NORTHERN CONTINENTAL DIVIDE ECOSYSTEM

GRIZZLY BEAR POPULATION MONITORING TEAM

ANNUAL REPORT – 2019

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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.

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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-marked grizzly bears with the Demographic Monitoring Area (DMA). The DMA is composed of the Primary Conservation Area (PCA; equivalent to the Recovery Zone) and Zone 1 (a buffer area around the PCA). This report summarizes field accomplishments during 2019. During 2019, we captured 28 grizzly bears (13F, 15M) for trend monitoring. An additional 40 bears (16F, 24M) were captured for management or other purposes. Including bears captured in previous years, we monitored 73 bears (50F, 23M) with radio-telemetry for research or management. We documented the deaths of 8 radio-marked bears (3F, 5M). All radio-marked deaths involved bears captured for management. Reproductive status was documented for 28 radio-marked adult females and included 9 with cubs, 8 with yearlings, 3 with 2-year-old offspring, and 7 with no offspring. Survival of accompanying dependent offspring was monitored for 10 females. We documented 4 known or presumed mortalities among 5 cub litters and 2 known mortalities among 5 yearling litters. Including unmarked bears, 51 known or probable mortalities of grizzly bears were documented within the NCDE population. We evaluated various demographic parameters relative to thresholds set forth in the 2018 Conservation Strategy. During the 6-year period of 2014–2019, 22 of 23 BMUs within the PCA and all 7 OUs within Zone 1 were occupied by females with offspring during at least one year, above the minimum thresholds of 21 BMUs and 6 OUs. For the 6-year period 2014–2019, we estimated an annual survival rate of 0.94 (± 0.01 SE) for independent females within the DMA, above the minimum threshold rate of 0.93. Within the DMA, we documented 12 and 17 mortalities of independent (≥2 years old) bears for females and males, respectively. From these, we estimated 16 total reported and unreported (TRU) mortalities for independent females and 26 TRU mortalities for independent males. During 2014–2019, the 6-year average of TRU mortalities for independent females within the DMA was 16, which fell below the maximum threshold of 23. The 6-year average for independent males was 21, which fell below the maximum threshold of 29. Based on radio-monitoring or genotypes for bears sampled through 2018, we found no new evidence of immigration from the Cabinet-Yaak or Selkirk Ecosystems. To date, we have not detected evidence of immigration into the NCDE from the Greater Yellowstone Ecosystem (GYE) or emigration from the NCDE into the GYE.

TABLE OF CONTENTS

1. Introduction and Statement of Need 1
2. Program Objectives 1
3. Geographic Scope of Monitoring Program 2
4. Field Activities 3
   Methods 3
   Results 4
5. Conservation Strategy Objectives and Thresholds 6
   Methods 7
   Results 8
6. Literature Cited 11

LIST OF APPENDICES

Appendix A. Fate of radio-marked grizzly bears monitored with radio-telemetry in the NCDE, 2019 12

Appendix B. Observed reproductive status and fate of offspring for adult female grizzly bears monitored with radio-telemetry in the NCDE, 2019 14

Appendix C. Summary of known and probable grizzly bear mortalities in the NCDE, 2019 15

Appendix D. Observed occupancy of 23 Bear Management Units within the PCA and 7 Occupancy Units within Zone 1 by female grizzly bears with offspring, 2014–2019 17

1. INTRODUCTION AND STATEMENT OF NEED

The grizzly bear (*Ursus arctos horribilis*) was 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; population size during 2004 was estimated to be 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 (MFWP), 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 primarily by radio-monitoring grizzly bears, particularly females.

2. 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 of radio-transmitted grizzly bears. 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:

- population trend,
- grizzly bear survival rates,
- grizzly bear reproductive rates,
- grizzly bear movements and habitat selection,
- grizzly bear distribution in western Montana,
- mortality levels in the NCDE, and
- levels of unreported mortality.

The 2018 Conservation Strategy detailed demographic monitoring protocols and management objectives developed by an interagency team to maintain and enhance a recovered grizzly bear population in the NCDE. It set forth 3 demographic objectives and associated thresholds. Although the Conservation Strategy is intended to take effect upon removal of the NCDE grizzly bear population from threatened status under the Endangered Species Act, the objectives and thresholds represent the most recent monitoring methodologies, therefore we report on these objectives using field data obtained through 2019.

3. GEOGRAPHIC SCOPE OF THE MONITORING PROGRAM

Our trend monitoring program is focused within the Demographic Monitoring Area (DMA; Fig. 1), which encompasses the 23,119-km^2 Primary Conservation Area (PCA: equivalent to the Federal Recovery Zone) and the 19,460-km^2 Zone 1, which roughly correlates to a 10-mile buffer surrounding the PCA (USFWS 1993, NCDE Subcommittee 2018). The DMA includes Glacier National Park, parts of five National Forests (Flathead, Helena, Kootenai, Lewis and Clark, and Lolo); parts of the Blackfeet and Flathead Reservations; Bureau of Land Management lands; state lands, and private lands. The NCDE grizzly bear population is also contiguous with those in the Canadian provinces of British Columbia and Alberta, therefore some captures and monitoring occur north of the United States in Canada. Within the DMA, we designated 9 subunits for localized analyses, based on distinct land ownerships and grizzly bear population management authorities.

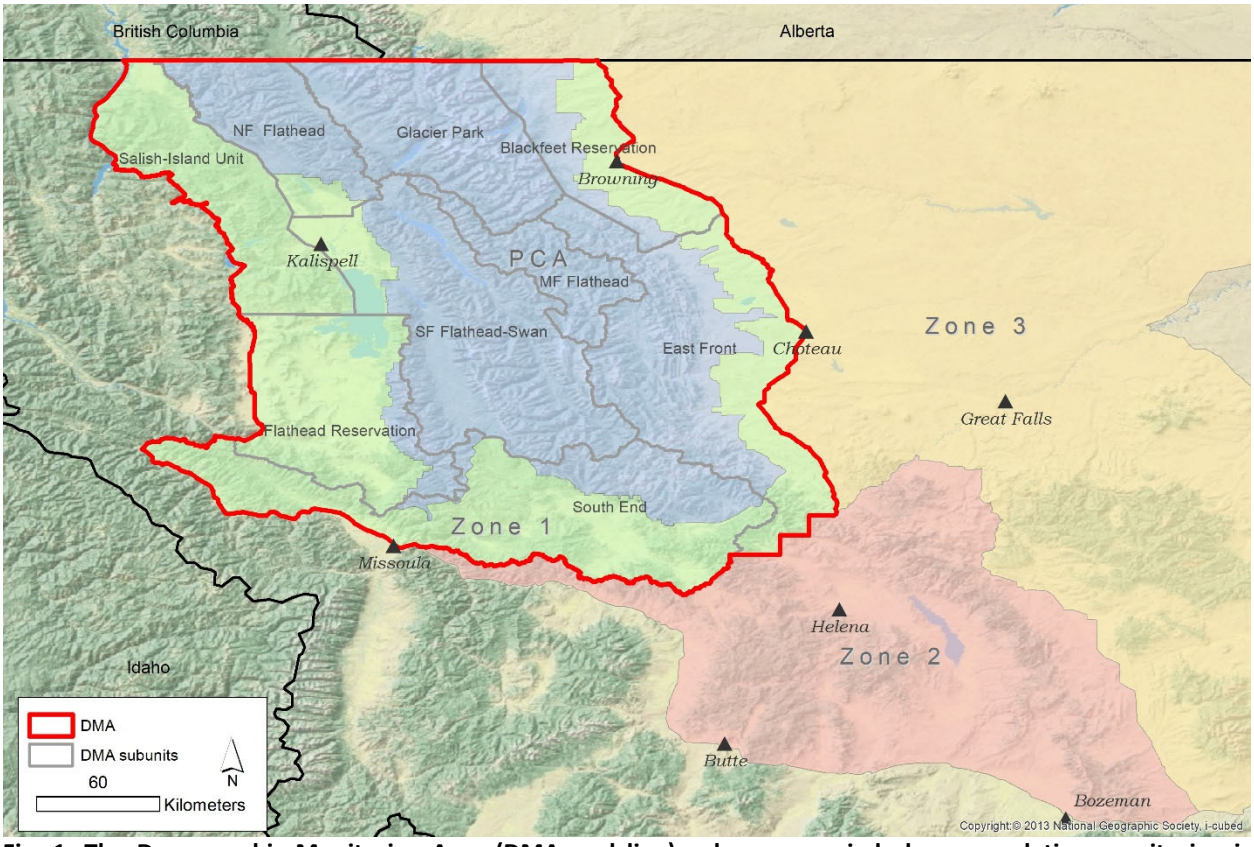

Fig. 1. The Demographic Monitoring Area (DMA; red line), where our grizzly bear population monitoring is conducted, consists of the Primary Conservation Area (PCA; blue) and Zone 1 (green). The DMA is divided into subunits (gray lines) for localized population analyses. Zone 2 (pink) is the area of potential genetic connectivity between the NCDE and the Greater Yellowstone Ecosystem. Zone 3 (orange) is an area occupied by grizzly bears which does not provide habitat linkage to other populations.

Although our focus for trend monitoring is the DMA, we also document mortalities and other observations outside of the DMA. Notable areas include: Zone 2, an area of potential connectivity between the NCDE and the Greater Yellowstone Ecosystem (GYE); and Zone 3, an area occupied by grizzly bears which does not provide habitat linkage to other grizzly bear populations (NCDE Subcommittee 2018).

4. FIELD ACTIVITIES

Methods

Each year, we capture grizzly bears primarily using leg-hold snares and culvert traps. We follow 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 tag all bears subcutaneously with passive transponder tags and pull a pre-molar tooth for age determination (Stoneberg and Jonkel 1966). We radio-mark most females and a sample of males using a variety of transmitters, including: very high frequency (VHF) neck-mounted collars (Telonics, Inc., Mesa, AZ); VHF ear-tag transmitters (Advanced Telemetry Systems, Inc., Isanti, MN); store-on-board global positioning system (GPS) collars (TGW-4500; Telonics, Inc.); Argos GPS collars (Models TGW-3580 and TGW-3583; Telonics, Inc.); spread-spectrum GPS collars (TGW-3690; Telonics, Inc.), and Iridium GPS collars (TGW-4570-3; Telonics, Inc.). We capture research bears throughout the study area. We attempt to distribute our sample of research females in proportion to relative grizzly bear density, based on the distribution of female bears detected at DNA hair traps in 2004 (Kendall et al. 2009). Grizzly bears are also captured and radio-marked for management purposes. Individual bears are classified as either research bears or management bears using the terminology of Mace et al. (2012).

We monitor survival and reproduction using aerial telemetry flights conducted monthly and by remote downloads of GPS data. We attempt to investigate mortality signals within 2 weeks to ascertain whether the bear died or shed its collar. If a dead bear is found, we conduct preliminary necropsies in the field and collect relevant samples for laboratory analyses. In early spring, when bears are beginning to emerge from dens, we conduct observation flights for adult female bears to ascertain reproductive status, and age of offspring and litter size (if present). We continue to conduct monthly telemetry flights throughout the active season, when possible, to document survival of dependent offspring.

We record and report known and probable mortalities of marked and unmarked grizzly bears each year. Known mortalities involve a carcass or parts which substantiate death; probable mortalities lack a carcass but involve strong evidence that a bear died (e.g., blood loss).

Results

In 2019, we captured 70 individuals during 77 capture occasions (7 recaptures). We captured 28 individuals for trend monitoring purposes (Table 1), including 13 females and 15 males. Eleven females and 2 males were fitted with radio-transmitters. In addition to research captures, bears were captured in association with management actions, although some were non-target individuals. These captures included 16 females and 24 males, and 10 females and 9 males were fitted with radio-transmitters. Trapping for individuals to augment the population in the Cabinet-Yaak Ecosystem (CYE) was also conducted during 2019. One male and one female were captured and translocated to the CYE.

Including bears collared during previous years, we radio-monitored 50 independent female grizzly bears during all or part of 2019: 28 females monitored for trend research and 22 females monitored for bear-human conflict management. We also radio-monitored 1 cub for management. We radio-monitored 23 independent males during 2019: 7 for trend research and 18 for conflict management. We documented the deaths of 3 radio-marked females during 2019: 1 automobile collisions and 2 agency removals. We documented the deaths of 5 radio-marked males during 2019: 2 agency removals and 3 from undetermined cause. All radio-marked deaths involved bears captured for management purposes. No deaths were documented among the research sample. A summary of the fates of radio-marked bears during 2019 are presented in Appendix A.

We recorded the reproductive status of 28 adult females during 2019, including 9 with cubs, 8 with yearlings, 3 with 2-year-old offspring, and 7 with no offspring. First observations for reproductive status ranged from March 14 (ground observation) to October 7 (new capture) and averaged June 4. We documented 5 litters with 1 cub, 3 litters with 2 cubs, and 1 litter with 3 cubs. First observations for these litters ranged from April 16 (flight observation) to October 7 (new capture). Mean date of first verified litter size was June 19. We monitored survival of 5 cub litters (9 cubs) and 5 yearling litters (9 yearlings) through repeated observations during the year. We documented 4 presumed or known cub mortalities and 2 known yearling mortalities. A summary of the reproductive observations of radio-marked females are presented in Appendix B.

Fifty-one known or probable grizzly bear mortalities were documented in the NCDE during 2019 (Table 2). Forty-six occurred within the DMA: 26 inside the PCA and 20 within Zone 1 (Fig. 2). Seven mortalities occurred outside the DMA: 3 in Zone 3 and 2 in Canada. The two mortalities in Canada were included because they were bears captured and radio-marked in Montana and were collared at the time of death. Among 33 mortalities of independent bears, causes of death were: agency removal due to conflict (14); agency removal for augmentation of the Cabinet-Yaak populations (2); agency humane

removal (1); agency handling mortality (1); defense of life kill (2); automobile collision (3); poaching/malicious kill (1); train collision (4); and undetermined or under investigation (5). Eighteen dependent bear mortalities included individuals that died, individuals that were orphaned and then captured and moved to zoos, or cubs that were orphaned and assumed dead (if fate is unknown, cubs are assumed dead). Causes of death were: automobile collision (4); train collision (4); agency removal due to conflict (4); agency removal due to orphaning (2); assumed dead due to orphaning (1); natural (2); and illegal defense of property (1). Two mortalities documented in 2019 involved orphaned offspring that were originally counted as probable mortalities in 2018. There were an additional 2 mortalities that were discovered or reported in 2019, but occurred in 2018. These included an adult that died of undetermined cause and a yearling male killed in defense of life. A summary of all documented mortalities in the NCDE during 2019 is reported in Appendix C.

Table 1. Number of individual grizzly bears captured and fitted with radio-transmitters in the NCDE, 2019.

	Captured			Radio-marked		
Type	Female	Male	Total	Female	Male	Total
Research	13	15	28	11	2	13
Management	16	24	40	10	9	19
Augmentation	1	1	2	0	0	0
Total	30	40	70	21	11	32

Table 2. Number of documented known or probable mortalities of grizzly bears in the NCDE, 2019.

		Sex			
	Ageclass	Female	Male	Unknown	Total
Inside DMA	Dependent	7	8	2	17
	Independent	11	15	3	29
	Total	18	22	5	46
Outside DMA	Dependent	1	0	0	1
	Independent	0	4	0	4
	Total	1	4	0	5

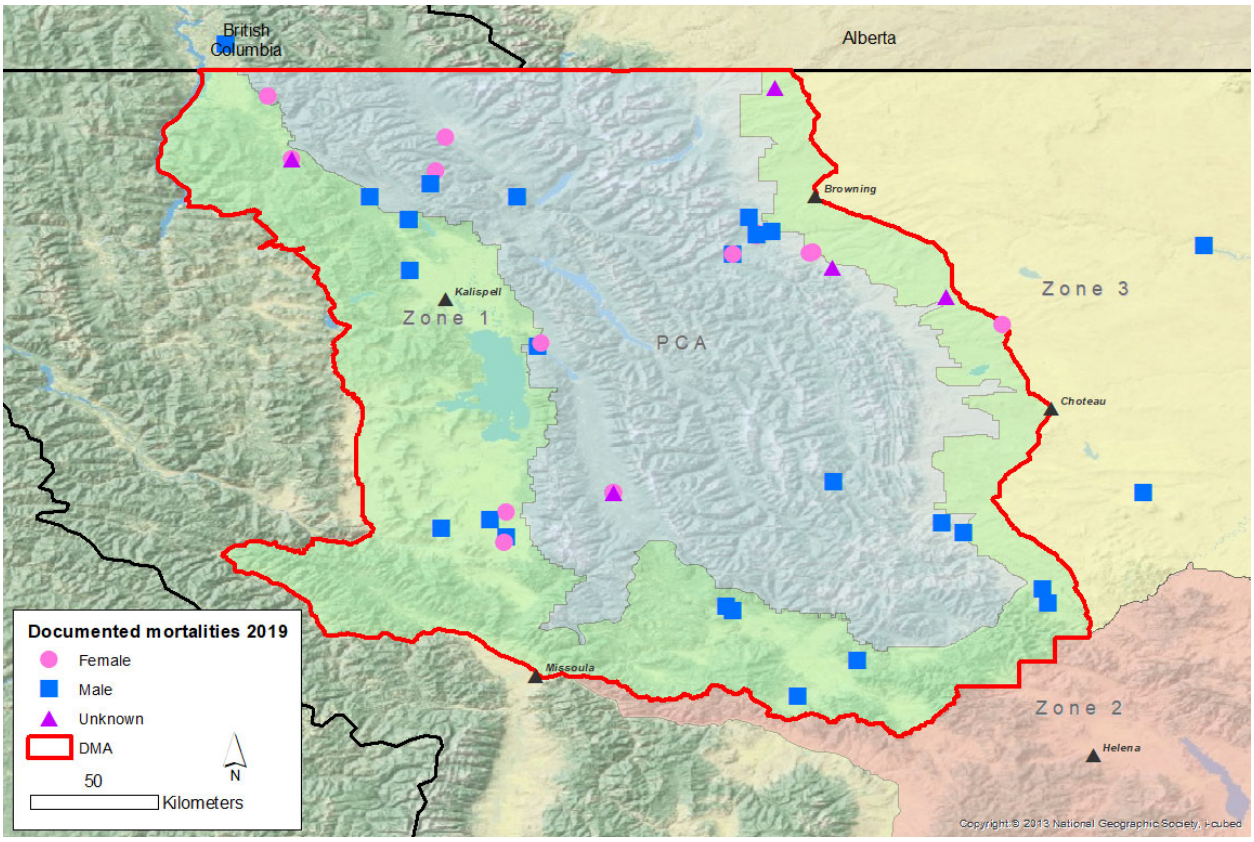

Fig. 2. Location of known and probable grizzly bear mortalities in the NCDE, 2019. Zones as described in Fig. 1.

5. CONSERVATION STRATEGY OBJECTIVES AND THRESHOLDS

The NCDE Conservation Strategy (NCDE Subcommittee 2018) articulated an overarching management goal to maintain a recovered, genetically diverse grizzly bear population throughout the DMA while maintaining demographic and genetic connections with Canadian populations and providing the opportunity for demographic and/or genetic connectivity with other ecosystems, with the following objectives and thresholds:

Objective 1: Maintain a well-distributed grizzly bear population within the DMA

- Occupancy threshold: Maintain the documented presence of females with offspring in at least 21 of 23 BMUs of the PCA and in at least 6 of 7 occupancy units of Zone 1 at least every 6 years.

Objective 2: Manage mortalities from all sources to support a ≥90% estimated probability that the grizzly bear population within the DMA remains above 800 bears, considering the uncertainty associated with all the demographic parameters.

- Independent female survival threshold: Using a 6-year running average, maintain estimated annual survival of independent females within the DMA to: (a) a rate of ≥ 0.90; and (b) a rate at or above the minimum level consistent with a projected ≥90% probability that the population within the DMA will remain above 800 bears based on population modeling.
- Independent female mortality threshold: Using a 6-year running average, limit annual estimated number of total reported and unreported (TRU) mortalities of independent females within the DMA to: (a) a number that is ≤10% of the number of independent females estimated within the DMA based on population modeling; and (b) a number that is at or below the maximum level consistent with a projected ≥90% probability that the population within the DMA will remain above 800 bears based on population modeling.
- Independent male mortality threshold: Using a 6-year running average, limit annual estimated number of TRU mortalities of independent males within the DMA to a number that is ≤15% of the number of independent males estimated within the DMA based on population modeling.

Objective 3: Monitor demographic and genetic connectivity among populations

- Estimate spatial distribution of the NCDE grizzly bear population biennially.
- Identify the population of origin for individuals sampled inside and outside of the DMA to detect movements of individuals to and from other populations or recovery areas.

Methods

Each year, we document presence of females with cub, yearling, or 2-year-old offspring within units, based on visual observations obtained from radio-marked females; verified remote camera photos; other verified visual observations; known or probable mortalities of family units (death of the mother, dependent young, or both); and telemetry or GPS locations of radio-marked females known to have offspring. The PCA component of the threshold represents a continuation of the occupancy targets established within the Recovery Zone prior to delisting (USFWS 1993) and utilizes the same BMUs (Fig. 3). The Zone 1 component utilizes Occupancy Units (OUs) demarcated using established political boundaries (i.e., state/tribal boundaries and FWP regional boundaries) and the boundaries of the two Demographic Connectivity Areas (NCDE Subcommittee 2018).

We estimate survival of independent females within the DMA based on known-fate analysis of data collected from radio-marked female bears within the DMA (Costello et al. 2016). Analysis incorporates the time series of survival data from known-fate monitoring since 2004 and differentiates the most recent 6 years of data to compare to the threshold. Based on the number of known and probable mortalities recorded each year, and the human reporting rate observed among radio-marked bears (Costello et al. 2016), we estimate numbers of TRU mortalities of independent female and male grizzly bears within the DMA and assess the female and male mortality thresholds using an average for the last 6 years. We previously developed thresholds for a 6-year management period during 2019–2023 (NCDE Subcommittee 2018). Thresholds were developed by simulating population growth using current estimates of vital rates (Costello et al. 2016) to year 2012 and then projecting another 25 years to predict effects of changing female and male independent bear survival. Under this scenario, and assuming selection of a 6-year management period of 2019–2023, the minimum threshold for independent female survival was 0.93, the maximum threshold for the number of independent female mortalities was 23, and the maximum threshold for the number of independent male mortalities was 29.

We estimate the distribution of the NCDE grizzly bear population biennially, by applying zonal analysis and ordinary kriging (Bjornlie et al. 2014) to 7-km x 7-km cells with verified grizzly bear locations documented during a 10-year window up to the current year. Verified locations are collected from GPS transmitters; VHF telemetry flights; capture and mortality locations; grizzly bear-human conflict sites; observations (sightings or tracks) or remote camera photos confirmed by agency personnel; and opportunistic samples of grizzly bear hair, blood, scat, or tissue confirmed by DNA analysis. DNA samples obtained during captures or at any of verified grizzly bear sites are analyzed for population of origin to document movement of individuals to and from other populations or recovery areas (Haroldson et al. 2010). Genetic samples are not submitted until the end of each field season and take some time to analyze, therefore there is typically a 1-year lag in reporting results for population of origin.

Results

During 2019, we verified presence of reproductive females within 18 of 23 BMUs (78%) and within 7 of 7 supplementary BMUs (100%; Fig. 3). For the 6-year period 2014–2019, 22 of 23 BMUS were occupied by females with offspring, thus exceeding the objective of 21 of 23 BMUs occupied (Appendix D). All OUs were occupied during the last 6 years, exceeding the objective of 6 of 7 OUs occupied. Using the 6-year tally, the occupancy thresholds for the PCA and Zone 1 have been met each year since 2006.

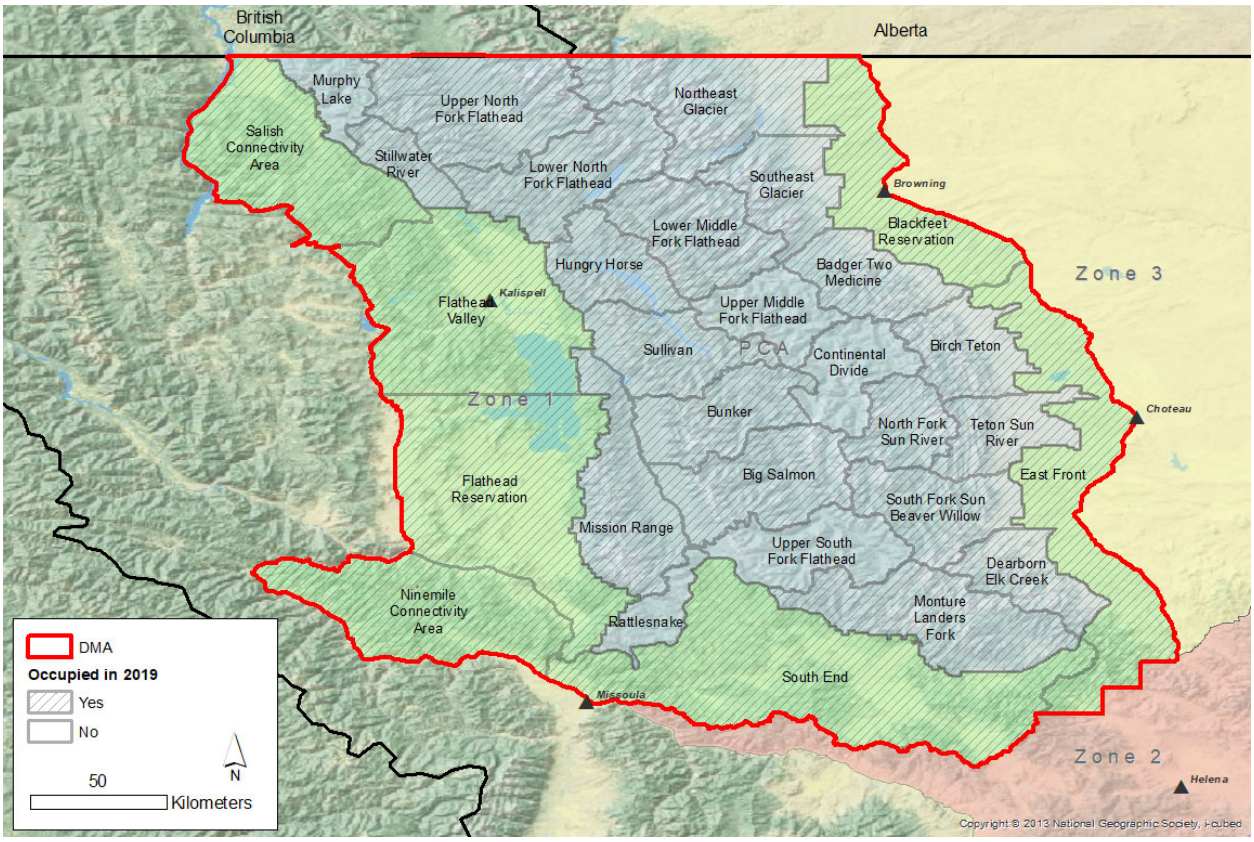

Fig. 3. Documented occupancy of female grizzly bears with offspring in 23 BMUs of the PCA and 7 OU of Zone 1 during 2019. Occupancy has been documented in all units during the last 6 years, except for the Continental Divide BMU in the Bob Marshall Wilderness. Zones as described in Fig. 1.

For the 6-year period 2014–2019, we estimated an annual survival rate of 0.94 (± 0.01 SE) for independent females within the DMA, which meets the minimum threshold rate of 0.93 (Fig. 2; NCDE Subcommittee 2018).

Within the DMA, there were 12 and 17 known mortalities reported for independent females and independent males, respectively (Fig. 2). We estimated the number of total reported and unreported (TRU) mortalities of independent bears within the DMA using these numbers and the reporting rates observed among radio-marked bears. We estimated 16 TRU mortalities of independent females and 26 TRU mortalities of independent males within the DMA (Table 3). During 2014–2019, the 6-year average of TRU mortalities for independent females within the DMA was 16, which falls below the maximum threshold of 23 (NCDE Subcommittee 2018). The 6-year average for independent males was 21, falling

below the maximum threshold of 29 (NCDE Subcommittee 2018). An updated summary of all demographic parameters documented during the 6-year period 2014–2019 are reported in Appendix E.

The biennial population distribution analysis was completed for the 2018 report, therefore we did not update the analysis for this report. Based on genotypes for bears sampled through 2018 (genotypes from 2019 are not yet available), we have not detected evidence of immigration into the NCDE from the GYE or emigration from the NCDE into the GYE.

Table 3. Summary of independent grizzly bear mortalities within the DMA, NCDE, 2019.

	Documented mortalities by method of discovery				Estimated reported and unreported[e]	Estimated total mortality
Sex	Agency removal[a] (A)	Telemetry[b] (B)	Reported[c] (high)	Reported[d] (low)	(C)	(A + B + C)
Female	5	1	5	1	10	16
Male	11	1	3	2	14	26
Total	16	2	8	3	24	42

[a] Count of agency-sanctioned removals, including those involving radio-marked bears

[b] Count of deaths for bears wearing functional radio-transmitters, except for agency removals

[c] Count of non-radioed bear deaths reported by the public or discovered by agency personnel with high reporting rates (illegal defense-of-property, defense-of-life, train collision, automobile collisions, illegal hunting-misidentification)

[d] Count of non-radioed bear deaths reported by the public or discovered by agency personnel with low reporting rates (poaching/malicious, natural, undetermined)

[e] Bayesian estimate of the total number of reported and unreported deaths of non-radioed bears, predicted from the number of reported deaths of non-radioed bears in the high- and low-reporting rate categories (as per Cherry et al. 2002 and Costello et al. 2016).

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Appendix A. Fate of radio-marked grizzly bears monitored with radio-telemetry in the NCDE, 2019.

Sex	Capture type	DMA subunit	Bear ID	Fate
Female	Research	Blackfeet Reservation	81289535	Censored
Female	Research	Blackfeet Reservation	81278116	Alive
Female	Research	Blackfeet Reservation	839821018	Censored
Female	Research	Blackfeet Reservation	839845540	Alive
Female	Research	East Front	41375278	Censored
Female	Research	Flathead Reservation	41299353	Censored
Female	Research	Flathead Reservation	41519364	Alive
Female	Research	Flathead Reservation	79558051	Censored
Female	Research	Flathead Reservation	79558279	Alive
Female	Research	Flathead Reservation	41089770	Censored
Female	Research	Glacier National Park	10876305	Alive
Female	Research	Glacier National Park	36554783	Alive
Female	Research	Glacier National Park	41078883	Alive
Female	Research	Glacier National Park	41515561	Alive
Female	Research	Glacier National Park	839846062	Alive
Female	Research	Glacier National Park	842018043	Alive
Female	Research	Multiple subunits	839828530	Censored
Female	Research	Multiple subunits	839822818	Alive
Female	Research	North Fork Flathead	11052544	Alive
Female	Research	North Fork Flathead	67006850	Censored
Female	Research	North Fork Flathead	79570382	Alive
Female	Research	North Fork Flathead	601618304	Alive
Female	Research	South End	11018035	Alive
Female	Research	South End	11065603	Alive
Female	Research	South Fork Flathead River-Swan Valley	55598849	Alive
Female	Research	South Fork Flathead River-Swan Valley	79050043	Censored
Female	Research	South Fork Flathead River-Swan Valley	839826876	Alive
Female	Research	South Fork Flathead River-Swan Valley	601609326	Alive
Female	Research	South Fork Flathead River-Swan Valley	839839014	Alive
Female	Management	Blackfeet Reservation	11044088	Alive
Female	Management	Blackfeet Reservation	41090260	Alive
Female	Management	Blackfeet Reservation	81279041	Censored
Female	Management	Blackfeet Reservation	839823853	Alive
Female	Management	Blackfeet Reservation	839824884	Alive
Female	Management	Blackfeet Reservation	839828868	Censored
Female	Management	Blackfeet Reservation	839841332	Censored
Female	Management	East Front	39086301	Censored
Female	Management	East Front	39088331	Alive
Female	Management	East Front	41532565	Alive
Female	Management	East Front	41623606	Alive
Female	Management	Multiple subunits	41261364	Dead
Female	Management	Multiple subunits	839825532	Alive

Sex	Capture type	DMA subunit	Bear ID	Fate
Female	Management	North Fork Flathead	11032039	Censored
Female	Management	North Fork Flathead	55577095	Censored
Female	Management	Outside DMA	81289829	Censored
Female	Management	Outside DMA	839815522	Censored
Female	Management	Outside DMA	839825561	Alive
Female	Management	South Fork Flathead River-Swan Valley	41379363	Censored
Female	Management	South Fork Flathead River-Swan Valley	841893590	Alive
Female	Management	South Fork Flathead River-Swan Valley	842005026	Dead
Female	Management	South Fork Flathead River-Swan Valley	839828828	Dead
Male	Research	East Front	41360823	Censored
Male	Research	East Front	41638038	Censored
Male	Research	East Front	41779283	Alive
Male	Research	Glacier National Park	11022885	Censored
Male	Research	South End	41086114	Alive
Male	Research	South End		Censored
Male	Research	South Fork Flathead River-Swan Valley	41382533	Censored
Male	Management	Blackfeet Reservation	11003083	Dead
Male	Management	Blackfeet Reservation	41365620	Censored
Male	Management	Blackfeet Reservation	839824321	Alive
Male	Management	Blackfeet Reservation	11009019	Alive
Male	Management	East Front	41546593	Alive
Male	Management	North Fork Flathead River	80626085	Censored
Male	Management	North Fork Flathead River	55576046	Dead
Male	Management	North Fork Flathead River	601608324	Dead
Male	Management	North Fork Flathead River	601619778	Alive
Male	Management	Outside DMA	11029050	Dead
Male	Management	Outside DMA	839841348	Censored
Male	Management	Outside DMA	839820364	Alive
Male	Management	Outside DMA	839832101	Censored
Male	Management	Outside DMA	839843617	Alive
Male	Management	South End	55584076	Censored
Male	Management	South Fork Flathead River-Swan Valley	601608564	Alive
Male	Management	South Fork Flathead River-Swan Valley	601620113	Dead
Male	Management	South Fork Flathead River-Swan Valley	842010334	Alive

Appendix B. Observed reproductive status and fate of offspring for adult female grizzly bears monitored with radio-telemetry in the NCDE, 2019.

Capture type	DMA subunit	Bear ID	Status	Litter size	Offspring mortality
Management	Blackfeet Reservation	11044088	Yearlings	2	
Research	Blackfeet Reservation	81278116	Cubs	1	
Research	Blackfeet Reservation	839845540	Cubs	1	
Management	Blackfeet Reservation	839841332	Yearlings	1	
Management	East Front	39086301	None		
Management	East Front	41532565	Two-year-olds	1	
Management	East Front	41623606	Cubs	1	
Research	Flathead Reservation	79558279	Yearlings	3	
Research	Glacier National Park	36554783	Cubs	2	1
Research	Glacier National Park	10876305	None		
Research	Glacier National Park	41078883	Yearlings	2	
Research	Glacier National Park	839846062	Yearlings	2	
Research	Glacier National Park	842018043	Cubs	2	
Research	Multiple subunits	839828530	None		
Management	North Fork Flathead River	11032039	Yearlings	2	2
Research	North Fork Flathead River	11052544	Two-year-olds	2	
Research	North Fork Flathead River	79570382	Two-year-olds	2	1
Research	North Fork Flathead River	601618304	Yearlings	2	
Management	Outside DMA	81289829	None		
Research	South End	11065603	Yearlings	1	
Research	South Fork Flathead River-Swan Valley	79050043	None		
Research	South Fork Flathead River-Swan Valley	839826876	None		
Management	South Fork Flathead River-Swan Valley	842005026	Cubs	1	
Research	South Fork Flathead River-Swan Valley	55598849	Cubs	1	
Research	South Fork Flathead River-Swan Valley	601609326	Cubs	2	
Management	South Fork Flathead River-Swan Valley	839828828	Cubs	3	3
Research	South Fork Flathead River-Swan Valley	839839014	None		

Appendix C. Summary of known and probable grizzly bear mortalities in the NCDE, 2019.

Date	Date accuracy	Certainty of death	DMA[1]	Sex[2]	Age Class[3]	Bear ID	Collared[1]	Cause
4/13/2019	Week	Known	Y	M	SA		N	Defense of life
4/22/2019	Day	Known	Y	F	SA		N	Capture mortality
4/23/2019	Day	Known	Y	M	SA		N	Agency (livestock)
5/1/2019	Day	Known	N	M	SA		N	Agency (livestock)
5/6/2019	Day	Known	N	F	CB		N	Automobile
5/2/2019	Day	Known	Y	M	YR	41298369[4]	N	Agency (livestock)
5/3/2019	Week	Known	Y	F	YR	601604350	N	Natural
5/12/2019	Day	Known	Y	M	SA		N	Agency (site conflict)
5/30/2019	Day	Known	Y	M	SA		N	Agency (livestock)
5/30/2019	Day	Known	Y	M	YR	79579003[4]	N	Agency (livestock)
6/1/2019	Day	Known	Y	M	AD		N	Automobile
6/6/2019	Day	Known	Y	F	AD	28517094	N	Train
6/6/2019	Day	Known	Y	M	YR		N	Train
6/6/2019	Day	Known	Y	F	YR		N	Train
6/12/2019	Day	Known	Y	M	YR	601603326	N	Agency (site conflict)
6/12/2019	Day	Known	Y	M	YR	55598300	N	Agency (site conflict)
6/14/2019	Day	Known	Y	M	CB		N	Illegal defense of property
6/5/2019	Month	Known	Y	U	SA		N	Undetermined
7/12/2019	Day	Known	Y	F	SA	72258821	N	Agency (augment)
7/14/2019	Day	Known	Y	M	SA	72107089	N	Agency (augment)
7/18/2019	Day	Known	Y	M	SA	11029050	Y	Agency (site conflict)
7/19/2019	Day	Known	N	M	SA		N	Agency (livestock)
6/15/2019	Season	Known	Y	U	SA		N	Poached/malicious
8/5/2019	Day	Known	Y	M	AD	232	N	Agency (livestock)
8/12/2019	Day	Known	Y	M	AD		N	Agency (livestock)
7/20/2019	Day	Known	Y	M	AD	11003083	Y	Undetermined
9/7/2019	Day	Known	Y	M	SA		N	Agency (site conflict)
9/10/2019	Day	Known	Y	F	AD	839828828	Y	Agency (site conflict)
9/5/2019	Day	Known	Y	F	CB	601625009	N	Agency (orphaned)
9/6/2019	Day	Known	Y	F	CB	842007844	N	Agency (orphaned)
9/10/2019	Day	Probable	Y	U	CB	839828828	N	Orphaned
9/24/2019	Day	Known	Y	F	SA		N	Automobile
9/23/2019	Day	Known	Y	M	SA		N	Agency (humane)
10/1/2019	Day	Known	Y	F	SA		N	Train
10/4/2019	Day	Known	Y	F	CB		N	Automobile
10/6/2019	Day	Known	Y	F	SA		N	Train
10/6/2019	Day	Known	Y	F	SA	41261364	Y	Automobile
10/6/2019	Day	Known	Y	M	SA		N	Train
5/14/2019	Day	Known	Y	F	AD		N	Agency (livestock)
4/18/2019	Year	Known	Y	U	SA		N	Undetermined
10/7/2019	Day	Known	Y	M	AD	11033809	N	Agency (livestock)

Date	Date accuracy	Certainty of death	DMA[1]	Sex[2]	Age Class[3]	Bear ID	Collared[1]	Cause
10/11/2019	Day	Known	N	M	SA	55576046	Y	Under investigation
10/11/2019	Day	Known	N	M	SA	601608324	Y	Under investigation
10/14/2019	Day	Known	Y	F	CB		N	Train
10/14/2019	Day	Known	Y	U	CB		N	Train
10/25/2019	Day	Known	Y	F	AD	842005026	Y	Agency (site conflict)
11/5/2019	Day	Known	Y	M	CB		N	Automobile
11/7/2019	Day	Known	Y	F	AD	41549027	N	Defense of life
11/8/2019	Day	Known	Y	M	SA	601620113	Y	Agency (site conflict)
11/9/2019	Week	Known	Y	M	CB		N	Natural
11/11/2019	Week	Known	Y	F	CB		N	Automobile
7/25/2018[5]	Year	Known	Y	M	YR		N	Defense of life
11/15/2018[5]	Year	Known	Y	M	AD		N	Undetermined

[1] Y = Yes, N = No

[2] F = female, M = male, U = unknown sex

[3] AD = adult (≥5 years old), SA = subadult (2-4 years old), YR = yearling (1 year old), CB = cub (<1 year old)

[4] Known mortalities of orphaned offspring originally counted as probable mortalities in 2018

[5] 2018 mortalities that were discovered or reported in 2019

Appendix D. Observed occupancy of 23 Bear Management Units within the PCA and 7 Occupancy Units within Zone 1 by female grizzly bears with offspring, 2014–2019. Units known occupied during a given year are signified by the symbol ×. Twenty-two of 23 BMUs and 7 of 7 OUs were occupied during a 6-year period ending with 2019.

Bear Management Unit (PCA)	2014	2015	2016	2017	2018	2019
Murphy Lake	×			×		
Upper North Fork Flathead	×	×	×	×		×
Northeast Glacier	×	×	×	×	×	×
Stillwater River	×				×	×
Lower North Fork Flathead	×	×	×	×	×	×
Hungry Horse	×	×	×	×	×	×
Lower Middle Fork Flathead	×	×	×	×	×	×
Southeast Glacier	×	×	×	×	×	×
Sullivan	×	×	×	×	×	×
Upper Middle Fork Flathead	×	×	×	×	×	
Badger Two Medicine	×	×	×	×	×	×
Mission Range	×	×	×	×	×	×
Bunker	×	×	×	×	×	×
Continental Divide						
Birch Teton		×	×	×	×	×
Big Salmon	×				×	×
North Fork Sun River				×	×	×
Teton Sun River	×	×		×		×
Rattlesnake	×		×			
Upper South Fork Flathead	×			×		
South Fork Sun Beaver Willow		×		×	×	×
Monture Landers Fork	×	×	×	×		×
Dearborn Elk Creek				×		×
Occupied during year	18	15	14	19	15	18
Occupied during last 6 years	23	23	23	23	22	22
Occupancy Unit (Zone 1)						
Salish Connectivity Area	×		×	×	×	×
Flathead Valley	×	×	×	×	×	×
Flathead Reservation	×	×	×	×	×	×
Ninemile Connectivity Area					×	×
South End	×	×	×	×	×	×
East Front		×	×	×	×	×
Blackfeet Reservation	×	×	×	×	×	×
Occupied during year	5	5	6	6	7	7
Occupied during last 6 years	7	7	7	7	7	7

Appendix E. Thresholds and observed estimates for demographic parameters described in the 2018 Conservation Strategy including: occupancy of females with offspring within 23 Bear Management Units (BMUs) in the Primary Conservation Area (PCA) and 7 Occupancy Units (OUs) in Zone 1, tallied over the last 6 years; survival rate of independent females within the Demographic Monitoring Area (DMA) averaged over the last 6 years; and numbers of total reported and unreported (TRU) mortalities of independent female and male grizzly bears within the DMA averaged over the last 6 years.

			Year					
Parameter	Area/Sex	Criteria/observed	2014	2015	2016	2017	2018	2019
Occupancy	PCA (BMUs)	Minimum threshold	21	21	21	21	21	21
		Observed	23	23	23	23	22	22
	Zone 1 (OUs)	Minimum threshold	6	6	6	6	6	6
		Observed	7	7	7	7	7	7
Survival rate	Female	Minimum threshold	0.93	0.93	0.93	0.93	0.93	0.93
		Observed	0.95	0.96	0.95	0.95	0.93	0.94
TRU mortalities	Female	Maximum threshold	22	22	22	22	22	23
		Observed	14	14	16	14	15	16
	Male	Maximum threshold	28	28	28	28	28	29
		Observed	16	16	15	19	21[1]	21

[1] Parameter was recalculated based on the additional mortality of an independent male bear discovered in 2019, but assumed to have died in 2018.