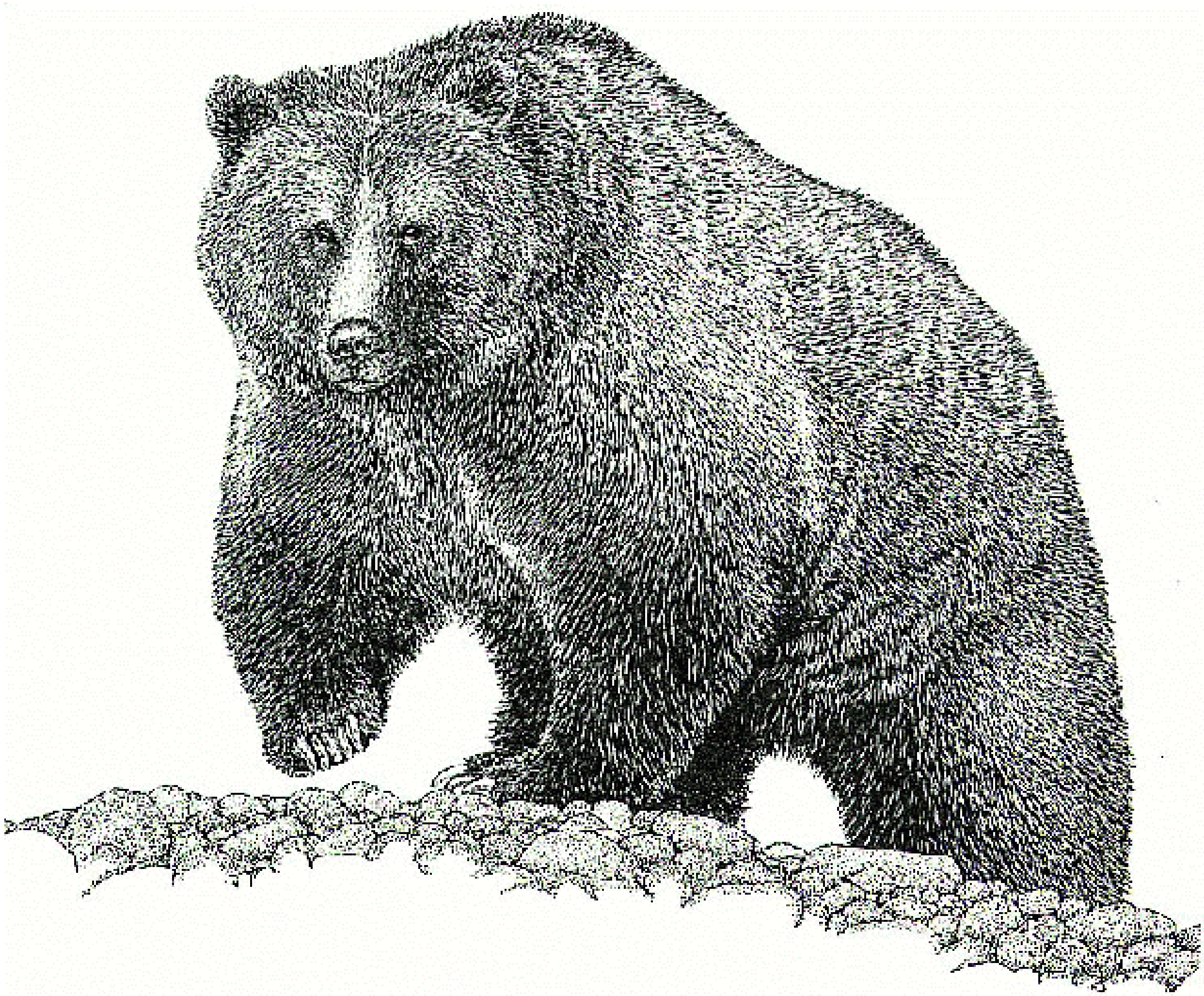
SELKIRK MOUNTAINS GRIZZLY BEAR RECOVERY AREA 2024 RESEARCH AND MONITORING PROGRESS REPORT



PREPARED BY
WAYNE F. KASWORM, THOMAS G. RADANDT, JUSTIN E. TEISBERG, TYLER VENT, MICHAEL PROCTOR, HILARY COOLEY, AND JENNIFER K. FORTIN-NOREUS

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UNITED STATES FISH AND WILDLIFE SERVICE
GRIZZLY BEAR RECOVERY COORDINATOR'S OFFICE
UNIVERSITY OF MONTANA, 356 CORBIN HALL
MISSOULA, MONTANA 59812
(406) 243-4903

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ABSTRACT

The U.S. Fish and Wildlife Service (USFWS) has led a grizzly bear monitoring and research program in the Selkirk Mountains Ecosystem (SE) since 2012. Cooperators include Idaho Department of Fish and Game (IDFG), Colville and Idaho Panhandle National Forests (USFS), Idaho Department of Lands, Kalispel Tribe, Kootenai Tribe of Idaho, and Washington Department of Fish and Wildlife. The British Columbia (B.C.) effort was led by Michael Proctor with key funding provided by B.C. Habitat Conservation Trust Fund and B.C. Fish and Wildlife Compensation Fund. Fieldwork was limited by COVID-19 during 2020–21.

Recovery plan monitoring targets include the most recent 6-year tracking of the average number of unduplicated females with cubs (6), distribution of females with young by U.S. Bear Management Units (BMUs) (7 of 10 occupied), and human-caused mortality (≤4% of the estimated population). Numbers of females with cubs varied from 2–4 per year and averaged 3.2 per year from 2019–2024. Nine of 10 U.S. BMUs and two of six B.C. units had sightings of females with young during 2019–2024. Human-caused mortality averaged 3.9% during 2019–2024 (2.0 bears per year with 1.5 males and 0.5 females). Twelve known or probable human caused mortalities occurred in or within 10 miles (16 km) of the U.S. SE or inside the B.C. South Selkirk Unit during 2019–2024, including three females, eight males, and one unknown sex. Mortality included two adult females (one management removal and one mistaken identity), one adult male (one management removal), one subadult female (vehicle collision), seven subadult males (three management removal, one each poaching neck snare, vehicle collision, mistaken identification, and self-defense), and one bear of unknown age or sex (train). Recovery targets for distribution and mortality were met, but numbers of females with cubs were not.

Ninety-five instances of known and probable grizzly bear mortality were detected inside or within 10 mi (16 km) of the U.S. SE and the B.C. South Selkirk grizzly bear population unit during 1980–2024. Seventy-nine were human caused, 12 were natural mortality, and 5 were unknown cause. Fifty-six occurred in B.C., 32 in Idaho, and 7 in Washington.

The estimated finite rate of increase (λ) for 1983–2024 using Booter software with the unpaired litter size and birth interval data option was 1.029 (95% CI=0.962–1.085, annual rate of change = 2.9%). The probability that the population was stable or increasing was 82%.

Capture, telemetry, and genetic data were analyzed to evaluate movement and subsequent reproduction resulting in gene flow in or out of the SE from 1983–2024. Twenty-nine grizzly bears were identified as immigrants or emigrants. Seventeen individuals (16 males and 1 female) are known to have moved into the SE from adjacent populations; however, six males and 1 female were killed or removed. Known gene flow from North Purcells has been identified through reproduction by 5 immigrants (4 males and 1 female) resulting in 28 offspring in the SE.

Sixty-eight grizzly bears were radio collared for research purposes from 2007 to 2024, the most recent period of active bear research in B.C. (37 bears 2007–2016) and the U.S. (31 bears 2012–2024). Home range summary calculations and maps were provided. Den entrance and exit dates were summarized.

Monitoring of the Bog Creek Road construction project was conducted and results from telemetry and camera monitoring is presented in Appendix 2.

Berry counts indicated average production for huckleberry during 2024.

Contents

ABSTRACT 2

INTRODUCTION 5

OBJECTIVES 6

STUDY AREA 6

METHODS 7

- Grizzly Bear Observations 7
- Survival and Mortality Calculations 7
- Reproduction 8
- Population Growth Rate 8
- Capture and Marking 9
- Hair Sampling for DNA Analysis 10
- Radio Monitoring 11
- Isotope Analysis 11
- Berry Production 12
- Body Condition 12

RESULTS AND DISCUSSION 12

- Grizzly Bear Occupied Range Mapping 12
- Grizzly Bear Mortality, Observations, and Recovery Plan Criteria 12
- Grizzly Bear Survival, Reproduction, Population Trend, and Population Estimate 20
  - Grizzly Bear Survival and Cause-Specific Mortality 20
  - Management Grizzly Bear Survival and Cause-Specific Mortality 21
  - Grizzly Bear Reproduction 21
  - Population Trend 23
- Bog Creek Road Monitoring for U.S. Border Patrol 23
- Hair Collection, Remote Camera, and Genetics 24
- Movements and Gene Flow 28
- Known Grizzly Bear Mortality 29
- Capture and Marking 30
- Grizzly Bear Monitoring and Home Ranges 32
- Grizzly Bear Denning Chronology 32

Grizzly Bear Habitat Analysis..35
Grizzly Bear Use by Elevation..35
Inter-ecosystem Isotope Analysis 36
Berry Production 37
Body Condition..39
ACKNOWLEDGMENTS...42
LITERATURE CITED 43
APPENDIX Table 1. Estimating Occupied Range for Grizzly Bears in the Cabinet-Yaak and Selkirk Mountains..46
APPENDIX 2. Bog Creek Monitoring 2023 Update 49
APPENDIX Table 3. Movement and gene flow to or from Selkirk Mountains recovery area. 56
APPENDIX 4. Grizzly bear capture information from the Selkirk Mountain study area, 2007–2024. Multiple captures of a single bear during a given year are not included. 58
APPENDIX Table 5. Black bears captured by study personnel in the Selkirk Ecosystem, 2007–2024...60
APPENDIX 6. Grizzly Bear Home Ranges 62
APPENDIX 7. Fine scale habitat modeling for the South Selkirk and Cabinet-Yaak ecosystems 82

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). Six areas were identified in the Recovery Plan, one of which was the Selkirk Mountains Grizzly Bear Recovery Zone (SE) of northern Idaho, northeast Washington, and southeast British Columbia (B.C.) (Fig. 1). The recovery area includes the South Selkirks B.C. grizzly bear population unit and encompasses approximately 6,700 km^2.

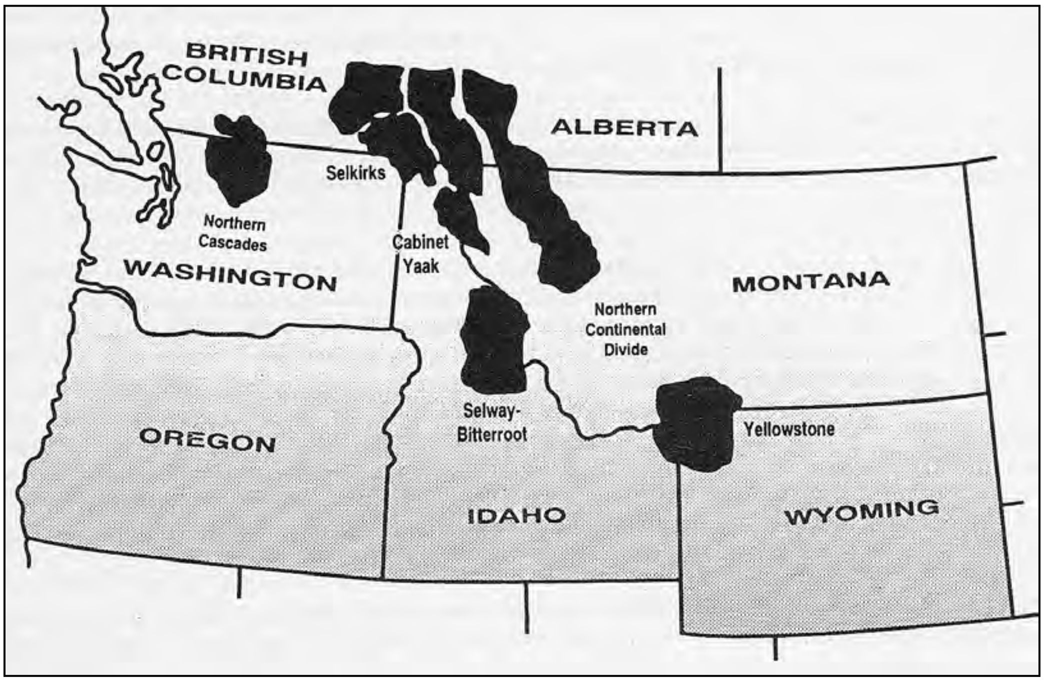

Figure 1. Grizzly bear recovery areas in the U.S., southern British Columbia, and Alberta, Canada.

Surveys of sightings, sign, and mortality were first documented by Layser (1978) and Zager (1983). Idaho Department of Fish and Game (IDFG) captured and monitored a radio-collared sample of grizzly bears in the SE from 1983 until 2002 to determine distribution, home ranges, cause specific mortality, reproductive rates, and population trend (Almack 1985, Wakkinen and Johnson 2004, Wakkinen and Kasworm 2004). This effort was suspended in 2003 due to funding constraints and management decisions. In cooperation with IDFG and the Panhandle National Forest (USFS) this effort was reinitiated during 2012 with personnel from the U.S. Fish and Wildlife Service (USFWS). During 2013, the program was expanded with funding from IDFG, USFS, several sources in B.C., and USFWS. This cooperative research and monitoring effort was further expanded in 2014 to involve Idaho Department of Lands, the Kalispel Tribe, the Kootenai Tribe of Idaho, and Washington Department of Fish and Wildlife. USFWS began a trapping and monitoring effort to collect and update known-fate population vital rates of radio-collared grizzly bears within the SE. In 2013–2024, we also collected camera and hair samples at DNA hair corral, camera, and rub post locations, adding to similar efforts conducted by IDFG and USFS personnel.

OBJECTIVES

1. Document grizzly bear distribution in the SE.
2. Describe and monitor the grizzly bear population in terms of reproductive success, age structure, mortality causes, population trend, and population estimates and monitor the targets for recovery as described in the grizzly bear recovery plan (USFWS 1993).
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 permeability of the Kootenai River valley between the SE and adjacent grizzly bear populations.
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.

STUDY AREA

The SE encompasses 6,735 km^2 of the Selkirk Mountains of northeastern Washington, northern Idaho, and southern B.C. (Figure 2). Approximately 53% lies in the U.S. with the remainder in B.C. Land ownership in B.C. is approximately 65% crown (public) land and 35% private. Land ownership in the U.S. portion is about 80% federal, 15% state, and 5% private.

Elevation on the study area ranges from 540 to 2,375 m. Weather patterns are characterized as Pacific maritime-continental climate, with long winters and short summers. Most of the precipitation falls during winter as snow, with a second peak in spring rainfall.

SE vegetation is dominated by various forested types. Dominant tree species include subalpine fir (*Abies lasiocarpa*), Englemann spruce (*Picea engelmannii*), western red cedar (*Thuja plicata*), and western hemlock (*Tsuga heterophylla*). Major shrub species include alder (*Alnus* spp.), fool's huckleberry (*Menziesia ferruginea*), mountain ash (*Sorbus scopulina*), and huckleberry (*Vaccinium* spp.).

Historically, wildfire was the primary disturbance factor in the SE. The 1967 Trapper Peak (6,000 ha) and Sundance (9,000 ha) fires produced large seral huckleberry shrubfields. Timber management and recreation are currently the principal land uses.

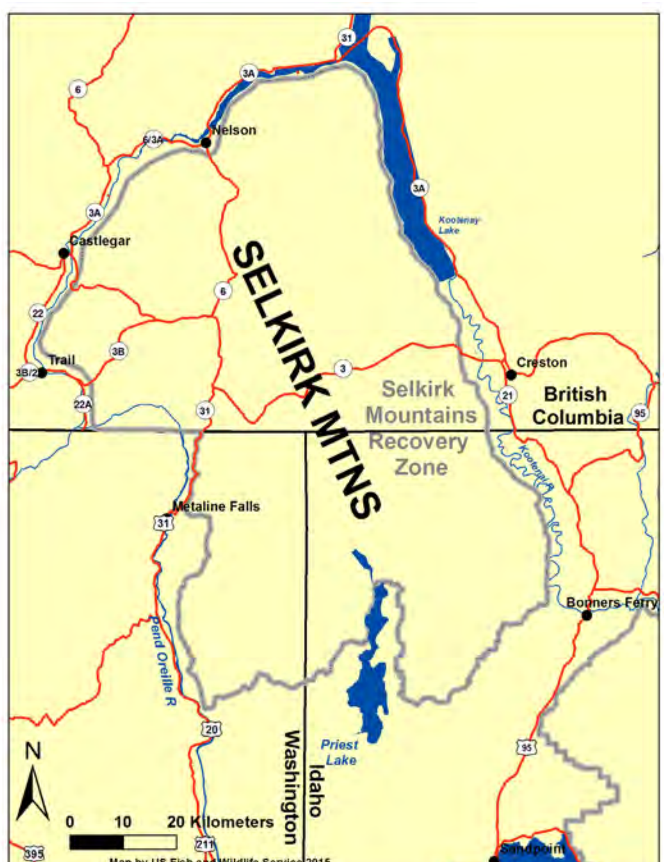

Figure 2. Selkirk Mountains grizzly bear recovery area.

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 rating 1 or 2 may not always be recorded.

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 were 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. Observer had sufficient time and was close enough or had binoculars to aid identification. Observer demonstrates sufficient knowledge of 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 one or two 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 secondhand reports from other than the observer.

Observations, remote camera photos, genetics data from hair snags, mortalities, and radio telemetry are used to determine numbers of unduplicated females with cubs, distribution of females with young, and mortality levels as directed by the grizzly bear recovery plan (USFWS 1993).

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. Survival rates were calculated separately for native and management bears because of biases associated with the unknown proportion of management bears in the population and known differences in survival functions.

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 as: {1 - (cub mortalities / 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.

Reproduction

Reproduction data was gathered through observations of radio-collared females with offspring and genetics data analyzed for maternity relationships. Because of possible undocumented neonatal loss of cubs, no determination of litter size was made if an observation occurred in late summer or fall. Inter-birth interval was defined as 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 and maternity relationships in genetics data from known age individuals.

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 (λ, or lambda) for the study area's grizzly bear populations. The estimate of λ 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 λ. 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 - (cub mortalities / 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 were defined by 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 inter-birth 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 inter-birth 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). Lack of mortality in specific sex-age classes limited calculations for other time periods.

Bears captured initially as objects of conflict captures were not included. Several native bears that were captured as part of a preemptive move to avoid nuisance activity were included. Currently collared bears that became management bears while wearing a collar were included.

Bootstrapping is a statistical procedure that resamples a single data set to create many simulated samples which allows calculation of confidence intervals. In bootstrapping, a sample of size *n* is drawn from the population (*S*). The sampling distribution is created by resampling observations with replacement from *S m* times, with each resampled set having *n* observations. Increasing the number of resamples, *m*, will not increase the amount of information in the data. Resampling the original set 10,000 times is not more useful than resampling it 1,000 times. The amount of information within the set is dependent on the sample size, *n*, which will remain constant throughout each resample. The benefit of more resamples, then, is to derive a better estimate of the sampling distribution. Bootstrapping was run 5,000 times at the maximum allowed in the program. The program was run 10 times at this level. Lambda values in the each of the 10 runs were identical indicating that 5,000 replications were sufficient.

Capture and Marking

Capture and handling of bears followed an approved Animal Use Protocol through the University of Montana, Missoula, MT (040-20HCCFC-092420). Capture of black bears and grizzly bears was performed under Idaho and Washington state collection permits (ID 28353 and WA23-048) and U.S. Fish and Wildlife Service Endangered Species Permit [Section (i) C and D of the grizzly bear 4(d) rule, 50 60 CFR17.40(b)]. Bears were captured with foot-hold snares following the techniques described by Johnson and Pelton (1980) and Jonkel (1993). 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 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), homemade blowgun, modified air pistol, or 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 and food use studies. Immobilized bears were given oxygen at a rate of 2–3 liters per minute. Recovering bears were dosed with Atropine and Diazepam.

All grizzly bears (including management bears captured at conflict sites) 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). To prevent permanent attachment, a canvas 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 August. Trap sites were usually located within 500 m of an open road to allow vehicle access. In a few instances, trap sites were accessed behind restricted roads within the administrative motorized access provisions of the land management agency. Further, some remote trap sites were accessed with pack livestock. Traps were checked daily or in some cases twice daily. Bait consisted primarily of road-killed ungulates and a liquid lure composed of fish and livestock blood.

Hair Sampling for DNA Analysis

Genetic information from hair-snagging with remote-camera photo verification allows us to document a minimum number of individual grizzly bears occupying the study area and understand the level of relatedness within this population and between this and adjacent populations. Project objectives include: observations of females with young, sex ratio of sampled bears, and relatedness as well as genetic diversity measures of captured bears and source population and assessment of movement or gene flow in and out of the population.

Sampling occurred from May–September in the SE following standard hair snagging techniques with barbed wire hair corrals (Woods *et al.* 1999). Sampling sites were established based on location of previous sightings, sign, habitat quality, and radio telemetry from bears. Sites were lured with 2 liters of a blood and fish mixture to attract bears across a barb wire perimeter placed to snag hair. Sites were deployed for 2–3 weeks prior to hair collection. Hair sampling also occurred at sites where personnel observed bear hair and “rubbing” on a tree, artificial signpost, or similar object. When observed, personnel formally established these sites by attaching barbed wire at the spot of rubbing and designating the location with a unique site number. Crews then subsequently revisited these locations to collect hair. Hair was collected and labeled to indicate number and color of hairs collected, location, date, and barb number. Solid black hairs were judged to be from black bears and not analyzed further. Samples collected 1) as part of this formal hair sampling effort, 2) from captured and handled bears, and 3) opportunistically (i.e., not from established sampling sites, such as tree staubs along trail, within identified daybeds, etc.) were sent to Wildlife Genetics International Laboratory in Nelson, British Columbia for DNA extraction and genotyping. Only samples from known grizzly bears or that outwardly appeared to be grizzly bear were sent to the lab. Hairs visually identified as black bear hair by technicians on our project or at the Laboratory were not processed and hairs processed and determined to be black bear were not genotyped. Dr. Michael Proctor (Birchdale Ecological) is a cooperator on this project and assisted with genetic interpretations.

In most cases, we identified bears that moved between study populations (i.e., migrants) via locations of radio-collared bears, multiple locations of genetically marked bears, and maternity/paternity analysis. In the absence of these types of data, we used program GeneClass to identify migrants, as similarly applied in Proctor *et al*. (2005) and Proctor *et al*. (2012). Specifically, we examined the 1) pairwise log odds ratio of assignment to each study population and 2) probability of Type I error (Piry et al. 2004, Paetkau et al. 2004). To do this, we analyzed the genotype of an individual bear suspected of being a migrant (i.e., no known origin) alongside a dataset of bears with known origin (i.e., population of birth). We used bears that were DNA sampled prior to 2006, after which population interchange increased and reduced precision in determining population of origin. This dataset only included bears in a perfectly matched triad (mother [with known range], father, and offspring where the offspring inherit an allele at each of 21 microsatellite loci from each parent. This sample consisted of bears from each study population: Cabinets (n = 17), South Selkirk (n = 43), Yaak (n = 27, Purcells south of Highway 3) and North Purcells (n = 18, Purcells north of B.C. Highway 3).

A bear was only determined to be a migrant when it had a high probability of being born in a population other than the one it was detected within (alpha = 0.005), ruling out several expected 'chance migrants' (the Type I error rate). For more detailed treatment of this process see Proctor *et al*. (2005). We also assessed pairwise log odds ratios, only assigning an origin population if the log odds ratio between the possible "home" population and the next most likely was higher than simulation ratios from the base sample of bears. While this was a considerably conservative threshold, we find this decreased the chance of 1) calling offspring of direct migrants as direct migrants themselves, and 2) misassigning a bear to an incorrect population, especially in cases of split population ancestry.

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 not in dens. Global Positioning System (GPS) collars were programmed to attempt locations every 1–2 hours depending on configuration, and data were stored within the collar and then downloaded to a lap top computer in an aircraft (Telonics Inc., Mesa AZ). Beginning in 2016, we have used iridium collars on select males to enable remote download. All collars were equipped with a release mechanism to allow them to drop off and be retrieved prior to denning. Expected collar life varied from 1–3 field seasons over the course of the study depending upon model of collar and programming. Life home ranges (minimum convex polygons; Hayne 1959) were calculated for grizzly bears during the study period. We generated home range polygons using ArcGISPro.

Isotope Analysis

Hair samples from known age, captured grizzly bears were collected and analyzed for stable isotopic ratios. Stable isotope signatures indicate source of assimilated (i.e., digested) diet of grizzly bears. Nitrogen stable isotope ratios (^{15}N) indicate trophic level of the animal; an increased amount of ingested animal matter yields higher nitrogen isotope ratios while lower values tie to more plant-based diets. In the SE, carbon isotope signatures vary depending on the amount of native C3 vs. C4 plant matter ingested. Corn, a C4 plant, has elevated $^{13}C/^{12}C$ ratios relative to native C3 plants. Because much of the human food stream is composed of corn, carbon stable isotope signatures allow for verification or identification of human food conditioned bears.

Hair samples were rinsed with a 2:1 chloroform:methanol solution to remove surface contaminants. Samples were then ground in a ball mill to homogenize the sample. Powdered hair was weighed and sealed in tin boats. Isotope ratios of $\delta^{13}C$ and $\delta^{15}N$ were assessed by continuous flow methods using an elemental analyzer (ECS 4010, Costech Analytical, Valencia, California) and a mass spectrometer (Delta PlusXP, Thermofinnigan, Bremen, Germany) (Brenna *et al*. 1997, Qi *et al*. 2003).

Berry Production

Quantitative comparisons of annual fluctuations and site-specific influences on fruit production of huckleberry 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^2 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 m intervals and empty frames were counted. Fifty frames containing the desired species were counted on each transect. Timbered shrub fields 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. Berry phenology, berry size, and plant condition were recorded. Monitoring goals identified annual trend of berry production and did not include documenting forest succession.

Temperature and relative humidity data recorders (LogTag®, Auckland, New Zealand) were placed at berry monitoring sites. These devices record conditions at 90-minute intervals and will be retrieved, downloaded, and replaced at annual intervals. We used a berries/plot calculation as an index of berry productivity. Transects were treated as the independent observation unit. For each year observed, mean numbers of berries/plant (berries/plot) were used as transect productivity indices.

Body Condition

Field measurements and bioelectric impedance analysis (BIA) of captured bears allows us to estimate body condition of grizzly bears (Farley and Robbins 1994). More specifically, these methods allow estimation of body fat content, an important indicator of quality of food resources and a predictor of cub production for adult females. We attempted estimation on captured bears, characterized by sex-age class, reproductive status, area of capture, and management status. ANOVA and post-hoc Tukey-HSD tests were performed to test for differences in body fat content across factors (management status, sex, and month of capture). Body condition (primarily, body fat content) of reproductive-aged females offers an *indirect* metric of whether females were of a physiological condition that supports cub production (Robbins *et al*. 2012).

RESULTS AND DISCUSSION

Grizzly bear research and monitoring in the SE was conducted by IDFG from 1983–2011. The USFWS has been leading monitoring and research since 2012. All tables and calculations are updated when new information becomes available. Covid-19 protocols reduced the monitoring effort substantially during 2020–2021.

Grizzly Bear Occupied Range Mapping

Grizzly bear occurrence data from telemetry sightings, mortality, and genetics was used to produce a map of occupied range for male and female grizzly bears and females only in the Cabinet-Yaak and Selkirk recovery areas during 2005–2024 (Appendix 1). This map is updated every two years with the next update in 2026.

Grizzly Bear Mortality, Observations, and Recovery Plan Criteria

One known natural mortality of a female occurred during 2024 (Table 1, Figure 3). Nine thousand six hundred twenty-five detections of grizzly bears from all sources (credible public sightings rating 4 or 5, trail camera photographs, genetic samples, etc.) were recorded during 2024 (Table 2). Many detections were associated with increased monitoring efforts from the Bog Creek project (Appendix 2). Detections occurred in all Bear Management Units (BMUs) except Ball-Trout, Salmo-Priest, and Lakeshore. Sightings of females with young or mortalities occurring within 10 miles (16 km) of the recovery zone were counted in the closest BMU.

Recovery Target 1: 6 females with cubs over a running 6-year average both inside the recovery zone and within a 10-mile area immediately surrounding the U.S. portion of the recovery zone including Canada.

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 female with cub sightings within 10 miles of the U.S. portion of the recovery zone count toward recovery goals. Seventeen credible sightings of a female with cubs occurred during 2024 in Myrtle, State Lands, Sullivan-Hughes BMUs or Bears Outside Recovery Zone (BORZ) units (Tables 2, 3, 4, 5 and Fig. 4). There appeared to be three unduplicated females with cubs in the recovery area during 2024. Unduplicated sightings of females with cubs (including Canada) varied from 2–4 per year and averaged 3.2 per year from 2019–2024 (Tables 3, 4). Recovery plan targets require a running 6-year average of 6.0 females with cubs per year and therefore this target has not been met.

Recovery Target 2: 7 of 10 BMU's occupied by females with young from a running 6-year sum of verified evidence.

Nine of 10 BMUs in the U.S. portion of the recovery zone BMUs had sightings of females with young (cubs, yearlings, or 2-year-olds) during 2019–2024 (Fig. 4 and Table 5). Credible sightings of a female with young occurred in Blue-Grass, Myrtle, State lands, and Sullivan-Hughes BMU in 2024. Occupied U.S. BMUs were Ball-Trout, Blue-Grass, Kalispel-Granite, LeClerc, Long-Smith, Myrtle, Salmo-Priest, State Lands, and Sullivan-Hughes BMUs during 2019–2024. Occupied B.C. BMUs included Boundary and Three Sisters. Recovery plan criteria indicate the need for 7 of 10 U.S. BMUs to be occupied. This target has been met.

Recovery Target 3: The running 6-year average of known, human-caused mortality should not exceed 4 percent of the population estimate based on the most recent 3-year sum of females with cubs. No more than 30 percent shall be females. These mortality limits cannot be exceeded during any 2 consecutive years for recovery to be achieved.

No known human-caused mortality occurred in the U.S. or B.C. during 2024. Twelve known or probable human-caused grizzly bear mortalities occurred in or within 10 miles of the SE in the U.S. or inside the B.C. South Selkirk Unit during 2019–2024, including two adult females (one management removal in B.C. Erie BMU and one mistaken identity in Long-Smith BMU), one subadult female (vehicle collision in Long-Smith BMU), one adult male (management removal in Ball-Trout BMU), seven subadult males (three management removals in B.C. Erie, Myrtle, and Ball-Trout BMUs, one poaching neck snare in Long-Smith BMU, one vehicle collision in B.C. Pend Oreille BMU, one self-defense in Myrtle BMU, and one mistaken identity in State Land BMU), and one bear of unknown age or sex (train collision in B.C. West Arm BMU) (Table 1 and Figure 4). We estimated minimum population size by dividing observed females with cubs (11), minus any human-caused adult female mortality (0) from 2022–2024, by 0.6 (sightability correction factor as specified in the recovery plan) then divide the resulting dividend by 0.333 (adult female proportion of population as specified in the recovery plan) (Tables 3, 4) (USFWS 1993). This resulted in a minimum population of 56 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 of 2.2 bears per year. The female limit is 0.7

females per year (30% of 2.2). Average annual human caused mortality for 2019–2024 was 2.0 bears/year and 0.5 females/year. Mortality levels for total bears and females were below the calculated limits during 2019–2024 indicating that the recovery target was met. The recovery plan established a goal of zero human-caused mortality for this recovery zone due to the initial low number of bears; however, it also stated "In reality, this goal may not be realized because human bear conflicts are likely to occur at some level within the ecosystem." All tables and calculations were updated when new information became available.

Table 1. Known and probable grizzly bear mortality in the Selkirk Mountains recovery area, 1980–2024.

Mortality Date	Tag Number	Sex	Age	Mortality Cause	Location	<500m from open road	Owner[1]	BMU / BORZ[2]
11-May-80	None	F	5.0	Human, Hunting	Barrett Creek, BC	Unk	BC	E
2-May-82	None	M	AD	Human, Poaching	Priest River, ID	Yes	USFS	Outside
Sept 1982	None	U	Unk	Human, Undetermined	LeClerc Creek, WA	Yes	USFS	LC
1-Jul-85	949	M	4.5	Human, Undetermined	NF Granite Creek, WA	Yes	USFS	KG
Autumn, 1985	867-85a	U	Cub	Natural	Cow Creek, ID	Unk	USFS	LS
1-Sep-86	898	F	1.5	Human, Undetermined	Grass Creek, ID	Unk	USFS	BG
10-Sep-86	None	M	7.0	Human, Management	Curtis Lake, BC	Yes	BC	TS
June 1987	1005	M	10.5	Human, Poaching	Wall Mtn, BC	Unk	BC	TS
8-Sep-87	962	M	7.5	Human, Poaching	Trapper Creek, ID	No	IDL	IDL
30-May-88	None	M	5.0	Human, Hunting	Monk Creek, BC	Unk	BC	BY
Sept 1988	1050	M	1.5	Natural	Porcupine Creek, BC	No	BC	C
Sept 1988	1085	F	3.5	Human, Mistaken Identity	Cow Creek, ID	No	USFS	IDL
14-Aug-89	1044	F	20+	Natural	Laib Creek, BC	No	Private	C
22-Sep-89	None	M	2.0	Human, Management	49 Mile Creek, BC	Yes	Private	E
22-Sep-89	None	U	Unk	Human, Management	49 Mile Creek, BC	Yes	Private	E
6-Aug-90	None	M	Unk	Human, Management	Ymir Area, BC	Yes	Private	E
16-Sep-90	1042	F	3.5	Human, poaching	Maryland Creek, BC	Yes	BC	BY
1-Aug-91	1076	F	20+	Natural	Next Creek, BC	No	BC	IDL
23-Apr-91	867-92a	U	1.5	Natural	Trapper Creek, ID	Unk	IDL	TS
11-Apr-92	None	M	Unk	Unknown	Atbara, BC	Yes	BC	WA
22-May-92	None	M	4.0	Human, Hunting	Cottonwood, BC	Unk	BC	WA
July 1992	None	M	Unk	Human, Management	Lost Creek, BC	Yes	BC	TS
7-Sep-92	1090	M	5.5	Unknown	Laib Creek, BC	Yes	BC	C
25-Sep-92	1015	F	12.5	Human, Self Defense	Monk Creek, BC	No	BC	BY
2-Jun-93	None	M	4.0	Human, Management	Lost Creek, BC	Yes	BC	TS
5-Jun-93	None	M	4.0	Human, Hunting	Elmo Creek, BC	Unk	BC	TS
2-Nov-93	867	F	15.5	Human, Poaching	Willow Creek, WA	No	USFS	S-H
2-Nov-93	867-93a	U	0.5	Human, Poaching	Willow Creek, WA	No	USFS	S-H
23-May-94	None	M	12.0	Human, Hunting	Wall Mountain, BC	Unk	BC	TS
10-May-95	None	F	1.5	Human, Undetermined	Boundary Creek, ID	Yes	USFS	BG
31-Oct-95	1100	M	2.5	Human, Mistaken Identity	Granite Pass, WA	Yes	USFS	Outside
Autumn, 1995	None	M	AD	Human, Mistaken Identity	Mill Creek, WA[2]	Yes	USFS	KG
Autumn, 1996	1027-96b	U	Cub	Natural	Cedar Creek, ID	Unk	USFS	IDL
10-Oct-1996	1022	M	2.5	Human, Management	Boswell, BC[2]	Yes	Private	Outside
Sept 1997	None	M	1.5	Human, Management	Salmo, BC	Yes	Private	TS
29-May-98	1023	M	4.5	Human, Hunting	Findlay Creek, BC[2]	Yes	BC	Outside
Aug 1998	None	M	3.5	Human, Undetermined	Usk, WA	Yes	Private	Outside
Oct 1999	1032	M	18.0	Human, Management	Procter, BC	Yes	Private	WA
Oct 1999	9810	M	10.0	Human, Undetermined	Smith Creek, ID	Unk	USFS	LS
Autumn 2000	None	U	Unk	Unknown	Hughes Meadows, ID	Yes	USFS	SH
29-Aug-01	7	F	13.0	Natural	Porcupine Creek, BC	Yes	BC	C
25-Oct-01	None	F	2.0	Human, Management	49 Mile Creek, BC	Yes	Private	E
Oct 2001	None	M	Unk	Human, Management	Cottonwood Creek, BC	Yes	Private	WA
12-May-02	17	M	6.0	Human, Management	Nelway, BC	Yes	Private	BY
15-Sep-02	None	F	10+	Human, Management	Blewett, BC	Yes	Private	E
15-Sep-02	None	U	0.5	Human, Management	Blewett, BC	Yes	Private	E
15-Sep-02	None	U	0.5	Human, Management	Blewett, BC	Yes	Private	E
15-Sep-02	None	U	0.5	Human, Management	Blewett, BC	Yes	Private	E
4-Oct-02	19	M	3.5	Human, Undetermined	Lamb Creek, ID	Yes	USFS	Priest
May 2003	None	U	1.5	Human, Mistaken Identity	Smith Creek, ID	Yes	Private	LS

Mortality Date	Tag Number	Sex	Age	Mortality Cause	Location	<500m from open road	Owner[1]	BMU / BORZ[2]
2-Sep-03	None	F	AD	Human, Management	Blewett, BC	Yes	Private	E
23-Sep-03	None	F	5.0	Human, Management	Blewett, BC	Yes	Private	E
23-Sep-03	None	F	0.5	Human, Management	Blewett, BC	Yes	Private	E
3-Oct-03	30	F	2.5	Human, Management	Erie Creek, BC	Yes	Private	PO
May 2004	None	M	AD	Human, Undetermined	Hughes Meadows, ID	Yes	USFS	SH
Autumn 2004	32	M	7.0	Human, Undetermined	Bismark Meadows, ID	Unk	Private	LAKE
Spring 2005	None	U	Unk	Human, Undetermined	E F Priest River, ID	Unk	IDL	Outside
10-May-05	31	M	6	Human, Hunting	Russell Creek, BC[2]	Yes	BC	Outside
May 2006	None	M	AD	Human, Management	Procter, BC	Yes	Private	WA
23-Oct-06	None	F	1.0	Human, Management	Blewett Ski Hill, BC	Yes	Private	E
23-Oct-06	None	M	1.0	Human, Management	Blewett Ski Hill, BC	Yes	Private	E
1-Aug-07	29	F	AD	Vehicle Collision	Kootenay Pass, BC	Yes	BC	BY
1-Oct-07	1000	F	AD	Human, Mistaken Identity	Pass Creek Pass, WA	Yes	USFS	KG
4-Oct-07	5393	M	SA	Human, Management	Priest River, ID	Yes	Private	Outside
29-Sep-08	119	M	13.0	Human, Management	Salmo, BC	Yes	Private	TS
18-Aug-10	8005	F	5	Vehicle Collision	Summit Creek, BC	Yes	BC	TS
5-May-11	None	M	2.5	Human, Management	Porthill, ID	Yes	Private	Outside
25-May-11	0012	M	2.5	Human, Management	Nelson, BC	Yes	Private	WA
25-May-11	None	M	2.5	Human, Management	Nelson, BC	Yes	Private	WA
28-Aug-11	002	M	20	Human, Management	Kootenay River, BC	Yes	Private	BY
7-Oct-12	None	M	3.0	Human, Mistaken Identity	Beaverdale Creek, BC	Yes	BC	E
16-Oct-12	170	F	6.0	Human, Undetermined	Salmo River, BC	Yes	Private	PO
6-Jun-14	12006	F	4	Human, Undetermined	Boundary Creek, BC	Yes	BC	BY
27-Sep-14	None	F	AD?	Human, Management	Ootishenia Creek, BC	Unk	BC	BG
Summer 2014	3023a	U	Cub	Natural	Malcolm Creek, ID	Unk	USFS	BG
Summer 2014	3023a	U	Cub	Natural	Malcolm Creek, ID	Unk	USFS	E
7-May-15	None	M	AD	Vehicle Collision	Summit Creek, BC	Yes	BC	BY
27-Aug-16	None	M	2.5?	Train Collision	Deep Creek, ID	Yes	Private	CY 19
25-Jun-17	226	F	10	Human, Management	Kootenay River, BC	Yes	BC	M
25-Jun-17	None	M	0.5	Human, Management	Kootenay River, BC	Yes	BC	BY
25-Jun-17	None	F	0.5	Human, Management	Kootenay River, BC	Yes	BC	BY
1-Sep-17	922	M	5	Human, Self Defense	Porthill Creek, BC	Yes	BC	BY
4-Oct-17	None	M	4	Human, Mistaken Identity	McCormick Creek, ID	No	IUSFS	BY
Summer 2018	None	U	1	Natural	Bugle Creek, ID	Unk	USFS	M
Autumn 2018	None	U	1	Natural	Smith Creek, ID	Unk	USFS	BG
1-Jun-19	865	M	3	Human, Management	Brush Creek, ID	Yes	Private	BG
2-Jun-19	None	F	AD	Human, Management	Cottonwood Creek, BC	Yes	Private	BT
2-Jun-19	None	M	SA	Human, Management	Cottonwood Creek, BC	Yes	Private	E
17-Sep-19	2003	F	15	Human, Mistaken Identity	Beaver Creek, ID	No	USFS	E
Spring 2020	None	M	3	Human, Poaching neck snare	Parker Creek, ID	Yes	USFS	LS
1-May-20	None	Unk	Unk	Train Collision	Drewry Creek, BC	Yes	BC	WA
10-Jun-20	None	F	3	Vehicle Collision	Olds Creek, ID	Yes	IDOT	LS
8-Oct-21	None	M	SA	Vehicle Collision	Salmo, BC	No	Private	LS
8-Jun-22	None	M	2	Human, Self Defense	Ruby Creek, ID	Yes	Private	PO
4-Aug-22	None	M	6	Human, Management	Olds Creek, ID	Yes	Private	M
12-Sep-22	718	M	5	Human, Management	Highland Creek, ID	Yes	Private	BT
8-Aug-23	None	M	AD	Human, Mistaken Identity	Trapper Creek,ID	Yes	IDL	IDL
11-Sept-24	3023	F	20	Natural	Blue Joe Creek, ID	Yes	USFS	BG

[1] BC – British Columbia Crown Lands, IDL – Idaho Department of Lands, USFS – U.S. Forest Service, CNF – Colville National Forest, IPNF – Idaho Panhandle National Forest.

[2] BG – Blue-Grass, BT – Ball-Trout, BY – Boundary, C – Cultus, E – Erie, IDL – Idaho Department of Lands, KG – Kalispel-Granite, LAKE – Lakeshore, LC – LeClerc, LS – Long-Smith, M – Myrtle, Outside – more than 10 miles outside recovery zone in the U.S or outside the BC South Selkirk grizzly bear population unit, PO – Pend Oreille, SH – Sullivan-Hughes, SP – Salmo-Priest, TS – Three Sisters, WA – West Arm.

Table 2. Credible grizzly bear sightings, credible female with young sightings, and known human-caused mortality by Selkirk Mountain bear management unit (BMU) or area, 2024. Females with young occurring outside of the recovery zone, but within 10 miles in the U.S. are counted in the nearest BMU for occupancy.

BMU OR AREA	2024 Credible[1] Grizzly Bear Detections	2024 Detections of Females with Cubs (Total)	2024 Females with Cubs (Unduplicated[2])	2024 Detections of Females with Yearlings or 2-year-olds (Total)	2024 Females with Yearlings or 2- year-olds (Unduplicated[2])	2024 Human Caused Mortality
Ball-Trout	0	0	0	0	0	0
Blue Grass	1171	0	0	354	2	0
Kalispel-Granite	315	0	0	0	0	0
Lakeshore	12	0	0	0	0	0
LeClerc	1402	0	0	0	0	0
Long-Smith	331	0	0	2	0	0
Myrtle	11	2	1	2	1	0
Salmo-Priest	264	0	0	0	0	0
State Idaho	1703	1	1	4	1	0
Sullivan-Hughes	2389	3	1	4	0	0
Pack River North	8	0	0	5	0	0
Pack River South	15	2	0	8	0	0
Priest River	0	0	0	0	0	0
Kootenai Valley North Bonners Ferry	147	0	0	1	1	0
Deep Creek South Bonners Ferry	12	0	0	2	0	0
Pend Oreille River East	25	0	0	0	0	0
Pend Oreille River West	811	0	0	0	0	0
Boundary British Columbia	1009	0	0	0	0	0
TOTAL	9625	8	3	382	5	0

[1]Credible sightings are those rated 4 or 5 on a 5-point scale (see methods).
[2]Sightings may duplicate the same bear in different locations. Only the first sighting of a duplicated female with cubs was counted toward total females (Table 3), however subsequent sightings contribute toward occupancy (Table 5).

Table 3. Status of the Selkirk Mountains recovery zone during 2019–2024 in relation to the demographic recovery targets from the grizzly bear recovery plan (USFWS 1993).

Recovery Criteria	Target	2019–2024
Females w/cubs (6-year avg)	6	3.2 (19/6)
Human Caused Mortality limit [1] (4% of minimum population estimate)	2.2	2.0 (6-year avg)
Female Human Caused mortality limit [1] (30% of total mortality)	0.7	0.5 (6-year avg)
Distribution of females w/young in the most recent 6 years [2]	7 of 10 US BMUs	9 of 10 US BMUs

[1] Includes both U.S. and B.C. mortalities.
[2] Includes only U.S. BMUs.

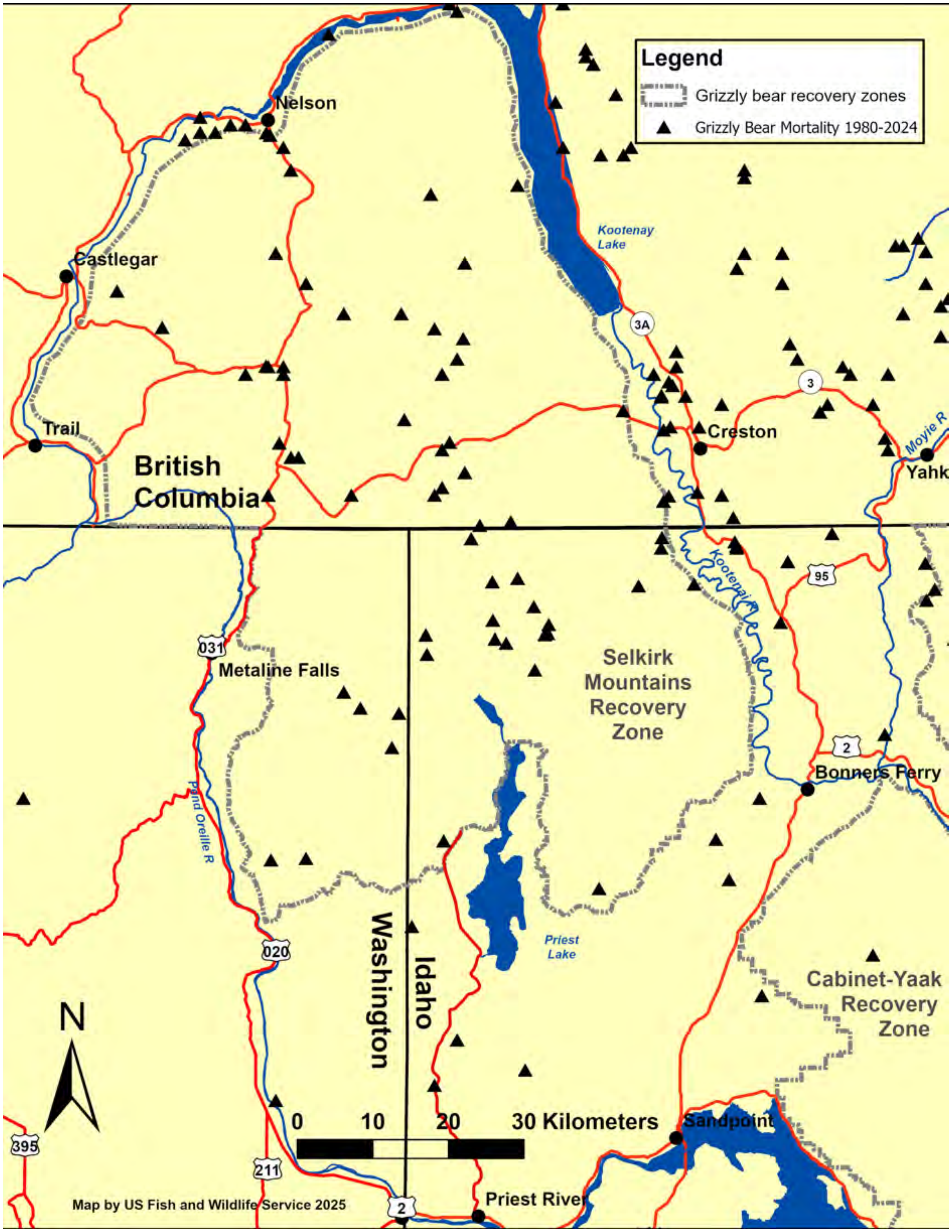

Figure 3. Grizzly bear known or probable mortalities from all causes (1980–2024) in the Selkirk Mountains recovery area.

Table 4. Annual Selkirk Mountains recovery zone grizzly bear unduplicated counts of females with cubs (FWC's) and known human-caused mortality, 1993–2024.

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	30% ALL FEMALE HUMAN CAUSED MORTALITY LIMIT	TOTAL HUMAN CAUSED MORTALITY 6 YEAR AVERAGE	FEMALE HUMAN CAUSED MORTALITY 6 YEAR AVERAGE
1993	1	1	2	5	0.0	0.0	0.8	0.3
1994	1	0	0	1	0.2	0.1	0.2	0.0
1995	1	0	1	3	0.2	0.1	0.5	0.2
1996	1	0	0	0	0.4	0.1	0.5	0.2
1997	1	0	0	1	0.6	0.2	0.7	0.2
1998	1	0	0	1	0.6	0.2	0.8	0.2
1999	1	0	0	2	0.6	0.2	1.2	0.2
2000	2	0	0	0	0.8	0.2	1.2	0.2
2001	2	0	1	2	1.0	0.3	1.0	0.2
2002	0	1	3	6	0.6	0.2	2.0	0.7
2003	1	2	4	5	0.0	0.0	2.7	1.3
2004	1	0	0	2	0.0	0.0	2.8	1.3
2005	1	0	0	1	0.2	0.1	2.7	1.3
2006	0	0	1	3	0.4	0.1	3.2	1.5
2007	0	2	2	3	0.0	0.0	3.3	1.7
2008	0	0	0	1	0.0	0.0	2.5	1.2
2009	0	0	0	0	0.0	0.0	1.7	0.5
2010	0	1	1	1	0.0	0.0	1.5	0.7
2011	0	0	0	4	0.0	0.0	2.0	0.7
2012	1	1	1	2	0.0	0.0	1.8	0.7
2013	1	0	0	0	0.2	0.1	1.3	0.3
2014	3	2	2	2	0.4	0.1	1.5	0.7
2015	4	0	0	1	1.2	0.4	1.7	0.7
2016	3	0	0	1	1.6	0.5	1.7	0.5
2017	6	1	2	5	2.4	0.7	1.8	0.8
2018	4	0	0	0	2.4	0.7	1.5	0.7
2019	2	2	2	4	1.8	0.5	2.2	1.0
2020	4	0	1	3	1.6	0.5	2.3	0.8
2021	2	0	0	1	1.2	0.4	2.3	0.8
2022	4	0	0	3	2.0	0.6	2.7	0.8
2023	4	0	0	1	2.0	0.6	2.0	0.5
2024	3	0	0	0	2.2	0.7	2.0	0.5

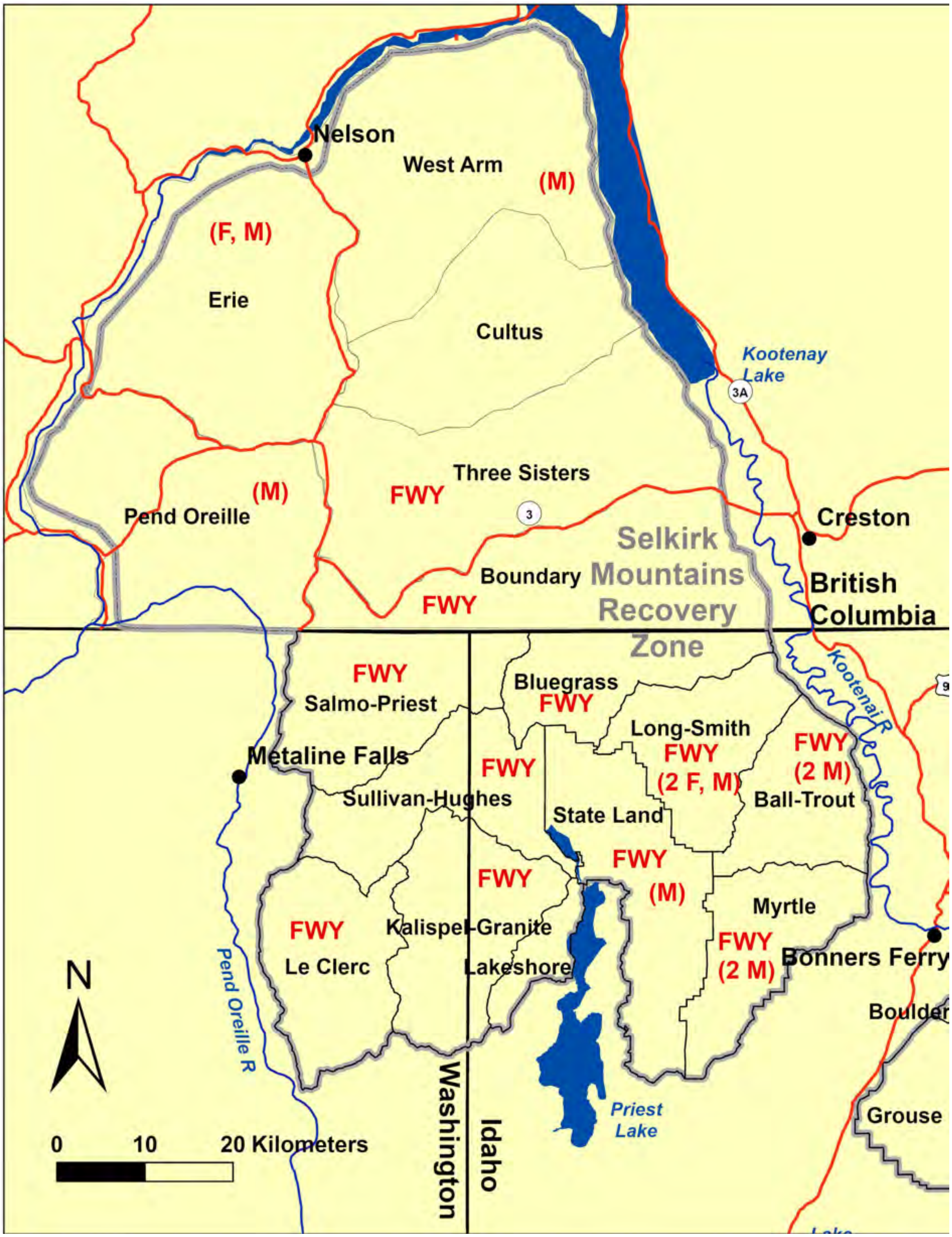

Figure 4. Female with young occupancy and known or probable human-caused mortality within Bear Management Units (BMUs) in the Selkirk Mountains recovery zone 2019–2024. FWY indicates occupancy of a BMU by a female with young, and sex of any mortality is in parentheses.

Table 5. Occupancy of bear management units by grizzly bear females with young in the Selkirk Mountains recovery zone 1996–2024.

YEAR	Ball-Trout	Blue-Grass	Kalispell-Granite	Lakeshore	LeClerc	Long-Smith	Myrtle	Salmo-Priest	State Idaho	Sullivan-Hughes	US BMUs Occupied last 6	BC Boundary	BC Cultus[1]	BC Erie[1]	BC Pend Oreille[1]	BC Three Sisters[1]	BC West Arm[1]
1996	Y	Y	N	N	N	Y	Y	N	N	N		N					
1997	Y	Y	N	N	N	Y	Y	N	Y	N		N					
1998	Y	Y	N	N	N	Y	N	Y	Y	N		N					
1999	N	Y	N	N	N	Y	N	Y	Y	N		N					
2000	N	N	N	N	N	N	N	N	N	N		N					
2001	N	Y	Y	N	N	Y	Y	N	Y	N	7	N					
2002	N	Y	Y	N	N	Y	Y	N	Y	N	7	N					
2003	N	Y	Y	N	N	Y	N	N	Y	N	7	N					
2004	N	Y	Y	N	N	Y	N	N	Y	N	6	N					
2005	N	Y	Y	N	N	Y	N	N	Y	N	5	N					
2006	N	N	Y	N	N	Y	Y	N	N	Y	6	N					
2007	N	N	Y	N	N	Y	Y	N	N	Y	6	N					
2008	N	N	Y	N	N	Y	Y	N	N	Y	6	N					
2009	N	N	N	N	N	N	N	N	N	N	6	N					
2010	N	N	N	N	N	N	N	N	N	N	5	N					
2011	N	Y	N	N	N	Y	N	N	N	N	5	N					
2012	N	Y	N	N	N	Y	N	N	Y	N	6	N					
2013	N	Y	N	N	N	Y	N	N	Y	N	6	N					
2014	N	Y	N	N	N	Y	Y	Y	Y	Y	6	Y					
2015	N	Y	N	N	Y	Y	Y	Y	Y	N	7	Y					
2016	N	Y	N	N	Y	Y	N	N	Y	Y	7	Y					
2017	N	Y	N	N	Y	Y	Y	N	Y	Y	7	Y					
2018	N	Y	N	N	Y	Y	Y	N	Y	N	7	Y					
2019	Y	Y	N	N	N	Y	N	N	Y	N	8	N					
2020	N	Y	N	N	N	Y	Y	N	Y	N	8	Y	N	N	N	Y	N
2021	N	Y	Y	N	Y	Y	Y	Y	Y	Y	9	Y	N	N	N	N	N
2022	Y	Y	N	N	Y	N	Y	Y	N	Y	9	N	N	N	N	N	N
2023	N	Y	N	N	N	Y	N	N	Y	N	9	N	N	N	N	N	N
2024	N	Y	N	N	N	Y	Y	N	Y	Y	9	N	N	N	N	N	N

[1] Monitoring of females with young in these B.C. units was not conducted until 2020.

Grizzly Bear Survival, Reproduction, Population Trend, and Population Estimate

This report segment updates information on survival rates, cause-specific mortality, and population trend following the methods used in Wakkinen and Kasworm (2004).

Grizzly Bear Survival and Cause-Specific Mortality

Kaplan-Meier survival and cause-specific mortality rates were calculated for six sex and age classes of native grizzly bears from 1983–2024 (Table 6). We calculated survival and mortality rates for management bears separately (see below).

Table 6. Survival and cause-specific mortality rates of native grizzly bear sex and age classes based on censored telemetry data in the Selkirk Mountains recovery zone, 1983–2024.

	Demographic parameters and survival or mortality rates					
Parameter	Adult female	Adult male	Subadult female	Subadult male	Yearling	Cub
Individuals / bear-years[a]	49 / 107.8	41 / 52.0	23 / 23.5	27 /26.6	44 / 26.7	44 / 44
Survival[b] (95% CI)	0.909 (0.855–0.964)	0.946 (0.882-1.0)	0.895 (0.782–1.0)	0.931 (0.837-1.0)	0.875 (0.745–1.0)	0.886 (0.754-0.962)
Mortality rate by cause						
Natural	0.031	0	0	0	0.096	0.091
Defense of life	0.008	0	0	0	0	0
Mis-ID	0.008	0	0.033	0.035	0	0
Management	0	0	0.034	0	0	0
Highway collision	0	0	0.037	0	0	0
Poaching	0.009	0.037	0	0	0	0.023
Unknown human	0.010	0.017	0	0.034	0	0
Unknown	0.009	0	0	0.	0	0
Unknown probable	0.016	0	0	0	0.029	0

[a] Bear-years computed on basis of weeks monitored.
[b]Kaplan-Meier survival estimates which may differ from BOOTER survival estimate, Cub survival based on counts of individuals alive and dead .

Management Grizzly Bear Survival and Cause-Specific Mortality

Kaplan-Meier survival rates were calculated for 19 adult or subadult grizzly bears captured for management purposes from 1983–2024. Bears captured specifically for management purposes were calculated separately from native research bear captures that later became management bears (Table 6). Fifteen bears were males aged 2–16 and four were females aged 6–13. Four dependent cubs of unknown sex were not included in the analysis. Survival rate for males was 0.475 (95% CI=0.250–0.699) with three instances of management removal, two unknown but human-caused mortality, one legal hunt mortality, and one probable mortality among 15 radio-collared bears monitored for 8.5 bear-years. Survival rate for females was 0.857 (95% CI=0.598–1.0) with one instance of management removal among 4 radio-collared bears monitored for 6.3 bear-years.

Grizzly Bear Reproduction

Reproductive parameters originated from all bears monitored from 1983–2024. Mean age of first parturition among 12 female grizzly bears was 6.3 years (95% CI=6.0–6.7, Table 10). First age of parturition was determined by observation of radio-collared bears and genetic parentage analysis and known age of offspring. Thirty-eight litters comprised of 84 cubs were observed through both monitoring radio-collared bears and known genetic parentage analysis paired with remote camera observation, for a mean litter size of 2.21 (95% CI=2.04–2.38, Table 7). Twenty-nine reproductive intervals were determined through both monitoring radio-collared bears and known genetic parentage analysis paired with remote camera observation (Table 7). Mean inter-birth interval was calculated as 3.45 years (95% CI=3.16–3.74). 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 0.325 female cubs/year/adult female (95% CI=0.277–0.385, n = 27 adult females, Table 8). In all calculations, the sex ratio of cubs born was assumed 1:1.

Table 7. Grizzly bear reproductive data from the Selkirk Mountains 1985–2024.

Bear	Year	Age	Reproductive interval	Cubs	Age at first reproduction	Cubs (relationship and fate, if known)
138	2014	8	3			litter of at least 3 cubs
183	2006	7	3			at least 1 cub (female 170), recruited to 6 years of age
867	1985	7	2	2	7	Female 898
867	1987	9	3	2		female 1042, male 1077
867	1990	12	3			At least 1 cub F1000 (this is correct
867	1993	15		2		Adult Female killed Cub M1022 and other assumed killed
1000	1995	5		2	5	1000A, 1000B
1000	2001	11		3		male 28, 21C, and 21D the 3 cubs, 1000 now tagged 21
1003	2016	6	4	1	6	Male 1006 at capture, photo 6/15/16
1003	2020	10		2		2 cubs observed out of plane (June 2020?)
1015	1987	7	3	2	7	at least 2 cubs, male 1090, male 1091
1015	1990	10		2		1015A and 1015B (one of these is (SS31F)
1024	1997	6		2	7	1024A and 1024B
1027	1996	6		2	6	1027A and 1027B
1029	1998	6	3	2	6	cubs became female 4 and male 10
1029	2001	9	3	2		1029C and 1029D S20918M
1029	2004	12	3			at least two cubs (became females 4208 and 2003)
1029	2007	15	3			at least two cubs (became male 4327 and female S11649F)
1029	2010	18	3	3		at least two cubs (male 16680 and female 1003)
1029	2013	21	3			at least two cubs (male S11514M and female S21947F)
1029	2016	24	5			at least two cubs (observed 2 on 7/7/16)
1041	2015	8	3	2		2 cubs Jungle Creek corral
1041	2018	11	2	2		2 cubs
1041	2020	13		3		litter of 3 cubs
1045	1989	9		2		2 cubs, 1045A and 1045B
1047	1989	11		2		1047A and 1047B
1056	1987	7	4	3		at least 3 cubs
1076	1989	20+		2		at least 2 cubs, 1076A and 1076B
1084	1985	16	4	2		At least 2 cubs
1087	1989	9	3	3		3 cubs 1087A, 1087B, 1087C
1087	1992	12	2			litter with at least 1 cub (female 1029)
1089	1992	7		3	7	3 cubs 1089A, 1089B, 1089C (one is Sunk1M)
2003	2010	6	4		6	At least 1 cub S3021F
2003	2014	10	3			Based on subsequent year and genetics, at least 2 cubs
2003	2017	13		3		3 cubs at capture 7/24/17 2003A, 2003B, 2003C
2008	2003	6	4		6	At least S2016
2008	2007	10	4			At least 1 cub S796F
2008	2011	14	4			At least 1 cub. Not in data, based on subsequent year.
2008	2015	18	4			At least 1 cub (1064)
2016	2011	8	4			At least 2 cubs not in data
2016	2015	12	5	2		observe with 2 cubs 6/1/15, 2016B and 2016C
2016	2020	17		3		photo DNA Joe Lake. 3 cubs S54257F, S45818M, 1 unk sex.
3017	2017	6		3	6	observe with 3 cubs 8/8/17
3017	2023	12		2		at least 2 cubs, corral photo 9/2
3021	2017	7	4	2	7	Photos of 2 cubs 7/30/17
3021	2021	11	3	2		Photos and DNA at multiple corral and camera sites
3021	2024	14		3		3 cub litter in Zee Creek
3023	2014	10	4	2		observe with 2 cubs 5/15/14 3023A and 3023B
3023	2018	14	4	2		2 cubs photo 8/24/18

Bear	Year	Age	Reproductive interval	Cubs	Age at first reproduction	Cubs (relationship and fate, if known)
3023	2022	18		2		2 cubs on trail camera 6/24/22
9037	2013	9		3		MGMT capture and move w/3 cubs
9037	2016	12	2	2		Photo 7/16/16 9037 w/ 2 cubs M1008 and S21698M
9037	2018	14	2	2		2 cubs photo 7/23/18 and again 10/5/2018
9037	2020	16		2		M Proctor genetically identified 2 cubs in born 2020
9809	2000	12		1		1 cub observed 9809A

[1]Number of years from birth to subsequent birth.

Population Trend

The estimated finite rate of increase (λ) for 1983–2024 using Booter software with the unpaired litter size and birth interval data option was 1.029 (95% CI=0.962–1.085, Table 8). Finite rate of change over the same period was an annual 2.9% (Caughley 1977). Subadult female survival and adult female survival accounted for most of the uncertainty in λ, 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 yielded wide confidence intervals around our estimate of trend (i.e., λ). Probability that the population was stable or increasing was 82%. Finite rates of increase calculated for the period 1983–2002 (λ = 1.019) suggested an increasing population (Wakkinen and Kasworm 2004). Lack of mortality in specific sex-age classes limited calculations for many time periods other than those shown here. Utilizing the entire survival and reproductive data set from 1983–2024 is partially the product of small sample sizes but also produces the effect of smoothing the data over time and results in a more conservative estimate of population trend. The Booter technique has been published in at least three different peer reviewed journals (Hovey and McLellan 1996, Mace and Waller 1998, Wakkinen and Kasworm 2004).

Maintaining or improving survival by reducing human-caused mortality is crucial for recovery of this population (Proctor *et al*. 2004).

Table 8. Booter unpaired method estimated annual survival rates, age at first parturition, reproductive rates, and population trend of native grizzly bears in the Selkirk recovery zone, 1983–2024.

Parameter	Sample size	Estimate (95% CI)	Std Error	Variance (%)[a]
Adult female survival[b] (S_a)	49 / 108.5[c]	0.908 (0.852–0.955)	0.026	20.3
Subadult female survival[b] (S_s)	23 / 22.5[c]	0.884 (0.745–1.0)	0.064	69.0
Yearling survival[b] (S_y)	44 / 26.1[c]	0.865 (0.736–0.968)	0.062	3.6
Cub survival[b] (S_c)[d]	44/44	0.886 (0.796–0.977)	0.048	2.0
Age first parturition (*a*)	12	6.3 (6.0–6.7)	0.182	0.6
Maximum age (*w*)	Fixed	27		
Unpaired Reproductive rate (*m*)[e]	24/34/40[f]	0.325 (0.277–0.385)	0.027	4.5
Unpaired Lambda (λ)	5000 bootstrap runs	1.029 (0.962–1.085)	0.032	

[a] Percent of lambda explained by each parameter.
[b]Booter survival calculation which may differ from Kaplan-Meier estimates in Table 13.
[c]individuals / bear-years (bear-years computed from days monitored).
[d]Cub survival based on counts of individuals alive and dead.
[e]Number of female cubs produced/year/adult female. Sex ratio assumed to be 1:1.
[f]Sample size for individual reproductive adult females / sample size for birth interval / sample size for litter size from Table 15.

Bog Creek Road Monitoring for U.S. Border Patrol

A progress report was prepared for monitoring of the reconstruction of the Bog Creek Road and subsequent Border Patrol activity and effects to grizzly bear (Appendix 2).

Hair Collection, Remote Camera, and Genetics

Remote cameras and corrals were deployed at 124 sites and checked for pictures and hair collection 202 times during 2024 (Tables 9 and 10, Figure 5). Grizzly bears were detected by cameras at 41 sites. Corral cameras detected females with young at 15 corral sites, documenting three females with cubs (Sullivan-Hughes, Myrtle, and State Lands BMUs). In addition, crews set up cameras at some rub sites and along open and closed roadways as well as trails (see Appendix 2 for Bog Creek monitoring details). This extended effort documented 12 additional site detections of female grizzly bears with young, including 4 unique females with young (Blue-Grass and Myrtle BMUs). Several other single individuals were detected at trail camera sites.

Hair samples were collected from signposts, bridges, and rub trees, as observed by study personnel. Since 2013, interagency personnel have identified and installed 609 bear rub locations in the SE. During 2024, 528 rub sites were checked a total of 2,205 times.

Corral, rub, or opportune methods resulted in 3,256 samples during 2024 (34% corral, 62% rub, 4% opportune). Hair samples were visually examined by study personnel to screen out hair that appeared to be black bear and the remaining 646 samples were sent to Wildlife Genetics International for analysis. Analysis of 2024 samples will be reported in 2025 report.

In 2023, 110 rub sites (23% of checked) yielded grizzly bear hair. The rub effort alone identified 27 individual grizzly bears. Hair collection efforts via corral and rub sites genetically detected 31 individual grizzly bears within the U.S. in 2023. Three additional bears were genetically detected from opportunistic hair collections (i.e., collections along trails, at trap sites, on cattle fencing or tree staubs). Four of the 7 bears collared or captured for research monitoring in 2023 were also genetically detected via rub, corral, or opportune DNA collections.

All combined efforts (hair collection, photos, captures, mortalities) identified a minimum population of 57 individual grizzly bears (19 female, 21 male, 17 unknown [9 cubs, 8 yearlings]) alive and within the U.S. portion of the SE grizzly bear population at some point during 2023. There was one known mortality in the U.S. Selkirks in 2023. We were able to assign sex-age class to all 57 individuals detected, but distributions may be skewed given our reliance on rub sampling methods. Pre-census sex-age class distribution consisted of 21% adult females, 26% adult males, 18% subadults, and 35% dependents in 2023. New genotypes from individuals detected in 2023 were added to the grizzly bear genetic database from the South Selkirk Mountains that now contains 276 individuals, 1983–2023.

It is biologically inappropriate to infer changes in minimum counts from year to year as changes in total population size. These minimum counts are influenced by and dependent on the level of effort available each year. Available effort is influenced by funding, number of personnel, area of emphasis, and most recently COVID-19. All these factors have varied in recent years and have contributed to variable minimum counts. Hence, we use the word “minimum” rather than “total” population size. For population growth estimates, refer to population trend section later in this report.

Table 9. Grizzly bear hair rubs and success in the Selkirk study area, 2014–2024.

Year	Number of rubs checked	Number of samples collected (%GB[1])	Number of samples sent to Lab (%GB[1])	Number of rubs with grizzly DNA	Individual grizzly bear genotypes	Males	Females
2014	8	11 (9)	9 (11)	1	1	1	0
2015	31	267 (1)	14 (21)	1	1	0	1
2016	166	528 (10)	155 (35)	32	13	9	4
2017	292	1035 (15)	275 (58)	68	20	15	5
2018	372	1575 (18)	482 (58)	103	26	15	11
2019	413	1540 (14)	417 (52)	101	26	14	12
2020	442	1460 (21)	565 (55)	96	25	17	8
2021	449	1858 (19)	613 (58)	123	24	20	4
2022	466	1381 (14)	340 (55)	94	22	15	7
2023	488	1677 (16)	486 (56)	110	27	17	10
2024	528	2004 (--)	429 (--)	--	--	--	--
Total[2]	576[3]	11332 (16)	3360 (55)	301[3]	63[4]	37[4]	26[4]

[1] Percentage of samples yielding a grizzly bear DNA genotype.

[2] Totals are through 2023. 2024 genetic results from the lab are not yet complete.

[3] Unique rub locations. Some rub locations visited multiple times among years.

[4] Some individuals captured multiple times among years.

Table 10. Grizzly bear hair snagging corrals and success in the U.S. Selkirk Mountains study area, 2013–2024. DNA genetic results not yet complete for 2024 samples.

Year	Number of sites	Sites with grizzly bear DNA (%[1])	Sites with grizzly bear photos or DNA (%[1])	Individual grizzly bear genotypes	BMUs with grizzly pictures or hair at corral	Comments
2013	29	0(3)	4(17)	0	Blue-Grass, Kalispel-Granite, Long-Smith, State Land, Sullivan-Hughes	
2014	47	4(9)	13(28)	4	Blue-Grass, Kalispel-Granite, Le Clerc, Long-Smith, Myrtle, State Land, Sullivan-Hughes	Female with cubs Blue-Grass, Long-Smith, Myrtle
2015	189	20(11)	28(15)	20	Blue-Grass, Le Clerc, Myrtle, Long-Smith, State Land, Sullivan-Hughes	Female with cubs Blue-Grass, Le Clerc
2016	181	12(7)	19(10)	14	Blue-Grass, Kalispel-Granite, Le Clerc, Long-Smith, Myrtle, State Land, Sullivan-Hughes	Female with cubs Blue-Grass Female with young Long-Smith
2017	121	21(17)	32(26)	26	Blue-Grass, Le Clerc, Long-Smith, Myrtle, State Land, Sullivan-Hughes	Female with cubs Blue-Grass, Long-Smith, Myrtle, State Lands Female with young Le Clerc
2018	129	23(18)	31(24)	28	Ball-Trout, Blue-Grass, Le Clerc, Long-Smith, Myrtle, State Lands, Sullivan-Hughes	Female with cubs Blue-Grass, Le Clerc, State Lands Female with young Myrtle, Long-Smith
2019	118	23(19)	28(24)	23	Blue-Grass, Le Clerc, Long-Smith, Myrtle, State Lands, Sullivan-Hughes	Female with cubs Blue-Grass, Long-Smith Female with young State Lands
2020	96	22(23)	24(25)	17	Blue-Grass, Long-Smith, Le Clerc, Myrtle, Sullivan-Hughes	Female with cubs Blue-Grass, Long-Smith, Myrtle
2021	130	21(16)	35(27)	18	Ball-Trout, Blue-Grass, Kalispel-Granite, LeClerc, Long-Smith, Myrtle, Salmo-Priest, State Land, Sullivan-Hughes	Female with cubs Myrtle Female with young Blue-Grass, Kalispell-Granite, Le Clerc, Long-Smith, State Lands
2022	109	16(15)	25(23)	13	Ball-Trout, Blue-Grass, Kalispel-Granite, LeClerc, Long-Smith, Myrtle, Salmo-Priest,	Female with young Myrtle

Year	Number of sites	Sites with grizzly bear DNA (%[1])	Sites with grizzly bear photos or DNA (%[1])	Individual grizzly bear genotypes	BMUs with grizzly pictures or hair at corral	Comments
					State Land, Sullivan-Hughes	
2023	128	12(9)	31(24)	13	Blue-Grass, Kalispel-Granite, LeClerc, Long-Smith, Myrtle, State Land, Sullivan-Hughes	Female with cubs Long-Smith, State Land Female with young Blue-Grass
2024	124	--	41(33)[2]	--	Blue-Grass, Kalispel-Granite, LeClerc, Long-Smith, Myrtle, Salmo-Priest, State Land, Sullivan-Hughes	Female with cubs Myrtle, State Land, Sullivan-Hughes Female with young Blue-Grass, Long-Smith
Total	1401	174	311	79 [3]		

[1]Percent success out of total number of sites deployed within the year.
[2]Numbers represent sites with photos only. Awaiting 2024 genetic results.
[3]Some individuals captured multiple times among years.

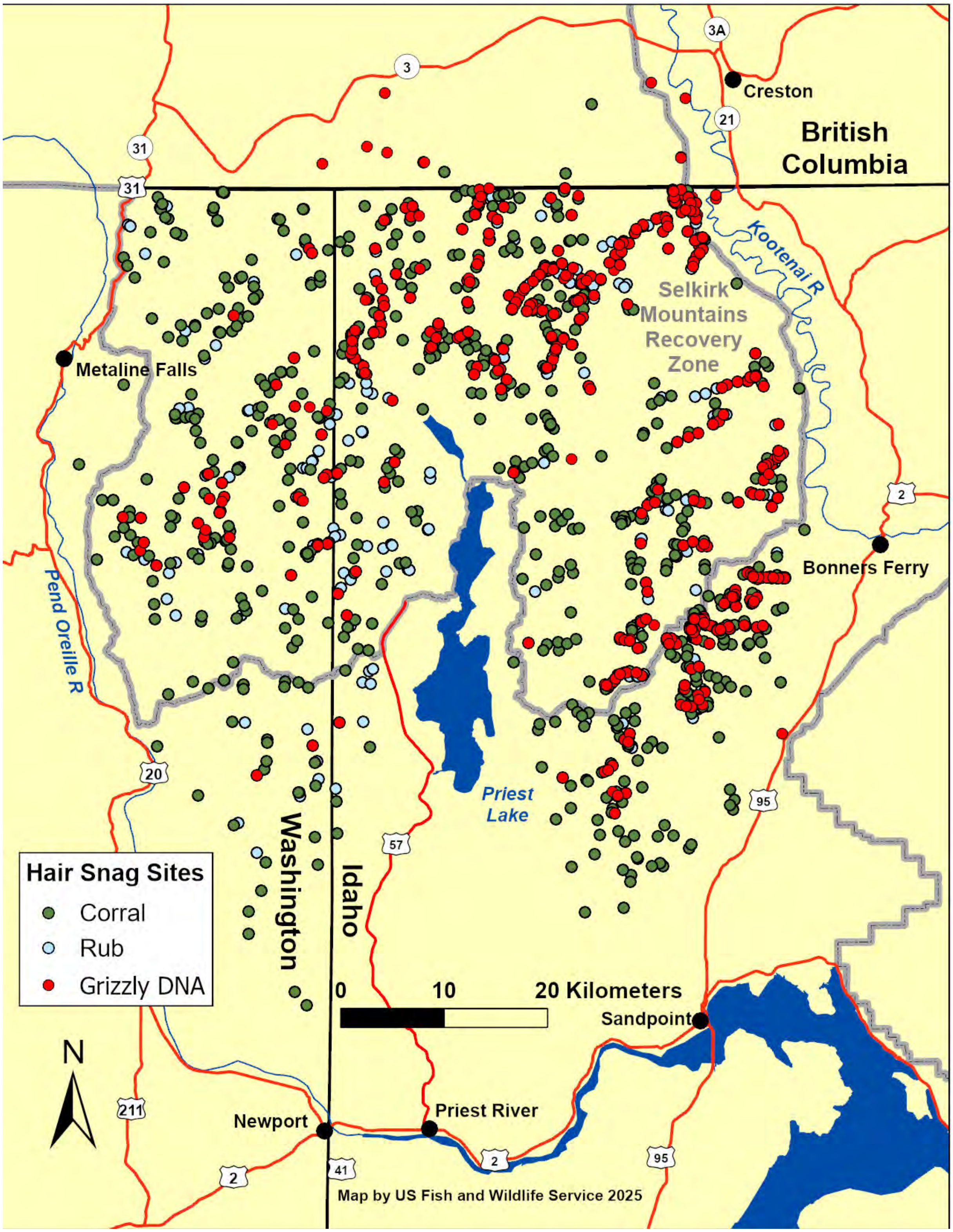

Figure 5. Location of hair snag corral and rub sampling sites in the U.S. Selkirk Mountains, 2014–2024. "Grizzly DNA" represents a site where collected hair was genetically identified as grizzly bear.

Movements and Gene Flow

The SE population was previously identified as having low genetic diversity as determined by heterozygosity calculations (*H*=0.54, Proctor *et al*. 2012). This 2007 level was among the lowest of all interior North American grizzly bear populations. Low heterozygosity was believed to be the result of a small remnant population that has grown by reproduction with little immigration and gene flow from adjacent populations. Capture, telemetry, and genetic data were analyzed to evaluate movement and subsequent reproduction resulting in gene flow into and out of the SE from 1983–2024. Laboratory analysis of genetics data from 2024 has not been completed. Twenty-nine grizzly bears were identified as immigrants or emigrants. While movement and gene flow out of the SE may benefit other populations, gene flow into the SE is most beneficial to genetic health. Seventeen individuals (16 males and 1 female) are known to have moved into the SE from adjacent populations; however, six males and 1 female were killed or removed (Figure 6). Known gene flow has been identified through reproduction by five immigrants (four males and one female) resulting in 28 offspring in the SE (Appendix Table T3). Additional analysis of changes in heterozygosity and other genetic measures is planned.

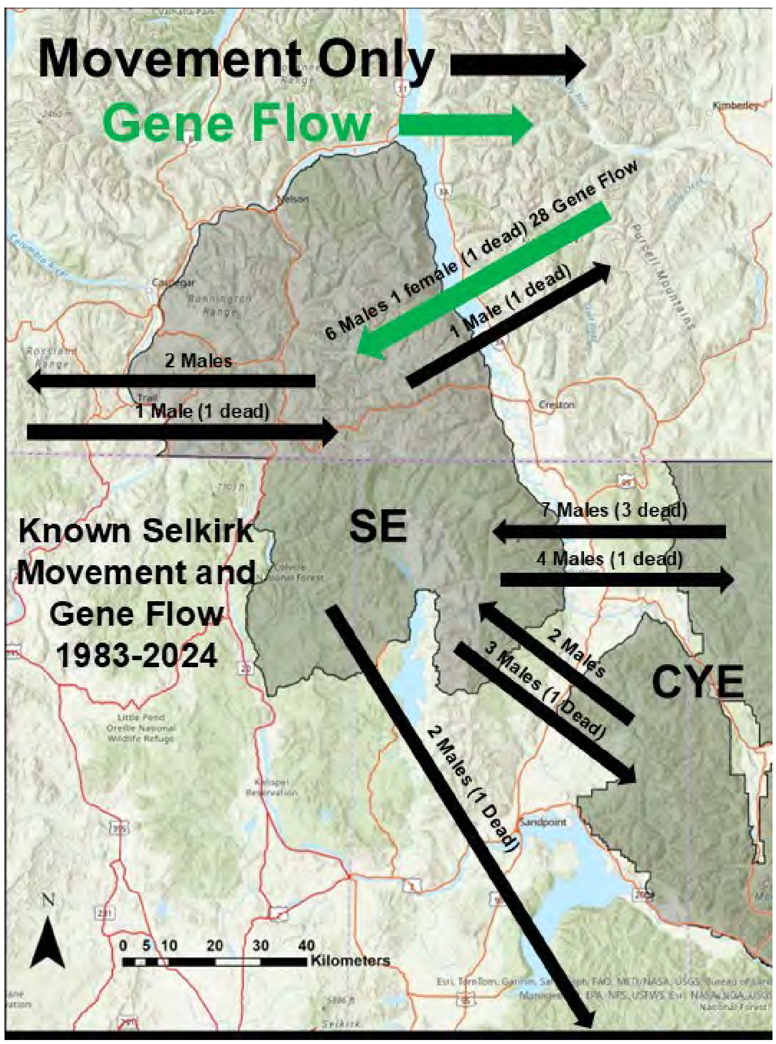

Figure 6. Known immigration (black arrows) and gene flow (green arrows) into the Selkirk Mountains, 1983–2024.

Known Grizzly Bear Mortality

In 2024 there was no known human-caused grizzly bear mortality and one known natural mortality. Ninety-five instances of known and probable grizzly bear mortality were detected inside or within 10 mi (16) km of the U.S. SE and the B.C. South Selkirk grizzly bear population unit during 1980–2024 (Tables 2 and 11, Figure 3 and 7). Seventy-nine were human-caused, 11 were natural mortality, and 5 were unknown cause. Fifty-six occurred in B.C., 32 in Idaho, and 7 in Washington. Eighteen were adult females, 21 adult males, 6 subadult females, 20 subadult males, 10 yearlings, and 11 cubs (Table 8). Mortality causes (frequency) were management removal (27), property defense (11), natural (12), unknown but human-caused (9), mistaken identity (8), poaching (7), vehicle/train collision (7), B.C. legal hunting (5), unknown (5), and defense of life (4). Nineteen mortalities occurred in spring (April 1 to May 31), 28 in summer (June 1 to August 31), 43 in autumn (September 1 to November 30), and 4 on unknown dates.

Table 11. Cause, timing, and location of known or probable grizzly bear mortality in or within 10 mi (16) km of the Selkirk Mountains recovery zone (with South Selkirk Population Unit), 1980–2024.

	Mortality cause										
Age / sex / season / ownership	Defense of life	Defense of Property	Legal Hunt	Management removal	Mistaken identity	Natural	Poaching	Vehicle/Train Collision	Unknown, human	Unknown	Total
BC Adult female	1	2	1	4		3		2	1		14
US Adult female					2	1	1				4
BC Subadult female				2			1		1		4
US Subadult female					1			1			2
BC Adult male	1	1	2	5			1	1	1		12
US Adult male				2	2		2		3		9
BC Subadult male		1	2	5	1			1			10
US Subadult male	2	1		2	1		1	1	2		10
BC Yearling		2		1		1					4
US Yearling					1	3				2	6
BC Cub		4		2							6
US Cub						4	1				5
BC Unknown				4				1		1	6
US Unknown									1	2	3
Total	4	11	5	27	8	12	7	7	9	5	95
Season[1]											
Spring	1	1	4	4	1	1	2	2	1	2	19
Summer	1		1	11	1	7	1	3	3		28
Autumn	3	10		12	6	3	4	1	3	2	44
Unknown						1			2	1	4
Ownership											
BC Private		10		20		1		2	1		34
BC Public	2		5	3	1	3	2	3	2	1	22
US Private	1	1		4				2	2		10
US Public	1				7	8	5		4	4	29

[1]Spring = April 1 – May 31, Summer = June 1 – August 31, Autumn = September 1 – November 30.

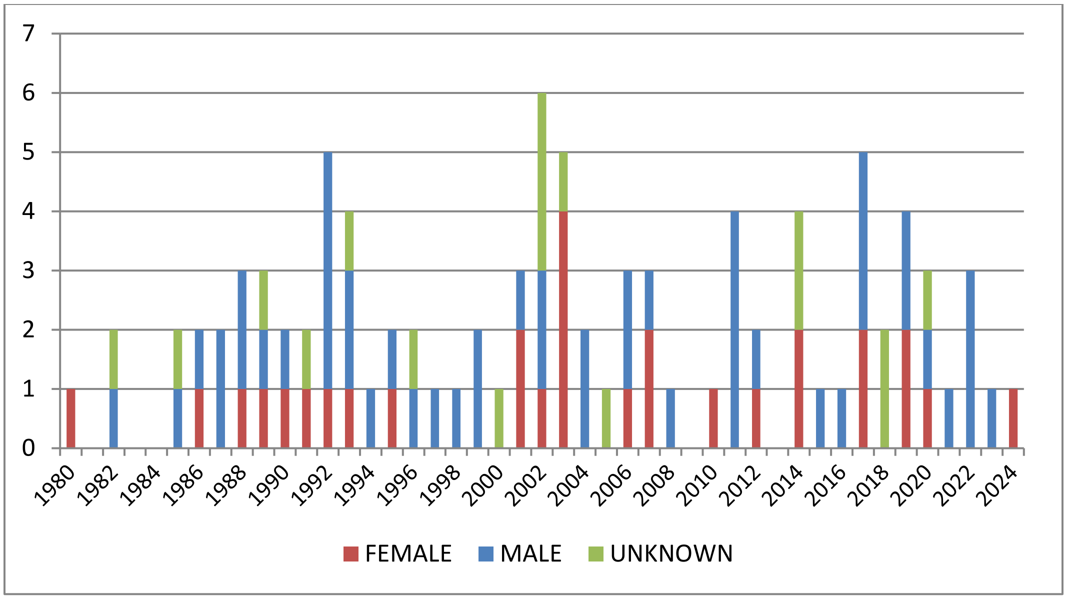

Figure 7. Known grizzly bear annual mortality from all causes in Selkirk Mountains recovery area (including Canada), 1980–2024.

Capture and Marking

One subadult female and 1 adult female grizzly bear were captured during research trapping in 2024 (all in the U.S.). Sixty-eight grizzly bears were captured during 2,632 trap-nights in B.C. and the U.S. during 2007–2024 (Table 12). Ninety-five individual black bears were captured during these efforts (Appendix Table T4). One grizzly bear was captured outside the study area in Washington in a management conflict situation (1 subadult male). Largely, we base our trap site selection, effort, and distribution on known or suspected grizzly bear spatial density, occupancy, DNA monitoring success, and past trap success (Figure 8). There was no research trapping in B.C. during 2018–2024.

Rates of grizzly bear capture were higher in B.C. than the U.S. Thirty-seven individual grizzly bears have been captured in B.C. at a rate of 1 new individual every 16 trap-nights. Rates of capture of grizzly bears in the U.S. were 1 new individual every 66 trap-nights. Rates of capture for black bears were similar in B.C. and the U.S. at 1 new individual every 25 and 29 trap-nights, respectively. Black bear data are provided for comparison purposes.

Table 12. Research capture effort and success for grizzly bears and black bears within the Selkirk Mountains study areas, 2007–2024.

Area / Year(s)	Trap-nights	Grizzly Bear Captures	Black Bear Captures	Trap-nights / Grizzly Bear	Trap-nights / Black Bear
Selkirks, US, 2012–2024					
ID Total Captures	1293	32	48	40	27
WA Total Captures	760	16	25	48	30
US Individual bears[1]	2053	31	72	66	29
Selkirks, BC, 2007–2017					
Total Captures	579	42	28	14	21
BC Individual bears[1]	579	37	23	16	25

[1]Only captures of individual bears included. Recaptures are not included in summary.

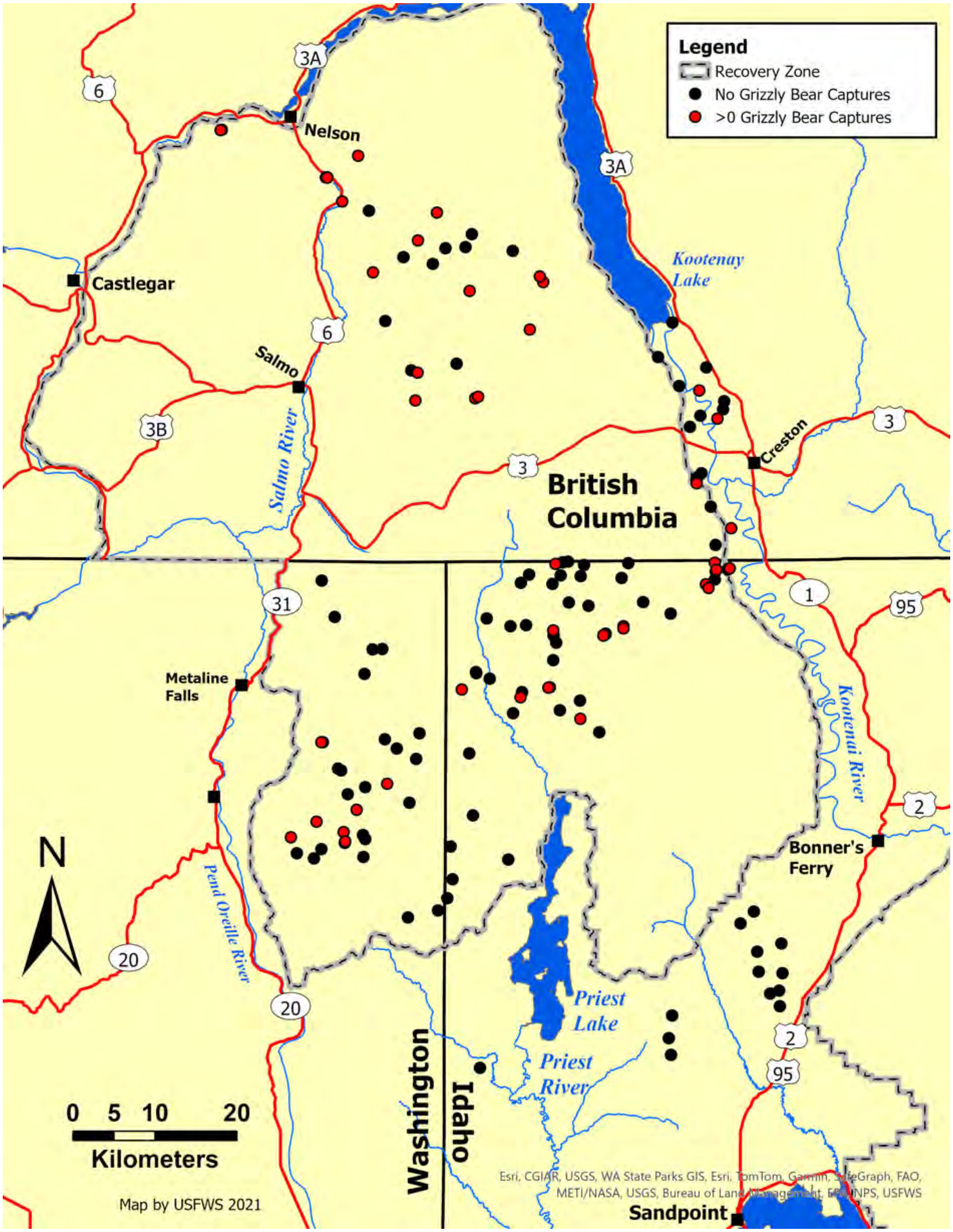

Figure 8. Research trap site locations in the Selkirk Mountains study area 2007–2024. Red dots represent sites with one or more grizzly bear captures.

Grizzly Bear Monitoring and Home Ranges

Eight grizzly bears were monitored by GPS radio collars during portions of 2024 in the Selkirks study area. Monitoring included four females (1 adult and 3 subadults) and four males (2 adults and 2 subadults). One subadult male grizzly bear was collared for management purposes.

We used VHF and GPS location data from radio-collared grizzly bears to calculate home ranges. Convex polygon life ranges were computed for bears monitored during 2007–2024 (Appendix 5, Figs. A1-A74). Annual home range estimates and basic statistics were calculated for research bears with ≥ 5 months of telemetry in a single year (Table 13). Adult male annual range averaged 729 km^2 (95% CI ± 236, *n* = 17) using the minimum convex polygon. Adult female annual range averaged 252 km^2 (95% CI ± 63, *n* = 20) using the minimum convex polygon estimator.

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.

Table 13. Selkirk research bears, 2007–2024, mean annual home range (square kilometers) by sex and age class. Bears that have less than 5 months of data per year were not included in calculations.

Sex and age class	N	Mean (Km^2)	95% CI
Subadult male	5	1,894	± 2,535
Subadult female	7	534	± 340
Adult male	17	729	± 236
Adult female	20	252	± 63

Grizzly Bear Denning Chronology

We used VHF and GPS location data from radio-collared grizzly bears during 1986–2024 to summarize den entry and exit dates by month and week. Den entry dates (*n* = 107) ranged from the first week of October to the second week of December. Ninety-five percent (*n* = 102) of entries occurred between the 2nd week of October and the 4th week of November (Fig. 9). SE grizzly bears (median entry during 4th week of October) entered dens 2 and 4 weeks earlier than bears in the Cabinet Mountains and Yaak River drainage (Kasworm *et al.* 2024), respectively (median entry during 2nd week of November for Cabinet bears and 4th week of November for Yaak bears). Males typically enter dens one week later than females (Fig. 9). By December 1, 97% of monitored SE grizzly bears had entered winter dens (100% of females, 92% of males; Fig. 10). By this same date, only 63% of Cabinet and Yaak grizzly bears had entered dens (76% of females, 45% of males; Kasworm *et al*. 2024).

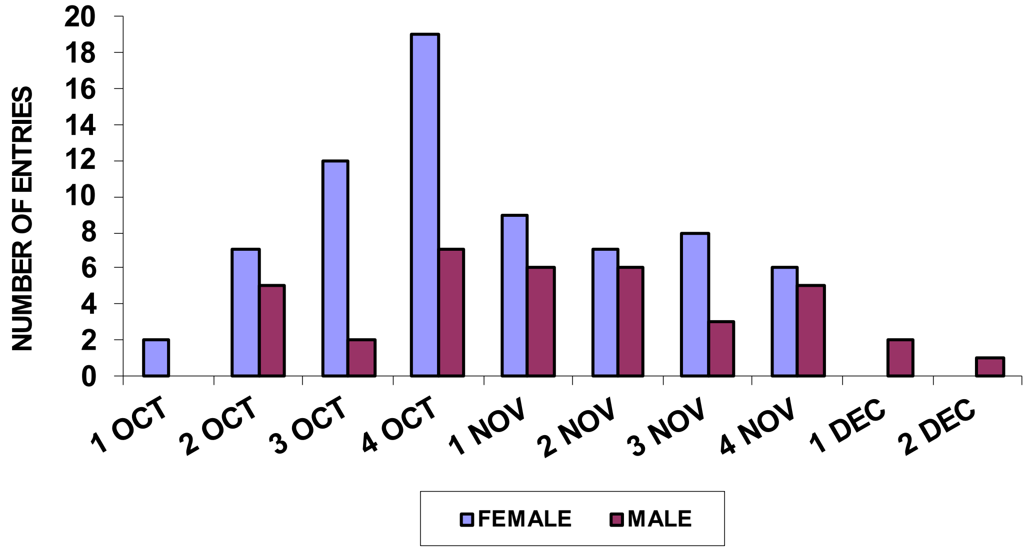

Figure 9. Month and week of den entry for male and female radio-collared grizzly bears in the Selkirk Ecosystem, 1998–2024.

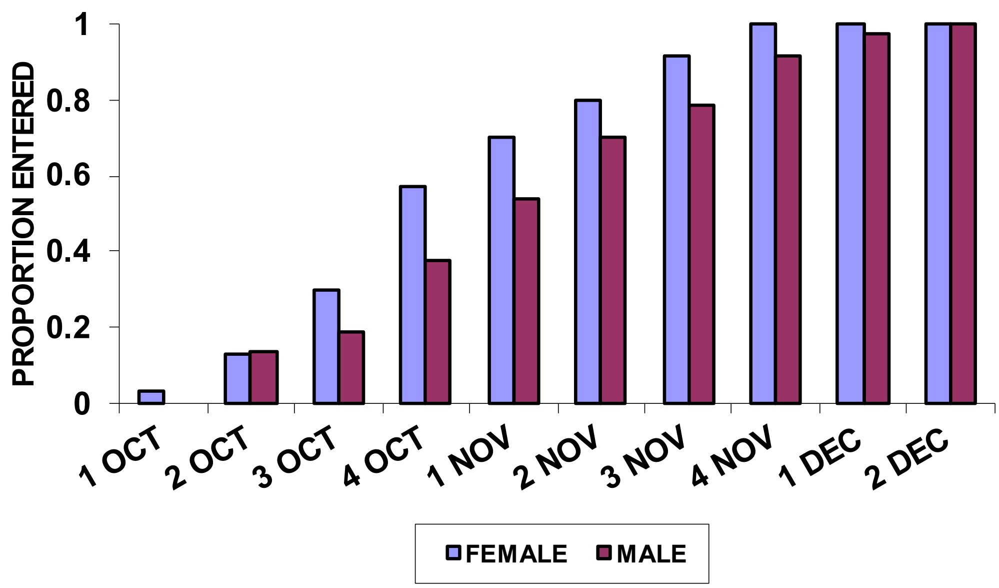

Figure 10. Cumulative proportion of den entries for female and male, radio-collared grizzly bears in the Selkirk Ecosystem, by month and week, 1986–2024.

We have fewer den exit dates for SE radio-collared grizzly bears (n = 82), and most emergence data is from female grizzly bears (71%). Exit dates for female SE grizzly bears ranged from the third week of March to the third week of May (median of 3rd week in April) (Fig. 11). Exit dates for SE females are typically one week later than that of females in the Cabinet

Mountains and Yaak drainage (Kasworm *et al*. 2024). Females with cubs exit dens much later than adult females without cubs, with all females with cubs remaining in dens until April 15 (Fig. 12). Overall, 81% of female SE grizzly bears are still in their dens on April 15; less than half (42%) of males are still in dens on that same date (Fig. 13).

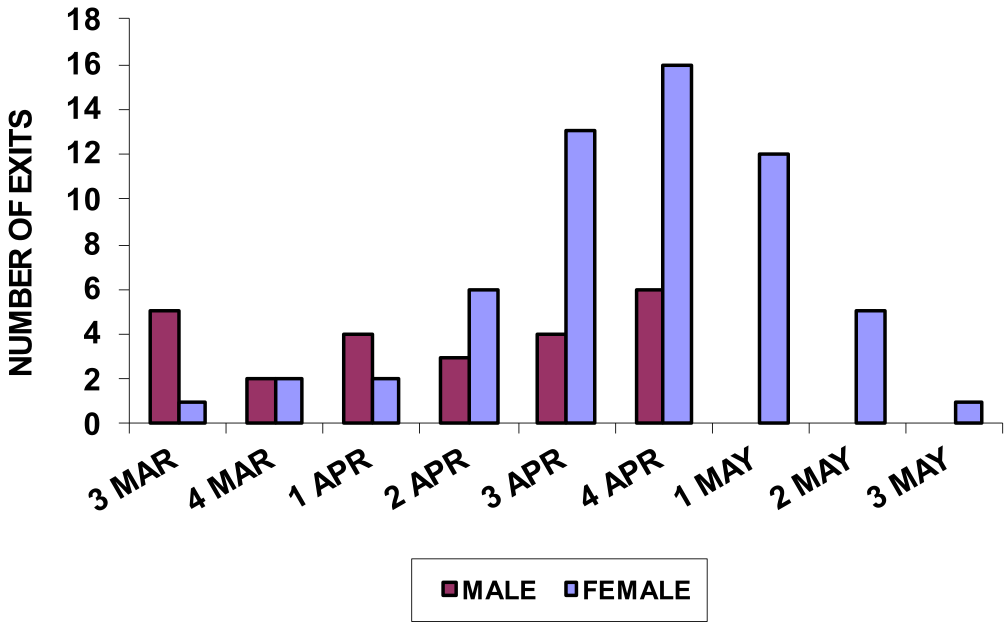

Figure 11. Month and week of den exit for male and female radio-collared grizzly bears in the Selkirk Ecosystem, 2013–2024.

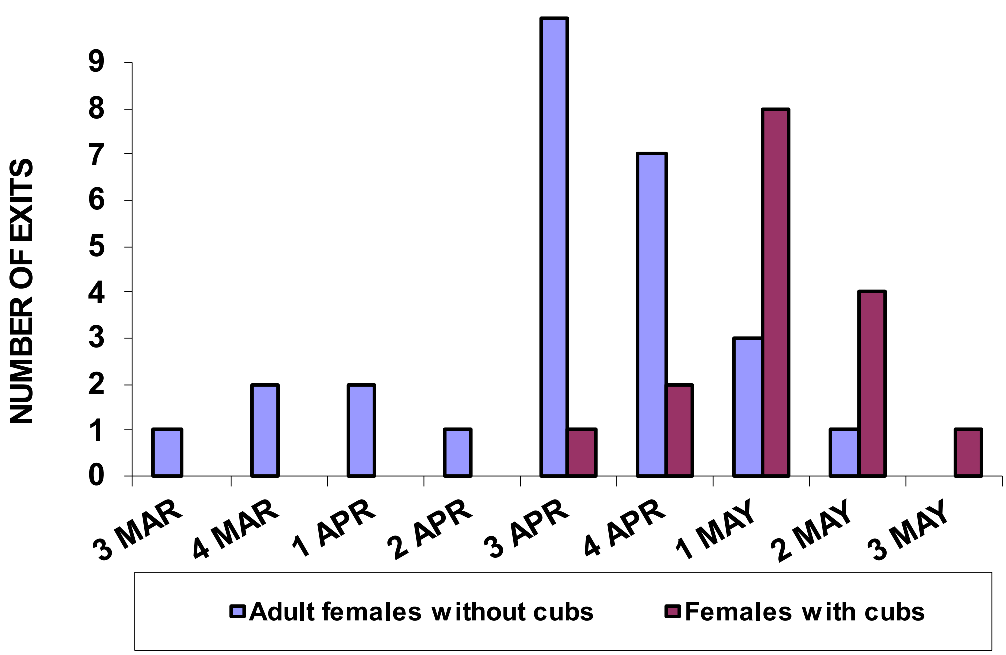

Figure 12. Month and week of den exit for adult female, radio-collared grizzly bears (with and without cubs) in the Selkirk Ecosystem, 1986–2024.

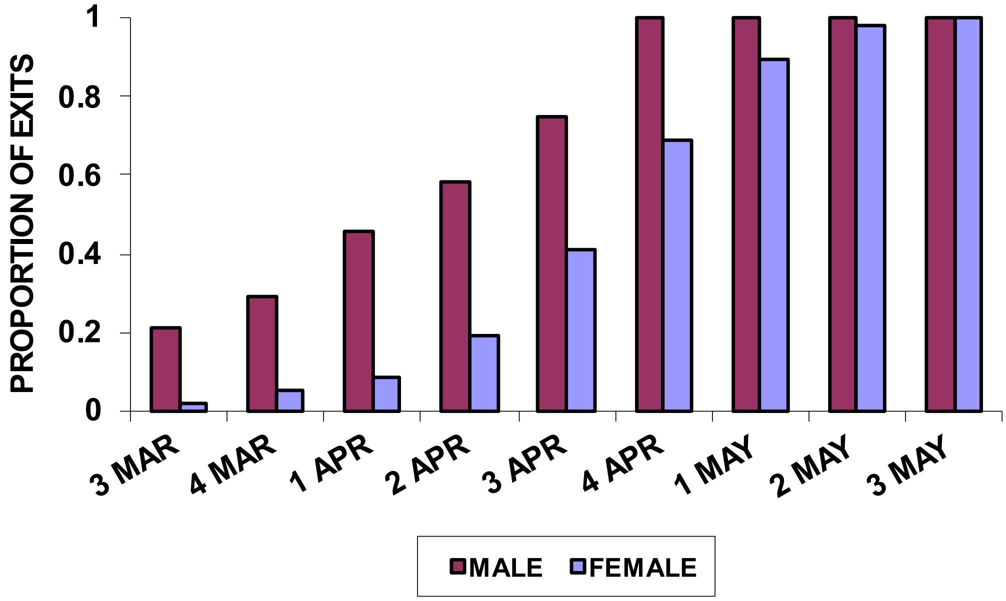

Figure 13. Cumulative proportion of den exits for female and male, radio-collared grizzly bears in the Selkirk Ecosystem, by month and week, 1986–2024.

Grizzly Bear Habitat Analysis

Resource selection functions were utilized to develop seasonal habitat use maps for the Cabinet-Yaak (CYE) and SE and surrounding area based on telemetry locations collected from 2004–2015. See Appendix 6 for methodology and maps. The following habitat analysis will discuss both recovery areas and all telemetry data from 1983–2024.

Grizzly Bear Use by Elevation

Differences in elevation between the CYE and SE are reflected in individual bear's radio location data (GPS &VHF) from both areas. Locations were first assigned to the area of interest: Cabinets, Yaak, and Selkirks. To account for differences in sample size between VHF and GPS collared bears, monthly mean elevation for each bear was first calculated. These means were then averaged. Only bears with at least four locations per month were utilized. Grizzly bears in all three study areas exhibited the same general pattern of elevation use (Fig. 14). In spring, bears are at lower elevations accessing early green vegetation. As the year progresses, bears move to higher elevations to utilize a variety of berry species. The use of lower elevations by Yaak River bears during October and November corresponds with the Montana general hunting season. Bears may be utilizing wounded animals and gut piles. Selkirk bears do show an increase in meat consumption later in the year, but by the first week of November 50% of bears have entered dens and may not have the ability to respond to the presence of this protein source. The difference in Idaho and Montana's elk hunting season structure may account for some of the differences in fall elevation use.

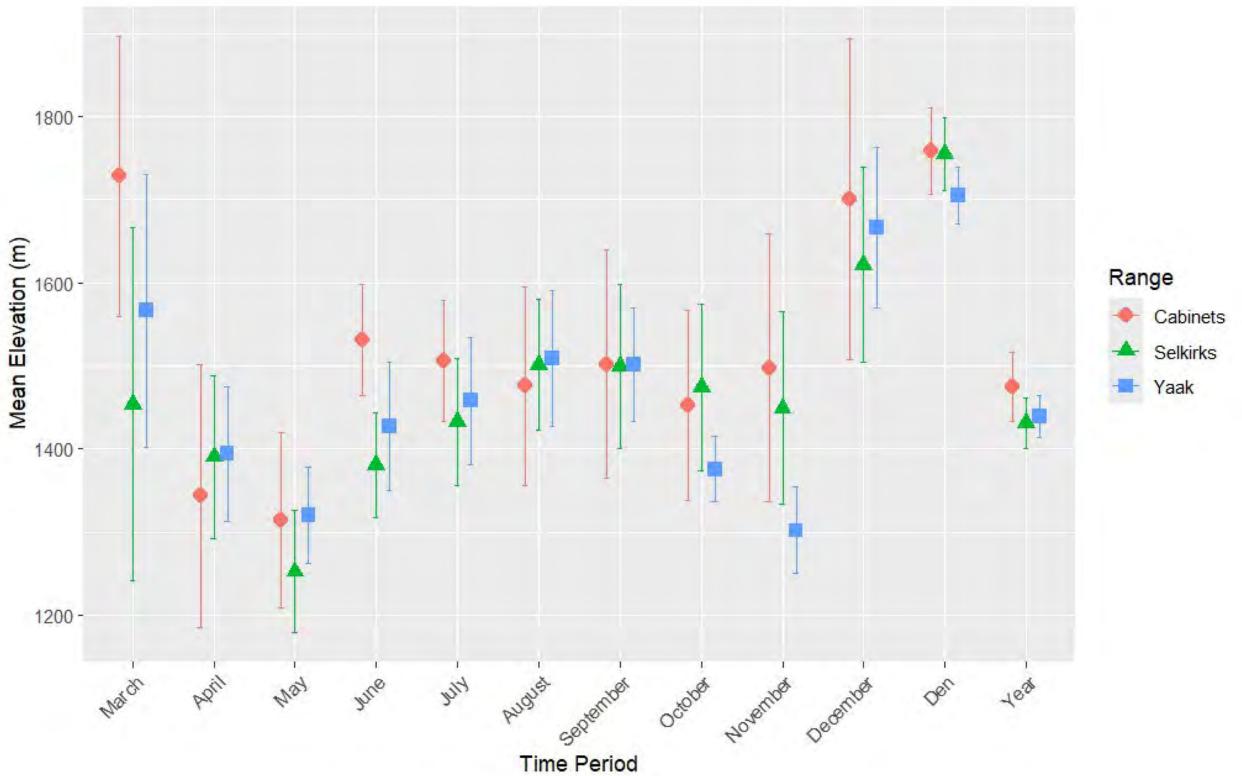

Figure 14. Mean monthly use by elevation for radio locations from research bears located in the Cabinet Mountains (*n* = 36) (including locations of augmentation bears that stay for more than 12 months) from 1983–2024, the Yaak (*n* = 74) from 1986–2024, and the Selkirk Mountains (*n* = *94* from 1986–2024 for VHF and GPS collared bears. Error bars represent 95% CI.

Inter-ecosystem Isotope Analysis

We are using isotope analysis to compare grizzly bear food use (plant vs. animal matter) between ecosystems, among sex-age classes, and across management status. Samples currently analyzed are only from grizzly bears of known sex and age. Most samples came from capture events; future analysis will include samples from known grizzly bears at hair rub and hair corral sites. To date, we have obtained carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) isotope ratios from 237 grizzly bear hair and blood samples between 1984 and 2015 in the CYE and SE. Across the SE and CYE, adult males consume slightly more animal matter (22%) than adult females (14%) and subadults (13%). Adult females in the Yaak River consume higher proportions of animal matter (22%) than do adult females in the Cabinets (10%) and the SE (6%).

We estimate that 14 percent of the annual diet of Cabinet Mountain grizzly bears (*n* = 19 hair samples from non-management bears) is derived from animal matter. Adult males had slightly higher $\delta^{15}N$ stable isotope signatures (4.2‰) than adult females (3.1‰), indicating greater use of available animal matter (24% vs. 10% animal matter, respectively). Yaak grizzly bear diets contain nearly 22% animal matter (*n* = 84 hair samples). Adult female use of animal matter varies widely; $\delta^{15}N$ and diet values ranged as low as 2.3‰ (~6% animal matter) to as high as 7.2‰ (~80% animal matter). Males in the Yaak have similar numbers (average 25% animal matter; range = 9.1-71.4%). Sampled grizzly bears in the SE consumed less animal matter than CYE bears (12%; *n* = 36 hair samples). Diets of SE non-management, adult female bears include only 7% animal matter, while males were not much higher at 15%. However, one adult female captured in a management incident in the Creston Valley fed on animal matter at a rate of 82%. We suspect bears such as her likely gain meat from bone piles or dead livestock at nearby dairy operations.

Across ecosystems, conflict and management bears had slightly higher proportions of meat (26%) in assimilated diets than research bears (17%). Management bears did not necessarily have higher $\delta^{13}C$ signatures as would indicate a more corn-based or anthropogenic food source (-23‰ for both research and management bears). In fact, highest $\delta^{13}C$ in our dataset came from a research female caught in Corn Creek of the Creston Valley, BC in 2008. By all indication, she likely fed extensively on corn from nearby fields without human conflict.

By analyzing different hair types that initiate growth at different times of the year, we have observed increases in proportion of animal matter in bear diets as they transition from summer months (diet estimated from guard hairs) to fall months (diet from underfur). Previous studies have emphasized the importance of splitting these hair types due to temporal differences in growing period (Jones *et al*. 2006). We currently have 45 bear capture events with paired guard hair and underfur samples collected at capture. In all cases, grizzly bears have either 1) the same dietary meat proportion in summer vs. fall or 2) have higher amounts of meat in their fall diet. On average, grizzly bears' meat consumption nearly doubles from summer to fall (10.7% summer to 17.6% fall). Fall shifts toward meat use were not isolated to a specific sex-age class. Larger shifts include: an adult male (4327) shifting from 31% meat in summer to 82% meat in fall, an adult female (mortality on 5/18/2012) consuming 14% in spring, then 38% in the fall, and a subadult female grizzly (675) with a summer diet consisting of 6% meat and fall diet of 16% meat. We suspect that wounding loss and gut piles from hunted ungulates contribute to observed increases in meat use by grizzly bears in fall months.

Berry Production

Huckleberries are an important summer and early-fall food for SE grizzly bears. Berries contain high amounts of sugars, which bears readily convert into body fat. Fat stores are important energy sources for winter denning and reproduction. To index year-to-year production of huckleberries, we established and evaluated one huckleberry transect in the SE in 2014. In 2015, we established and evaluated four additional transects in the SE. Surveys were repeated on these five sites in 2016–2024 (Fig. 15).

In 2024, SE transect counts were slightly higher than the 2014–2024 average at 2.8 berries per frame (range = 1.3–4.9; 95% CI = 1.30) (Fig. 16). In comparison, mean huckleberry indices in the CYE were similar to those for the SE in 2023, at 2.1 berries per plot (n = 15 transects; range = 1.0–3.3), with both ecosystem indices tracking one another year-to-year (i.e., estimate confidence intervals overlap every year, 2015–2024) (Fig. 17) (Kasworm *et al*. 2024).

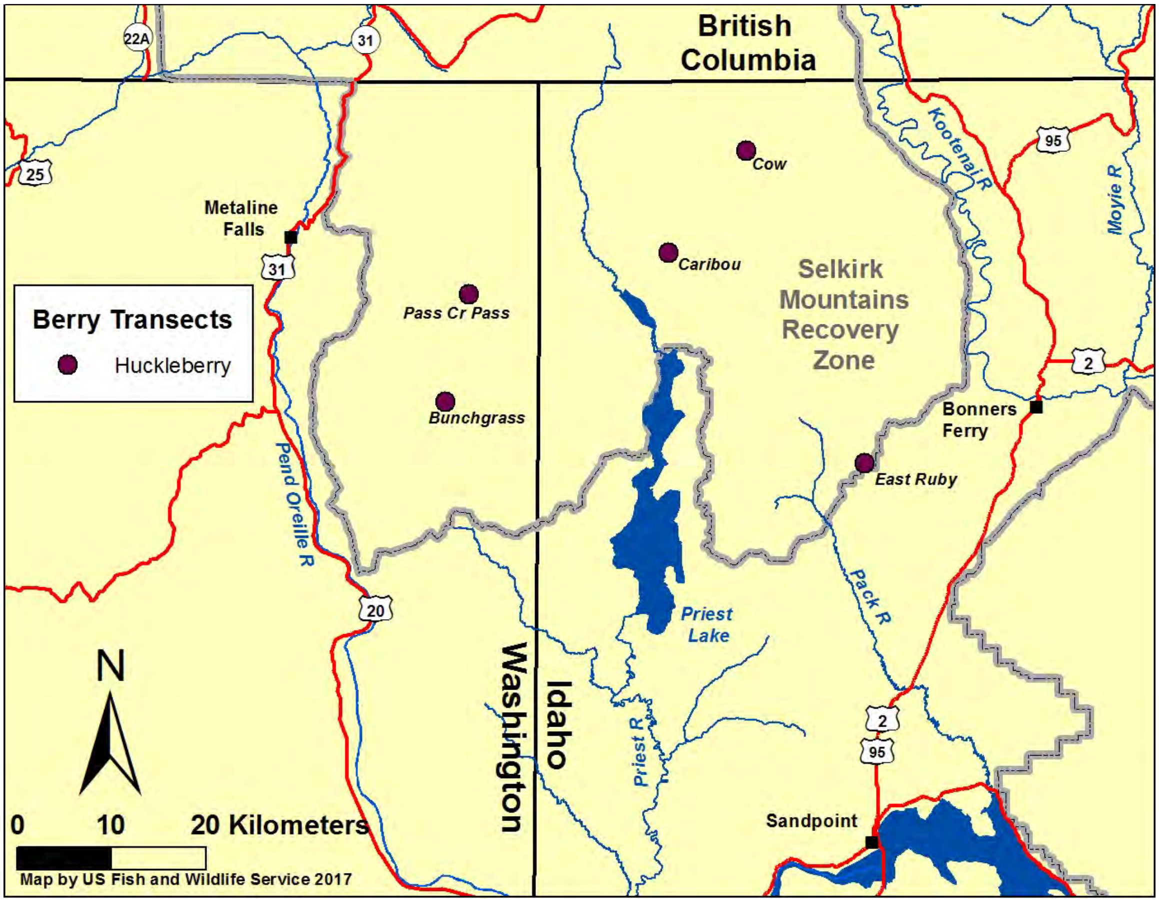

Figure 15. Locations of huckleberry transects surveyed in the Selkirk Mountain study area, 2014–2024.

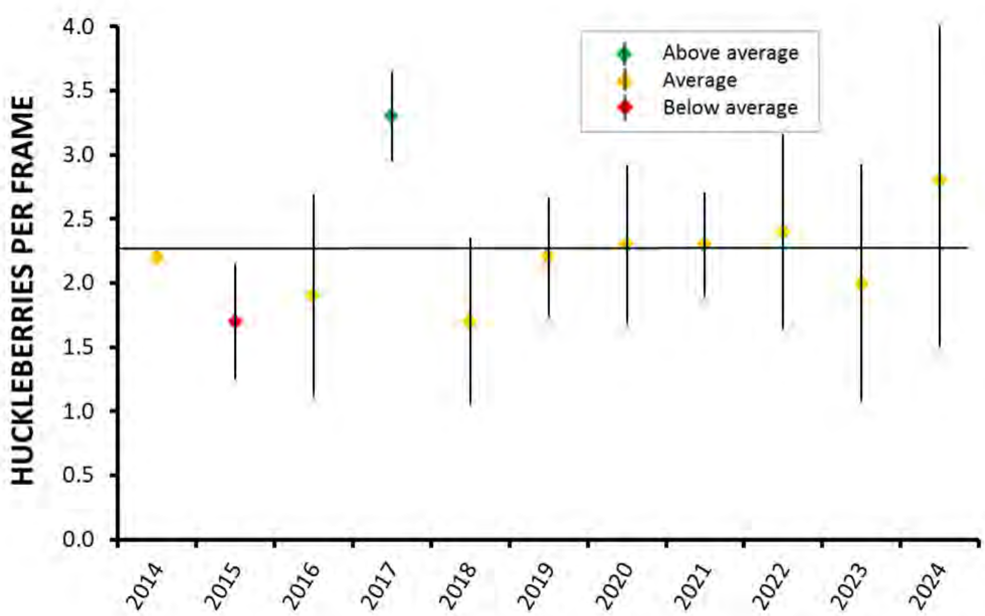

Figure 16. Mean berries per plot frame (± 95% confidence interval) for huckleberry transects in the Selkirks, 2014–2024. Horizontal line indicates study-wide mean production, 2014–2024.

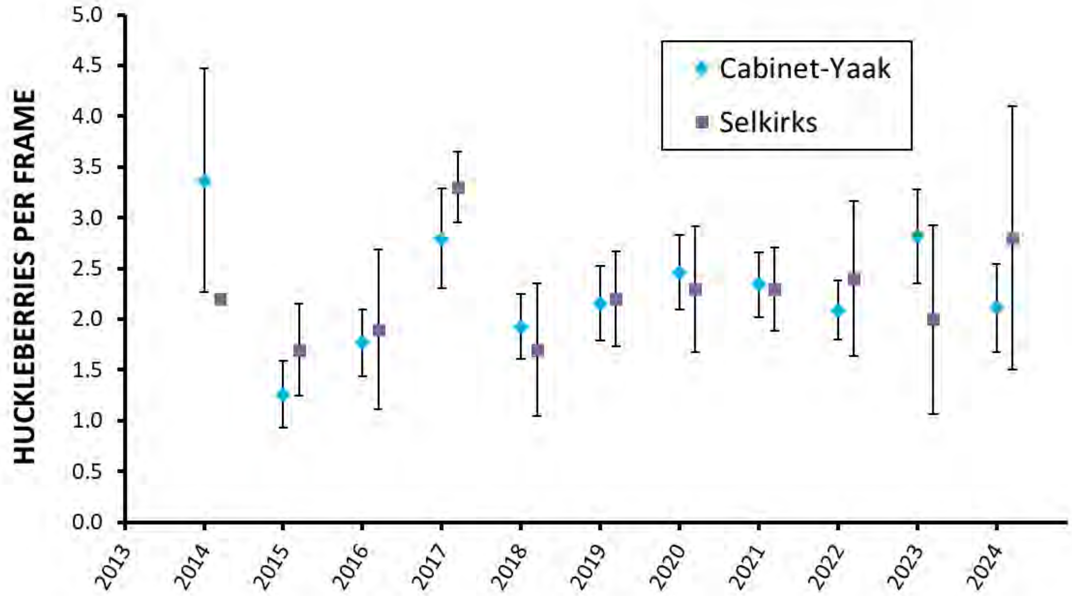

Figure 17. Comparison of mean annual huckleberry production indices (berries per plot frame; +/- 95% CI) for the Cabinet-Yaak and Selkirk ecosystems, 2014-2024.

Body Condition

We determined body mass of Cabinet-Yaak and Selkirk (CYS) research grizzly bears at 100 independent capture instances, May-October (1983-2024). We assessed whether body mass differed by sex and age (83 males, 69 females) and whether body mass varied for adult grizzly bears (≥5 years old) by month and sex, as follows: May/June (M = 26, F = 14), July (M = 3, F = 13), August (M = 11, F = 8), September (M = 3, F = 4) (Figures 19 and 20).

Body mass of male and female grizzly bears started diverging approximately at the age of two, with females reaching an asymptote before males. The best-fit curve for male and females was from a von Bertalanffy based growth curve (Matsubayashi *et al*. 2016) (Fig. 18). The mean male body mass has a declining trend from May to August and increases in September. Male body mass is similar during the months of May/June and September. The mean female body mass increases throughout the year with the largest increase in body mass being in September (Fig. 19).

We estimated body fat content of Cabinet-Yaak and Selkirk (CYS) grizzly bears at 137 independent capture instances, May through November 2010–2024. We assessed whether body fat content of CYS grizzly bears differed by sex (80 males, 57 females), capture type (109 research, 28 management captures), and month of capture. Researchers in the Greater Yellowstone and Northern Continental Divide Ecosystem have noted that body fat content of grizzly bears varies by month, exhibiting a trend that is presumably dependent on denning (i.e., inactive) season and availability and quality of foods consumed during the active season (Schwartz *et al*. 2014; Teisberg et al. *in prep*). We similarly partitioned our seasonal data into categorical bins by month, as follows: May (*n* = 25), June (*n* = 45), July (*n* = 24), August (*n* = 23), and September–November (*n* = 20).

Body fat content of male and female grizzly bears did not differ (P = 0.298; Table 14). Body fat content of research-captured vs. management-captured grizzly bears also did not differ (P = 0.0137; Table 15), suggesting that management bears do not necessarily obtain a more nutritionally rich diet than research-captured bears. However, body fat content of CYS grizzly bears did differ by month ($P < 0.0001$; Fig. 20). Body fat content in September–November was significantly higher than those in all other months, and August fat contents were higher than those in June (Tukey-HSD contrasts; $P<0.05$). With all other months, fat content did not differ. CYS grizzly bears appear to start gaining fat as early as July. These results suggest habitat and foods available to CYS grizzly bears allow for body fat gain, such that bears can attain above-average body fat contents in the months preceding den entrance. Reproductive-aged, female grizzly bears experience 1) delayed implantation of already-fertilized eggs in November and 2) cub birth in the den (Jan–Feb). Studies suggest adult females must reach a pre-denning body fat content more than ~20% to support implantation and winter cub production (Robbins *et al.* 2012).

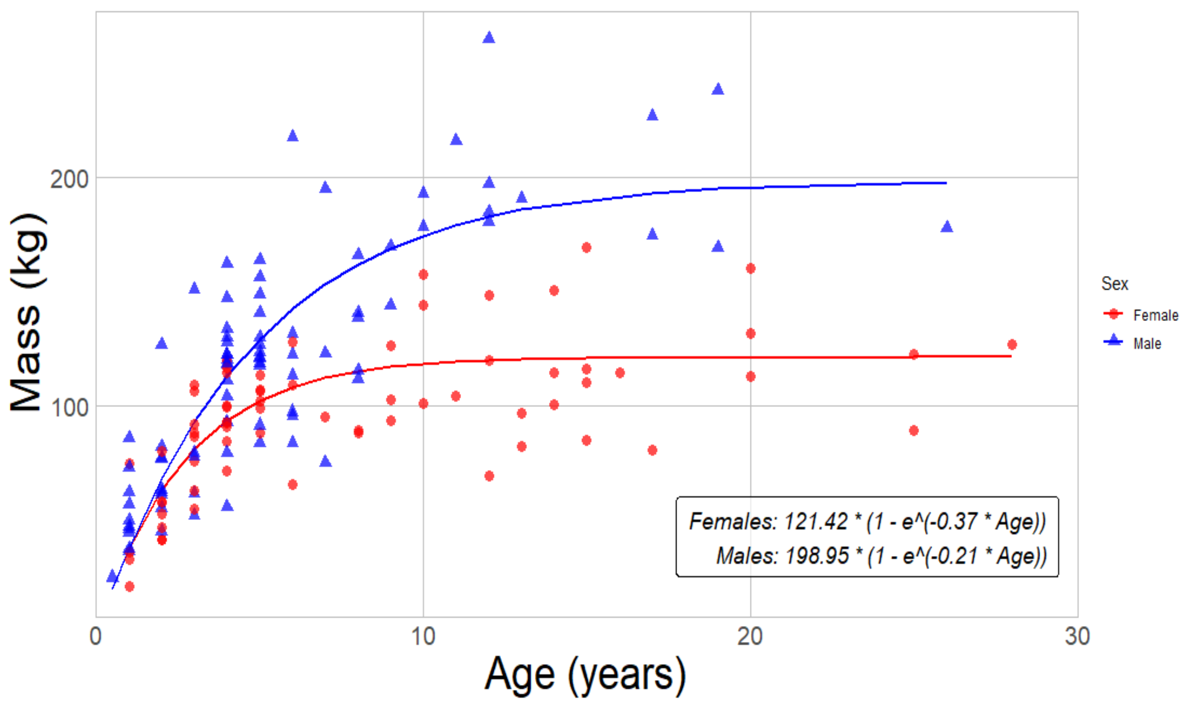

Figure 18: Body mass (kg) of captured research male and female grizzly bears by age in the Cabinet-Yaak and Selkirk Mountains, 1983–2024.

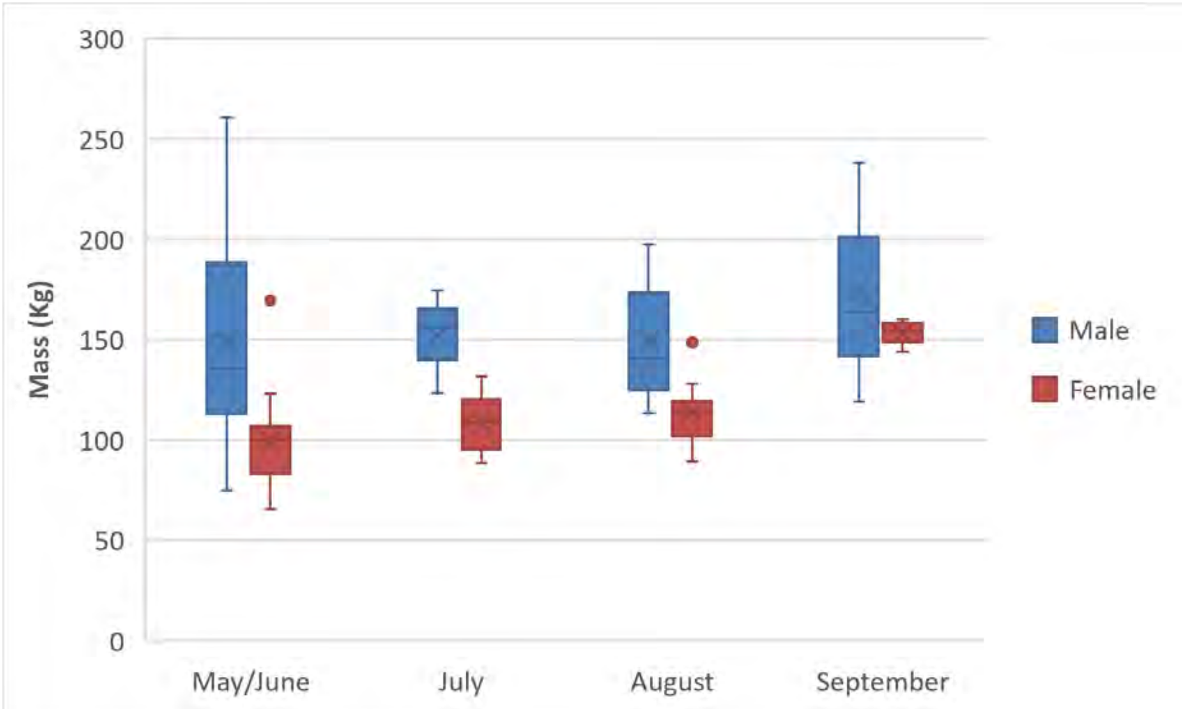

Figure 19: Box plot of body mass (kg) of captured adult research male and female grizzly bears in the Cabinet-Yaak and Selkirk Mountains, 1983–2024. Points represent outliers in the data set, X's are the mean, and the line in the box is the median.

Table 14. Mean estimates of percent body fat content (kg fat / kg body mass) and effect size (+/- standard error, SE) of Cabinet-Yaak and Selkirk grizzly bears, by factors of interest, 2010–2024.

Factor / *Level*	**Mean**	**SE**
Capture Type		
Research	17.5	+/-0.7
Management	21.2	+/-1.5
Sex		
Female	17.5	+/-1.0
Male	18.8	+/-0.8
Month		
May	17.9	+/-1.1
June	14.2	+/-0.9
July	16.7	+/-1.4
August	21.1	+/-1.2
Sept-Nov	26.3	+/-1.4

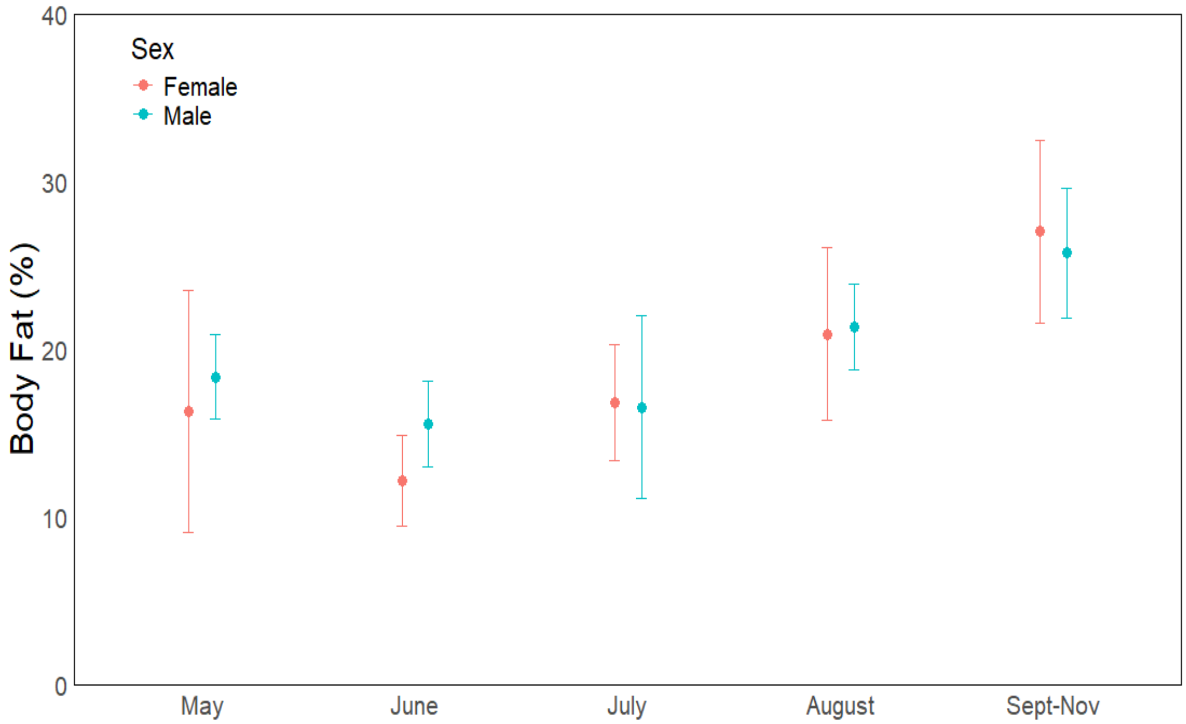

Figure 20. Mean percent body fat content (kg fat / kg body mass) of captured female and male grizzly bears in the Cabinet-Yaak and Selkirk mountains 2010–2024, by month. Error bars represent 95% confidence intervals.

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APPENDIX Table 1. Estimating Occupied Range for Grizzly Bears in the Cabinet-Yaak and Selkirk Mountains

Introduction: Occupied range is an estimate of the roughly contiguous area within which bears have established residency or have demonstrated habitat use. Estimated occupied range represents a minimum known area of occupancy. It does not include occasional forays outside the estimated range or low-density peripheral areas and therefore does not represent the total known extent of occurrences. Due to the smoothing inherent in the methodology, range edges may extend over features that might act as partial barriers to grizzly bear movement, such as I-90 or Lake Koocanusa. Range estimates for neighboring populations may also overlap, but this does not represent evidence of genetic and/or demographic connectivity. Males generally disperse farther than females, and often account for the leading edge of range expansion. As grizzly bears expand into historical range, it is possible to have occupied range without female presence; however, female reproduction is necessary to establish a population.

Background: Bjornlie *et al*. (2014) developed a technique using all verified grizzly bear location data, zonal analysis, and kriging to estimate occupied range for the Greater Yellowstone Ecosystem. This document provides clarification and guidance for applying the technique developed by Bjornlie *et al.* (2014) to each grizzly bear population in the lower-48 States.

Methods:

Data:

Location data will include the following sources: known locations of captures, mortalities, human-grizzly bear conflicts, and field collection of hair samples attributed to grizzly bears through DNA analysis; VHF and GPS locations from radio-monitored bears; and locations of sightings or tracks reported or verified by experienced agency personnel.

Data from GPS collared bears will be screened. Unlike other data sources that rarely include more than one location/individual/day, GPS data sets may include as many as 48 locations/individual/day. To account for this sizable difference in data frequency, GPS data for each individual will be screened to exclude all but 1 randomly selected location/day. This will ensure that GPS data are not overrepresented in the data set and are appropriately scaled to the daily activity radius used to determine the grid size *(see Grid Size below*).

Data from bears that were relocated as a response to human-bear conflict or translocated for population and/or genetic augmentation, will be screened. After relocation and/or translocation, bears often wander widely, while trying to return to their original area or while searching for a suitable place to settle. To reduce the effect of these human-influenced movements on occupied range estimates, post-relocation/translocation locations will be excluded if they are outside of previous estimates of occupied range and they are either: (1) outside of either the bear's known home range or a circular area around the capture site with a radius equal to the mean home range radius (NCDE: 12 km for females, 21 km for males), indicating they have not successfully returned to their place of origin; or (2) they are wide-ranging and non-concentrated (i.e., do not resemble a newly-established home range).

The 1/day screening of GPS locations should help reduce the influence of any occasional long-range, single-track excursions made by collared bears (not associated with translocation). If not, however, movements such as these might be excluded if they are assumed to be associated with a temporary movement by a single individual and if they unduly distort the extent of occupied range. Other considerations may include known age and population of origin, as subadult individual movements tend to include exploratory excursions.

Timeframe:

Grizzly bears are a long-lived species and due to small sample size, annual data from observations and radio-collaring efforts cannot accurately represent the extent of occurrence. Because of this, the NCDE and GYE will use a 15-year moving window. The CYE and SE will use a 20-year moving window due to the smaller population size and resulting smaller available data set.

Grid size:

A 3km x 3km grid was laid across the lower-48 States using ArcGIS. The grid-cell size was selected based on the mean daily activity radius for male grizzly bears (1.44 km for the GYE, 1.29 km for the NCDE, and 1.21 km for the CYE and SE). For further details see Bjornlie *et al.* 2014.

Kriged surface:

One contiguous, occupied range was mapped for each grizzly bear population. Disjunct “islands”, separate from the larger population range, were excluded.

Results:

Grizzly bear occurrence data from telemetry sightings, mortality, and genetics was used to produce a map of occupied range for male and female grizzly bears and females only in the Cabinet-Yaak and Selkirk recovery areas during 2005-2024 (Figure 1). In the Cabinet-Yaak, male and female distribution covers 98% of the recovery zone and female only distribution covers 80%. In the Selkirk Mountains male and female distribution covers 95% of the recovery zone and female only distribution covers 94%. Male and female distribution from both the Cabinet-Yaak and Selkirks overlaps the other, however female only distribution does not.

Literature cited:

Bjornlie, D. D., D. J. Thompson, M. A. Haroldson, C. C. Schwartz, K. A. Gunther, S. L. Cain, D. B. Tyers, K. L. Frey, and B. Aber. 2014a. Methods to estimate distribution and range extent of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Society Bulletin 38:182–187.

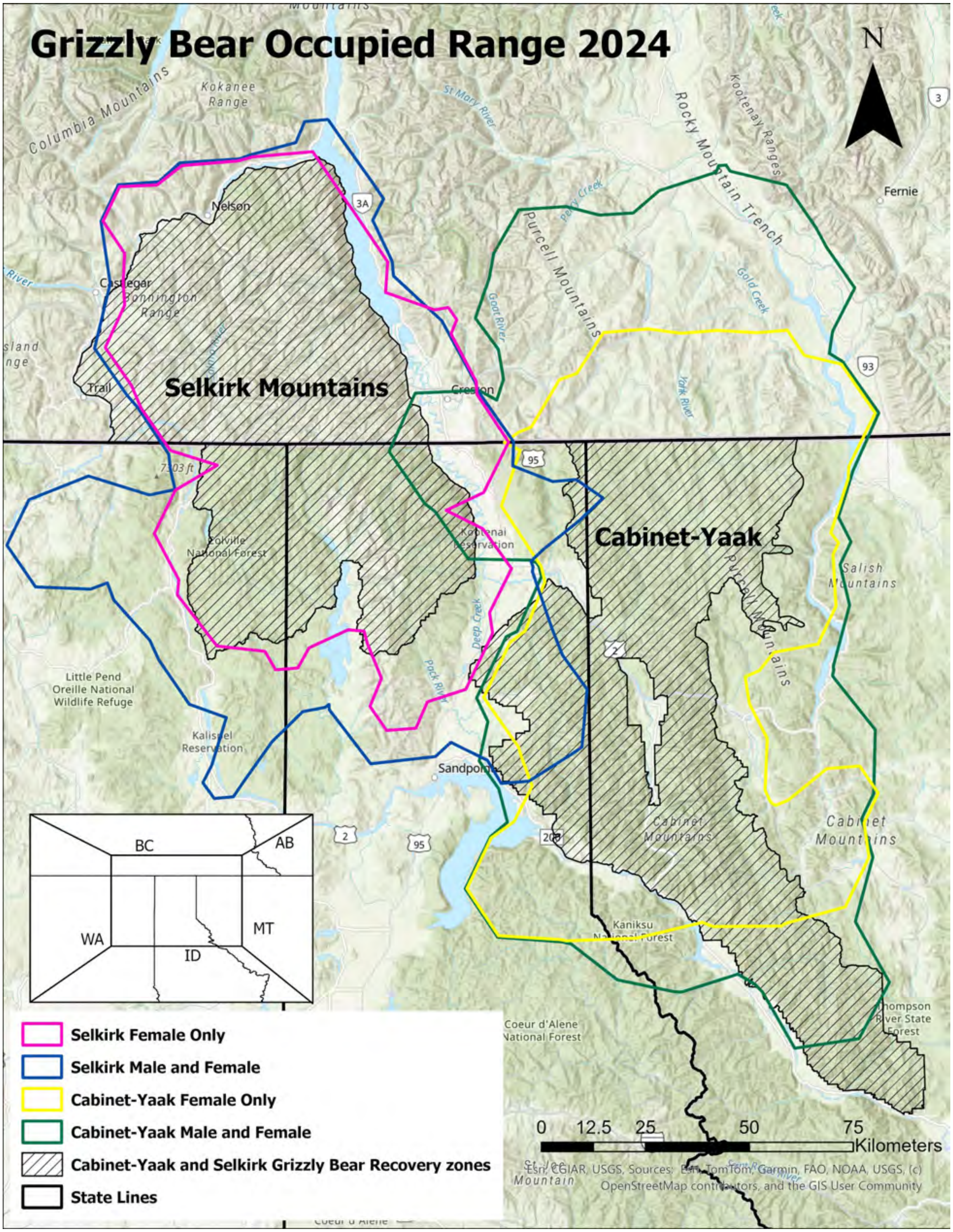


Figure 1. Occupied range of male and female grizzly bears and female grizzly bears only in the Cabinet-Yaak and Selkirk recovery areas, 2005-2024.

APPENDIX 2. Bog Creek Monitoring 2024 Update

Introduction

In March of 2019 a Biological Assessment (BA) was released for the Bog Creek Road Project which proposes road repair, maintenance, and motorized closures to facilitate border surveillance by U.S. Border Patrol in the Continental Mountain area of the Idaho Panhandle National Forest (IPNF) within the Bonners Ferry and Priest Lake Ranger Districts (SCWA and IPNF 2019). The project lies within the Selkirk Mountains grizzly bear recovery area and grizzly bears in this area are listed under the Endangered Species Act as threatened (Figure 1). The BA concluded that the proposed actions may affect, and are likely to adversely affect, grizzly bear. The U.S. Fish and Wildlife Service (USFWS) grizzly bear recovery program has been conducting research and monitoring of this population since 2012 and was requested to develop a monitoring proposal for this project.

The project proposed to rebuild 9 km of road in the Bog Creek drainage that has been unusable since 2000 and was heavily overgrown with brush, small trees, and other vegetation. Human use patterns on roads that approach the Bog Creek Road are expected to see changes because of this action. Road clearing and reconstruction was started in summer of 2021 and finished in summer of 2022. The IPNF instituted a motorized access management plan as part of the 2011 Forest plan (IPNF 2011). The plan sets management standards for core habitat, open road density, and total road density. Ongoing research has monitored 22 grizzly bears (12 females, 10 males) using the Grass and Bog Creek portions of the Bluegrass Bear Management Unit (BMU) since 2012 (Kasworm *et al*. 2023). This study also has established numerous hair collection sites at natural rubs and barb wire corrals with trail cameras to provide photographic and genetic evidence of grizzly bear use.

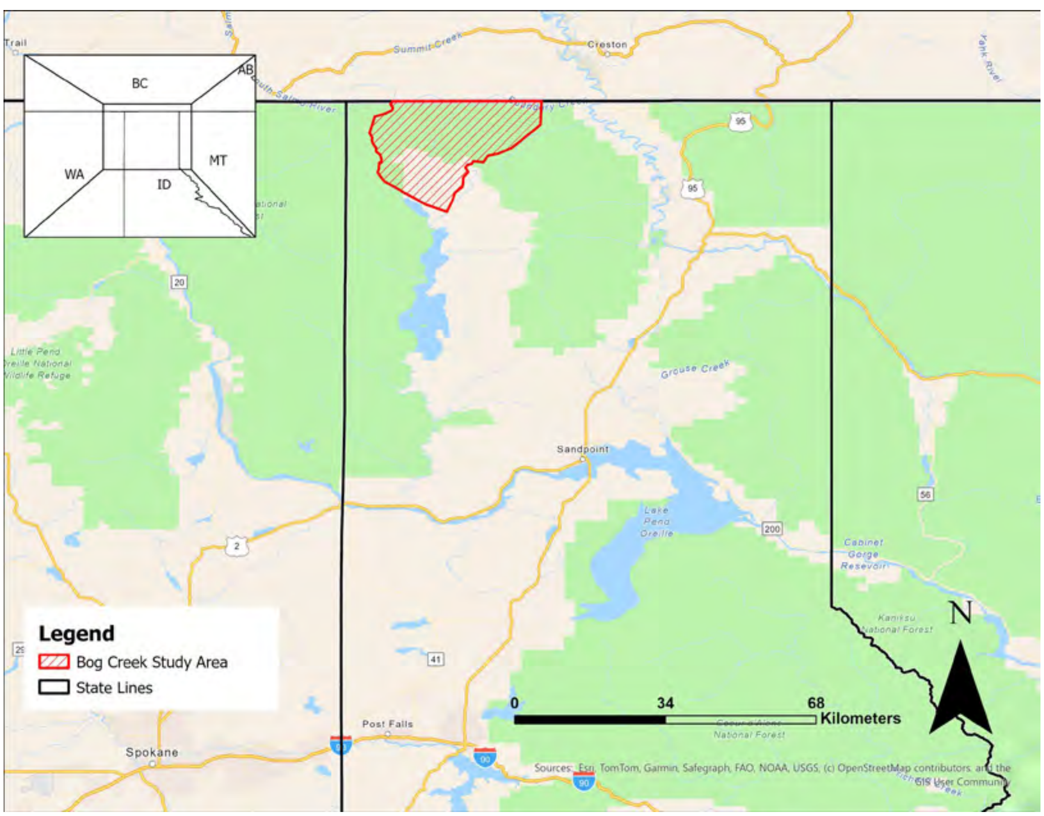


Figure 1. Bog Creek study area, north Idaho 2024.

Methods

We propose to monitor the effects of this project with radio telemetry from collared bears that use the affected area, genetic detection of individual grizzly bears by hair collection at natural rubs and corrals and expanded use of trail cameras along the affected roads to identify levels of wildlife and human use.

Remote cameras and Traffic Counters

Use of additional remote cameras along affected roads was the greatest expansion over previous efforts. Remote cameras were placed along the road system between gates at each end of the project area and selected spur roads along this route to provide comparative measures of bear use of road segments with differing levels of human use. Cameras provide measures of use before, during, and after project activities. Cameras were placed at 2 km intervals along the routes that access the reconstruction site from the east and a 1 km interval in the Bog Creek reconstruction zone (54 km total). We also established "control" monitoring locations on adjacent restricted roads with trail cameras spaced at 1 km interval (approximately 18 km). Traffic counters were utilized to obtain counts of motorized vehicles.

Monitoring on the Bog Creek Road started in 2019 with 10 trail cameras, 1 camera every kilometer along the road prior to any construction activity. Additionally, cameras were placed by the Forest Service in adjacent drainages to the East (Blue Joe and Grass creek) in 2019, 2020, and 2021. In 2022, an additional 34 cameras were placed along the routes that access the reconstruction site and on adjacent roads. In 2023, an additional 5 cameras were placed along open roads to compare road use and grizzly bear use from the reconstruction site and adjacent roads.

We counted grizzly bear, motorized, and non-motorized events within each road segment. A unique event is any single or a group of the same category (grizzly bear, motorized, and non-motorized) that occurs within 1 minute of each other.

Road segments in descending levels of motorized use were identified as: open public road (OR), gated with Continental Mine and administrative motorized use (Gated/CM/Admin), Bog with administrative motorized use (Gated/BP/Admin), and gated with limited administrative motorized use only (Gated/Limited-Admin). Nonmotorized use occurred on all road segments

Traffic counters were deployed in 2021, 2022, and 2023 in various locations along the access routes to the reconstruction site. We are comparing the sensitivity of the traffic counters to various types of vehicle traffic to cameras located in same locations as traffic counters.

Telemetry

Telemetry could determine current grizzly bear use in relation to the project status and progression. Starting in 2022 there was increased trap effort in the Bluegrass BMU (Bog, Blue Joe, and Grass Creeks) every year for the next several years to achieve a post-construction sample of at least 5 females and 3 males. Trapping was coordinated with road camera maintenance effort to limit trips behind gated roads.

Genetics

Interagency efforts (IPNF, USFWS) monitor bear rub objects for grizzly hair and genetic detection in the vicinity of the affected road length. After road reconstruction and associated closures were finished (2023), hair collections at rubs were expanded as new rub sites and corral sites were identified along the road system in the affected area. Rubs were typically visited, and hair collection made monthly. Corrals with trail cameras have been expanded in this area to detect additional females with young. Corrals were checked on a 2–4 week basis.

Results

We operated 49 cameras during all or part of the 2023 and 2024 field seasons. Ten cameras were on the Bog creek road and 39 cameras were in adjacent drainages (Blue Joe, Grass, Saddle, and Silver Creeks). Thirty-six of 49 cameras had grizzly bear events, with 21 of those cameras having female with young in 2023 (Figure 2). Forty-two of the 49 cameras had grizzly bear events, with only 7 of those cameras having female with young in 2024 (Figure 3). Three hundred twenty-four grizzly bear events were detected over 28,535 camera days during 2023–2024., One hundred forty-four grizzly bear events were detected over 16,064 camera days in 2023, and 180 grizzly bear events were detected over 12,471 camera days in 2024 (Table 1). Bog creek had similar numbers of grizzly bear events in 2023 and 2024, 49 and 51 respectively. The level of motorized events and grizzly bear events over 2023-2024 varied by road type and month (Figure 4). Grizzly bear events were contrary to motorized events in that gated admin roads had the highest number of grizzly bear events, but the lowest number of motorized events and open roads had the highest number of motorized events, but the fewest grizzly bear events (Figure 4).

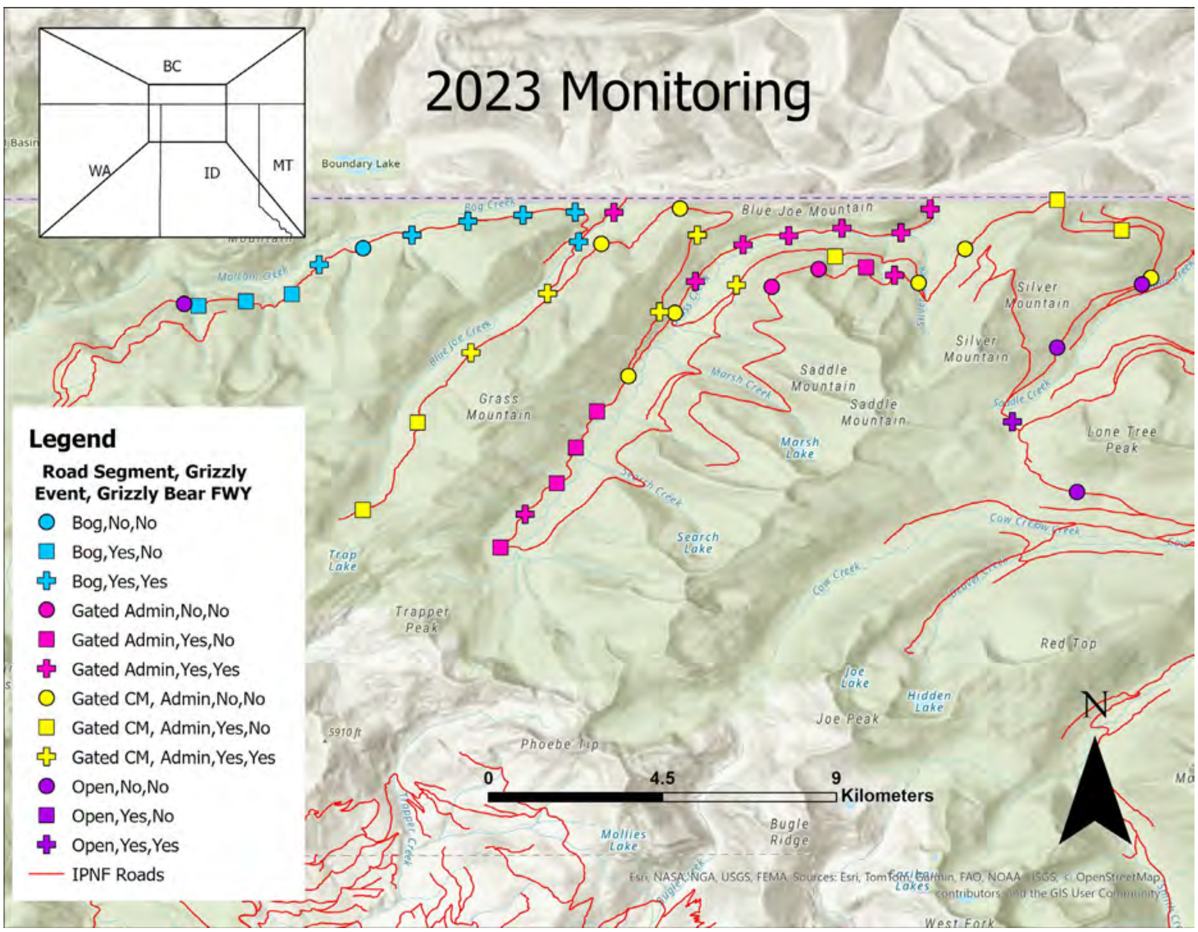


Figure 2. Camera locations during 2023 with grizzly bear detection in Bog creek and adjacent drainages (FWY indicates an adult female with young).

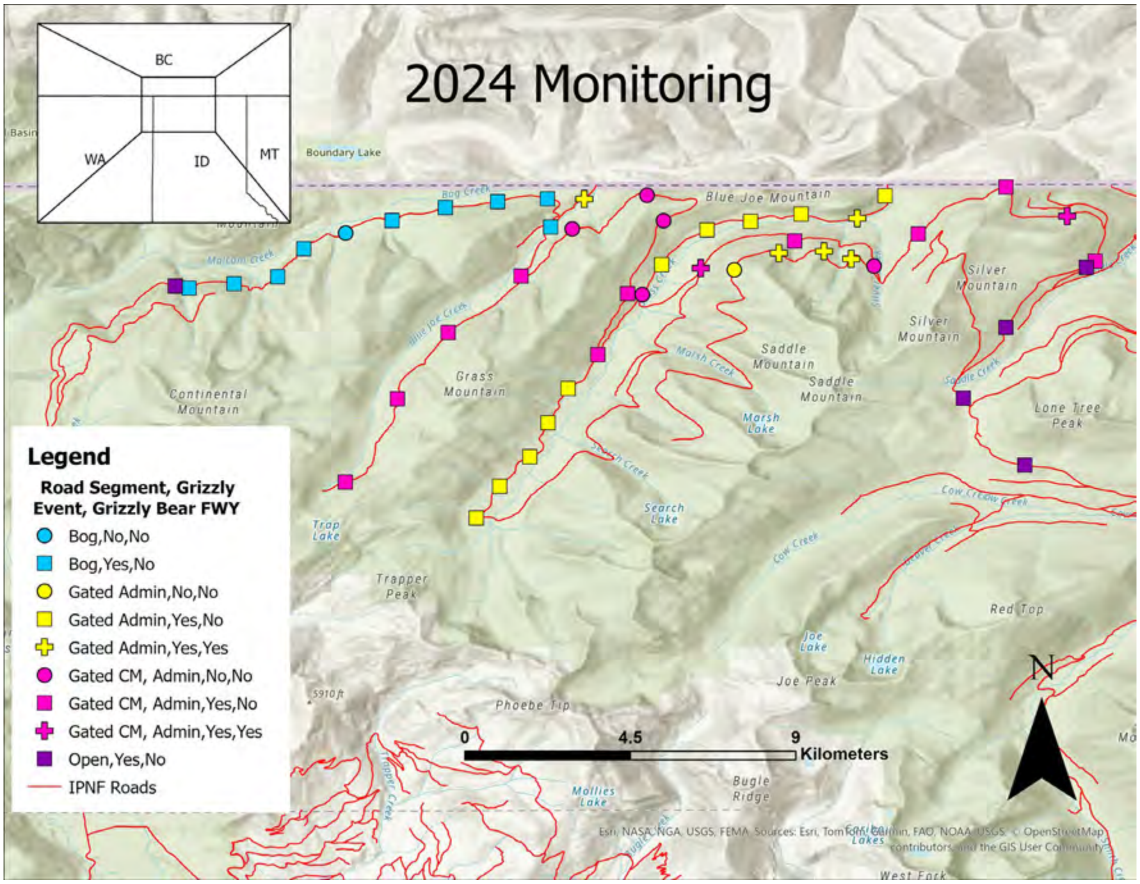


Figure 3. Camera locations during 2024 with grizzly bear detections in Bog creek and adjacent drainages (FWY indicates an adult female with young).

Table 1: Camera trap effort by road type in 2023 and 2024.

Year	Road Type	Number of Cameras	Camera Days out	GB Events	Motorized Events	Non-motorized Events	Camera Days / GB Event	Camera Days / Motorized Event	Camera Days /Non-Motorized Event	Types of Grizzly Bears
2023	Bog Admin	10	3,549	49	498	235	72.4	7.1	15.1	Single bears, FWYr2, FWC2, and FWC1
2023	Open	6	1,183	2	3,447	206	591.5	0.3	5.7	FWC1 and Single bear
2023	Gated Admin	16	5,647	69	453	175	81.8	12.5	32.3	FWYr2, FWYr1, single bears, FWC3, Sibling pair, Breeding pair, and FWC2
2023	Gated, CM, Admin	17	5,685	24	2,812	247	236.9	2.0	23.0	FWC1, Single bears, and FWYr2
2024	Bog Admin	10	2,473	51	302	239	48.5	8.2	10.3	Single bears, sibling pair, and breeding pair
2024	Open	6	1,490	9	3,158	409	165.6	0.5	3.6	Single bears
2024	Gated Admin	16	4,071	86	182	97	47.3	22.4	42.0	Single bears, FWYr2, breeding pair, and FWYr3
2024	Gated, CM, Admin	17	4,437	34	2,586	135	130.5	1.7	32.9	Single bears and FWYr3

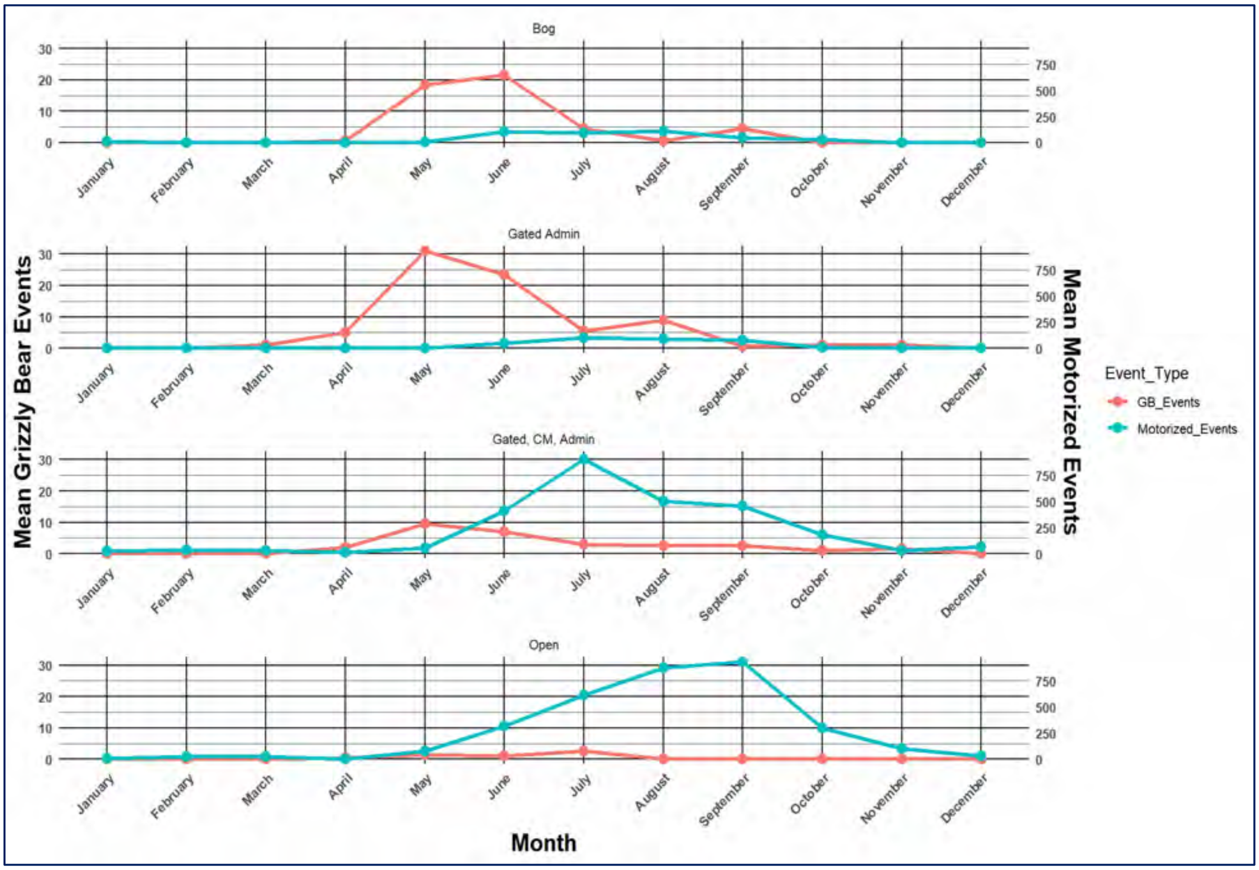


Figure 4. Mean motorized events and grizzly bear events by road type during 2023-2024.

We checked 39 corrals 81 times and 106 rubs 743 times from 2023-2024 (Figure 5). Ten individual grizzly bears were detected in 2023, 6 females and 4 males. Eight of those individuals were detected at rubs and 3 were at corrals, 1 female was detected at both rubs and corrals. We will not receive genetic results (unique individuals detected) from the 2024 field season until fall 2025.

Five grizzly bears (2 adult female, 1 sub-adult female, 1 sub-adult male, and 1 adult male) were collared during parts of 2023 and 2024 that used areas in or around Bog creek (Figure 6). The minimum convex polygons (MCP) ranged from 291 - 5,082 square kilometers.

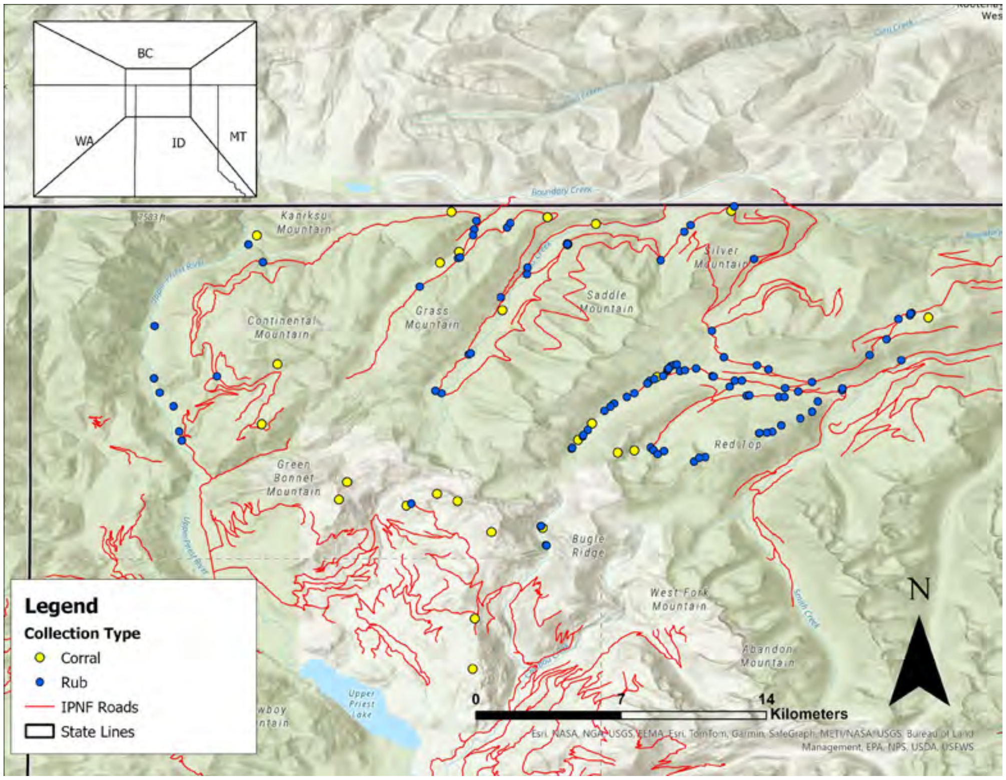


Figure 5 Corral and rub locations during 2023-2024 in Bog creek and adjacent drainages.

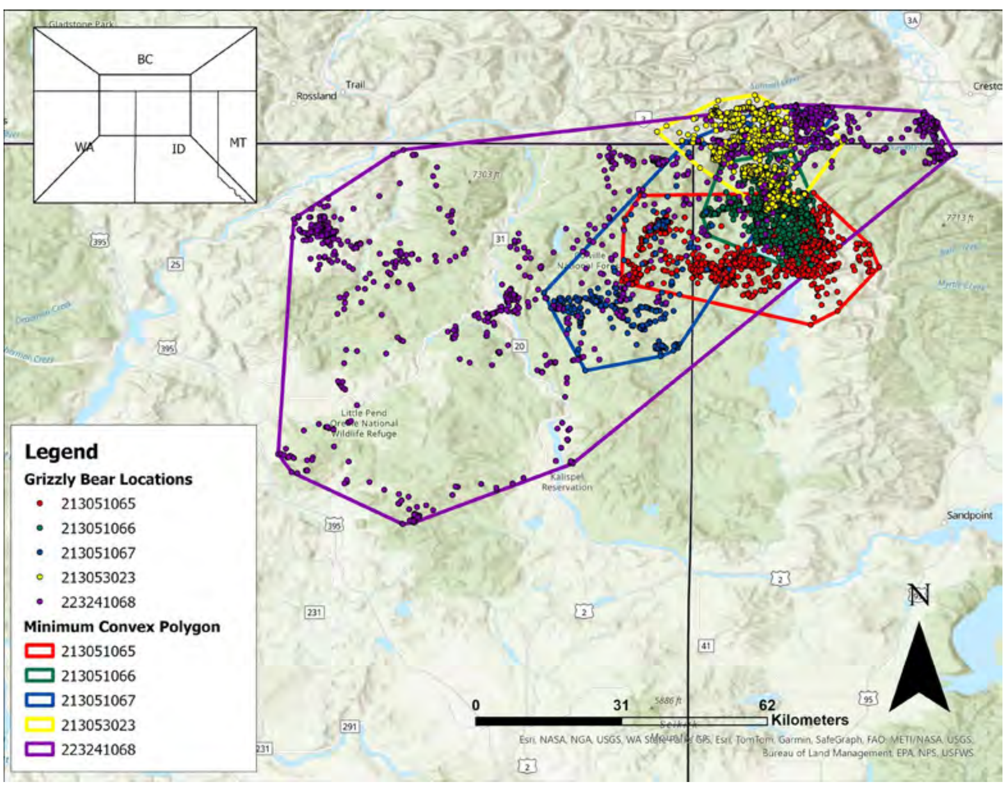


Figure 6 Locations and minimum convex polygons of grizzly bears that used area around Bog creek and had GPS collar on during the 2023-2024 field seasons.

Future Analysis

Comparisons of grizzly bear telemetry, genetic detections, and photographic monitoring will be made from pre-construction, construction and post construction activity levels. Trail cameras will provide a measure of human use along the road segments to relate to bear detections. Photographic data could be analyzed in a similar manner with the number of bear photographs per unit length of the roads as a comparable metric. Traffic volume from traffic counters and photographs will be used in our analysis during construction and post-construction activity levels.

We will compare post-construction radio location data (2023–2026) to pre-construction dataset in GIS and resource selection function (RSF) routine to assess changes in spatial use by grizzly bears relative to the Bog Creek project. Home range and movement patterns associated with differing levels of human activity could indicate any associated effects.

Genetic information from hair snags may enable us to identify unmarked individuals utilizing the project area. Similar to the camera effort, we will compare rate of detections at road rub sites pre- and post-construction, or along lengths of road with differing motorized use regardless of time period. Genetic data could be analyzed independently or in conjunction with camera detection data.

Literature Cited

Idaho Panhandle National Forest. 2011. Forest Plan Amendments for Motorized Access Management within the Selkirk and Cabinet-Yaak Grizzly Bear Recovery Zones.

Kasworm, W. F., T. G. Radandt, J. E. Teisberg, T. Vent, M. Proctor, H. Cooley and J. K. Fortin-Noreus. 2023. Cabinet-Yaak grizzly bear recovery area 2022 research and monitoring progress report. U.S. Fish and Wildlife Service, Missoula, Montana. 118 pp.

SWCA and Idaho Panhandle National Forest. 2019. Bog creek road project. Biological assessment. 132 pp.

APPENDIX Table 3. Movement and gene flow to or from Selkirk Mountains recovery area.

Area[1] Start / Finish	Action[2]	Genetics ID	Tag #	Sex	Age at Detect	Year Action Detected	Basis	Year Known Dead	Comments
Cabs / SPur / SSelk	Movement	C31885M	865	M	3	2018	Genetics Telemetry Mortality	2019	Born in Cabinets, mom is C10011F, captured near Athol, ID released in Cabs, monitored in SPur. Mortality in 2019 SSelk.
KG / SSelk	Movement	SWilfK156M	156	M	4	2012	Capture Genetics Mortality	2012	Traveled from KG in WA to SSelk (Creston Valley). Management removal 2012
NCDE / SSelk	Movement	N14		F	2	2000	Telemetry capture		Relocated several times in NCDE. Recaptured north of Bonners Ferry, ID relocated to NCDE.
NPur / SSelk	Gene flow	SCulveF	183	F	0.5	1999	Genetics Telemetry		Father SSelk S8M, Mother NPur S10739F Mom assigns to NPur
NPur / SSelk	Gene flow	S10739cM		M	0.5	2004	Genetics		Father SSelk Sunk1M, Mother NPur S10739F, Mom assigns to NPur.
NPur / SSelk	Gene flow	Creston	9412	F	0.5	2007	Genetics Telemetry Mortality	2011	Father SSelk SKirkM, Mother NPur S10739F Mom assigns to Npur. Mortality in 2011
NPur / SSelk	Gene flow	JillS226F	226	F	0.5	2007	Genetics Telemetry Mortality	2017	Father SSelk SKirkM, Mother NPur S10739F, Mom assigns to NPur, MGMT removal in 2017
NPur / SSelk	Gene flow	S43875M		M	0.5	2010	Genetics		Father SOsoM, Mother SSelk SS31F father assigns Purcells
NPur / SSelk	Gene flow	13082077777132		F	0.5	2010	Genetics		Father SOsoM, Mother SSelk SS31F father assigns Purcells
NPur / SSelk	Gene flow	S2006F	2006	F	0.5	2010	Genetics Telemetry Mortality	2014	Father SOsoM, Mother SSelk SS31F. Dad assigns Purcells mortality in 2014
NPur / SSelk	Gene flow	SFoccacia170F	170	F	6	2012	Genetics Mortality	2012	Father NPur SCptHM, Mother SSelk SCulveF
NPur / SSelk	Gene flow	S28776M	1064	M	0.5	2015	Genetics		Father NPur S14151M, Mother SSelk S2008F
NPur / SSelk	Gene flow	15124		F	0.5	2015	Genetics		Father NPur S14151M, Mother SSelk S252F
NPur / SSelk	Gene flow	S25506M		M	0.5	2015	Genetics		Father NPur S14151M, Mother SSelk S252F
NPur / SSelk	Gene flow	S92231M	9047	M	0.5	2015	Genetics	2016	Father NPur SCptHM, Mother SSelk JillS226F. Yearling hit on train tracks.
NPur / SSelk	Gene flow	S21690M	1008	M	0.5	2016	Genetics		Father NPur SCptHM , Mother SSelk SMaya4208F
NPur / SSelk	Gene flow	S21698M	9052	M	0.5	2016	Genetics	2022	Father NPur SCptHM , Mother SSelk SMaya4208F. Mgmt removal in 2022
NPur / SSelk	Gene flow	S25793M		M	0.5	2016	Genetics		Father NPur SCptHM, Mother SSelk S1029F
NPur / SSelk	Gene flow	S54257F		F	0.5	2020	Genetics		Father NPur YGB807M, Mother SSelk S2016F
NPur / SSelk	Gene flow	S45818M		M	0.5	2020	Genetics		Father NPur YGB807M, Mother SSelk S2016F
NPur / SSelk	Gene flow	S71750M		M	0.5	2022	Genetics		Father NPur YGB807M and mother SSelk S28F
NPur / SSelk	Gene flow	S71990F		F	0.5	2023	Genetics		Father NPur YGB807M and mother SSelk S25655F
NPur / Sselk	Gene flow	300997		F	0.5	Unk	Genetics		Father NPur SCptHM, Mother SSelk SCulveF.
NPur / SSelk	Gene flow	304800		F	0.5	Unk	Genetics		Father SCptHM, Mother SSelk 303724
NPur / SSelk	Gene flow	303068		M	0.5	Unk	Genetics		Father SCptHM, Mother SSelk 303724.
NPur / SSelk	Gene flow	304710		M	0.5	Unk	Genetics		Father SCptHM, Mother SSelk 303987
NPur / SSelk	Gene flow	303987		F	0.5	Unk	Genetics		Father SCptHM, Mother SSelk 304163
NPur / SSelk	Gene flow	304207		F	0.5	Unk	Genetics		Father SCptHM, Mother SSelk 304707

Area[1] Start / Finish	Action[2]	Genetics ID	Tag #	Sex	Age at Detect	Year Action Detected	Basis	Year Known Dead	Comments
NPur / SSelk	Gene flow	304534		M	0.5	Unk	Genetics		Father SCptHM, Mother SSelk 304707
NPur / SPur / SSelk	Movement	SOsoM	149	M	2	2001	Capture Genetics		Born in Purcells but traveled to SSelk. Genetics assign to Purcells
NPur / SSelk	Movement	S10739F		F	Adult	2005	Genetics		Born in NPur but traveled to SSelk. Genetics assign to NPur
NPur / SSelk	Movement	SCptHM	144	M	19	2008	Telemetry Genetics		Born in NPur. Traveled to SSelk and captured. Genetics determine parents in NPur
NPur / SSelk	Movement	PBobM	2	M	26	2011	Telemetry Mortality	2011	Collared in NPur, but recaptured later in SSelk and Management removal 2011
NPur / SSelk	Movement	S14151M	1002	M	6	2014	Genetics		Parents both NPur, Father NPur PKiddM, Mother NPur PKellyF
NPur / SSelk	Movement	19007		M	3-4	2015	Genetics		Assigns to NPur. Hair sampling and photos in SSelk.
NPur / SSelk / SPur / SSelk	Movement	S43945M		M	Adult	2020	Genetics		Assigns to NPur. Hair sampling and photos in SSelk.and SPur
NPur / SPur / SRock / Cabs / SSelk	Movement	928196	835	M	19	2021	Genetics, Telemetry		Assigns to NPur. Caught in SPur. Travel north from SPur across Kootenay in BC to SRock, SPur, then west to Cabs and SSelk
NPur / SPur / SSelk	Movement	YGB807M	807	M	5	2015	Genetics Telemetry		Travel west from capture in SPur to SSelk. Assigns to NPur origin. Sired offspring in Selkirks with female S2016F
NPur / SSelk SSelk / KG	Gene flow Movement	JC12-23		M	0.5, 8	2004 2012	Genetics Mortality		Father Sunk1M SSelk, Mother S10739F NPur, Male offspring JC12-23 in KG
NPur / SSelk / Cabs / Bitt	Gene flow Movement	S21285M	1006	M	0.5, 2	2016, 2018	Genetics Telemetry		Father NPur SCptHM, Mother SSelk S11675F, S21285M moved to Cabs 2018, dropped collar. Hair sampled in Bitterroot.
SPur / SSelk	Movement	YHydeM	103	M	3	2006	Telemetry		Captured in SPur 2006. Bear traveled to SSelk 2006, denned. Lost collar 2007.
SPur / SSelk	Movement	Y11048M	922	M	4	2017	Telemetry Mortality	2017	Travel west from SPur to Sselk after MGMT relocation. Mortality 2017
SPur / SSelk	Movement	Y718M	718	M	4	2021	Telemetry Mortality	2022	Caught in SPur, traveled to Sselk and dropped collar. MGMT removal in 2022.
SSelk / Bitt	Movement	B90307M	9239	M	5	2007	Genetics Mortality	2007	Killed in Bitterroot September 2007. Genetic analysis indicates origin in SSelk
SSelk / Cabs	Movement	S1001M	1001	M	6	2015	Telemetry Mortality	2015	Travel east from SSelk to Cabs. Mortality 2015
SSelk / Cabs	Movement	S38395M	884	M	2	2021	Telemetry		SSelk mom S21668F and SSelk father S262M. Traveled as 2-year-old to West Cabinets. Dropped collar in den.
SSelk / Cabs / SSelk	Movement	928442	1036	M	5	2012	Genetics		Father SSelk S9058aM, Mother SSelk SBettyF, Hair snagged 2012 in Cabs and in SSelk 2015
SSelk / KG	Movement	ApexS248M	248	M	4	2014	Telemetry		Radio collared and traveled west to KG from SSelk
SSelk / NPur	Movement	S1022M	1022	M	1	1994	Telemetry Mortality	1996	Captured in SSelk 1994, Management removal 1996 Boswell, BC NPur.
SSelk / SPur	Movement	S31M	31	M	4	2004	Telemetry Mortality	2005	Father SSelk SS3KM, Mother SSelk S1MF, Collared 2003 SSelk. Hunter-kill 2005 SPur
SSelk / SPur	Movement	16749		M	2	2015	Genetics		Father C134B2V2, Mother JillS226F, both SSelk. Male offspring 16749 in SPur
SSelk / SPur	Movement	16521		M	4	2018	Genetics		Father SSelk 928442, Mother SSelk S808F Male offspring 16521 hair snagged in SPur

[1]Cabs – Cabinet Mountains south and west of Highway 2, NCDE – Northern Continental Divide recovery zone, NPur – Purcell Mountains north of Highway 3, SPur – Purcell Mountains south of Highway 3, SSelk – South Selkirk Mountains south of Nelson, BC, Bitt – Bitterroot Mountains south of Highway 200

[2]Not a result of human-assisted action or transport via augmentation, translocation, relocation, or otherwise.

Appendix 4. Grizzly bear capture information from the Selkirk Mountain study area, 2007–2024. Multiple captures of a single bear during a given year are not included.

Bear	Capture Date	Sex	Age (Est.)	Mass kg	Location	Capture Type
119	4/21/07	M	19	205	Duck Lake, BC	Research
138	5/20/08	F	2	100	Corn Cr., BC	Research
144	6/16/08	M	12	(205)	Next Cr., BC	Research
150	6/21/08	F	7	71	Elmo Cr., BC	Research
151	6/23/08	F	20	82	Cultus Cr., BC	Research
10	6/27/08	M	11	(170)	Next Cr., BC	Research
149	6/12/09	M	10	216	Wildhorse Cr., BC	Research
6	6/15/09	F	18	82	Wildhorse Cr., BC	Research
163	6/16/09	F	7	(102)	Wildhorse Cr., BC	Research
8005	6/16/09	F	4	(90)	Salmo River, BC	Management, pig feed
165	6/19/09	F	14	(80)	Apex Cr., BC	Research
169	6/23/09	F	20	(80)	Wildhorse Cr., BC	Research
171	6/25/09	F	14	91	Seaman Cr., BC	Research
177	6/22/10	F	9	84	Hidden Cr., BC	Research
183	6/29/10	F	11	102	Sheep Cr., BC	Research
17	9/17/10	M	3	100	Nelson Golf Course, BC	Management, non-target capture
154	9/18/10	M	(4)	(91)	Summit Cr., BC	Research
7	9/25/10	F	13	132	Nelson Golf Course, BC	Management, grease bin
152	5/26/11	M	10	148	Cottonwood Cr., BC	Research
149	5/31/11	M	12	(205)	Cottonwood Cr., BC	Research
2	8/19/11	M	26	178	Creston Valley, BC	Management, animal feed
174	5/25/12	M	6	84	Cottonwood Cr., BC	Research
166	5/30/12	M	3	56	Cottonwood Cr., BC	Research
170	6/5/12	F	6	130	Salmo River, BC	Management, cat food
183	6/8/12	F	11	--	Lost Cr., BC	Research
156	8/17/12	M	2	125	Creston Valley, BC	Management, fruit trees
12003	8/15/12	F	8	111	Trapper Cr., ID	Research
12008	8/26/12	F	15	114	Trapper Cr. ID	Research
12006	8/29/12	F	2	60	Trapper Cr. ID	Research
221	8/29/12	M	6	149	Creston Valley, BC	Research
226	6/6/13	F	6	115	Creston Valley, BC	Management, frequenting dump
9037	6/11/13	F	(9)	(91)	Creston Valley, BC	Management, animal feed
13017	7/22/13	F	2	58	Trapper Cr., ID	Research
13021	7/30/13	F	3	76	Bugle Cr., ID	Research
13023	7/30/13	F	9	94	Trapper Cr., ID	Research
12016	8/23/13	F	10	104	Grass Cr., ID	Research
232	5/17/14	M	5	130	Apex Cr., BC	Research
174	5/22/14	M	8	116	Apex Cr., BC	Research
234	5/23/14	M	7	75	Ymir Cr., BC	Research
240	5/26/14	M	22	>245	Cottonwood Cr., BC	Research
150	6/14/14	F	14	70	Hidden Cr., BC	Research
248	6/19/14	M	4	93	Apex Cr., BC	Research
250	6/21/14	M	7	123	Wildhorse Cr., BC	Research
14327	6/21/14	M	7	195	Jackson Cr., ID	Research
227	6/24/14	M	8	112	Hidden Cr., BC	Research
229	6/26/14	F	4	72	Apex Cr., BC	Research
4250	10/6/14	F	(6)	(145)	Creston Valley, BC	Research
1019	5/30/15	F	2	100	Creston Valley, BC	Research
1020	6/7/15	F	6	144	Cultus Cr., BC	Research
150	6/13/15	F	14	182	Next Cr., BC	Research
1001	6/20/15	M	6	215	Trapper Cr., ID	Research
247	5/29/16	M	2	79	Creston Valley, BC	Research
1019	5/29/16	F	3	115	Creston Valley, BC	Research

Bear	Capture Date	Sex	Age (Est.)	Mass kg	Location	Capture Type
221	5/31/16	M	11	242	Creston Valley, BC	Research
1024	6/1/16	M	2	74	Creston Valley, BC	Research
1002	6/29/16	M	8	166	Willow Cr., WA	Research
138	8/6/16	F	10	(182)	Creston Valley, BC	Research
1003	8/14/16	F	6	128	Boundary Cr., ID	Research
4-011	8/15/16	F	>5	(68)	Kootenay R., BC	Management; fruit trees
4-002	8/15/16	F	(0.5)	(34)	Kootenay R., BC	Management; captured with mother 4-011
4-004	8/15/16	F	(0.5)	(34)	Kootenay R., BC	Management; captured with mother 4-011
1006	5/26/17	M	1	46	Boundary Cr., ID	Research
1028	6/5/17	F	2	58	Corn Cr., BC	Management; garbage
1026	6/5/17	F	2	60	Corn Cr., BC	Management; garbage
1030	6/10/17	F	3	110	Kootenay R., BC	Research
1031	6/14/17	F	(1)	40	Kootenay R., BC	Research
166	6/19/17	M	8	170	Cow Cr., ID	Research
1008	6/21/17	M	1	86	Boundary Cr., ID	Research
1009	6/21/17	M	3	151	Cow Cr., ID	Research
1029	6/25/17	F	25	123	Cow Cr., ID	Research
12008	7/23/17	F	20	113	Trapper Cr., ID	Research
12003	7/24/17	F	13	97	Bugle Cr., ID	Research
1002	6/21/18	M	10	178	W. Branch LeClerc, WA	Research
14327	6/26/18	M	11	216	W. Branch LeClerc, WA	Research
865	8/16/18	M	3	80	Rathdrum, ID	Management
12003	5/30/19	F	15	110	Cow Cr, ID	Research
9037	6/26/19	F	(12)	169	Boundary Cr., ID	Research
1003	7/25/19	F	9	127	Boundary Cr., ID	Research
1017	7/28/19	M	(4)	118	Boundary Cr., ID	Research
1036	6/18/20	M	(14)	191	Cow Cr., ID	Research
1037	6/20/20	M	(7)	193	Cow Cr., ID	Research
1038	6/28/20	M	(9)	227	Cow Cr., ID	Research
1017	6/30/20	M	6	121	Boundary Cr., ID	Research
1039	6/30/20	M	4	162	Boundary Cr., ID	Research
1029	7/26/20	F	28	127	Boundary Cr., ID	Research
1040	5/24/21	M	3	62	Whiteman Cr., WA	Research
1041	6/17/21	F	14	101	SF Granite Cr., WA	Research
1060	7/21/21	M	1	38	Jungle Cr., WA	Research
1061	8/27/21	M	1	47	Ruby Cr., ID	Research
1062	6/18/22	F	2	41.3	Noisy Cr., WA	Research
1063	6/18/22	F	2	41.3	Noisy Cr., WA	Research
1060	7/18/22	M	2	44.9	Onata Cr., WA	Research
1064	7/19/22	M	7	127.9	SF Granite Cr., WA	Research
9052	8/4/22	M	6	257.2	Olds Creek, ID	Management, livestock
1065	8/1822	F	2	58.3	Trapper Cr., ID	Research
1066	8/22/22	F	5	89.4	Trapper Cr., ID	Research
718	9/12/22	M	4	211.8	Highland Cr., ID	Management, livestock
1062	6/27/23	F	3	64	Onata Cr., WA	Research
1067	7/27/23	M	6	156.5	SF Granite Cr., WA	Research
1068	9/29/23	M	4	180.1	Onion Cr., WA	Management, animal feed
3023	7/19/24	F	20	102	Blue Joe Cr., ID	Research
1060	7/30/24	M	4	79	Onata Cr., WA	Research
1065	8/25/24	F	4	90.7	Bugle Cr., ID	Research
1068	9/14/24	M	5	155.6	Sherman Cr., WA	Management

APPENDIX Table 5. Black bears captured by study personnel in the Selkirk Ecosystem, 2007–2024.

Bear	Tag Color	Capture Date	Sex	Age (Est.)	Mass kg (Est)	Location	Capture Type
116	BLACK	4/24/2007	M	13	(125)	Corn Cr., BC	Research
118	BLACK	4/26/2007	M	3	(57)	Corn Cr., BC	Research
120	BLACK	4/28/2007	M	UNK	163	Corn Cr., BC	Research
120	BLACK	4/30/2008	M	UNK	(136)	Corn Cr., BC	Research
118	BLACK	4/30/2008	M	(4)	(73)	Duck Lake, BC	Research
136	BLACK	5/17/2008	M	(6)	(79)	Leach Cr., BC	Research
146	BLACK	6/17/2008	M	UNK	(59)	Cultus Cr., BC	Research
148	BLACK	6/20/2008	M	UNK	76	Laib Cr., BC	Research
142	BLACK	6/21/2008	M	UNK	(68)	Cultus Cr., BC	Research
153	BLACK	6/24/2008	M	UNK	67	Elmo Cr., BC	Research
143	BLACK	5/17/2009	M	20	(109)	Corn Cr., BC	Research
145	BLACK	5/24/2009	UNK	UNK	(79)	Corn Cr., BC	Research
143	BLACK	5/27/2009	M	20	(109)	Dodge Cr., ID	Research
401	GREEN	6/22/2011	F	5	56	Fall Cr., ID	Research
403	GREEN	6/26/2011	F	9	79	Fall Cr., ID	Research
405	GREEN	6/29/2011	M	4	58	Fall Cr., ID	Research
407	GREEN	7/13/2011	M	2	47	Dodge Cr., ID	Research
409	GREEN	7/15/2011	M	3	54	Trail Cr., ID	Research
411	GREEN	7/18/2011	M	2	52	Fall Cr., ID	Research
417	GREEN	7/21/2011	M	UNK	37	Fall Cr., ID	Research
8006	GREEN	8/18/2011	F	2	41	Roman Nose Cr., ID	Research
155	GREEN	9/19/2011	F	8	(73)	Dodge Cr., ID	Research
165	GREEN	9/25/2011	M	11	139	SF Dodge Cr., ID	Research
160	BLACK	5/26/2012	M	4	(68)	Blewett Cr., BC	Research
2001	GREEN	5/29/2012	M	11	95	Fedar Cr., ID	Research
162	BLACK	5/29/2012	M	3	60	Blewett Cr., BC	Research
2005	GREEN	8/23/2012	M	3	61	Abandon Cr., ID	Research
3016	GREEN	7/21/2013	M	10	74	Hughes Meadows, ID	Research
3019	GREEN	7/22/2013	M	4	49	Upper Priest Rv., ID	Research
3020	GREEN	7/29/2013	M	3	49	Bugle Cr., ID	Research
3013	GREEN	8/20/2013	F	16	75	Silver Cr., ID	Research
238	BLACK	5/25/2014	M	9	58	Porcupine Cr., BC	Research
236	BLACK	5/25/2014	M	8	90	Clearwater Cr., BC	Research
236	BLACK	6/12/2014	M	6	93	Apex Cr., BC	Research
4326	GREEN	6/13/2014	M	6	61	Jackson Cr., ID	Research
246	BLACK	6/17/2014	M	8	102	Wildhorse Cr., BC	Research
244	BLACK	6/17/2014	M	15	76	Wildhorse Cr., BC	Research
392	RED	6/28/2014	M	(4)	72	Hemlock Cr., WA	Research
388	RED	7/19/2014	M	(6)	96	LeClerc Cr., WA	Research
389	RED	7/25/2014	F	(9)	57	Le Clerc Cr., WA	Research
391	RED	7/26/2014	M	(5)	63	Jungle Cr., WA	Research
390	RED	7/26/2014	F	(4)	61	Sema Meadows, WA	Research
4330	GREEN	8/22/2014	M	8	103	Trapper Cr., ID	Research
4331	GREEN	8/24/2014	F	(8)	(79)	Bugle Cr., ID	Research

Bear	Tag Color	Capture Date	Sex	Age (Est.)	Mass kg (Est)	Location	Capture Type
4332	GREEN	8/26/2014	M	16	105	Trapper Cr., ID	Research
4333	GREEN	8/28/2014	M	3	53	Trapper Cr., ID	Research
4305	GREEN	6/24/2015	F	6	47	Lime Cr., ID	Research
4306	GREEN	7/18/2015	M	(12)	113	Bugle Cr.,ID	Research
4307	GREEN	8/23/2015	M	(7)	(125)	Grass Cr., ID	Research
601	RED	5/27/2016	M	7	88	SF Granite, WA	Research
602	RED	6/9/2016	M	6	74	NF Harvey, WA	Research
603	RED	6/27/2016	M	6	74	Willow Cr., WA	Research
---	---	8/23/2016	---	(1)	(18)	Boundary Cr., ID	Research culvert, not tagged
4308	GREEN	7/17/2017	M	5	62	Bugle Cr., ID	Research
4309	GREEN	7/19/2017	M	4	52	Trapper Cr., ID	Research
4310	GREEN	7/19/2017	M	14	65	Bugle Cr., ID	Research
4329	GREEN	7/21/2017	M	8	63	Trapper Cr., ID	Research
4334	GREEN	7/23/2017	M	3	(68)	Trapper Cr., ID	Research
4335	GREEN	8/1/2017	M	9	96	Trapper Cr., ID	Research
4336	GREEN	8/24/2017	M	(3)	61	Caribou Cr., ID	Research
9050	---	6/18/2018	---	(---)	---	Harvey Cr., WA	Research, grizzly predation
604	RED	6/20/2018	M	(8)	(113)	White Man Cr., WA	Research
605	RED	6/24/2018	M	(10)	101	WB Le Clerc Cr., WA	Research
1014	WHITE	6/19/2019	M	(4)	51	Boundary Cr., ID	Research
4337	GREEN	6/23/2019	M	(3)	68	Grass Cr., ID	Research
4338	GREEN	6/24/2019	M	(4)	72	Boundary Cr., ID	Research
4339	GREEN	7/12/2019	M	(1)	43	Boundary Cr., ID	Research
4340	GREEN	7/14/2019	M	(10)	98	Grass Cr., ID	Research
4341	GREEN	7/16/2019	M	(6)	78	Boundary Cr., ID	Research
4342	GREEN	7/18/2019	M	(14)	80	Grass Cr., ID	Research
4343	GREEN	6/25/2020	M	(10)	90	Saddle Cr., ID	Research
4344	GREEN	7/21/2020	M	(3)	70	Smith Cr., ID	Research
4338	GREEN	7/22/2020	M	(6)	88	Boundary Cr., ID	Research
613	RED	5/21/2021	M	(4)	82	West LeClerc Cr., WA	Research
606	RED	5/23/2021	M	(6)	85	West Le Clerc Cr., WA	Research
607	RED	6/15/2021	M	(5)	67	SF Granite Cr., WA	Research
608	RED	6/15/2021	M	(7)	83	N F Harvey Cr., WA	Research
609	RED	6/15/2021	M	(1)	41	Jungle Cr., WA	Research
610	RED	6/18/2021	M	(1)	(45)	NF Harvey Cr., WA	Research
611	RED	6/19/2021	M	(7)	116	Jungle Cr., WA	Research
612	RED	7/23/2021	M	(9)	93	SF Granite Cr., WA	Research
614	RED	7/24/2021	M	(10)	124	Jungle Cr., WA	Research
615	RED	7/27/2021	F	(20)	58	Onata Cr., WA	Research
616	RED	7/27/2021	M	(2)	(57)	SF Granite Cr., WA	Research
4345	GREEN	8/17/2021	M	(7)	63	Bugle Cr., ID	Research
4346	GREEN	8/22/2021	M	(5)	53	Bugle Cr., ID	Research
617	RED	6/27/2022	F	(8)	45	Gypsy Cr., WA	Research
869	WHITE	7/28/2022	M	(7)	70	Blue Joe Cr., ID	Research
14347	GREEN	8/9/2022	M	(4)	69	Ruby Cr., ID	Research
14348	GREEN	8/9/2022	M	(3)	56	Trapper Cr., ID	Research

Bear	Tag Color	Capture Date	Sex	Age (Est.)	Mass kg (Est)	Location	Capture Type
14349	GREEN	8/13/2022	M	(8)	92	Trapper Cr., ID	Research
14350	GREEN	8/16/2022	M	(7)	82	Bugle Cr., ID	Research
220756	GREEN	8/19/2022	F	(4)	54	Ruby Cr., ID	Research
359	RED	6/17/2023	M	(5)	71	SF Granite, WA	Research
220750	GREEN	8/16/2023	F	(9)	71	Boundary Cr., ID	Research
220751	GREEN	8/21/2023	M	(5)	82	Spread Cr., ID	Research
801	GREEN	6/19/2024	F	(6)	73	Grass Cr., ID	Research
802	GREEN	6/21/20224	M	(4)	68	Bog Cr., ID	Research
618	RED	6/24/2024	M	(6)	98	Jungle Cr., WA	Research
220752	GREEN	8/24/2024	M	(3)	79	Trapper Cr., ID	Research
220719	GREEN	8/27/2024	M	(10)	116	Bugle Cr., ID	Research

APPENDIX 6. Grizzly Bear Home Ranges

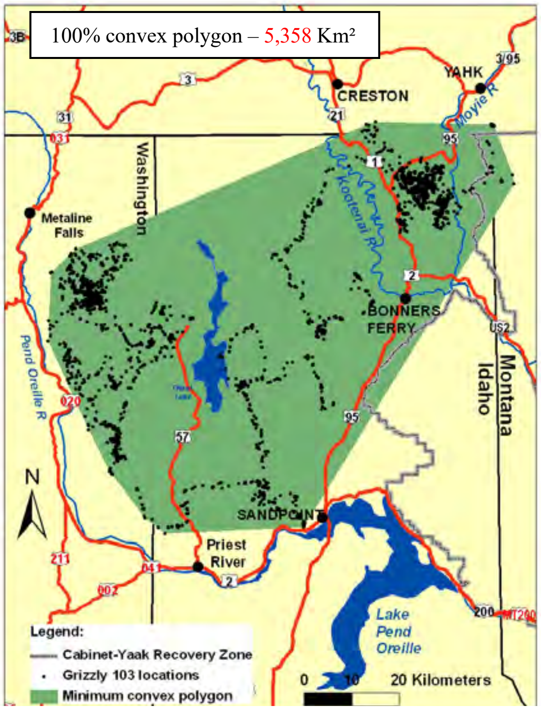


Figure A1. Radio locations and minimum convex (shaded) life range of male grizzly bear 103 in the Yaak River and Selkirk Mountains, 2006–2007.

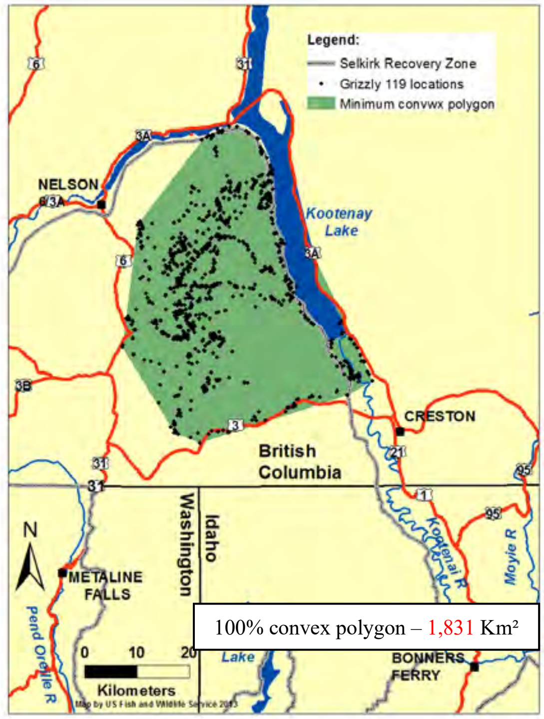


Figure A2. Radio locations and minimum convex (shaded) life range of male grizzly bear 119 in the Selkirk Mountains, 2008–2009.

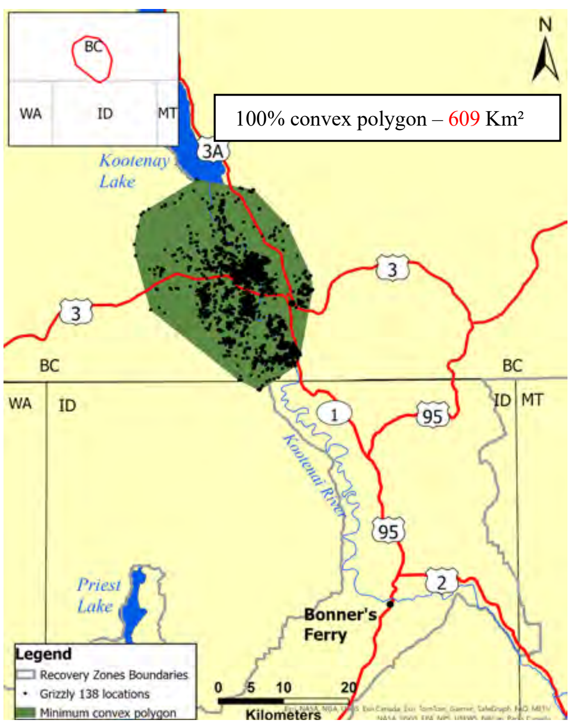


Figure A3. Radio locations and minimum convex (shaded) life range of female grizzly bear 138 in the Selkirk Mountains, 2008–2009.

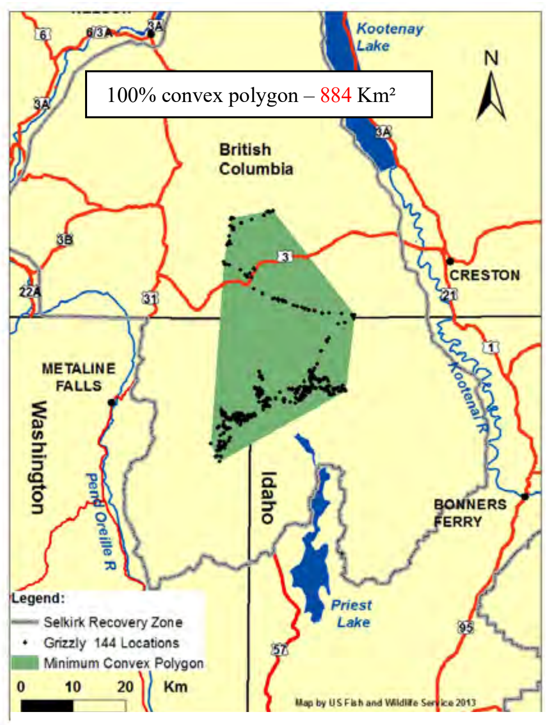


Figure A4. Radio locations and minimum convex (shaded) life range of male grizzly bear 144 in the Selkirk Mountains, 2008.

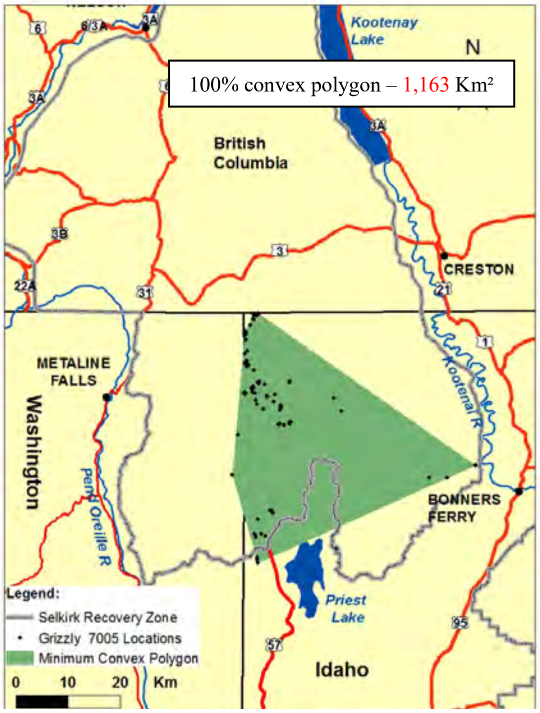


Figure A5. Radio locations and minimum convex (shaded) life range of management male grizzly bear 7005 in the Selkirk Mountains, 2008.

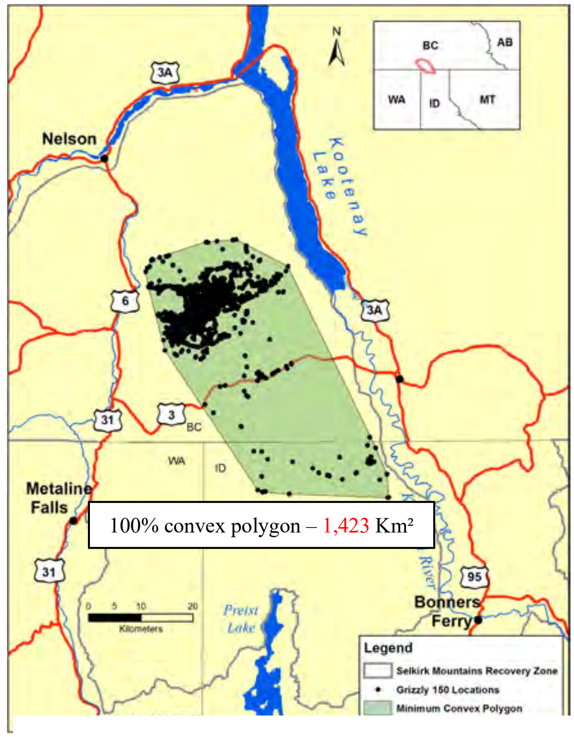


Figure A6. Radio locations and minimum convex (shaded) life range of female grizzly bear 150 in the Selkirk Mountains, 2008–2009, 2014–2016.

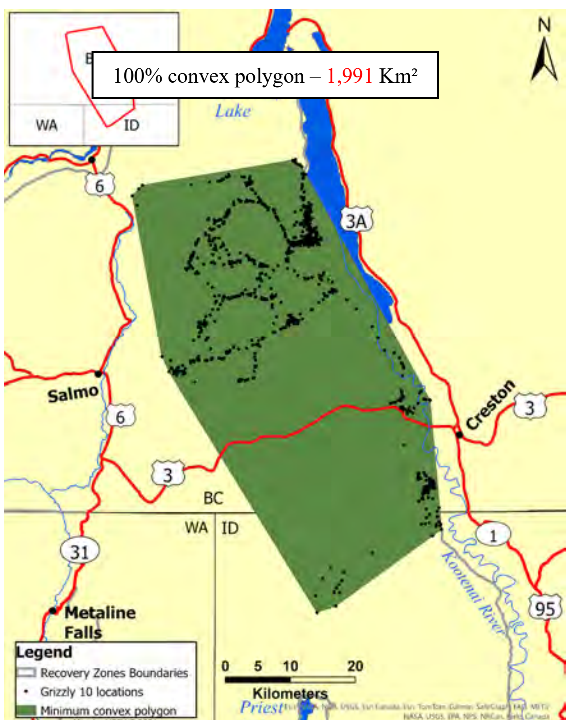


Figure A7. Radio locations and minimum convex (shaded) life range of male grizzly bear 10 in the Selkirk Mountains, 2008–2010.

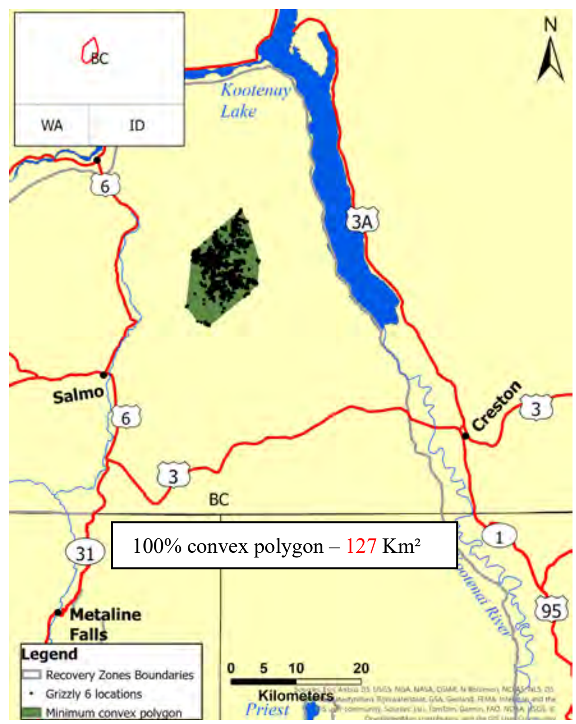


Figure A8. Radio locations and minimum convex (shaded) life range of female grizzly bear 6 in the Selkirk Mountains, 2009–2010.

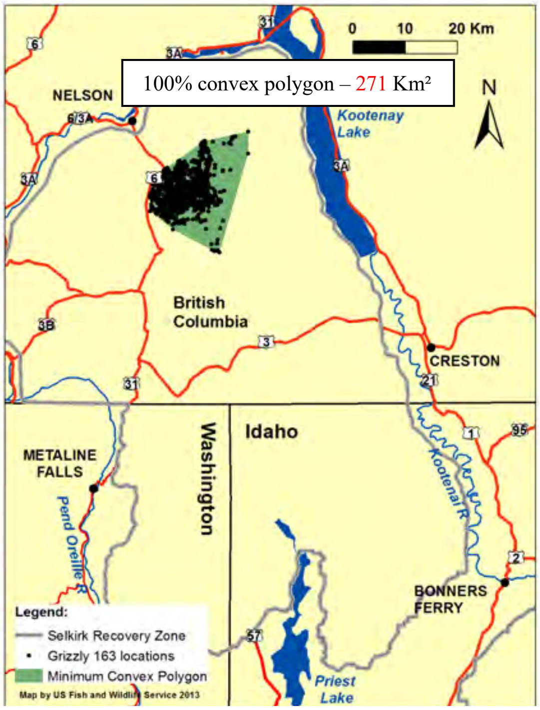


Figure A9. Radio locations and minimum convex (shaded) life range of female grizzly bear 163 in the Selkirk Mountains, 2009–2010.

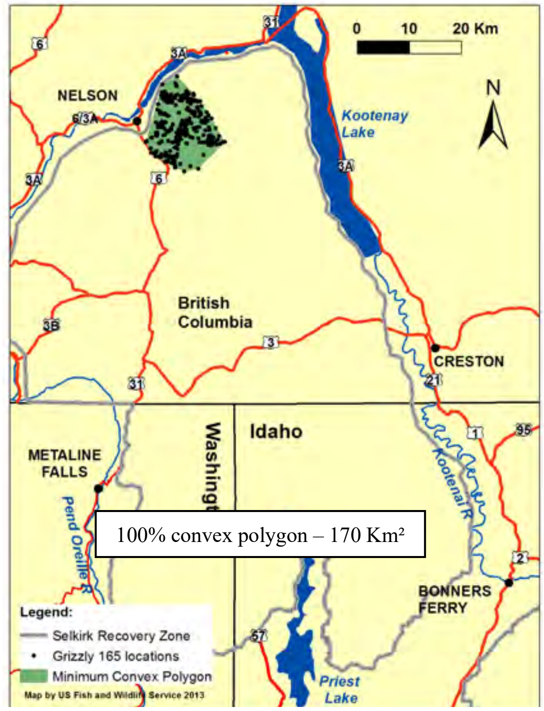


Figure A10. Radio locations and minimum convex (shaded) life range of female grizzly bear 165 in the Selkirk Mountains, 2009–2010.

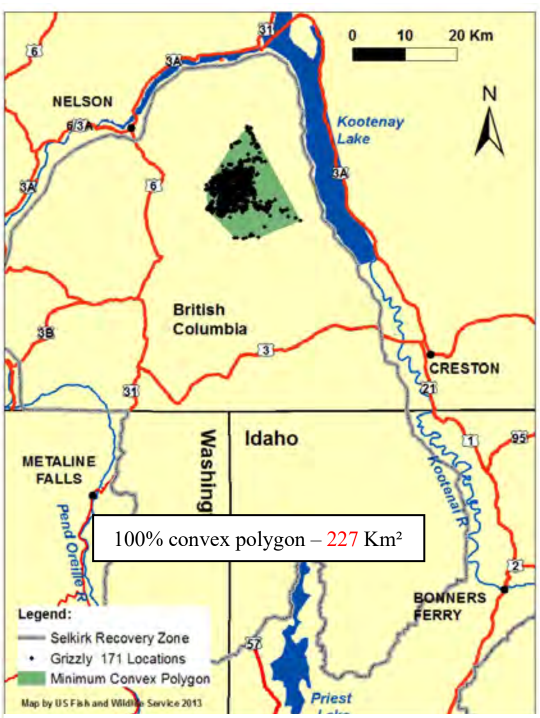


Figure A11. Radio locations and minimum convex (shaded) life range of female grizzly bear 171 in the Selkirk Mountains, 2009–2010.

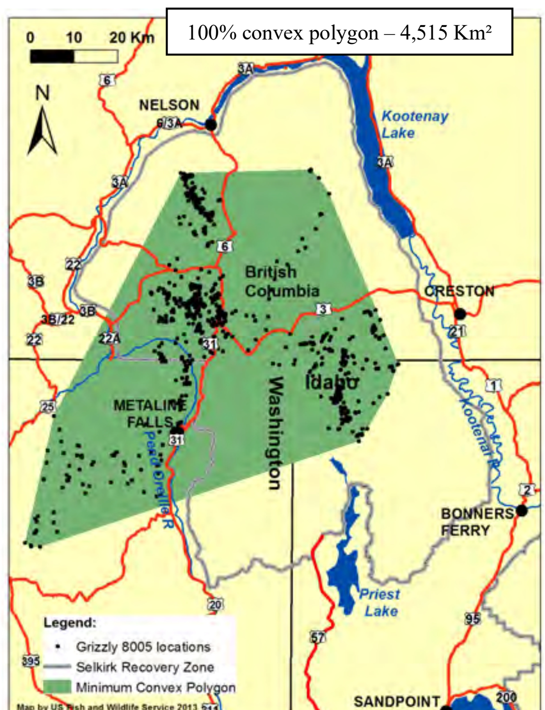


Figure A12. Radio locations and minimum convex (shaded) life range of female grizzly bear 8005 in the Selkirk Mountains, 2009–2010.

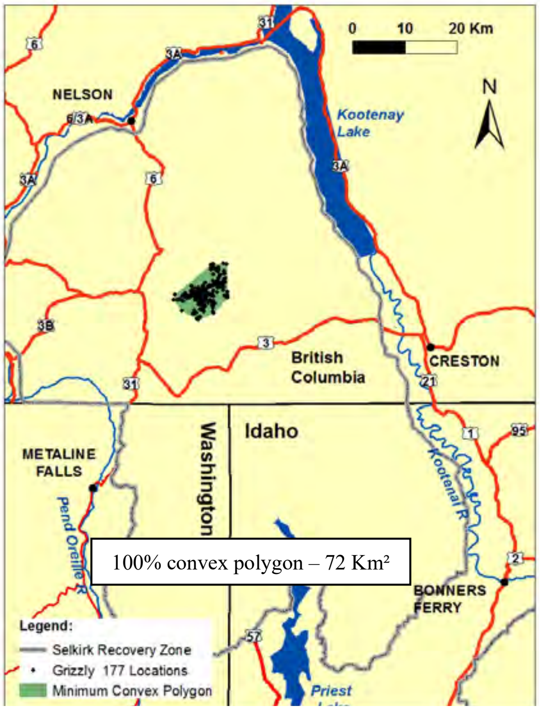


Figure A13. Radio locations and minimum convex (shaded) life range of female grizzly bear 177 in the Selkirk Mountains, 2010.

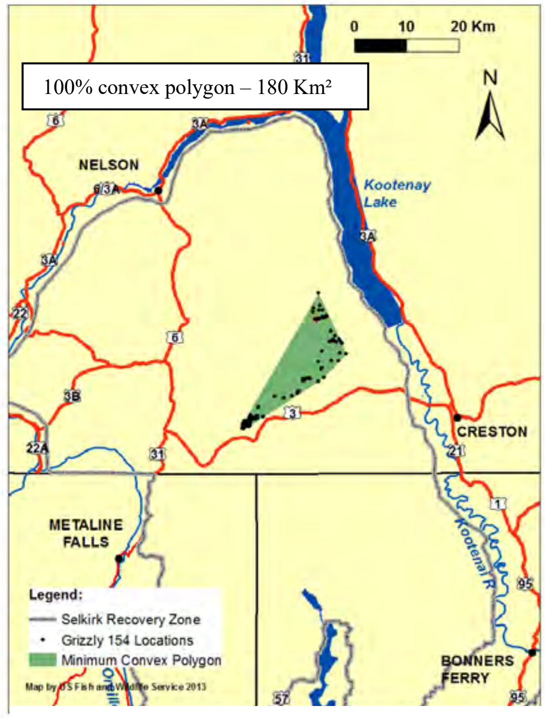


Figure A14. Radio locations and minimum convex (shaded) life range of male grizzly bear 154 in the Selkirk Mountains, 2010.

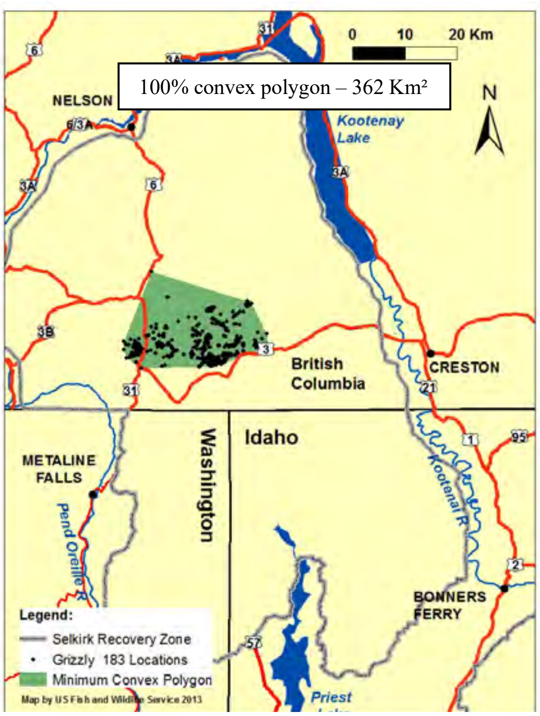


Figure A15. Radio locations and minimum convex (shaded) life range of female grizzly bear 183 in the Selkirk Mountains, 2010 and 2012–2013.

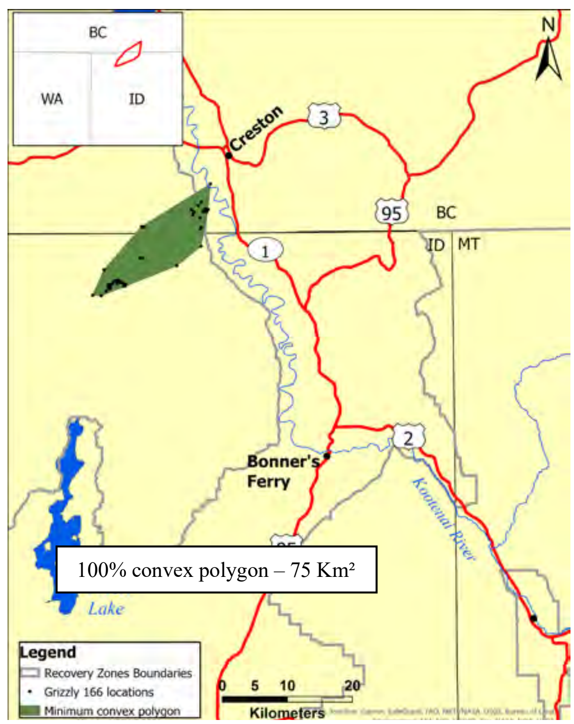


Figure A16. Radio locations and minimum convex (shaded) life range of male grizzly bear 166 in the Selkirk Mountains, 2012.

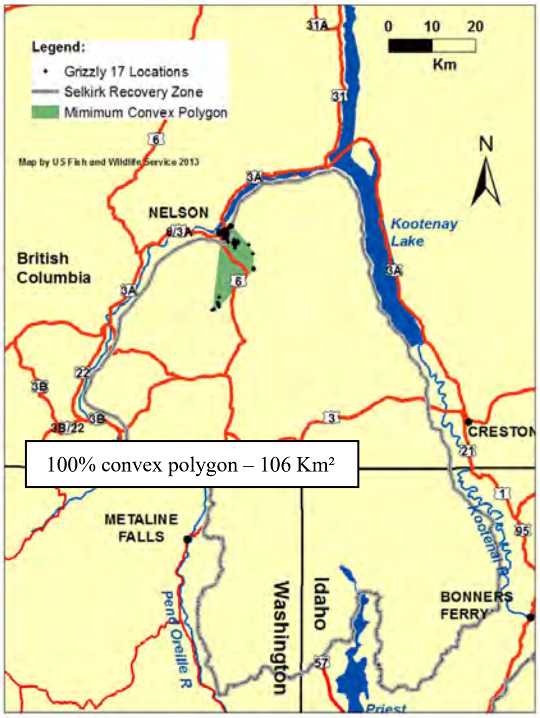


Figure A17. Radio locations and minimum convex (shaded) life range of management male grizzly bear 17 in the Selkirk Mountains, 2010.

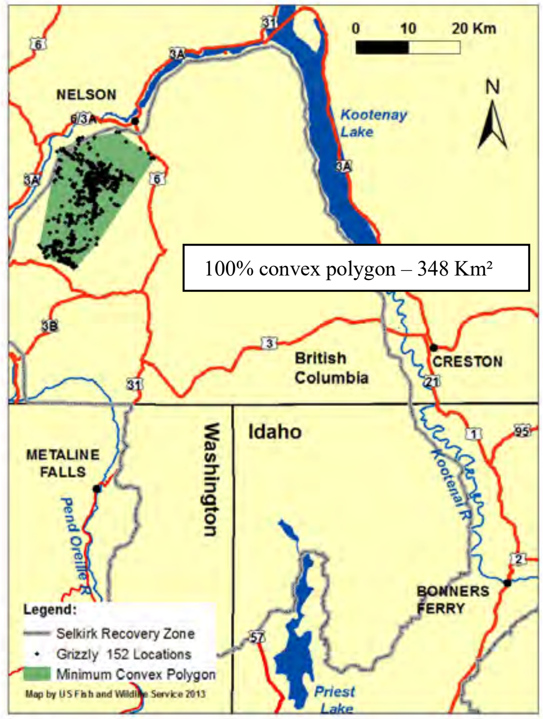


Figure A18. Radio locations and minimum convex (shaded) life range of male grizzly bear 152 in the Selkirk Mountains, 2011–2012.

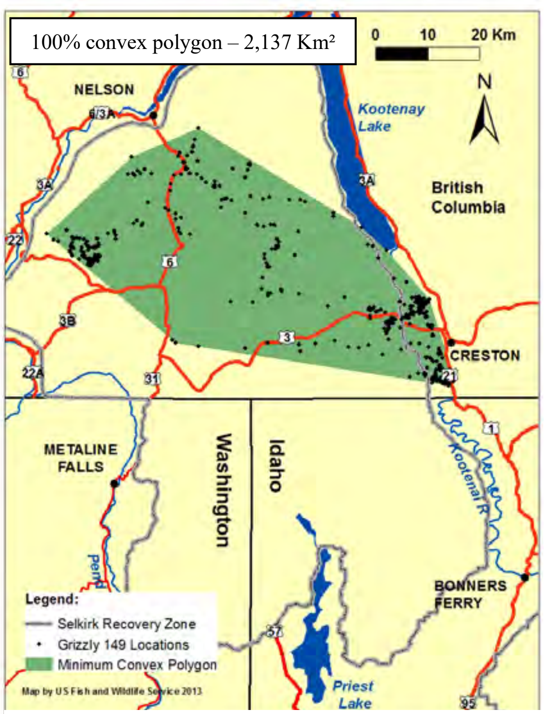


Figure A19. Radio locations and minimum convex (shaded) life range of male grizzly bear 149 in the Selkirk Mountains, 2011.

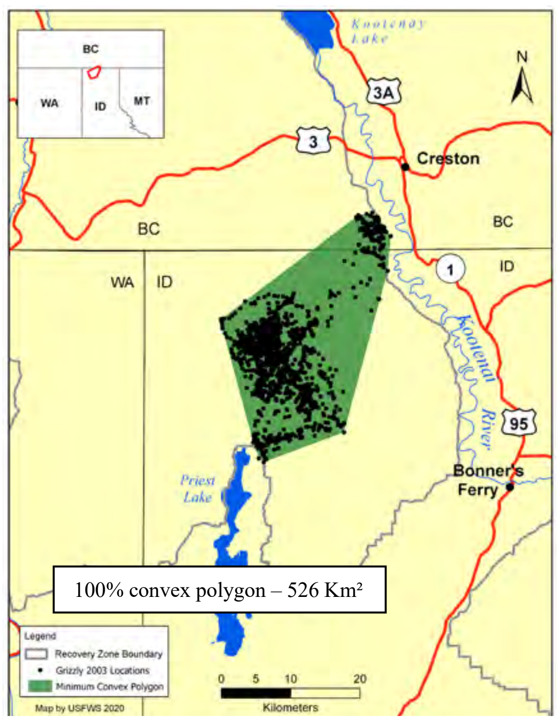


Figure A20. Radio locations and minimum convex (shaded) life range of female grizzly bear 12003 in the Selkirk Mountains, 2012–2014, 2017–2019.

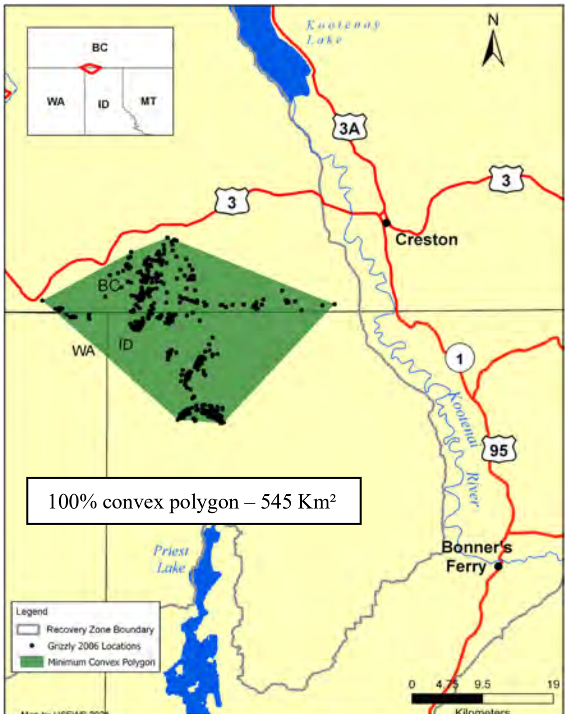


Figure A21. Radio locations and minimum convex (shaded) life range of female grizzly bear 12006 in the Selkirk Mountains, 2012–2014.

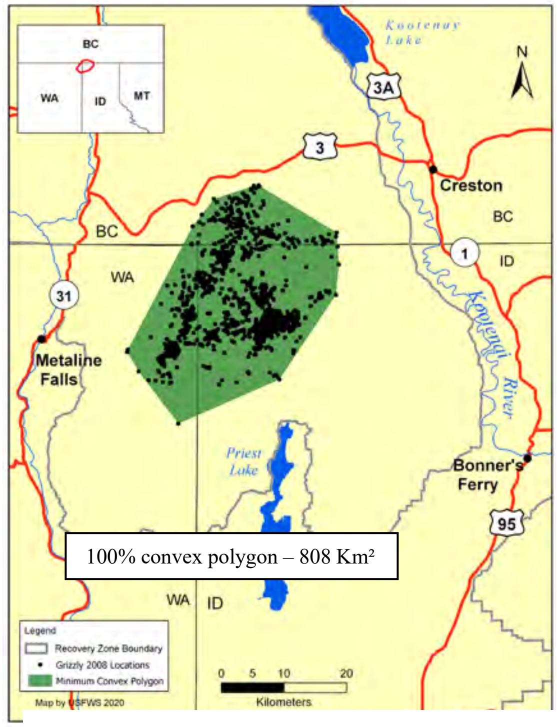


Figure A22. Radio locations and minimum convex (shaded) life range of female grizzly bear 12008 in the Selkirk Mountains, 2012–2014, 2017–2019.

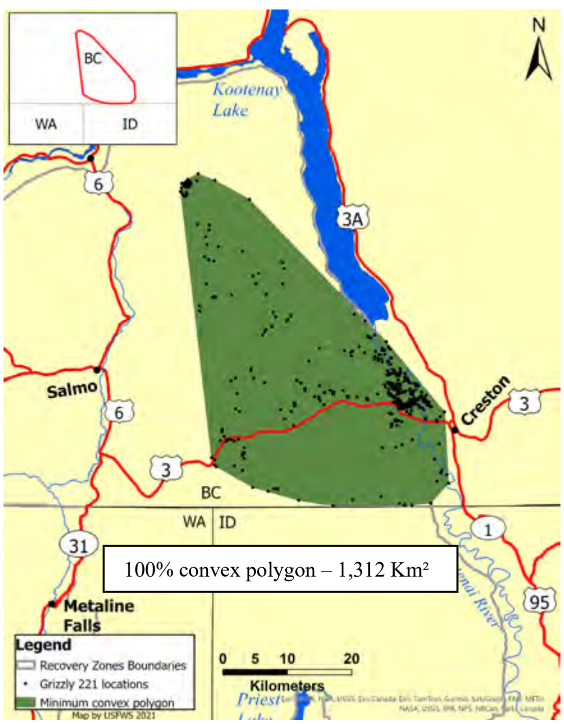


Figure A23. Radio locations and minimum convex (shaded) life range of male grizzly bear 221 in the Selkirk Mountains, 2012–2013.

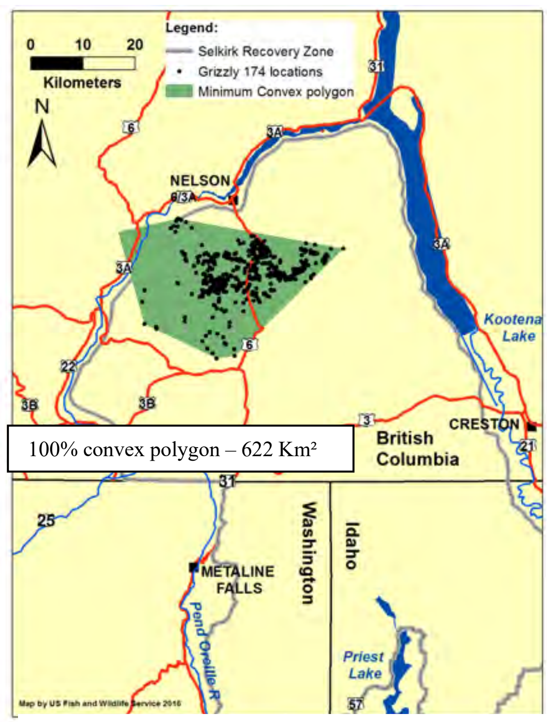


Figure A24. Radio locations and minimum convex (shaded) life range of male grizzly bear 174 in the Selkirk Mountains, 2012–2013, 2015.

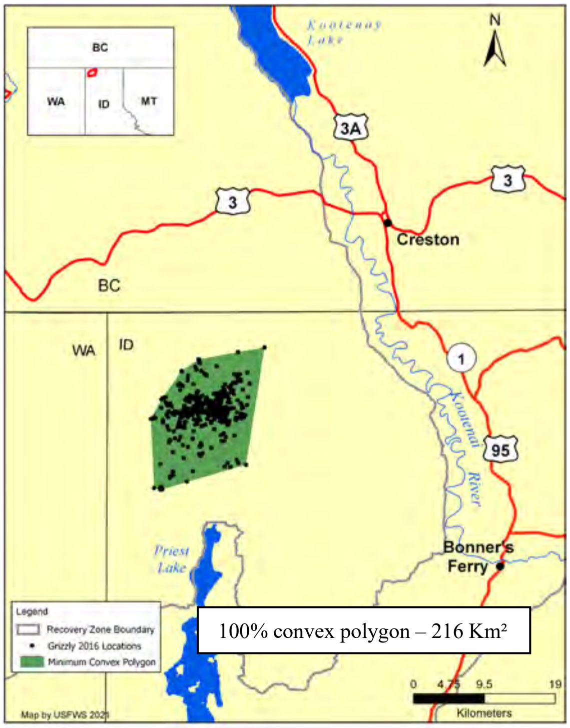


Figure A25. Radio locations and minimum convex (shaded) life range of female grizzly bear 12016 in the Selkirk Mountains, 2013–2016.

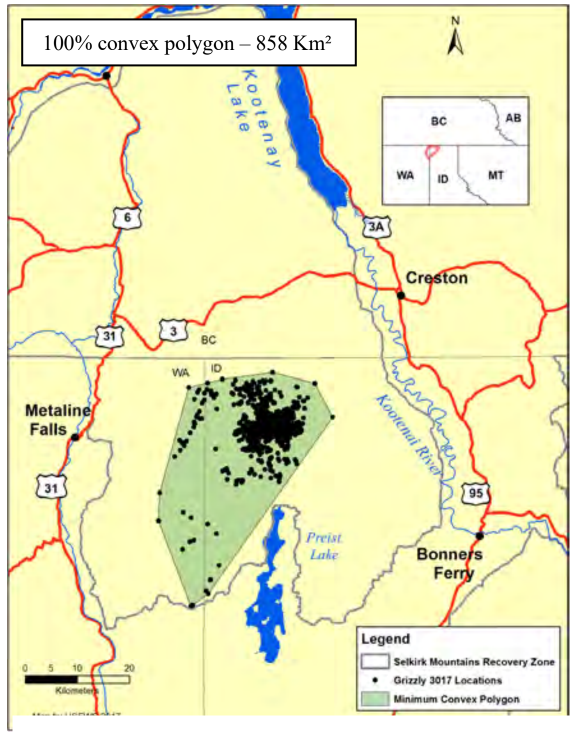


Figure A26. Radio locations and minimum convex (shaded) life range of female grizzly bear 13017 in the Selkirk Mountains, 2013–2016.

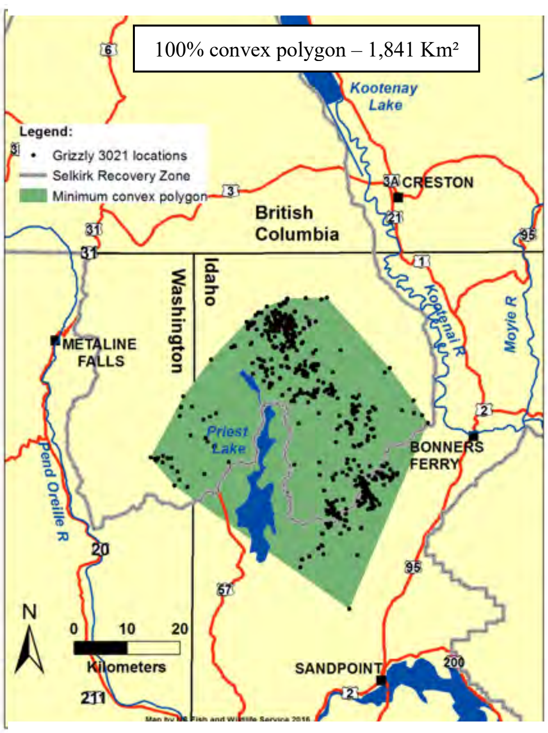
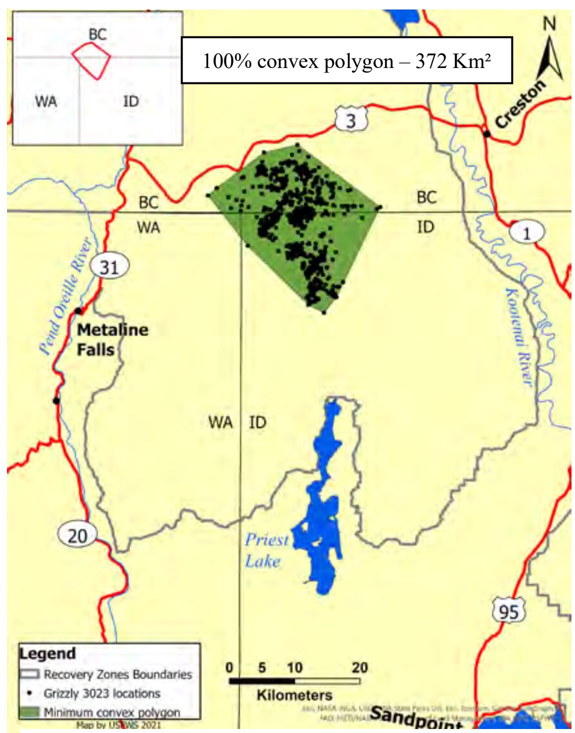


Figure A27. Radio locations and minimum convex (shaded) life range of female grizzly bear 13021 in the Selkirk Mountains, 2013–2015.



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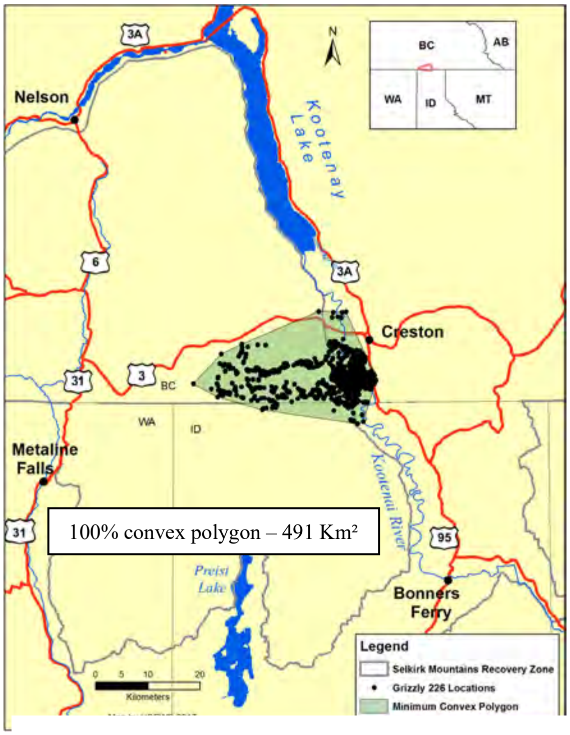

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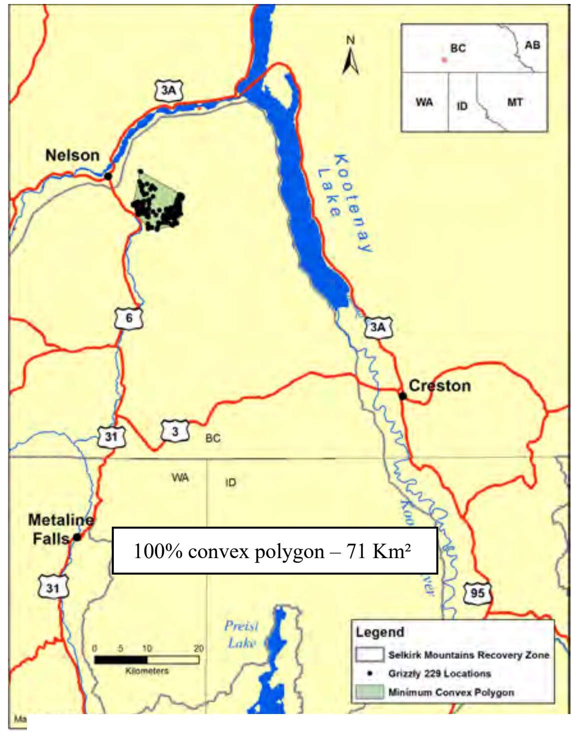

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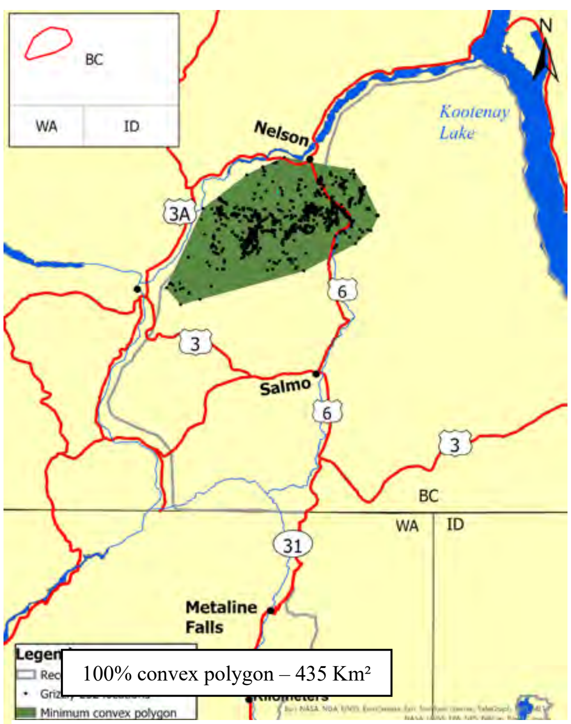

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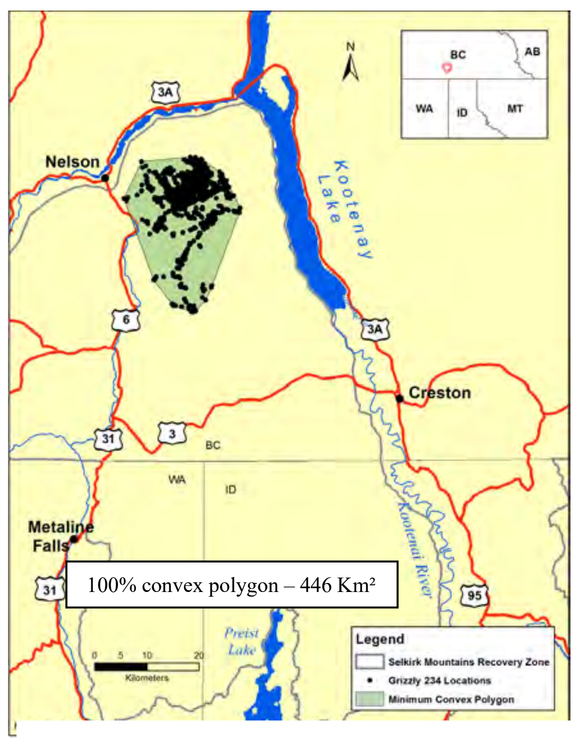

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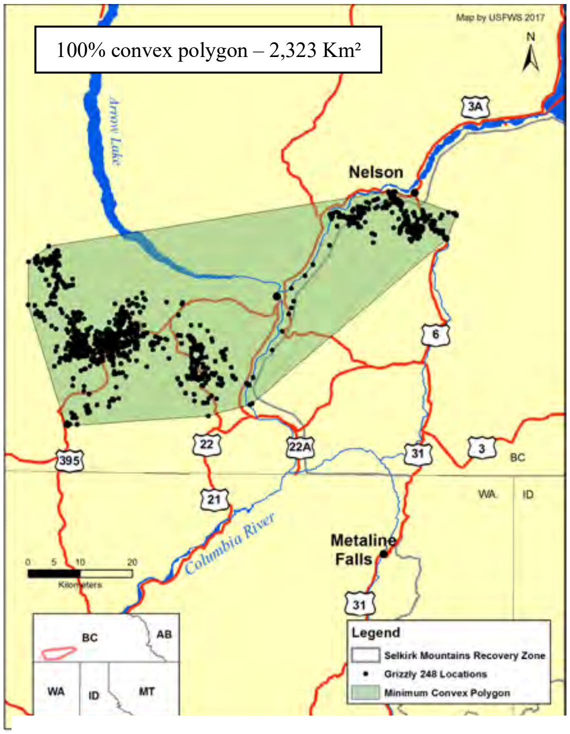

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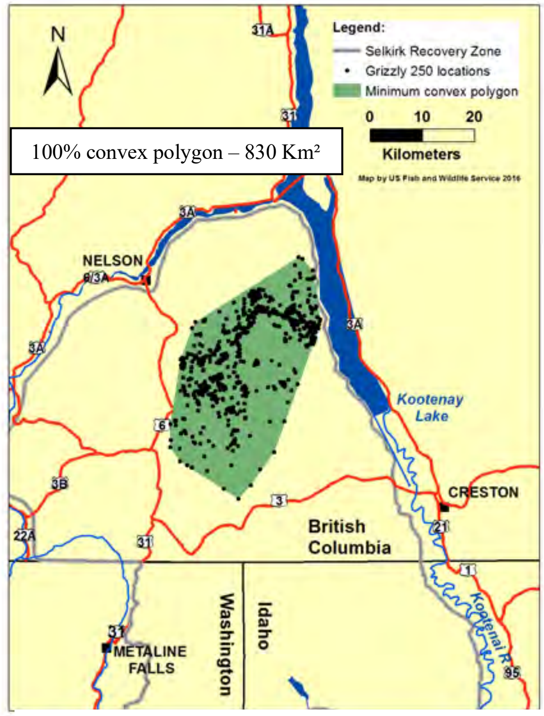

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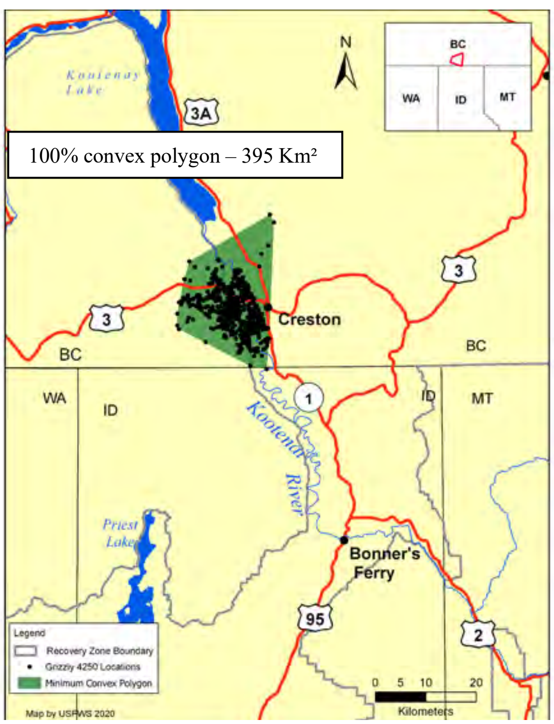

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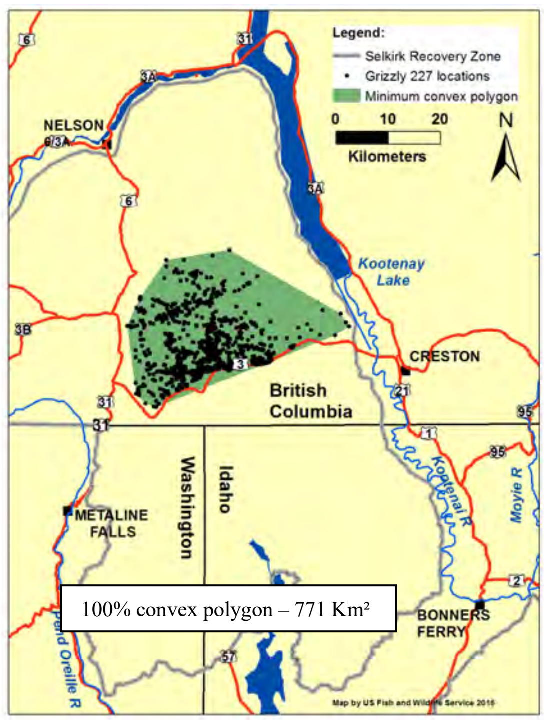

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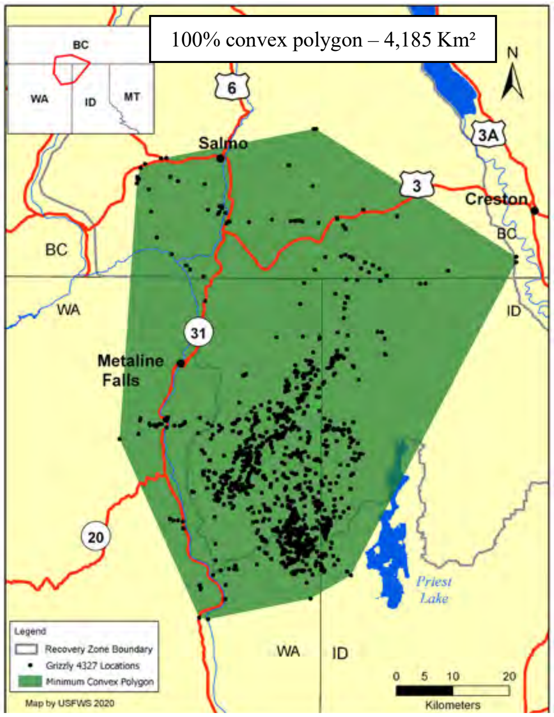

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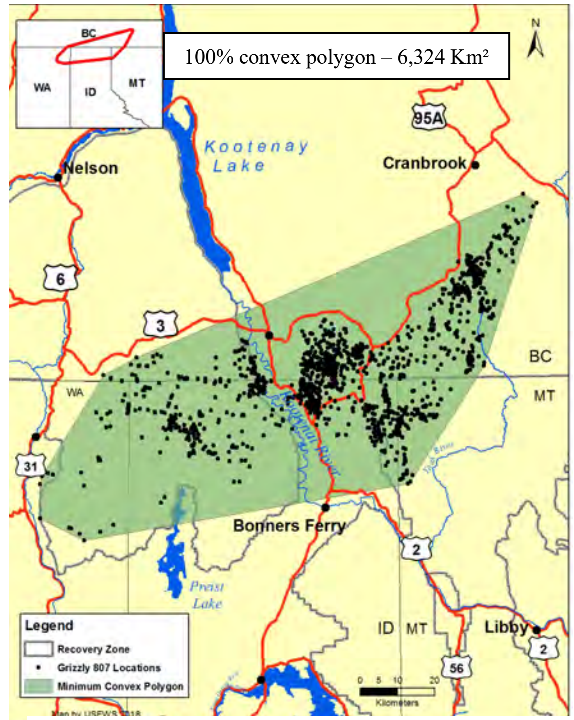

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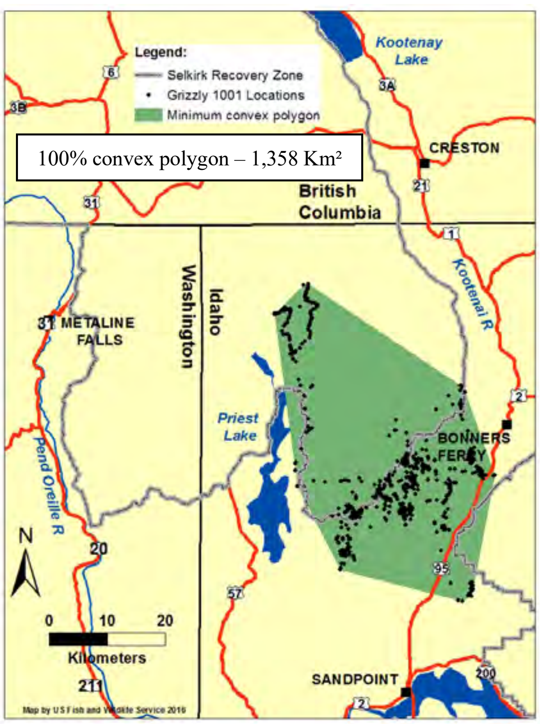

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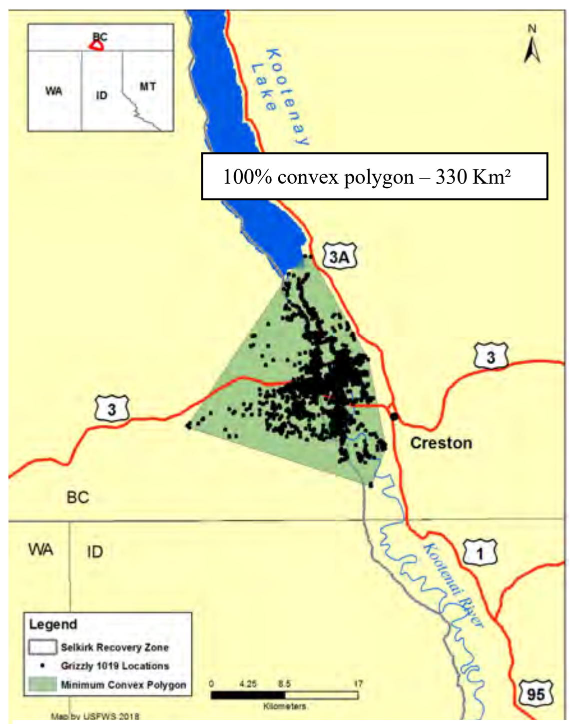

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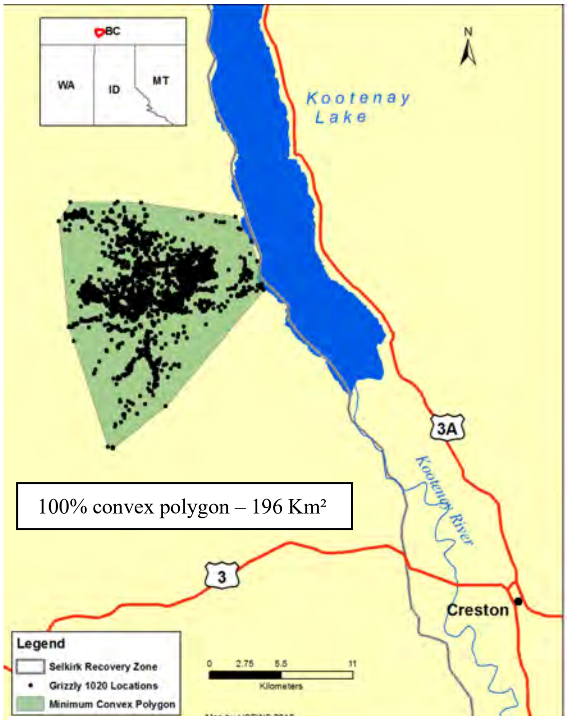

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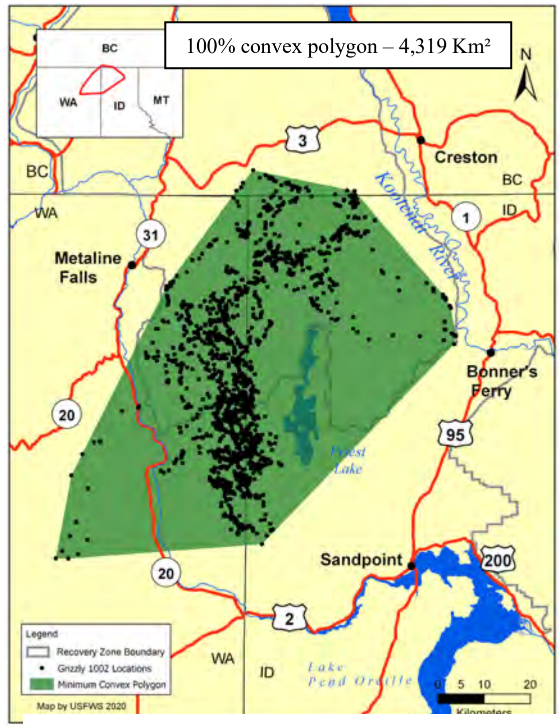

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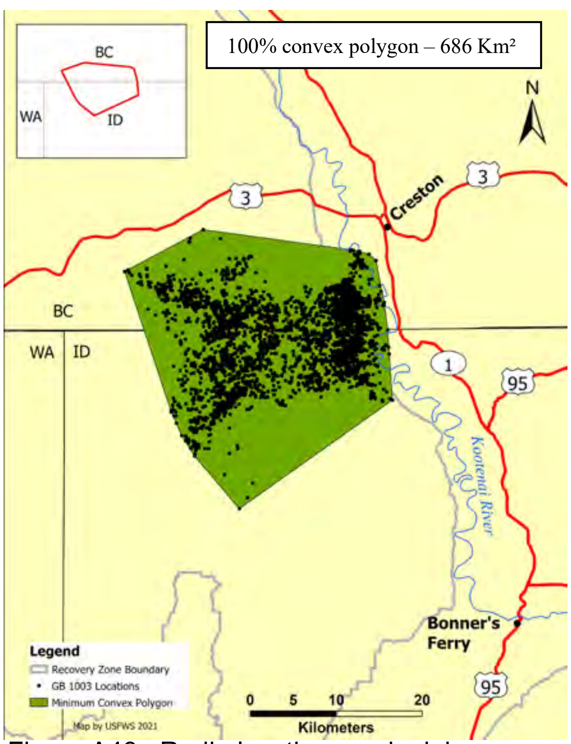

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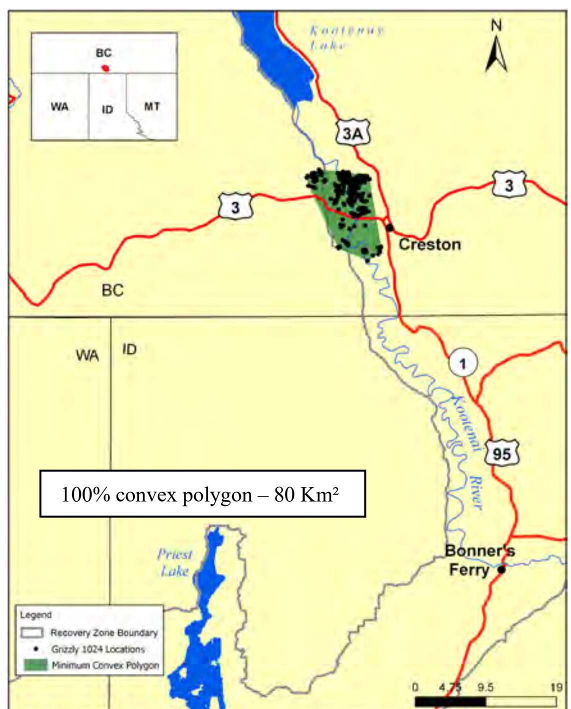

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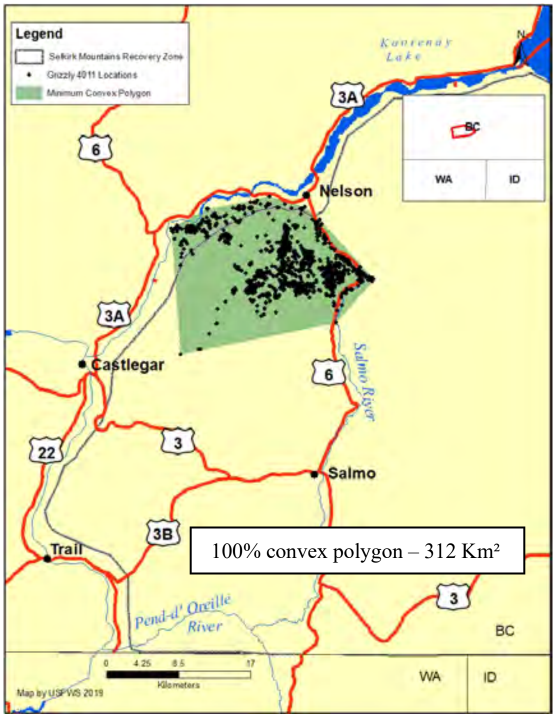

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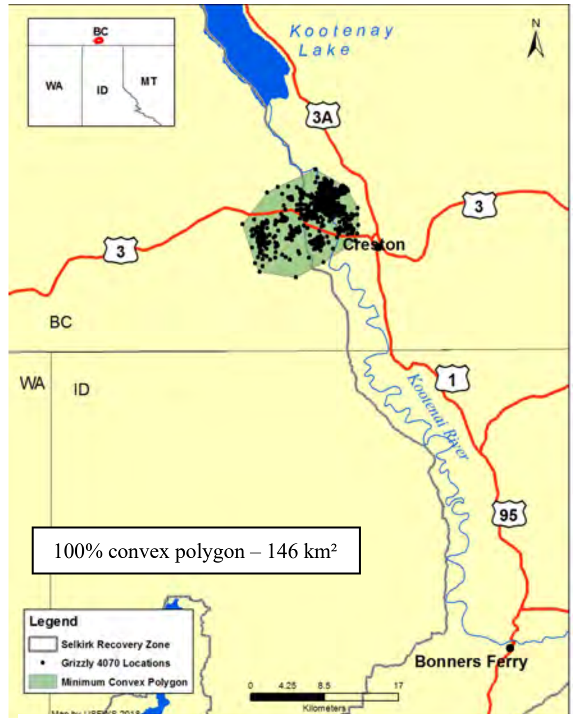

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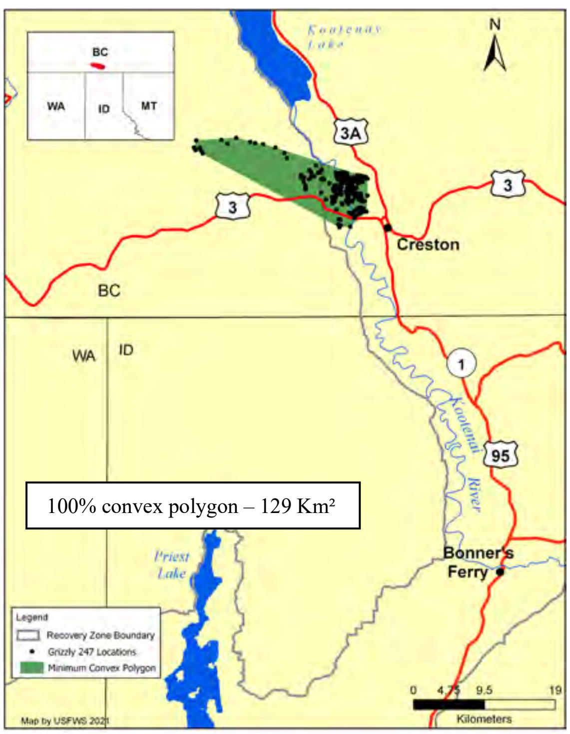

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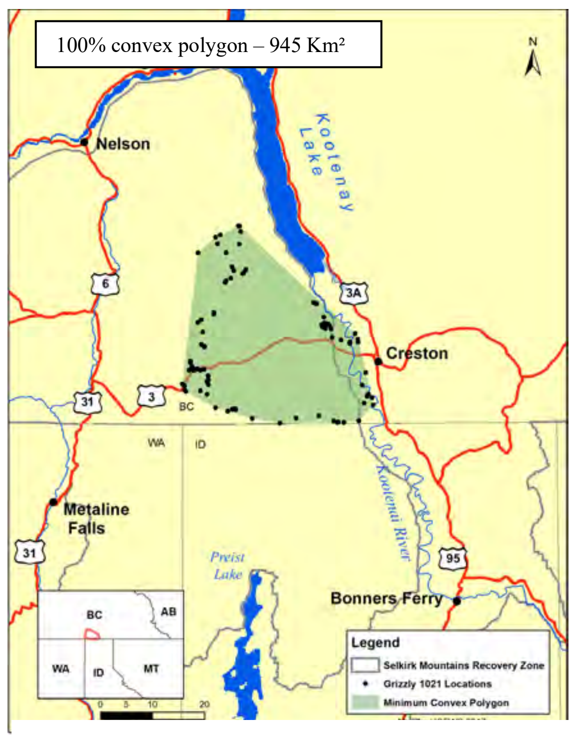

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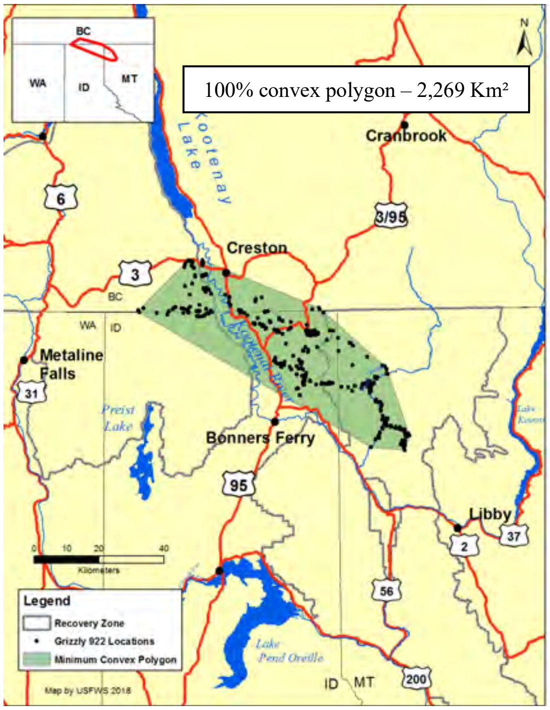

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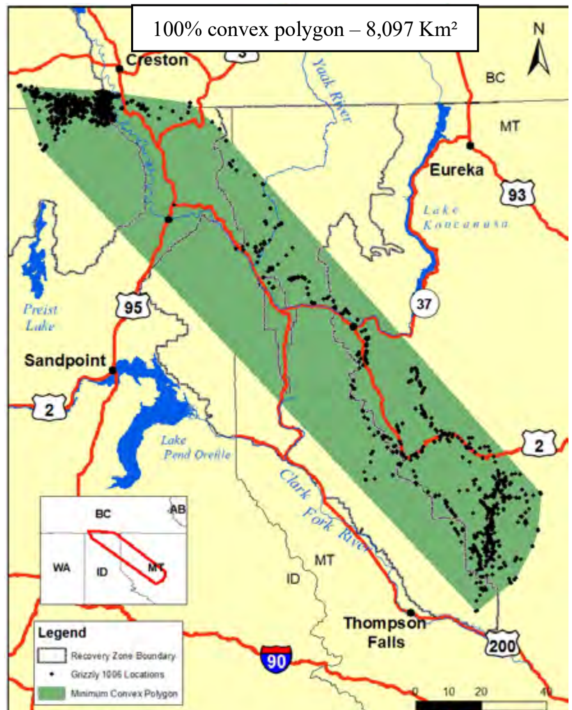

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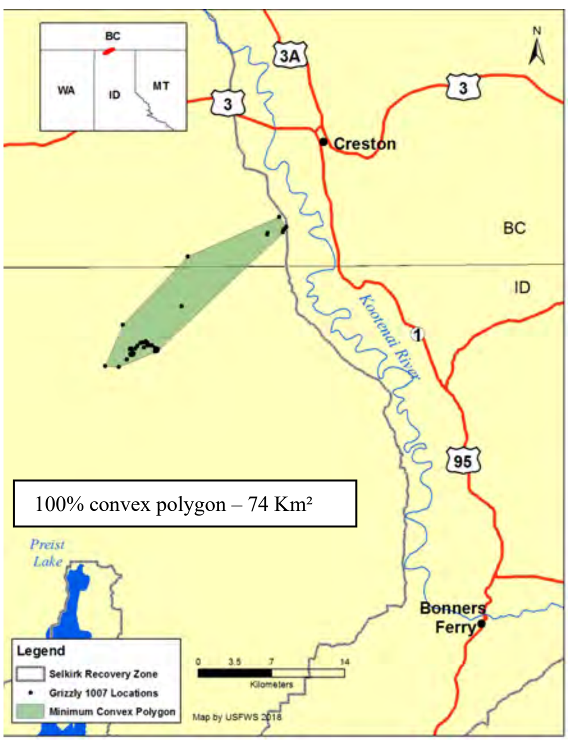

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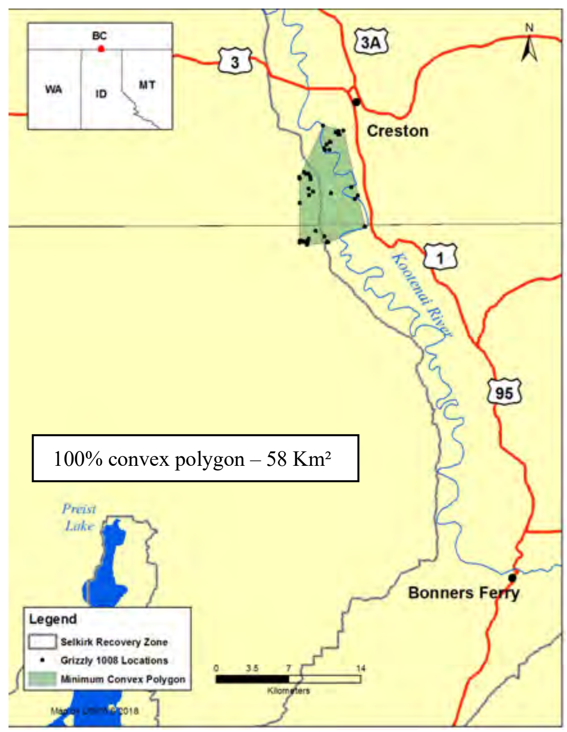

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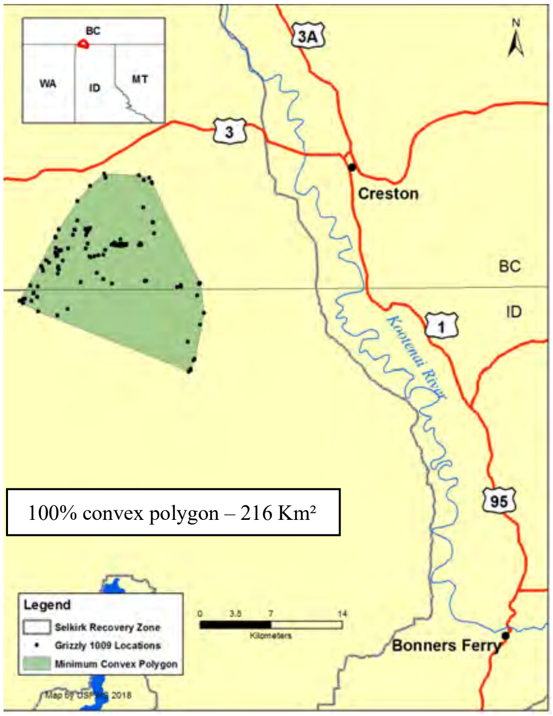

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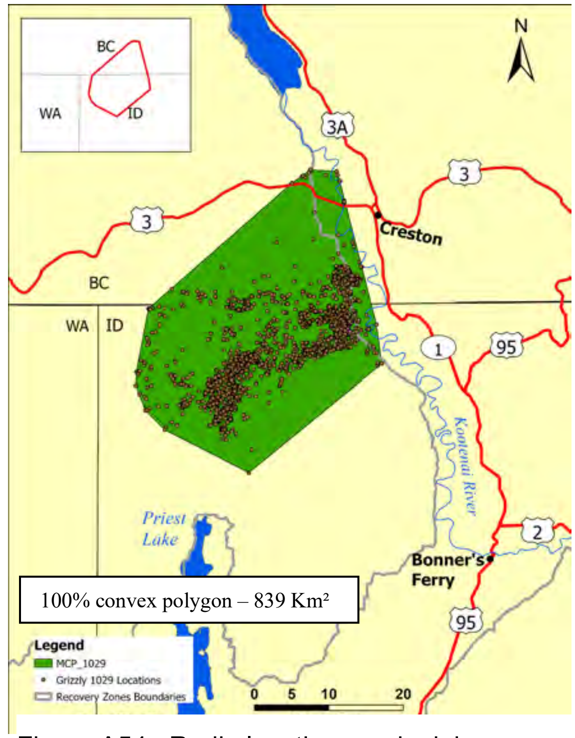

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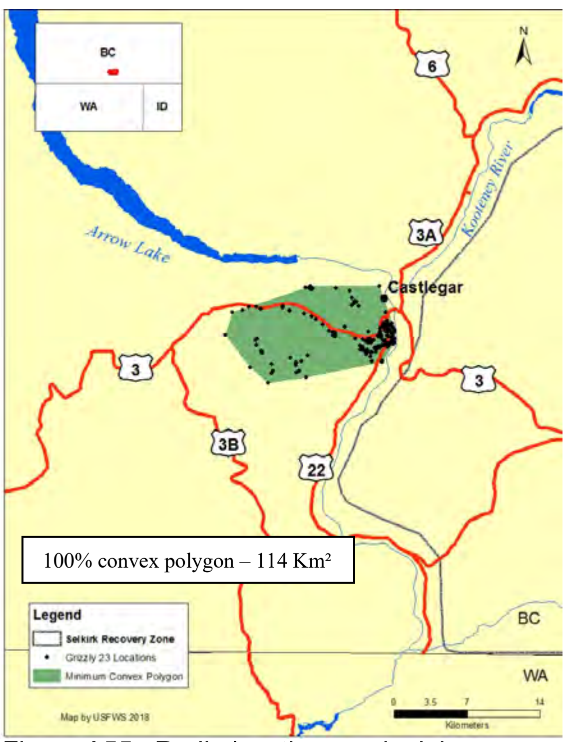

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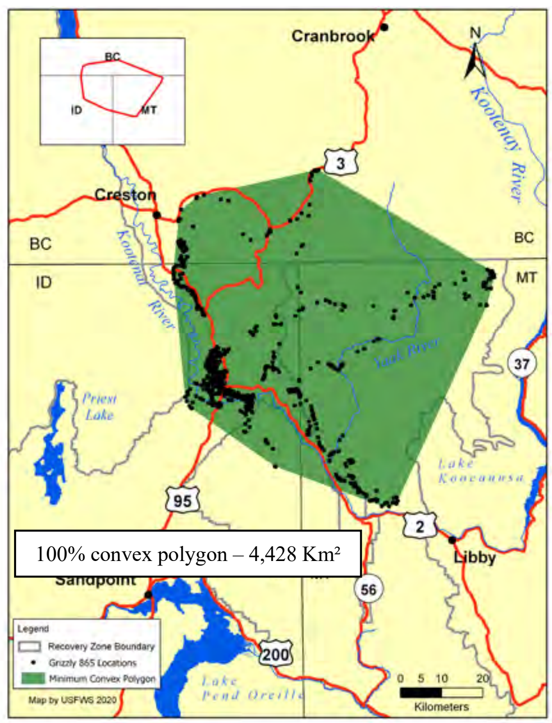
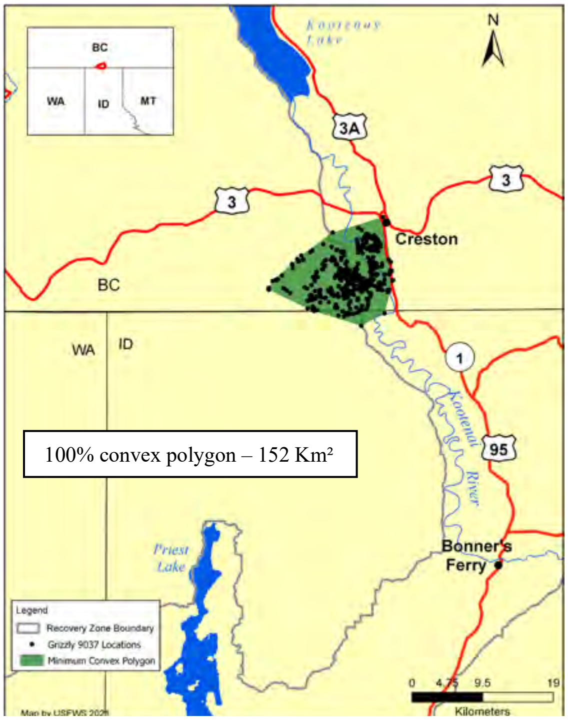


Figure A56. Radio locations and minimum convex (shaded) life range of management male grizzly bear 865 in the Kootenai and Yaak River, 2018–2019.



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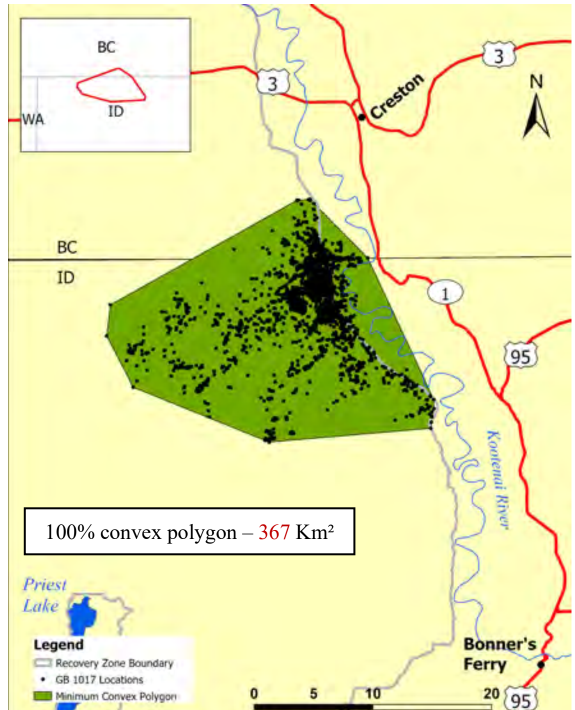

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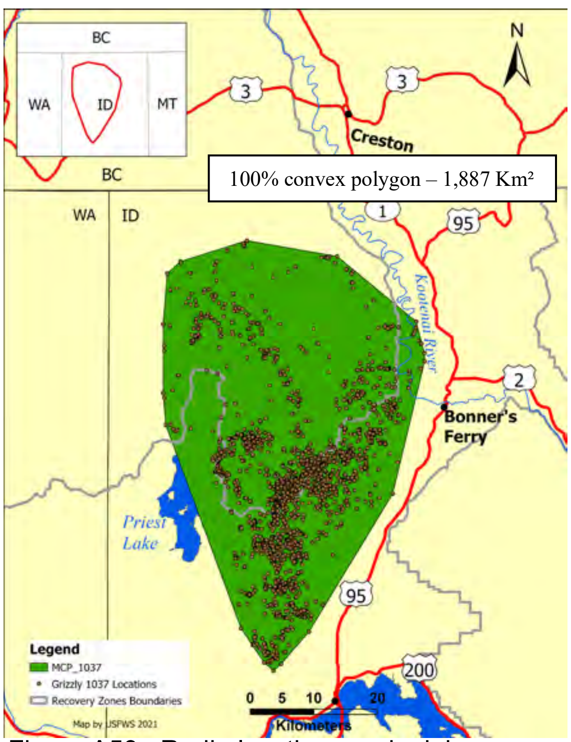

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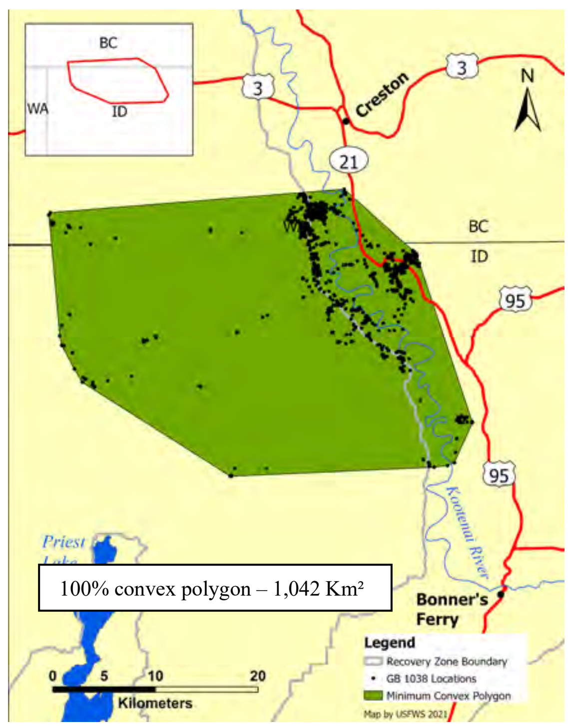

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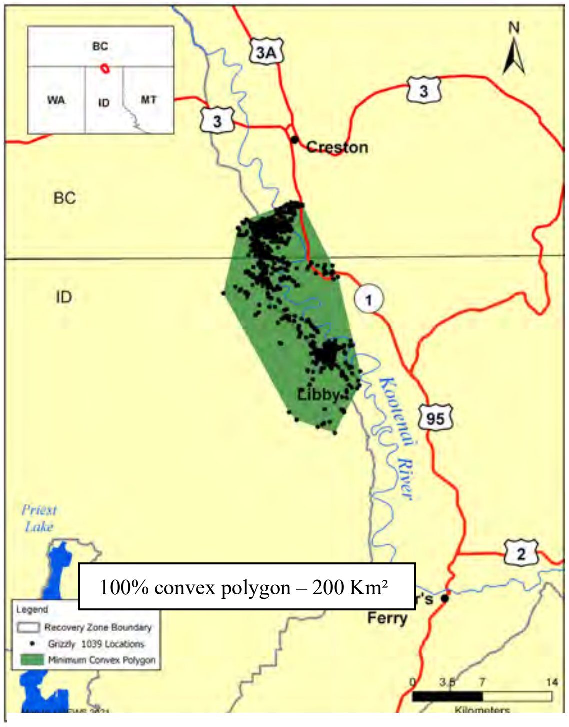

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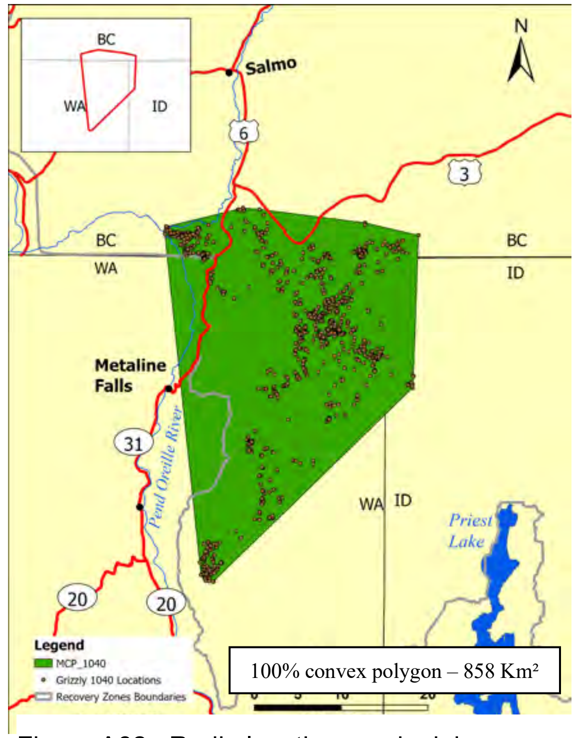

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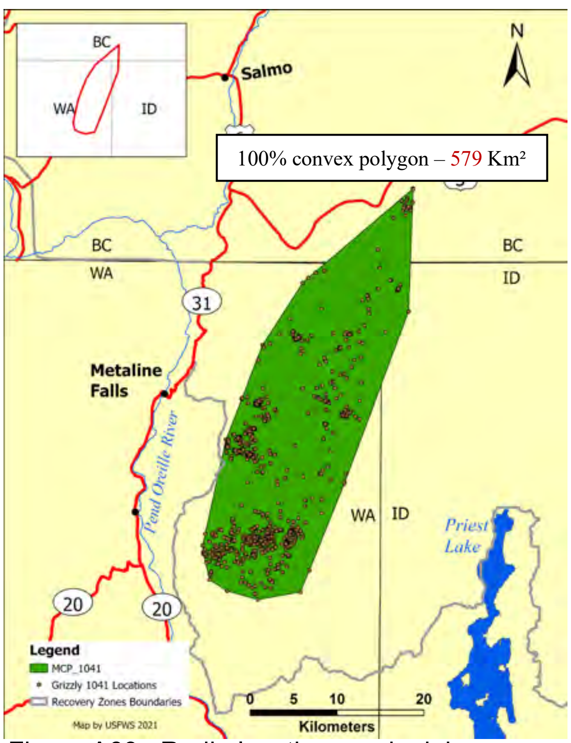

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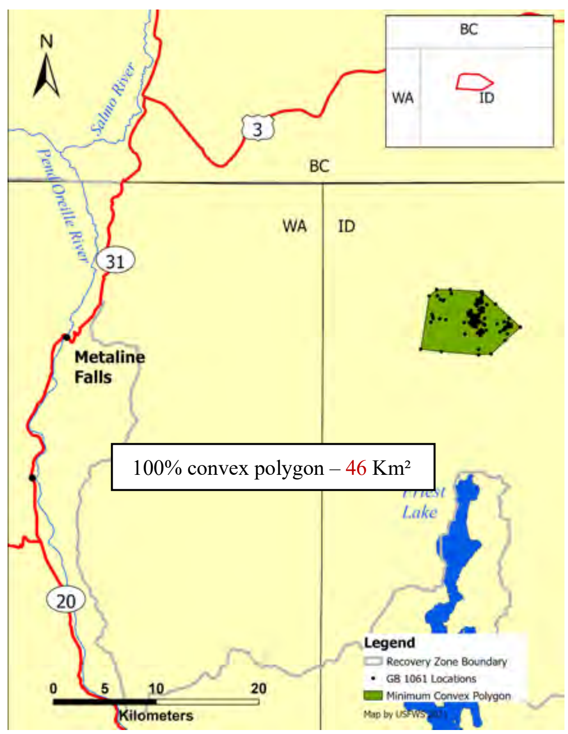

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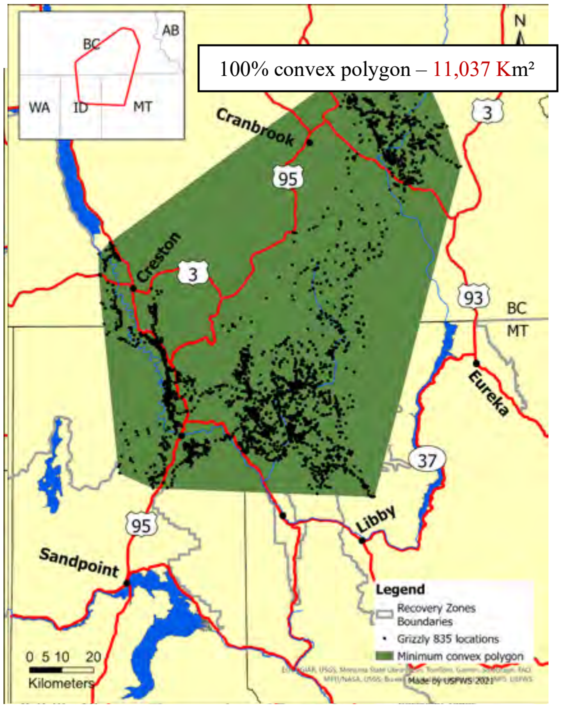

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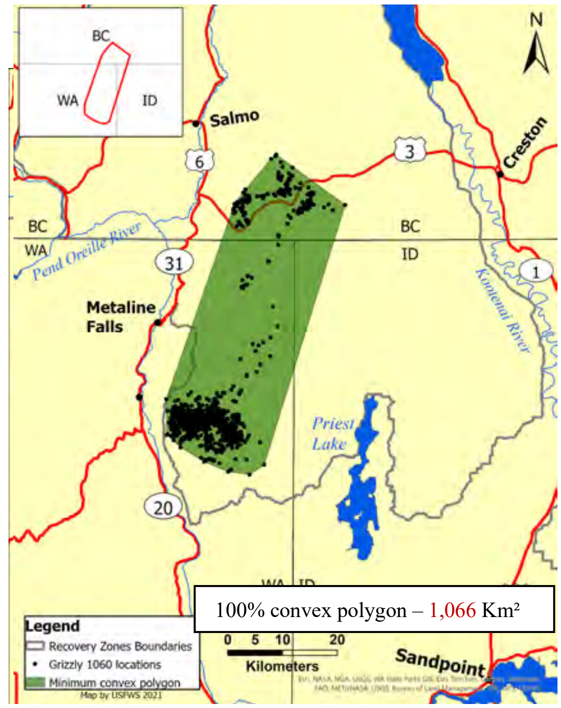

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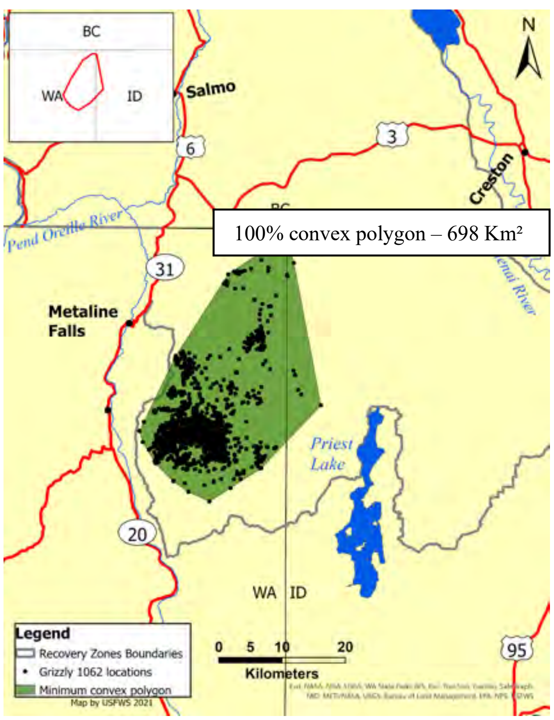

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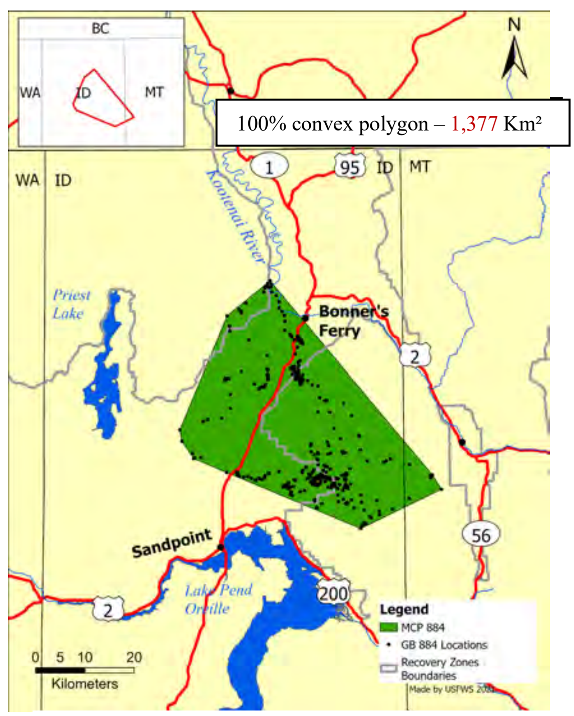

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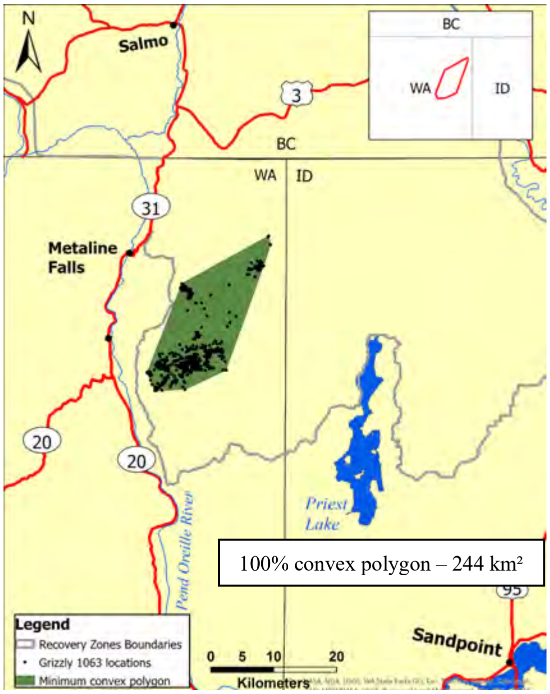

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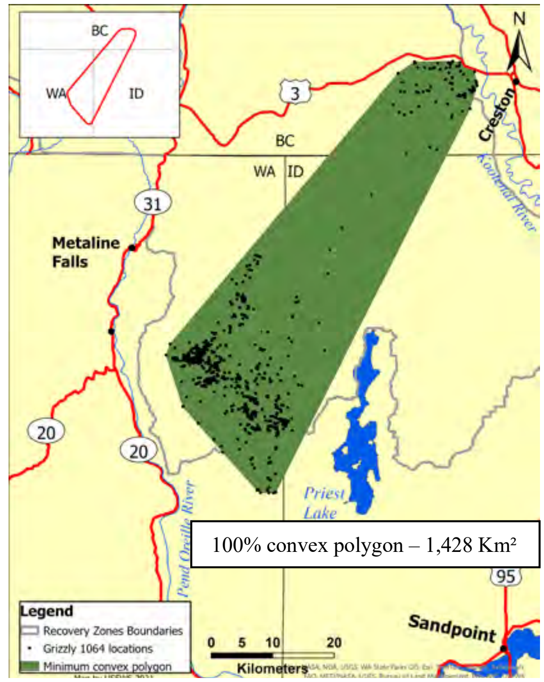

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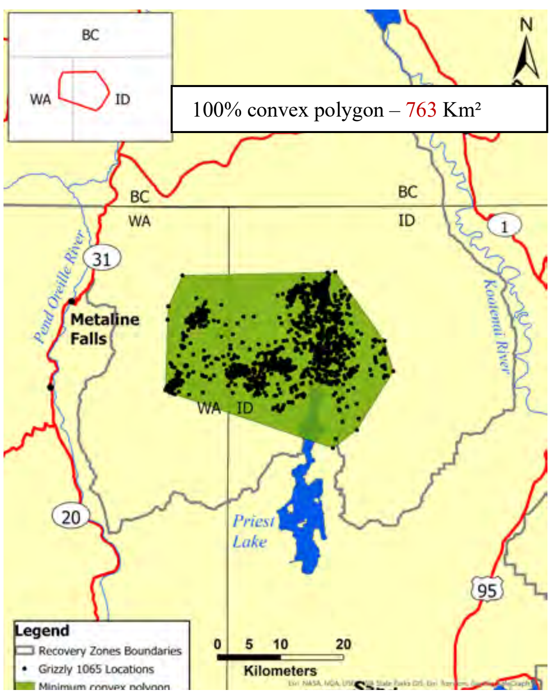

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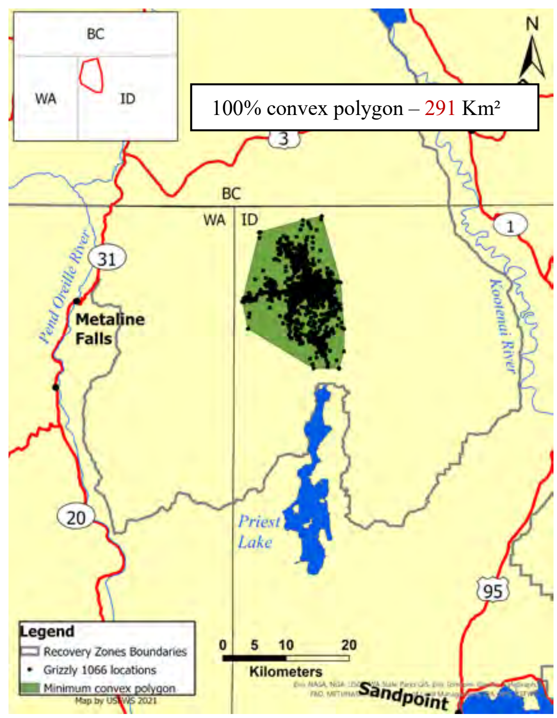
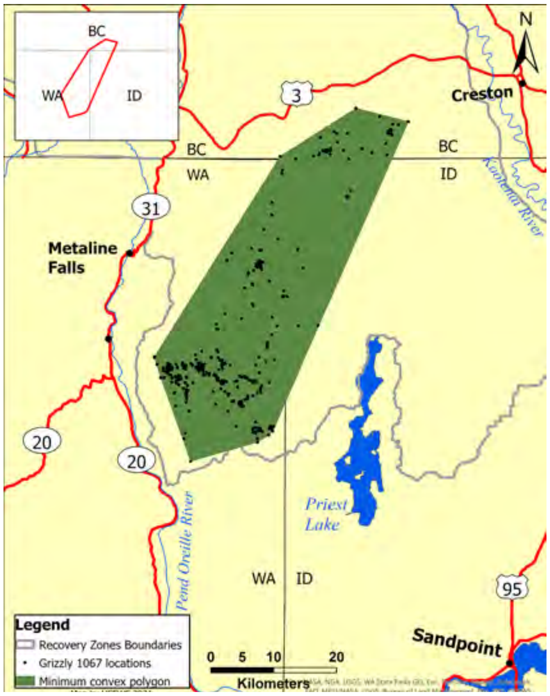


Figure A72. Radio locations and minimum convex (shaded) life range of female grizzly 1066 in the Selkirk Mountains, 2022–2024.



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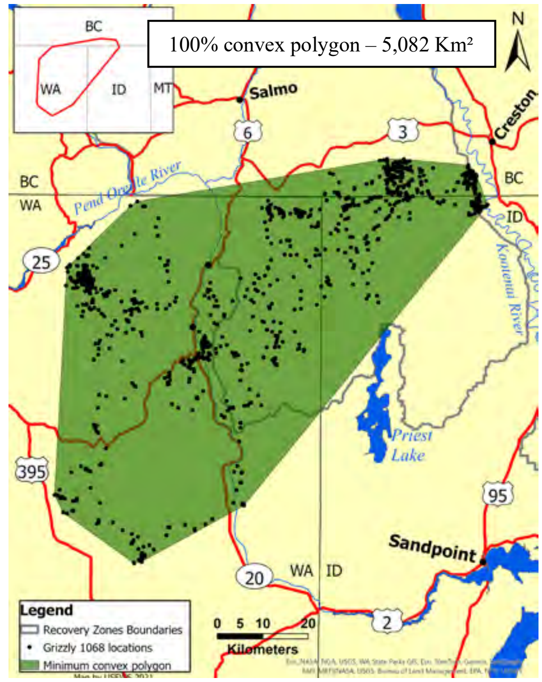

Figure A74. Radio locations and minimum convex (shaded) life range of male grizzly 1068 in the Selkirk Mountains, 2023-2024.

APPENDIX 7. Fine scale habitat modeling for the South Selkirk and Cabinet-Yaak ecosystems

Trans-border Grizzly Bear Project and the U.S. Fish & Wildlife Service
Michael Proctor TBGBP, & Wayne Kasworm USFWS

BACKGROUND

This document describes the methods and appropriate interpretation for fine scale habitat modeling of sex-, season- and ecosystem-specific habitat use modeling for grizzly bears. We modeled habitat use for females and males, in each of 3 seasons (spring, summer, fall) in each of 4 ecosystems (S Purcells in Canada, the international South Selkirks and Yaak, and the U.S. Cabinets). Here we present the female results. Females receive priority in grizzly bear conservation management because they are the reproductive engine of a population, they tend to have smaller home ranges and move significantly less than males. Management that secures important female habitat and food resources may be most efficient for conservation purposes. Males are important as well and, in some instances, can dominate the very best of food resources.

METHODS

We assessed habitat use for female and male bears separately at the scale of each of several ecosystems. Including the South Selkirk (international), the Yaak (international), the Cabinets (U.S.) and the South Purcell (north of Hwy 3 in Canada). We modelled habitat in each of the 3 non-denning seasons (Spring, den emergence – July 14; Summer berry season, July 15 – Sept 15; and Fall, Sept 16 – October 30). Methods below are very similar to those employed by Proctor *et al*. 2015.

Grizzly bear GPS location data

We deployed GPS-telemetry collars on 38 female grizzly bears in 2004–2015 (22 in the international S Selkirks, 10 in the International Yaak, and 6 in the Canadian South Purcells). Bears were captured with Aldrich foot snares and occasionally with culvert traps. We used Telonics Inc. (Mesa, Arizona, USA) Spread Spectrum radio-collars (and occasionally store-on-board collars) and remotely downloaded bear locations on a periodic basis.

Most bears were collared in May or June and were monitored for 1–3 years but usually monitoring spanned at least 2 non-denning periods (i.e., spring summer, fall). Locations were attempted every 1–4 hours depending on collar size (smaller bears carried smaller collars with less battery life), and age of bears (subadult bears carried collars designed to drop off earlier so as to not interfere with neck growth). Because we used only 2D and 3D fixes, overall fix success (the proportion of 2D and 3D fixes relative to fix attempts) was 84%. We also assessed potential location bias for canopy closure, which was the variable with the most potential for low fix success rate (Frair *et al*. 2004). We placed 13 GPS radio collars at ground level in conifer forest with canopy cover from 0 to 75% canopy and found no relationship between fix rate and canopy closure ($R^2 = 0.07$; regression significance, $P = 0.64$).

Because unequal observations among animals can lead to biased population level estimates (Gillies *et al*. 2006) and most bears had 1500–2000 locations, we used a maximum of 1600 locations from most bears by removing every n^{th} location from any one bear with > 1600 locations.

Grizzly Bear Habitat Modeling

Female grizzly bear GPS telemetry data were divided into 2 groups for each season and ecosystem. An 80% random sample was used for model training, while the remaining 20%

random samples of bear locations were withheld for model evaluation (Boyce *et al*. 2002, Nielsen *et al*. 2002). We used the GPS telemetry locations and a similar number of available (random) locations from within the composite home ranges of all grizzly bears to develop a resource selection function (RSF, Boyce and McDonald 1999, Manly *et al*. 2002, Nielsen *et al*. 2002). We estimated the parameters of the exponential RSF using logistic regression (Manly *et al*. 2002) and predictions from the RSF were transformed using the logistic function to normalize the right skewing of exponential RSF values and then mapped at a 100-m scale in ArcGIS 10.1 (ESRI, Redlands, CA). Logistic regression was performed using the statistical software package STATA (Intercooled 9.2, College Station, Texas, USA).

Model building was based on the principles of Hosmer and Lemeshow (1989) and more recently referred to as purposeful selection of variables (Bursac *et al*. 2008). We did not use an Information Theoretic approach (Burhnam and Anderson 1998) because our goal was predictive ability of grizzly bear habitat use and not testing of broader competing hypotheses (Nielsen *et al*. 2010). All predictor variables were tested for pairwise correlations (Chatterjee *et al*. 2000) and only terrain ruggedness and compound topographic index were correlated. All variables and their quadratic relationships were fit individually (uni-variable analyses) and ranked for their significance and explanatory power (pseudo R^2). Multi-variable models were then built by adding non-correlated variables in a forward stepwise fashion starting from higher to lower pseudo R^2. Models were compared sequentially after each variable addition; variable significance and explanatory power (pseudo R^2) were used to compare models and decide if a variable improved model predictability. When a variable increased the pseudo R^2 by at least 5%, we retained that variable in the model; when a variable increased the pseudo R^2 < 5% we did not retain it to favor a parsimonious model.

We used the Huber-White sandwich estimator in the robust cluster option in Stata to calculate standard errors because non-independent locations can lead to biased standard errors and overestimated significance of model parameters (White 1980; Nielsen *et al*. 2002, 2004b). Because the bears were the unit of replication, they were used to denote the cluster thus avoiding autocorrelation and/or pseudoreplication of locations within individual bears. We assessed the Receiver Operator Characteristic (ROC), a standard technique for summarizing classifier performance (i.e., how well did the model predict habitat and non-habitat correctly) for our most parsimonious models.

Environmental Variables

We used variables that were most consistently measured across the study area and between Canada and the U.S. including human-use, terrain, forest cover, and other ecological variables (Table 1). Ecosystem characteristics and human uses in the adjacent south Selkirk and south Purcell Mountains are similar (Meidinger and Pojar 1991) allowing development and prediction of models to these areas. Lowlands are dominated by Cedar-Hemlock (*Thuja plicata - Tsuga heterophylla*) forests and upland forests are dominated by Engelmann Spruce - Sub Alpine Fir (*Picea engelmanni – Abies lasiocarpa*). Douglas fir (*Psuedotsuga mensiezii*) forests are somewhat more common in the southern portions of the Purcell range (Meidinger and Pojar 1991). Human uses are relatively similar across the region and include timber harvest, some mining, ungulate hunting, and other forms of recreation.

Baseline Thematic Mapping land-cover variables (recently logged, alpine, avalanche, and riparian), Vegetation Resource Inventory variables (dominant tree species forest cover types, canopy cover), and backcountry resource roads (i.e., associated with timber harvest, mining) were obtained from the B.C. Ministry of Forests, Lands, and Natural Resource Operations in Canada. Land-cover information for the U.S. was from the U.S. Forest Service. Alpine, avalanche, burned, and riparian habitats contain a variety of grizzly bear food resources (Mace *et al*. 1996, McLellan and Hovey 1995, McLellan and Hovey 2001b). Forest cover variables (Table 1) were used because they often have been found to influence grizzly bear habitat selection (Zager *et al*. 1983, Waller and Mace 1997, Apps *et al*. 2004, Nielsen *et al*. 2004a). Greenness, an index of leafy green productivity, correlates with a diverse set of bear food resources and is often found to be a good predictor of grizzly bear habitat use (Mace *et al*. 1996, Nielsen *et al*. 2002). Greenness was derived from 2005 Landsat imagery using a Tassled Cap transformation (Crist and Ciccone 1984, Manley *et al*. 1992). Terrain variables of elevation, compound topographic index (CTI), solar radiation, and terrain ruggedness were derived from a digital elevation model (DEM) in ArcGIS. CTI is an index of soil wetness estimated from a DEM in a GIS using the script from Rho (2002). Solar radiation was estimated for the summer solstice (day 172), again using a DEM, and in this case the ArcInfo AML from Kumar (1997) that was modified by Zimmerman (2000) called shortwavc.aml. Finally, terrain ruggedness was estimated from the DEM based on methods from Riley *et al*. (1999) and scripted as an ArcInfo AML called TRI.aml (terrain ruggedness index) by Evans (2004). These terrain variables have been shown to influence the distribution of grizzly bear foods (Apps *et al*. 2004, Nielsen et al. 2004a, 2010) and also affect local human use. We included elevation as a variable because grizzly bears in our region use high country extensively, which may be for a variety of reasons (e.g., high elevation habitat types, thinner forest cover with more edible ground-based vegetation, human avoidance). Highways and human developments were digitized from 1:50,000 topographic maps and ortho-photos. Highways, human developments, and backcountry roads were buffered by 500 m on either side to reflect their influence on grizzly bear habitat use (Mace *et al*. 1996). The human-use variables have been demonstrated repeatedly to correlate with habitat selection by grizzly bears (Mace *et al*. 1996, 1999, Nielsen *et al*. 2002, Apps *et al*. 2004). Although none of the predictors were direct measures of food resources or human activities, each factor was thought to correlate with resources and behaviors used by bears or activity of humans (Mace *et al*. 1996, Nielsen *et al*. 2002, 2006, 2009, Apps *et al*. 2004).

RESULTS

Best models for each season and ecosystem were dominated by greater than expected use for canopy openness and high level of greenness and less than expected use of high road densities (Table 1). Model predictive ability was greatest in the International South Selkirk area in all 3 seasons, as predictions of habitat use and non-use were all > 0.8 (ROC, Receiver Operator Characteristic measures how well the model predicts habitat use GPS Locations that were in model predicted use areas vs non-used areas). Because we had very few resident females in the Cabinet population, most were augmented bears from the Rocky Mt region, and the ecology is similar to the South Selkirk region (Proctor *et al*. 2015), we applied our South Selkirk model to the Cabinet area. These models are similar to the all-season both-sex RSF model derived to predict linkage habitat within Proctor *et al*. (2015). That model was dominated by canopy openness, greenness, riparian, alpine, and elevation.

In the S Selkirk, S Purcell, and Cabinet area, our models were the most predictive with ROC scores usually > 0.75 and even > 0.80 (0.7 is considered a good predictive model). Models for the international Yaak were less predictive, especially in spring and fall (ROC scores were 0.66 and 0.59 respectively).

Where we had a huckleberry patch model available in the South Purcell area of Canada, it dominated the model along with greenness. We have a huckleberry patch model throughout this region within Canada. Therefore, we did not include it in international models in the S Selkirk, Yaak, or Cabinet areas. Canopy openness is a powerful predictor of huckleberry patches and in models without huckleberry patches, canopy openness plays a similar predictive role.

DISCUSSION

We envision that these habitat models will be useful for planning timber harvest, road building, road closing, road decommissioning, and prescribed burns. As canopy openness and greenness are two of the better predictors of female habitat use (Mace *et al*. 1996, Nielsen *et al*. 2002), certain timber harvest and prescribed burning practices may have some potential to improve grizzly bear habitat through opening canopy and promoting deciduous and herbaceous bear foods. In contrast, it might be desirable to plan access controls in areas where habitat quality and use is high, to provide security for female grizzly bears. In that regard, these models may be used to decide where roads might be closed, decommissioned, or left open.

It must also be kept in mind that grizzly bear habitat is dynamic spatially and temporally. Some open-canopy habitats that resulted from past timber harvest may change over time as those canopies fill in with forest regrowth. The same applies to habitat created from past burns. Also, some habitat may have a longer-term state of canopy openness (some higher elevation forests) that may remain desirable over longer time periods. Foresters' on-the-ground knowledge may be able to differentiate these types of habitats and their dynamic potential. Future iterations of these models can be run with updated canopy cover and greenness layers as they are derived from remote sensing.

Note that Riparian habitat was a strong predictor in the South Selkirk (and Cabinet) model. This result was driven by the heavy use of female grizzly bears in the Kootenay River Valley just north of the Canada-U.S. border in the Creston Valley in all 3 seasons. If populations continue to grow, the Kootenay River Valley or other main river valleys may see some increased habitat use by female grizzly bears at least seasonally within the U.S. We also think that the bears in the Creston Valley are getting a measure of agricultural foods that might be holding them in the valley even in the summer. In Canada and the U.S., there are developing programs to secure many of these agricultural products from the bears, but it may never all be secured and there will tend to be some bears spending time in these valley bottoms. On the other hand, this is somewhat desirable from the standpoint of female connectivity between the Selkirk and Purcell and Cabinet ranges (Proctor *et al*. 2012, 2015). Subadult female dispersal is usually of a short distance (McLellan and Hovey 2001, Proctor *et al*. 2004) so for female connectivity to develop, it is likely necessary that female grizzly bears spend a portion of their lives in valley bottoms. Conflict reduction efforts become especially important in that regard.

As we modeled each ecosystem separately, thresholds between ecosystems varied. Model outputs have ecosystem-specific thresholds for greater than expected use of specific habitats vs less than expected use built in. For most planning we would expect use of the summer models or occasionally the spring models. Fall modeling probably represents a time when berry feeding has passed, and bears may be preparing for denning by looking for protein in the form of wounded animals and gut piles from hunters.

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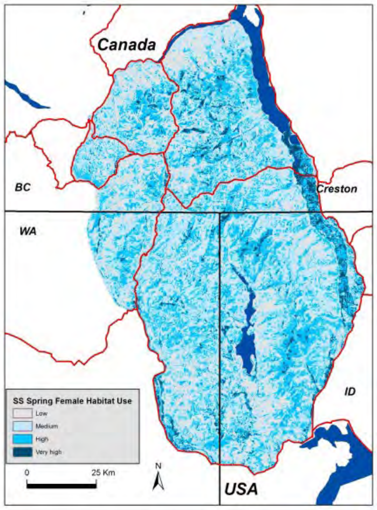
Table 1. Best female grizzly bear seasonal habitat use models for the Selkirk, S Purcell, Yaak, and Cabinet ecosystems. Huckleberry patch models were only available in the S Purcell area.

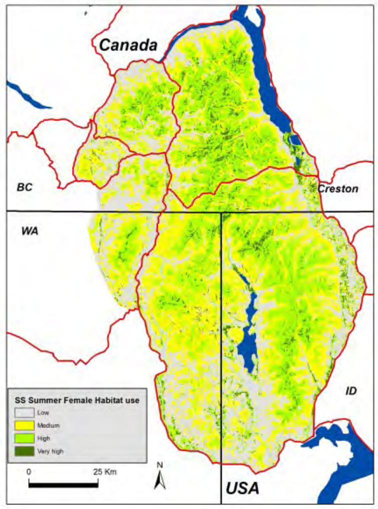
	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female	Female
	Selkirk	Selkirk	Selkirk	Yaak	Yaak	Yaak	Cabinet	Cabinet	Cabinet	Purcell	Purcell	Purcell	Canada	Canada	Canada
VARIABLES	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
canopy cover	-	+	+	-	+	+	-	+	+	+			-		
canopy cover^2		-	-		-	-		-	-						
greenness	+	+	+		+		+	+	+	+	+	+	+	+	+
road density	-	-	-	-			-	-	-				-	-	-
riparian	+	+	+				+	+	+					+	
forest age 100-250											-	-			
forest age 1-20					+										
forest age 20-60						-									
forest age 60-80											+				
alpine					+	+						+		+	+
avalanche	+						+						+		
deciduous forest				+	+	+				+					
elevation		+	+	+	+			+	+						
elevation^2			-	-	-				-						
Douglas fir forest			-	+					-						-
distance to road											+				
buildings				-	-										
distance to HuckPatch											-			-	-
HuckPatch X Dist2Road															+
highway			-			-			-						-
mortality risk				-								-			+
recently logged			-						-		-	-			
solar radiation										+		+			
terrain ruggedness										+				-	-
Pseudo R2	0.20	0.25	0.26	0.06	0.18	0.03	0.20	0.25	0.26	0.20	0.32	0.11	0.13	0.25	0.15
ROC AUC	0.80	0.82	0.83	0.66	0.78	0.59	0.80	0.82	0.83	0.79	0.86	0.73	0.75	0.82	0.80
Correct classified	73%	74%	80%	61%	70%	56%	73%	74%	80%	72%	78%	65%	74%	75%	76%

Figure 1a) Spring, b) Summer, & c) Fall female grizzly bear Habitat Use map.

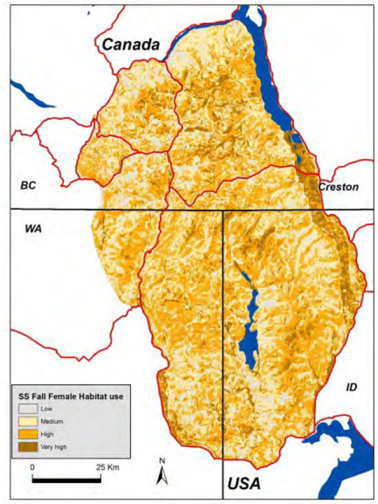
a S Selkirks Spring



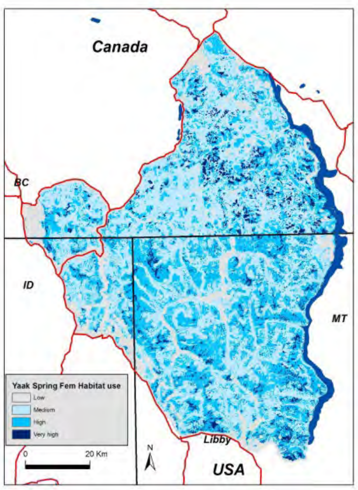
b S Selkirks Summer



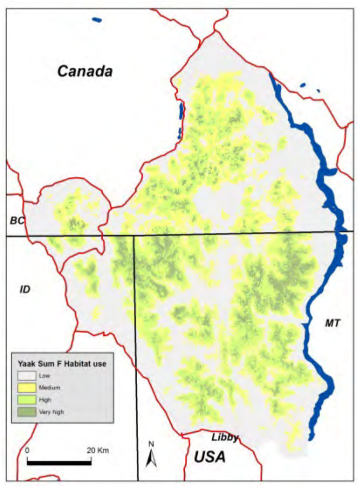
c S Selkirks Fall



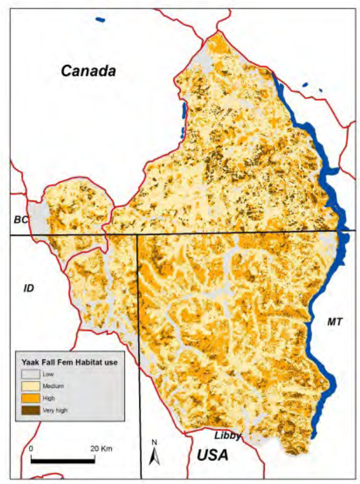
a Yaak Spring



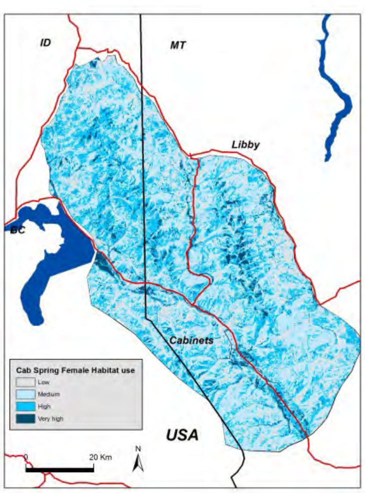
b Yaak Summer



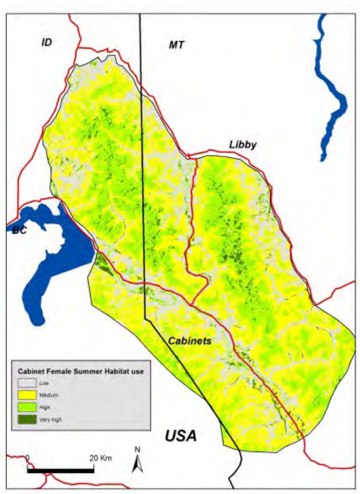
c Yaak Fall



a Cabinets Spring



b Cabinets Summer



c Cabinets Fall