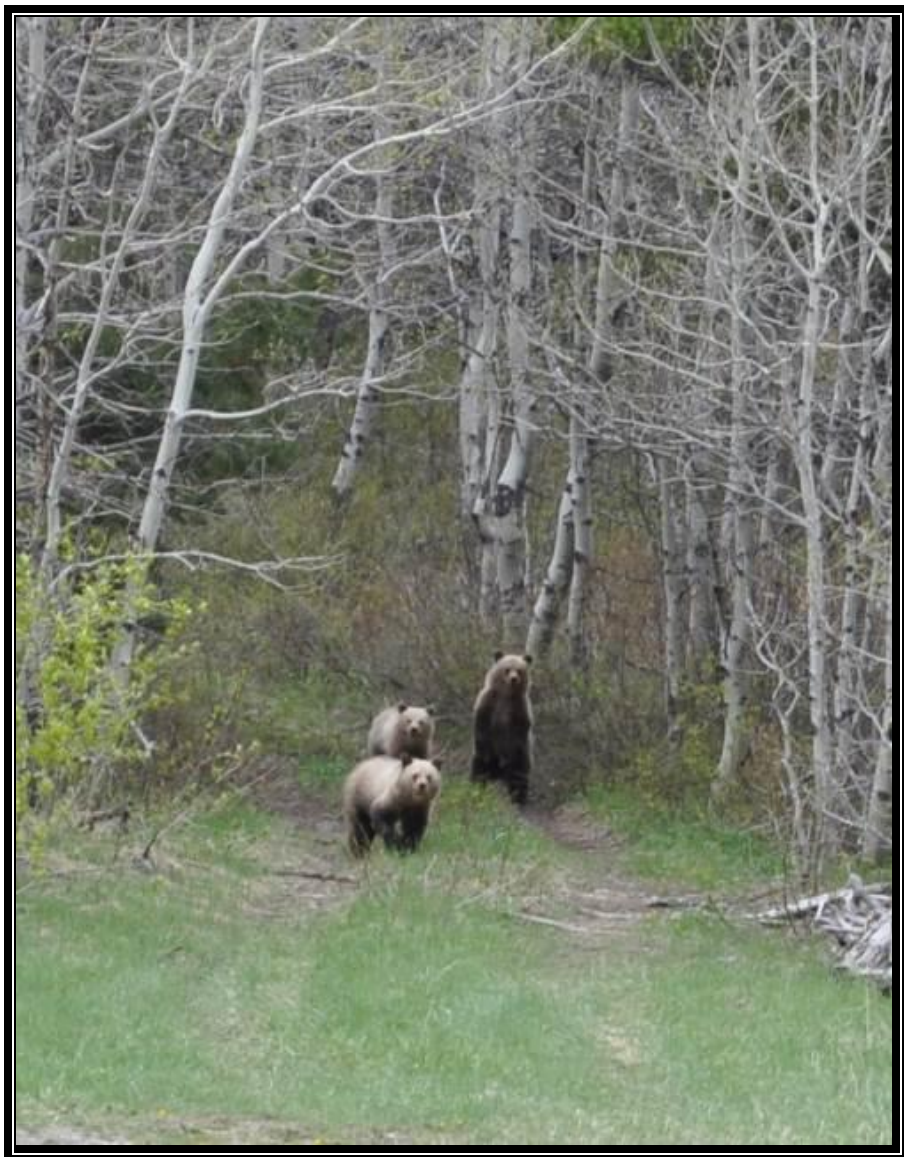
NORTHERN CONTINENTAL DIVIDE ECOSYSTEM

GRIZZLY BEAR POPULATION MONITORING

ANNUAL REPORT – 2014



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U.S. Forest Service

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This annual report summarizes data collection efforts to date. It is not a peer-reviewed document, and data summaries and interpretations are subject to change.

Suggested Citation: Mace, R. and L. Roberts. 2014. Northern Continental Divide Ecosystem Grizzly Bear Monitoring Team Annual Report, 2012. Montana Fish, Wildlife & Parks, 490 N. Meridian Road, Kalispell, MT 59901. Unpublished data.

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This Annual Report is available on the web at:
http://fwp.mt.gov/fishAndWildlife/management/grizzlyBear/monitoring.html

ABSTRACT

A program to monitor the population trend of grizzly bears in the Northern Continental Divide Ecosystem (NCDE) of Montana was initiated in 2004. The goal of this program is to estimate population trend by monitoring the survival and reproductive rates of radio-instrumented female grizzly bears. In 2014, 9 females and 14 males were captured for trend monitoring. An additional 9 independent females and 10 independent males were captured in 2014 for management purposes. In 2014, 54 individual bears were radio-monitored, 28 of which were research females. We instituted a new method to estimate the geographic distribution of grizzly bears in and adjacent to the NCDE. We now estimate that NCDE grizzly bears are distributed across 53,663 km^2 of habitat in western Montana. We provide denning chronology for female grizzly bears and provide information on current use of prairie habitats for female denning. Twenty-one known or probable grizzly bear mortalities were tallied in the NCDE during 2014. Eleven and 2 were independent-aged females and males, respectively.

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I. INTRODUCTION AND STATEMENT OF NEED

The grizzly bear *(Ursus arctos horribilis*) occupies over 8 million wilderness and non-wilderness acres in the Northern Continental Divide Ecosystem (NCDE) of western Montana. Notable regions within this ecosystem include Glacier National Park and the Bob Marshall wilderness complex. Grizzlies were listed as Threatened under the Endangered Species Act in 1975 for lack of information on its population status and habitat requirements. The NCDE has the largest population of grizzly bears in the lower 48 states; mean population size during 2004 was 765 bears (Kendall et al. 2009).

Managers and the public agree that information on both population size and trend is needed. Having these estimates will greatly improve our collective knowledge of grizzly bear ecology, and provide more measurable and precise information with which to judge the status of the grizzly population in the NCDE. Therefore in 2004 Montana Fish, Wildlife & Parks (MTFWP), in cooperation with other state, federal, and tribal agencies, established a team to monitor the population trend of grizzly bears in the NCDE. The purpose of this long-term program is to monitor grizzly bear survival rates, reproductive rates, and population trend by radio-monitoring female grizzly bears and their young.

II. PROGRAM OBJECTIVES

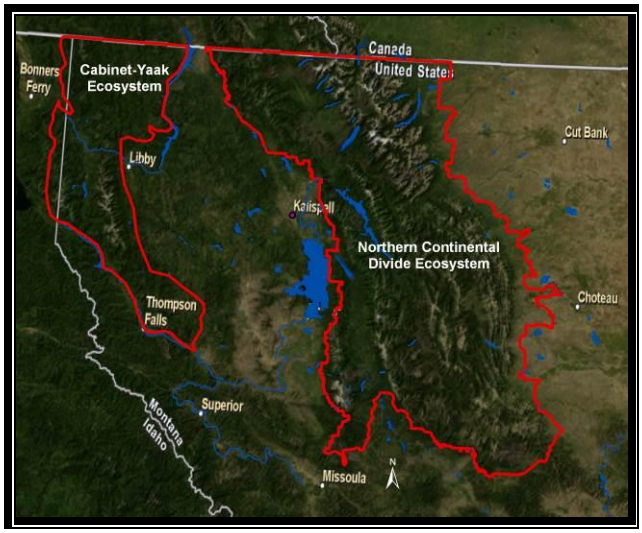
The primary objective of this program is to monitor the population trend of grizzly bears in the NCDE using known-fate estimators of survival, and documentation of reproductive rates. This will be accomplished by following the survival and reproductive rates of female grizzly bears throughout the ecosystem. Estimates of population vital rates will be required for recovery programs in this area. The ultimate responsibility of the monitoring team is to collect life history data on grizzly bears in western Montana and summarize findings in a comprehensive annual report. Major population monitoring categories will initially include:

1. population trend,
2. grizzly bear survival rates,
3. grizzly bear reproductive rates,
4. grizzly bear movements and habitat selection,
5. grizzly bear distribution in western Montana,
6. mortality levels in the NCDE, and
7. levels of unreported mortality.

III. GEOGRAPHIC SCOPE OF THE MONITORING PROGRAM

We monitored the population trend of grizzly bears in the NCDE of western Montana and into the Canadian provinces of British Columbia and Alberta (Fig. 1). Our primary emphasis was within the 23,136 km^2 federal recovery zone in the United States. We also captured and monitored bears up to 16 km north of the United States into Canada, which enlarged the study area to approximately 24,000 km^2. There were 2 national parks in the study area: Glacier National Park in Montana (4,081 km^2) and Waterton Lakes National Park (505 km^2) in Alberta, Canada. Portions of the Blackfeet Indian Reservation and the Confederated Salish and Kootenai Reservation occurred within our study area. Notable roadless regions outside the national parks included the Bob Marshall, Great Bear, Scapegoat, Rattlesnake, and Mission Mountain federal wilderness areas in the US. Non-wilderness areas of the NCDE were characterized by multiple-use lands under private state, corporate, and tribal ownership. Approximately 17% of the NCDE is private land.

Fig. 1. Location of the Northern Continental Divide Grizzly Bear Ecosystem in western Montana.



V. METHODS & RESULTS

Grizzly Bear Captures 2004-2014

Methods

We captured grizzly bears using leg-hold snares and culvert traps, by helicopter darting, and in some instances, we darted and immobilized bears over baits. We followed the handling and immobilization procedures found in the Montana Animal Care and Use Committee protocols for grizzly bears and black bears (Montana Fish, Wildlife and Parks 2004). We tagged all bears subcutaneously with passive transponder tags and pulled a pre-molar tooth for age determination (Stoneberg and Jonkel 1966). Bears were radioed instrumented using standard very high frequency (VHF) neck-mounted collars (Telonics, Inc., Mesa, AZ) and VHF ear-tag transmitters (Advanced Telemetry Systems, Inc., Isanti, MN) on some bears. We used 3 types of Telonics global positioning system (GPS) collars: standard GPS (TGW-4500; Telonics, Inc.), GPS-Argos (Models TGW-3580 and TGW-3583; Telonics, Inc.), and spread-spectrum collars (SST; TGW-3690; Telonics, Inc.). Individual bears were classified as either research bears or management bears using the terminology of Mace et al. (2012).

Results

Grizzly bears have been captured for population trend monitoring since 2004. Although females were the focus of the research, males were inadvertently captured as well. Annual capture of females has varied among years (Table 1). In 2014, the team captured 23 individuals of both sexes, 9 of which were females and 14 were males (Table 1). A list of research female bears monitored in 2014 is given in Appendix A.

In 2014, 9 females were captured 10 times (Table 2). Ten independent-aged males and 5 dependent young (cubs or yearlings) were captured in 2014. The fates of these bears in 2014 males are given in Appendix B and C.

Number of Bears Radio-monitored; 2004-2014

Each year, grizzly bears were captured and radio-instrumented for several purposes. These included captures for trend monitoring, for management, and for other research purposes. Annual sample sizes of bears radio-monitored in the NCDE have varied each year (Table 3). In 2014, we radio-monitored 54 individual grizzly bears for varying lengths of time: 28 of which were females for population trend. Eleven females were radio-monitored for other reasons, primarily conflict management. In 2014, we monitored 15 males (Table 3). We documented the death of one trend monitoring female in 2014 (AVID# 064054290) who was struck and killed by a vehicle.

Table 1. The number of grizzly bear captures and recaptures in the NCDE for population trend monitoring, 2004-2014. Not all individuals were radio collared.

Capture year	Sex	Number of individuals	Number of recaptures	Total captures
2004	Female	15	1	16
2004	Male	9	0	9
2004	Total	24	1	25
2005	Female	24	1	25
2005	Male	18	2	20
2005	Total	42	3	45
2006	Female	17	1	18
2006	Male	31	4	35
2006	Total	48	5	53
2007	Female	10	2	12
2007	Male	10	2	12
2007	Total	20	4	24
2008	Female	18	2	20
2008	Male	16	0	16
2008	Total	34	2	36
2009	Female	23	2	25
2009	Male	17	3	20
2009	Total	40	5	45
2010	Female	17	1	18
2010	Male	10	1	11
2010	Total	27	2	29
2011	Female	18	0	18
2011	Male	9	0	9
2011	Total	27	0	27
2012	Female	9	1	10
2012	Male	5	0	5
2012	Total	14	1	15
2013	Female	19	0	19
2013	Male	13	1	14
2013	Total	32	1	33
2014	Female	9	0	9
2014	Male	14	0	14
2014	Total	23	0	23

Table 2. Capture of grizzly bears in the NCDE for purposes other than trend monitoring. This includes captures for management, augmentation to the Cabinet-Yaak Ecosystem, or other research efforts, 2004-2014. Not all individuals were radio-collared.

Year	Number of individual bears captured for purposes other than trend (total recaptures)			Total individuals
	Independent females	Cubs and yearlings	Independent males	
2004	15 (20)	12 (15)	19 (24)	46
2005	8 (8)	4 (4)	12 (12)	24
2006	5 (5)	2 (2)	16 (17)	23
2007	4 (5)	5 (7)	19 (22)	28
2008	9 (12)	0	19 (21)	28
2009	13 (15)	2 (2)	23 (25)	38
2010	15 (17)	6 (6)	25 (27)	46
2011	13 (17)	10/20	15(20)	38
2012	8 (11)	5 (7)	30 (37)	43
2013	9 (10)	4 (0)	11 (13)	24
2014	9 (10)	5 (0)	10 (0)	24

Table 3. Total number of bears with radio telemetry locations each year in the NCDE, 2004-2014. Table does not include radioed bears for which no locations were obtained during the year.

Year	Radioed males (mgmt and other research)	Radioed females (mgmt and other research)	Radioed research females	Total number radioed bears
2004	13	13	12	38
2005	6	6	29	41
2006	11	5	32	48
2007	23	8	34	65
2008	30	10	37	77
2009	35	15	43	93
2010	27	18	36	81
2011	38	24	36	98
2012	31	21	35	87
2013	29	9	40	78
2014	15	11	28	54

Grizzly Bear Reproduction

Methods

We conducted observation flights in early spring when grizzly bears were emerging from their dens, as weather allowed, and ascertained which females had dependent offspring and the number of offspring per litter. We continue to conduct monthly telemetry flights to check on the monthly survival of the dependent offspring and recorded the females' reproductive status entering the den in the fall.

Results

We recorded the reproductive status of 22 research adult females in the spring 2014 (Table 4). We were unable to observed two adult females, although we did locate their dens and observed smaller sized tracks. Three adult females did not have dependent young in the spring of 2014. We observed 3 litter's of 1 cub, 4 litter's of 2 cubs, and 1 litter of 3 cubs. We observed five adult female with litters of two yearlings and we observed 2, 1, and 1 litter's with 1, 2, or 3 2-year-olds, respectively. In total, we monitored the fate of 31 dependent young.

By the fall of 2014, we had observations of 22 research adult females (Table 5). One female that had two cubs was hit by a car, but she had already lost her two cubs before her mortality. Three females cast their collars before entering the den. The four females that had offspring that were two years old, three of the litters dispersed naturally and the other set of two were captured and taken to the CYE to help augment that population. We added three adult females and their reproductive status to our sample over the course of the summer. In total, we finished 2014 monitoring the fate of

12 dependent young. A summary of the reproductive status for each female is given in Appendix D.

Table 4. Observed spring litter sizes of radioed research females in 2014.

Litter size/age	*n* individuals with given litter size	*n* dependent young
Unknown (ad)	2	
Solitary adults	3	0
1 cub	3	3
2 cubs	4	8
3 cubs	1	3
1yearling	0	0
2 yearlings	5	10
3 yearlings	0	0
1 2-year-old	2	2
2 2-year-old	1	2
3 2-year-old	1	3
Total	22	31

Table 5. Observed fall litter sizes of radioed research females in 2014.

Litter size/age	*n* individuals with given litter size	*n* dependent young
Unknown (ad)	1	
Solitary adults	13	0
1 cub	2	2
2 cubs	2	4
3 cubs	0	0
1yearling	2	2
2 yearlings	2	4
3 yearlings	0	0
1 2-year-old	0	0
2 2-year-old	0	0
3 2-year-old	0	0
Total	22	12

Grizzly Bear Distribution

Methods

We used all verified grizzly bear locations from 2000-2014 to create a distribution map for the NCDE. Verified locations were collected from GPS collars, VHF telemetry flights, capture and mortality locations, grizzly bear-human conflict sites, observations (sighting or track) that were confirmed by agency personnel, and opportunistic samples (hair, blood, scat, or tissue) that were confirmed grizzly bear by DNA analysis. We also used the location of hair samples collected in the USGS DNA projects from 2004-2011 (Kendall et al. 2009).

We used a geographic information system (ArcMap v. 10.1) to place a 7 x 7 km grid over the area that contained all of the grizzly bear locations. The grid-cell size was based on the average daily movements from 31 male grizzly bears, wearing GPS collars from 2003-2012, located throughout the ecosystem. Our mean daily movement for male grizzly bears was 7.44 km (CI 95% 5.84-9.05 km). We used the ordinary kriging method used by Bjornlie et al. (2013) to perform our distribution analysis. We also created individual distribution maps for males and females to compare the differences in area.

Results

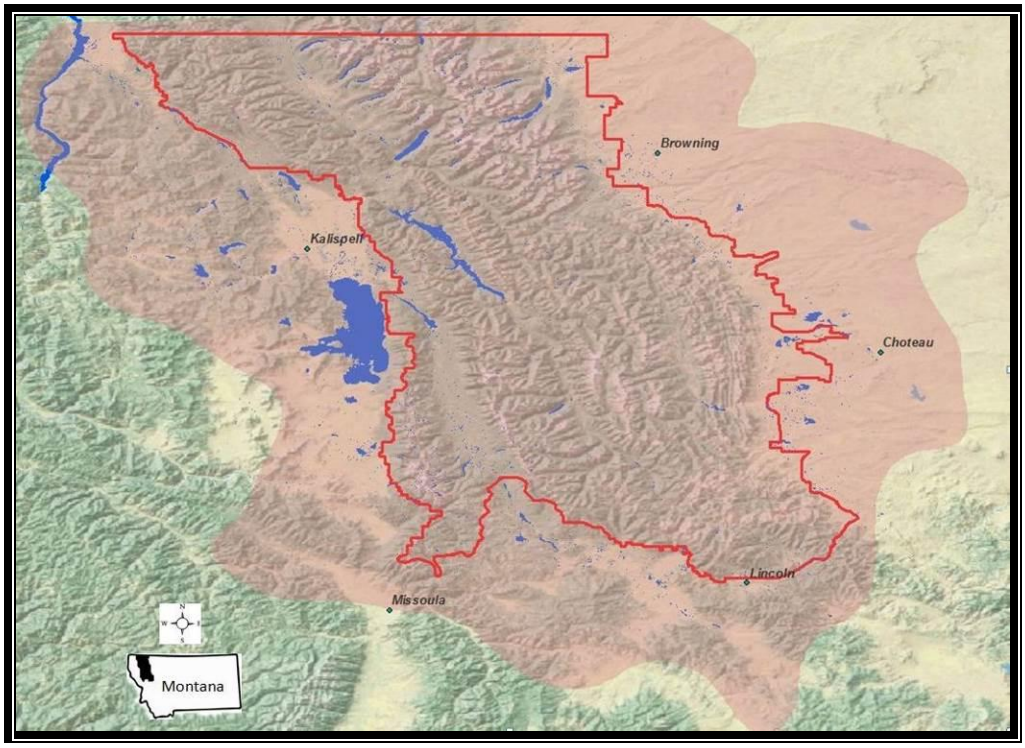
The NCDE federal recovery zone is 23,136 km^2. Using all of the verified grizzly bear locations from 2000-2014 (*n*=200,126) we created an estimated distribution of 53,663 km^2 (Fig. 2). When we separate the male locations from the female locations the

distribution is 47,734 km^2 and 46,308 km^2, respectively (Table 6). All of the distribution categories are double the size on the NCDE federal recovery zone.

Table 6. Distribution size of male and female grizzly bears in and beyond the NCDE Recovery Zone for the period 2000-2014.

Area	Size (km^2)	% Area outside the Recovery Zone
NCDE Recovery Zone	23,136	
Male Distribution	47,734	51.53%
Female Distribution	46,309	50.04%
Total Distribution	53,663	56.89%

Fig. 2. Distribution of grizzly bears relative to the NCDE federal recovery zone (2000-2014) based on telemetry data, mortality data, DNA detections and visual observations.



Female Grizzly Bear Denning Chronology

Methods

We obtained dates of den entry and emergence for female grizzly bears from 1987 to 2013. Our aerial telemetry flights for vhf-equipped bears were too infrequent to ascertain the exact days that bears entered and exited dens. To use data from VHF-equipped bears, we required that no more than seven days could elapse between the last fall location where the bear was out of the den (PD) and the first location of the bear in the den (FID). We used the same criterion for spring den emergence: there could be no more than seven days between the last spring location when a bear was still in the den (LID) and the date when a bear had emerged (OD). We estimated the dates of den entry and exit as (FID-PD)/2 + PD and (OD-LID)/2 + LID, respectively (Schwartz et al. 1987). Bears wearing GPS collars allowed us to ascertain the exact date bears entered and exited dens because signals to satellites were disrupted when bears were physically inside dens (Ciarniello et al. 2005). We categorized den entry and exit dates by week-of-month wherein the first 3 weeks of each month were 7 days long while the fourth week varied between 9 and 10 days. We classified females in the fall as either parturient (pregnant), solitary adults, adults with dependent young, or subadults (< 5 years old).

Results

The timing of fall den entry was based on 65 events from 52 (44 ad, 8 subad) female grizzly bears between the denning years 1987-88 and 2012-13. We obtained 31 (47.6%), 19 (29.2%), and 15 (23.1%) cases from GPS collars, from Argos collar downloads, and from VHF-collared bears respectively. Females entered their dens

between the 1st week Oct. and the 4th week Nov (Fig. 3). Most den entries (26.1%) occurred during the 4th week Oct. Eighty-six percent of the fall den entries had occurred by the 2nd week Nov. The mean week of den entry was the 1st wk Nov.

We evaluated 101 cases of spring den emergence from 72 (58 ad, 14 subad) females between 1988 and 2013. Forty-five (44.5%), 29 (28.7%), and 27 (26.7%) cases were obtained from downloaded GPS collars, Argos collars, and from aerial telemetry fixes from VHF-collared bears, respectively. Females emerged from their dens between the 3rd wk Mar and the 4th wk May (Fig. 3). Most den exits occurred (21.7%) during the 2nd week Apr. Eighty-six percent of the emergence cases had occurred by the 4th week Apr. The mean week of den emergence was the 2nd wk Apr.

We obtained 52 cases from 43 females (38 ad, 5 subad) where both den entry and exit dates met our criterion for a single denning event. Twenty-seven (52.0%), 16 (31.0%), and 9 (17.0%) cases were obtained from downloaded gps collars, Argos collars, and from vhf-collared bears, respectively. When pooled, females denned an average of 158 days (-95% CI =153, +95% CI=163. We knew the age and reproductive status of females in 50 instances. Parturient females did not remain in dens longer than other classes of females ($F=0.87, 4, P=0.49$) (Table 2). We had insufficient data to evaluate whether duration of the denning period varied over time.

We documented three female grizzly bear dens in short-grass prairie habitat along the eastern front of the Rocky Mountains. During the winter of 2009-10, an adult female gave birth to three cubs in the bank of a river at 1393 m, approximately 11 km east of the mountains. This bear was known to den in the mountains 2 years later.

During 2012-13, two females gave birth to two cubs each in prairie-foothills habitat. One of these females denned at 1464 m in short-grass prairie approximately 28 km from the mountains (Fig. 4) while the other denned approximately 10 km east of the mountains at 1746 m in an open-timbered glacial moraine.

Fig. 3. Week of den entry and exit for female grizzly bears in the NCDE of Montana.

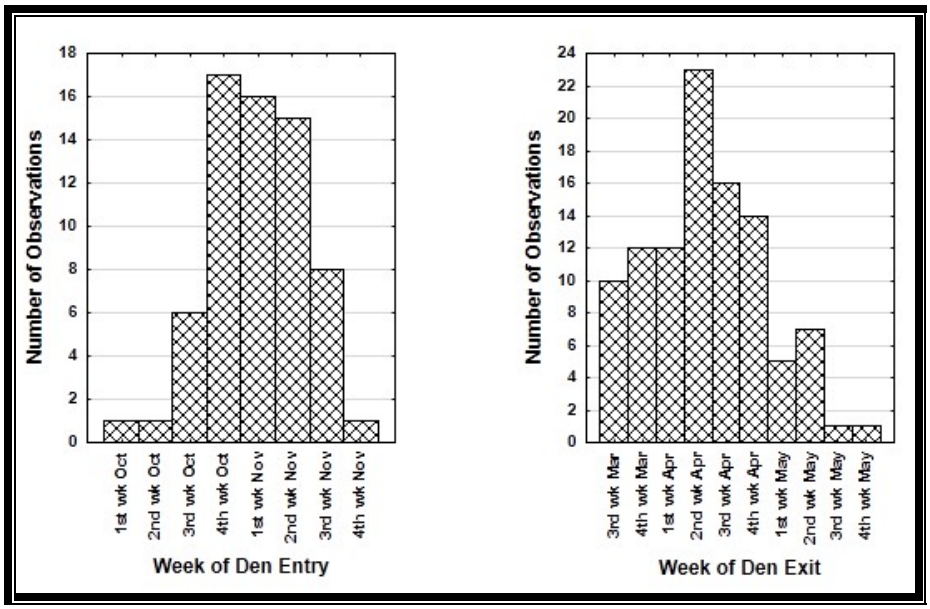


Fig. 4. Photograph of a maternal female grizzly bear den (inset) on the short-grass prairie approximately 28 km east of the Rocky Mountains (background), Montana.

Grizzly Bear Mortalities in the NCDE; 2014

Twenty-one known or probable grizzly bear mortalities (Fig. 5) were tallied in the NCDE in 2014 (Appendix E), all of which were within 10 miles of the NCDE federal recovery zone. Two additional bears died outside of the 10 mile buffer that were known or suspected to have lived partially within the NCDE boundary. The first of these, male AVID# 079575279, was shot in the Little Thompson River area near the Cabinet/Yaak Ecosystem. This bear was first captured in southern British Columbia in 2007, and was recaptured at a livestock depredation site within the NCDE in April 2014. The second bear, an unmarked adult female, was apparently struck by a train west of Dixon Montana.

Within the 10 mile mortality buffer, 7 independent females and 2 independent males died in 2014 (Table 7). Six dependent young were known to have died during the year. There were 3 agency removals in 2014, 2 of which were subadult female augmentations from the North Fork Flathead River area to the CYE (Table 8). Two mortalities were due to automobile collisions both of which were female bears. Four mortalities were due to either poaching or malicious causes. Four marked females were known to die within the NCDE in 2014 (AVID# 08127926, 064054290, 011040108, and 071816812). One unmarked male bear died of natural causes in Glacier National Park. One independent-aged whose gender is not known also died sometime during the fall of 2014. In this instance, a person found the front leg of a grizzly bear on a snow-covered road that had been dropped by wolves. A genetic sample to determine the gender was collected.

Table 7. Age and sex of grizzly bears (known and probable) that died within the 10 mile buffer of the NCDE recovery zone in 2014.

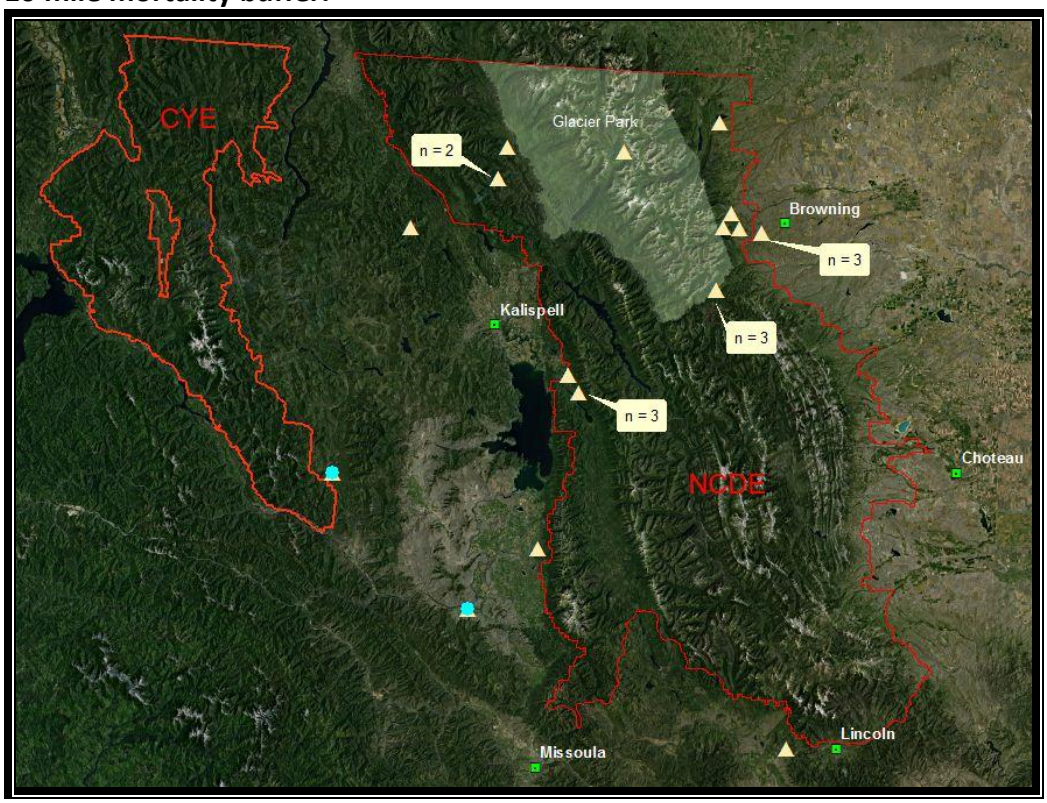
Sex	Ageclass				Total
	Subadult	Adult	Cub	Yearling	
Male	0	2	0	2	4
Female	4	7	0	0	11
Unknown	1	1	3	1	6
Total	5	10	3	3	21

Table 8. Cause of death for 21 known and probable grizzly bear mortalities within 10 miles of the NCDE boundary; 2014.

Primary Cause of mortality	Secondary cause of mortality	Gender			Total
		M	F	Ukn	
Agency Removal	Augmentation	0	2	0	2
Agency Removal	Livestock Depredation	1	0	0	1
Defense of Property		0	2	2[c]	4
Defense-of-life		0	2	0	2
Automobile		0	2	0	2
Poached/Malicious		2[b]	2	0	4
Orphaned		0	0	2[a]	2
Natural		1	0	1[a]	2
Capture-related		0	1	0	1
Undetermined		0	0	1	1

[a] Cub.
[b] Yearling.
[c] one unknown was a yearling.

Fig. 5. Location of all known or probable grizzly bear mortalities relative to the NCDE and CYE recovery zones; 2014. Mortalities depicted by blue dot occurred outside the 10 mile mortality buffer.



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Appendix A. Fate of radioed research females in 2014.

Bear Id	Fate	Location
11111	alive	B.C.
238	alive	B.C.
263	alive	B.C.
81279315	alive	BIR
76553865	alive	East Front
39088856	alive	East Front
39036349	alive	East Front
51071845	censor	East Front
18078025	censor	FIR
76361015	alive	Glacier Park
36554783	alive	Glacier Park
79589512	alive	Glacier Park
55588561	alive	Middle Fork
55599346	censor	Middle Fork
97630806	alive	N.F. Flathead
107585006	censor	N.F.Flathead
79570382	censor	N.F.Flathead
36558355	alive	N.F.Flathead
11048792	alive	N.F.Flathead
36547078	alive	S.F.Flathead
79050043	alive	S.F.Flathead
51586884	alive	South end
55597781	alive	South end
55588533	alive	South end
64054290	DEAD	South end
11052060	alive	South Fork
11087071	alive	South Fork
11060268	alive	Swan Valley

Appendix B. Fate of radioed management females in 2014.

Bear Id	Fate	Location
79604804	censor	BIR
39888030	alive	East Front
39087310	alive	East Front
18112314	alive	FIR
18119870	alive	FIR
11032039	alive	Flathead Valley
10874562	alive	Flathead Valley
82018000	censor	Flathead Valley
14592298	censor	Flathead Valley
107794628	alive	N.F. Flathead
55586851	alive	Swan Valley

Appendix C. Fate of radioed male grizzly bears in 2014.

Bear Id	Fate	Location
39071057	alive	East Front
18094085	alive	FIR
55599288	alive	South Fork
11007022	alive	BIR
93583873	alive	North Fork
11065593	alive	BIR
11066819	alive	BIR
10885078	alive	South End
11031601	alive	North Fork
39082589	censor	East Front
39875815	censor	East Front
79595821	censor	BIR
39072276	censor	East Front
79575279	DEAD	Salish
39073309	unresolved	East Front

Appendix D. Reproductive status of research females radio-monitored in the NCDE; 2014.

Bear id	Reproductive status in 2014
238	Solitary adult
263	2 yearlings
11111	1 cub
11048792	2 yearlings
11052060	Solitary adult
11060268	1 cub
11087071	2 cubs
18078025	Solitary adult
36547078	2 yearlings
36554783	3_2 year olds
36558355	Subadult
39036349	Solitary adult
39088856	at least 2 cub
51071845	lost cub litter unknown size
51586884	2 yearlings
55588533	Solitary adult
55588561	2 cubs
55597781	Subadult
55599346	1 cubs
64054290	2 cubs
76361015	3 cubs
76553865	1_2 year olds
79050043	1_2 year old
79570382	2_2 year olds
79589512	Solitary adult
81279315	2 yearlings
97630806	2 cubs
107585006	2 cubs

Appendix E. Summary of known or probable grizzly bear mortalities within 10 miles of the NCDE recovery zone during 2014 .

Date	Date Accuracy	Tag #	Ageclass	Sex	Cause	Certainty
04/18/2014	that day		adult	M	Livestock Depredation	Known
05/22/2014	that day		adult	M	Natural	Known
08/07/2014	that day	81279261	adult	F	Poached/Malicious	Known
09/10/2014	that day	64054290	adult	F	Automobile	Known
09/14/2014	that day	11040108	adult	F	Capture Mortality	Known
09/26/2014	that day	71816812	adult	F	Automobile	Known
10/20/2014	that day		adult	F	Defense of Life	Known
10/27/2014	that day		adult	F	Defense of Life	Known
11/11/2014	that day		adult	F	Poached/Malicious	Known
7/31/2014	sometime in fall		adult	Ukn	Undetermined	Known
07/31/2014	within a week		Cub	Ukn	Natural	Known
10/27/2014	that day		Cub	Ukn	Orphaned	Known
10/27/2014	that day		Cub	Ukn	Orphaned	Known
05/27/2014	that day		subadult	F	Defense of Property	Known
05/27/2014	that day		subadult	F	Defense of Property	Known
05/27/2014	that day		subadult	Ukn	Defense of Property	Known
06/18/2014	that day		subadult	F	Augmentation	Known
06/18/2014	that day		subadult	F	Augmentation	Known
05/11/2014	that day		yearling	Ukn	Defense of Property	Known
08/07/2014	that day		yearling	M	Poached/Malicious	Known
08/07/2014	that day		yearling	M	Poached/Malicious	Known