrub layer is well developed, and the forb layer is characteristically sparse due to limited light penetration.
4. Mixed Shrub/Snowchute - Shrub dominated communities resulting from, and often maintained by sudden snowslides on steep timbered drainages. They exist as narrow, linear openings in the forest canopy, or as extensive, broad chutes covering an entire slope.
5. Mixed Shrub/Cutting Unit - Open sites which have been harvested and are currently dominated by shrubs. Structure and composition is variable depending on harvest method, site treatment, habitat type, topographic position and time since harvest.
6. Mixed Shrub/Burn - Open sites, dominated by shrubs, which have developed following fire. Structure and composition is dependent on fire intensity, habitat type, topographic position and time since burn.
7. Alder Shrub - Tall shrub community dominated by alder (*Alnus sinuata*), almost to the exclusion of all other shrub species, with a herbaceous understory. Component can develop as a result of disturbance, but is often restricted to mesic sites.
8. Huckleberry Shrub - Seral shrubfields dominated by *Vaccinium* species. This open, low structured shrubfield is created and at times maintained by fire. Timber harvest and snowslides may have the same developmental effect.
9. Riparian Stream bottom - Stream bottom habitat is identified by riparian plant associations, which reflect the influence of increased soil moisture. Considerable variation in vegetation composition and structure exist, with some site being open and some timbered. The development and extent of riparian habitat is dependent on timber canopy and stream channel gradient.

10. Marsh - Open sedge dominated communities that are perennially moist, often containing standing water. Can exist as either unbroken monotypic communities or as infringing zones around open shallow lakes and ponds.

11. Wet Meadow - Mesic graminoid dominated communities along flat low elevation watersheds, and in slightly concave depressions at high elevations. Floristic composition varies between and within open meadows depending on slight differences in soil moisture.

12. Dry Meadow - Open graminoid dominated sites with level or gradual sloping topography, most commonly occurring at low elevations. Can be created by timber harvest, livestock grazing and fire. Vegetation composition is variable depending on the severity of soil disturbance and topographic position of the site, and unless maintained, most sites reestablish shrub or regenerating conifer canopies.

13. Drainage Forbfield - High elevation herbaceous fields with gradual to steep topography. Forbfields exist where sufficient soils have accumulated and where snowmelt percolating through shallow stony soils provides an endless supply of water through the growing season. Late in phenological development, a number of forbs continue to grow and flower into September and October.

14. Snowchute - Open, forb dominated snowchutes are the result of recent massive snowslides that remove both tree and shrub cover. Snowchutes in early successional herbaceous stages are uncommon, and occupy a site for a few years prior to shrub development.

15. Graminoid Sidehill Park - Graminoid dominated communities on moderate to steep slopes with convex topography, from mid to high elevations. Local topographic, edaphic and climatic influences combine to limit tree growth.

16. Beargrass Sidehill Park - Beargrass (*Xerophyllum tenax*) dominated communities on moderate to steep slopes with convex topography, from mid to high elevations. Generally located on shallow, well drained soils of south to west aspects. They exist as large homogenous openings along upper slopes and ridges, and small patches on basin headwalls.

17. Slabrock - Open sites of exposed blocks of scoured - glaciated bedrock, occurring at high elevations on steep to gentle topography.

18. Talus/Rock/Scree - Very steep to moderate slopes and benches of loose rock fragments of variable size, with very sparse vegetation.

19. Timbered Grass - Open timbered sites with 30 to 60% tree canopy coverage and a graminoid dominated understory. Generally occur on well-drained soils, with gentle to steep slopes with south to west aspects.