Yellowstone Grizzly Bear Investigations 2023

Annual Report of the Interagency Grizzly Bear Study Team

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YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

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2023

U.S. Geological Survey
Wyoming Game and Fish Department
National Park Service
U.S. Fish and Wildlife Service
Montana Fish, Wildlife and Parks
U.S. Forest Service
Idaho Department of Fish and Game
Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department

Edited by Frank T. van Manen, Mark A. Haroldson, and Bryn E. Karabensh

U.S. Department of the Interior
U.S. Geological Survey
2024

IGBST PARTNER WEBSITES

Interagency Grizzly Bear Study Team (U.S. Geological Survey):
https://www.usgs.gov/science/interagency-grizzly-bear-study-team

Grizzly Bear Recovery Program (U.S. Fish and Wildlife Service):
https://www.fws.gov/species/grizzly-bear-ursus-arctos-horribilis

U. S. Forest Service:
https://www.fs.usda.gov/visit/know-before-you-go/bears

Yellowstone National Park and Grand Teton National Park (National Park Service):
https://www.nps.gov/yell/learn/management/bear.htm
http://www.nps.gov/grte/planyourvisit/bearsafety.htm

Wyoming Game and Fish Department:
https://wgfd.wyo.gov/wyoming-wildlife/large-carnivore/grizzly-bears-wyoming

Montana Fish, Wildlife and Parks:
https://fwp.mt.gov/conservation/wildlife-management/bear

Idaho Department of Fish and Game:
http://fishandgame.idaho.gov/public/wildlife/?getPage=248

Eastern Shoshone and Northern Arapaho Tribal Fish and Game Department:
https://windriver.org/venue/shoshone-arapaho-fish-game/

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Abbreviations used in the report

DMA	Demographic Monitoring Area
et al.	and others
GPS	Global Positioning System
GTNP	Grand Teton National Park
GYE	Greater Yellowstone Ecosystem
GBRZ	Grizzly Bear Recovery Zone
IGBST	Interagency Grizzly Bear Study Team
IPM	Integrated Population Model
NPS	National Park Service
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WGFD	Wyoming Game and Fish Department
YNP	Yellowstone National Park

INTRODUCTION

Frank T. van Manen and Mark A. Haroldson, U.S. Geological Survey, Interagency Grizzly Bear Study Team

This Report

This Annual Report summarizes results of grizzly bear (*Ursus arctos*) research and monitoring conducted in the Greater Yellowstone Ecosystem (GYE) by the Interagency Grizzly Bear Study Team (IGBST) during 2023. Our efforts were focused on population estimation and demographic trends, in conjunction with monitoring important bear foods and habitats. This report also presents a summary of grizzly bear management actions to address conflict situations and agency outreach efforts. The information presented herein is a summary of annual data collections. Data, analyses, and summaries presented here supersede those published previously and may be subject to change contingent upon additional information, future publications, and the peer-review process.

Implementation of Integrated Population Model

As part of a multi-year effort to enhance key aspects of our demographic monitoring program, we have achieved several long-term goals in recent years. In a report (IGBST 2021) and a subsequent publication (van Manen et al. 2022), we addressed underestimation bias in estimates of female grizzly bears with cubs-of-the-year (females with cubs). Additionally, starting in 2018, we have collaborated with partner agencies working in other grizzly bear ecosystems in the lower 48 states to develop an integrated population model (IPM). A key advancement of IPMs is that we can use the full suite of demographic data we collect on an annual basis into a unified analysis, allowing the simultaneous estimation of multiple demographic parameters. This synergistic nature of IPMs allows us to leverage information shared among vital rates estimated from demographic and count data, producing "self-consistent estimates" that must reconcile with one another (Schaub and Kéry 2021). This framework explicitly links changes in population size over time with variations in vital rates, thus providing managers with improved techniques for decision-making. After more than 4 years of development and testing, we started implementation of the IPM with the IGBST data collections in 2022. In this annual report, we continue the reporting we started last year, by presenting an extensive suite of population and vital rate parameters for the year 2023 based on IPM analyses (see "***Population Size and Vital Rates***"). A manuscript detailing the IPM for the GYE grizzly bear population was published recently (Gould et al. 2024). The IGBST adoption of the IPM monitoring framework necessitated revisions to the demographic chapter (chapter 2) of the Conservation Strategy for grizzly bears in the Greater Yellowstone Ecosystem. Using outcomes of several IGBST workshops in 2022 and 2023, a technical team with representatives of member agencies of the Yellowstone Ecosystem Subcommittee focused on revising demographic criteria to align with the new capabilities of the IPM monitoring framework . Including previously approved revisions to chapter 3, the revisions to the demographic chapter were incorporated into the 2024 Conservation Strategy, which was approved by the Interagency Grizzly Bear Committee and its Yellowstone Ecosystem Subcommittee (Yellowstone Ecosystem Subcommittee 2024).

Population Monitoring

We follow monitoring protocols and recovery criteria established in the 2017 supplement to the Grizzly Bear Recovery Plan (USFWS 2017) and as newly revised under the 2024 Conservation Strategy (Yellowstone Ecosystem Subcommittee 2024). In 2023, the Chao2 estimate based on implementation of the 16-km (kilometers) distance criterion was 73 females with cubs (see "***Estimating Number of Females with Cubs***") within the DMA, from which we estimated a total population size of 1,030 using the IPM, with a 95% credible interval of 865 to 1,230 bears (see "***Population Size and Vital Rates***").

Food Monitoring

The distribution and availability of food sources, particularly high-calorie foods, is an important driver of population demographics of grizzly bears. Therefore, IGBST data collections include documenting indices of abundance for 3 high-calorie foods throughout the GYE: 1) cutthroat trout (*Oncorhynchus clarkii*) spawning numbers, 2) bear use of army cutworm moths (*Euxoa auxiliaris*) sites, and 3) whitebark pine (*Pinus albicaulis*) cone production. As we noted in the 2017 Annual Report (van Manen et al. 2018), we are no longer conducting surveys to document availability of winter-kill carcasses of large ungulates. However, as

meat from ungulates continues to be an important food resource for grizzly bears in the GYE (Schwartz et al. 2014), we have added a new section to the report to assess ungulate consumption by grizzly bears in Yellowstone National Park (see section "***Grizzly Bear Consumption of Ungulates in Yellowstone National Park"***) and provide online references for herd statistics available through agency websites.

Besides IGBST surveys to index whitebark pine cone production, monitoring the health of whitebark pine in the ecosystem continued with the cooperation of the Greater Yellowstone Whitebark Pine Monitoring Working Group. We reference these monitoring efforts in Appendix B. The protocol has been modified to document the mortality rate in whitebark pine from all causes, including mountain pine beetle (*Dendroctonus ponderosae*).

Habitat Monitoring

In this report we also detail findings from monitoring programs implemented since the 2007 delisting rule: 1) changes in secure habitat, open motorized access route density, and total motorized route density inside the designated Grizzly Bear Recovery Zone (hereafter GBRZ; also referred to as the Primary Conservation Area in the 2024 Conservation Strategy); 2) changes in number and capacity of developed sites inside the GRBZ; and 3) changes in number of commercial livestock allotments, permitted domestic sheep animal months inside the GRBZ, and livestock allotments with grizzly bear conflicts during the last 5 years (Appendix A).

History and Purpose of the IGBST

It was recognized as early as 1973 that a better understanding of the dynamics of grizzly bears in the GYE would best be accomplished by an independent research group responsible for collecting, managing, analyzing, and distributing information. To meet this need, agencies developed a Memorandum of Understanding and formed the IGBST, a science consortium among the U.S. Geological Survey (USGS), National Park Service (NPS), U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), and the state wildlife agencies of Idaho, Montana, and Wyoming. The Eastern Shoshone Tribe of the Wind River Reservation, Wyoming, and the Arapaho Tribe of the Wind River Reservation, Wyoming, formally joined the study team in 2009.

Quantitative data on grizzly bear abundance, distribution, survival, mortality, nuisance activity, and bear foods are critical to formulating management strategies and decisions. Moreover, this information is necessary to evaluate the recovery process. The IGBST coordinates data collection and analysis on an ecosystem scale, limits duplication of effort, and pools limited budgetary and personnel resources. Primary responsibilities of the IGBST are to: 1) conduct short- and long-term research projects addressing information needs for grizzly bear management; 2) monitor the grizzly bear population, including status and trend, numbers, reproduction, and mortality; 3) monitor grizzly bear habitats, foods, and impacts from humans; and 4) provide technical support to agencies and other groups responsible for the immediate and long-term management of grizzly bears in the GYE. Additional details are on the IGBST website: https://www.usgs.gov/science/interagency-grizzly-bear-study-team.

Previous and Recent Research

Since 1975, the IGBST has produced annual reports and numerous scientific publications summarizing the team's monitoring and research efforts within the GYE. Descriptions of the study area and sampling techniques are reported by Blanchard (1985), Mattson et al. (1991*a*), Haroldson et al. (1998), and Schwartz et al. (2006).

Newly published studies reflect our investment into improvements of the monitoring program and continuing collaborations with academic institutions to address important research questions related to bear ecology and management in the GYE and beyond. A study by Loggers et al. (2023) used 17 years of GPS location data to evaluate grizzly bear selection of bear management areas (BMAs) in Yellowstone National Park, which have human access restrictions in place to mitigate effects of human recreation on bears and reduce the likelihood of human-bear encounters. They found that individual bears varied widely in their preference for BMAs and access restrictions. Bears likely spend time in BMAs based on available food resources rather than restrictions to human access. Areas associated with BMAs had higher grizzly bear densities, indicating that restrictions to human access likely help

reduce the potential for human–bear interactions, accomplishing
one of the original objectives for establishing the BMAs.

On an ecosystem-wide scale, Hansen et al. (2024) identified private lands for conservation by combining indices of ecosystem integrity with habitat mapping of wildlife species valued by local residents, such as elk (*Cervus canadensis*) and grizzly bears. Whereas natural vegetation cover comprised 81% of the private lands, only 2% supported high levels of three biodiversity measures used in the analysis (ecological value, elk migration and winter range, and grizzly bear source area), about a quarter of which had conservation easements. These findings are helpful to identify and prioritize areas of high biodiversity value for conservation. A study on American black bears indicated that the northern range of Yellowstone National Park supports high densities of black bears (Bowersock et al. 2023). Results of that study support inference from previous research that habitat conditions on the northern range allow black bears to occur at much higher densities than grizzly bears. Gunther et al. (2024) analyzed a large sample of reports of grizzly and black bear reactions in interactions with people in Yellowstone National Park during 1991–2022. They found that bear interactions with people were usually predictable and that grizzly bears and black bears rarely reacted aggressively, made physical contact, or attacked people during such interactions. Safety messages encouraging calm, confident responses during bear-human interactions are warranted, and may have better efficacy than those that generate fear and apprehension.

Finally, Kurth et al. (2024) conducted a systematic literature review to examine how climate variability and change may impact black and brown bear ecology and interactions with humans. Climate-driven changes in natural food availability were frequently implicated in influencing bear behavior and demography, creating conditions under which human-bear interactions are likely to increase. Given the evidence of climate impacts to bears, the authors suggested that incorporating climate considerations into bear management plans can help managers strategically allocate resources and promote human-bear coexistence.

Acknowledgments

This report is a combined effort of the partner agencies and individual members of the IGBST, and many individuals contributed directly or indirectly to its preparation. To that end, we have identified author(s). Additionally, we wish to thank the following individuals for their valuable contributions to data collection, analysis, and other phases of IGBST research. **Idaho Department of Fish and Game**: C. Anderson, C. Bowin, J. Brower, R. Cavallaro, J. Heald, C. Hendricks, J. Hussman, C. Johnson, T. Lewis, J. Locke, D. Newman, T. Nicholson, A. Sorensen, T. Swearingen, S. Wood; **Montana State University**: A. Litt, E. Loggers; **Montana Fish, Wildlife and Parks**: : M. Becker, S. Brozovich, C. Costello, J. Cunningham, D. Fagone, K. Frey, W. Hansen, M. Heaton, D. McHugh, M. Jacobsen, B. Lloyd, K. Orozco, R. Pickens, R. Pohle, J. Ramsey, J. Smith, D. Scott, S. Stewart, G. Todd, M. Wemple, D. Waltee; **Yellowstone National Park**: : K. Atkins, J. Bergstrand, O. Dalling, K. Gunther, M. Gutt, J. Hadley, Z. Haroldson, M. King, E. Reinertson, K. Schafer, P.J. White, J. Wright, T. Wyman; **Grand Teton National Park:** B. Apel, L. Apel, T. Brasington, C. Butler, M. Clark, R. Clark, R. Coscarelli, S. Dewey, L. Fisher, T. Fisher, G. Gonsiewski, N. Gonsiewski, C. Hayden, T. Hayden, C. Hutson, L. Kirby, T. Kirby, A. Langford, J. Lieb, S. Liske, J. Lodge, R. Mascia, T. Mascia, S. Morriss, S. Morriss, L. Muir, J. Potter, A. Ryan, S. Ryan, J. Schwabedissen, J. Stephenson, R. Swift, R. Thomas-Kuzilik, D. Titley, K. Titley, P. Waite, Z. Ward, A. Willemain, C. Willemain, J. Willemain, K. Wilmot, A. Zuckerman; **Pilots and Observers**: N. Cadwell, M. Packila, G. Sperry; **Eastern Shoshone Tribe of the Wind River Reservation and Arapaho Tribe of the Wind River Reservation**: Eastern Shoshone Business Council, Northern Arapaho Business Council, I. Brown, J. Friday, A. Lawson, B. Snyder, W. Wagon, , D. Williams ; **University of Montana**: P. Lukacs, J. Nowak, S. Sells; **U.S. Forest Service**: S. Derusseau, J. Flower, E. Moyer, K. Murphy, M. Park, A. Pils, S. Pils, K. Skeen, D. Tyers; **U.S. Fish and Wildlife Service**: S. Becker, H. Cooley, J. Fortin-Noreus, P. Hnilicka, M. Mazur, W. Lane; **U.S. Geological Survey**: : C. Dickinson, M. Gould, M. Haroldson, B. Karabensh, C. Whitman, F. T. van Manen, A. Corradini, A. Donatelli, S. Stephens, B. Whitman; **U.S. Department of Agriculture Wildlife Services:** K. Glazier, F. Helske, C. Hoover, A. Kammann, C. Knopp, G. McDougal, J. Rost, D. Tidwell; **Wyoming Game and Fish Department:** C. Atkinson, M. Aughton, B. Baker, M. Boyce, J. Clapp, C. Class, T. Crane, J. Crump, A. Courtemanch, B. DeBolt, J. Dellinger, L. Ellsbury, B. Frude, K. Garrett, G. Gerharter, Z. Gregory, H. Haley, J. Hunter, B.

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BEAR MONITORING AND POPULATION TREND

Marked Animals *(Matthew J. Gould, Chad Dickinson, and Bryn E. Karabensh, U.S. Geological Survey, Interagency Grizzly Bear Study Team; Cade Bowlin, Idaho Department of Fish and Game; and Justin G. Clapp, Wyoming Game and Fish Department)*

During the 2023 field season, we captured 48 individual grizzly bears on 49 occasions from research and management capture efforts (Table 1), including 14 females (7 adult), 33 males (25 adult) and 2 yearling bears of unknown sex (Table 1). The 2 bears of unknown sex were captured at research trap sites and released without handling.

Thirty-one (64.6%) of the 48 individual bears were not previously marked. The percent of previously unmarked individual grizzly bears captured annually has remained relatively constant during the period 1998–2023, averaging 62%, with no evidence ($F = 0.088$, 1 degrees of freedom, P [significance or probability value] = 0.769) of a change in trend (Fig. 1). This finding continues to support the interpretation that in this closed population, recruitment through reproduction is occurring at a relatively constant rate. We would expect the number of new bears encountered annually to decline if this were not the case. The number of individuals we captured was lower than previous years as we established trap sites in areas previously untrapped, conducted trapping efforts in areas with lower densities of bears (e.g., edge of the demographic monitoring area), and competed with an abundance of natural food resources across the ecosystem.

We conducted research trapping efforts for a total of 512 trap days (1 trap day = 1 trap set for 1 day) in the GYE. During research trapping operations we had 16 captures of 16 individual grizzly bears for a trapping success rate of 1 grizzly capture every 32.0 trap days. All research captures occurred within the Demographic Monitoring Area (DMA).

There were 34 management captures of 33 individual bears during 2023 (Tables 1 and 2), including 11 females (5 adults) and 22 males (14 adults). Fifteen of the 34 management captures (5 females, 10 males) occurred outside the DMA.

Ten individual bears (3 females, 7 males) were relocated because of conflict situations (Table 1). In total, there were 23 management captures that resulted in removals (8 females, 15 males; Table 1). Eight (3 females, 5 males) of these removals occurred outside the DMA.

We radio-monitored 84 individual grizzly bears during the 2023 field season, including 41 females, 33 of which were adults (Tables 2 and 3). Forty-six grizzly bears entered their winter dens wearing active transmitters. Since 1975, 1,093 individual grizzly bears have been radiomarked in the GYE.

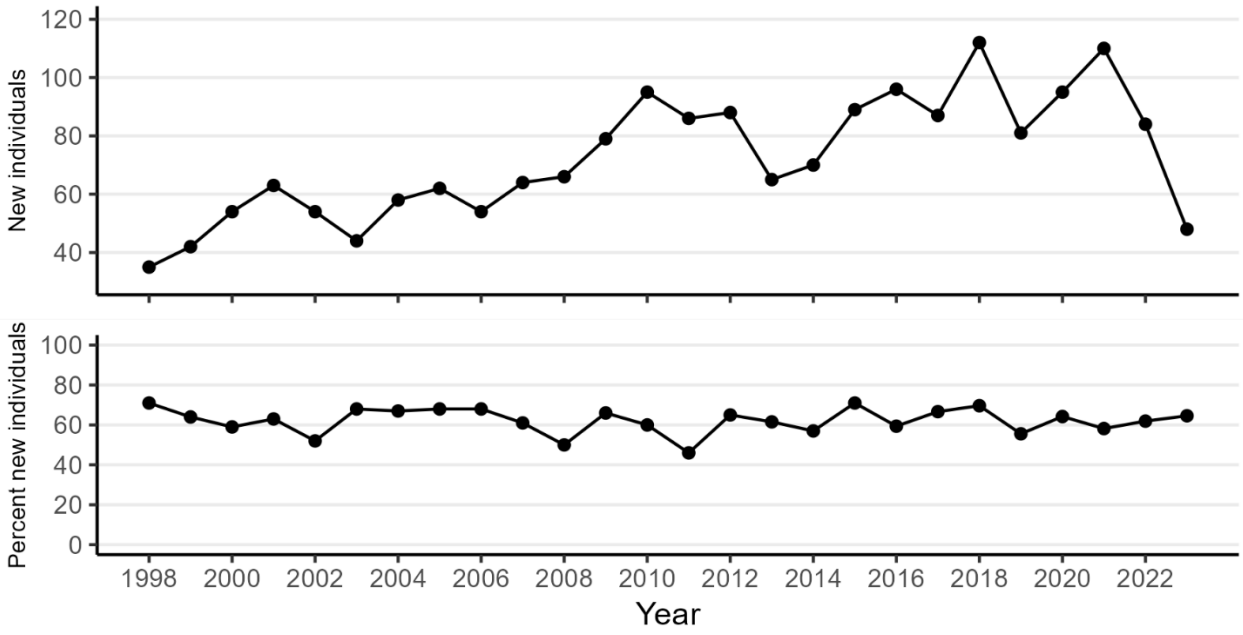

Fig. 1. Annual number of grizzly bears captured (top) and percent previously unmarked individuals (bottom) in the Greater Yellowstone Ecosystem, 1998–2023.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem, 2023.							
Bear	**Sex**	**Age**	**Date**	**General location[a]**	**Capture type**	**Release site[b]**	**Handler[c]**
Unm202301	Male	Adult	05/13/23	South Fork Shoshone River, PR-WY	Management	Removed (202305)	WGFD
889	Male	Adult	05/22/23	Grass Creek, BLM-WY	Research	On site	WGFD
1077	Male	Adult	05/22/23	Roach Creek, BLM-WY	Research	On site	WGFD
847	Male	Adult	05/30/23	Grass Creek, BLM-WY	Research	On site	WGFD
700	Male	Adult	06/12/23	Cottonwood Creek, SNF-WY	Research	On site	WGFD
1092	Female	Adult	06/07/23	Grass Creek, BLM-WY	Research	On site	WGFD
G280	Male	Subadult	06/28/23	Alkali Creek, PR-WY	Management	Transported	WGFD
G281	Male	Subadult	06/28/23	Alkali Creek, PR-WY	Management	Transported	WGFD
897	Male	Adult	06/29/23	Cottonwood Creek, BDNF-WY	Management	Removed (202312)	WS
G265	Male	Adult	07/03/23	Green River, PR-WY	Management	Removed (202313)	WGFD
373	Male	Adult	07/05/23	Henrys Fork, CTNF-ID	Management	Removed (202314)	IDFG
Unm202302	Female	Adult	07/08/23	Breteche Creek, PR-WY	Management	Removed (202316)	WGFD
1093	Female	Subadult	07/09/23	Lodge Pole Creek, PR-WY	Management	Transported	WGFD
Unm202303	Female	Subadult	07/14/23	Little Bear Creek, SNF-WY	Management	Removed	WGFD
1079	Male	Adult	07/20/23	Porcupine Creek, CTNF-ID	Research	On site	IDFG
1078	Male	Adult	07/20/23	Crow Creek, BTNF-WY	Management	Removed (202322)	WGFD
468	Male	Adult	07/21/23	Dry Creek, CTNF-ID	Research	On site	WGFD
729	Male	Adult	07/25/23	Crow Creek, BTNF-WY	Management	Removed (202323)	WGFD
1045	Male	Adult	07/26/23	Spring Creek, CTNF-ID	Research	On site	IDFG
Unm202304	Male	Adult	07/29/23	Wood River, PR-WY	Management	Removed (202324)	WGFD
706	Female	Adult	08/03/23	Henrys Fork, CTNF-ID	Research	On site	IDFG
1094	Female	Adult	08/06/23	Blaine Creek, PR-WY	Management	Transported	WGFD
Unm202306	Female	Subadult	08/06/23	Meadow Creek, PR-WY	Management	Removed (202326)	WGFD
Unm202305	Female	Subadult	08/06/23	Jack Creek, PR-MT	Management	Removed (202325)	MTFWP
633	Male	Adult	08/10/23	Horse Creek, PR-MT	Management	Removed (202327)	MTFWP
Unm202307	Male	Adult	08/12/23	Owl Creek, PR-WY	Management	Removed (202329)	WGFD
1095	Male	Adult	08/15/23	Willow Creek, PR-WY	Management		WGFD
Unm202308	Male	Adult	08/17/23	North Fork Owl Creek, PR-WY	Management	Removed (202330)	WGFD
Unm202309	Female	Adult	08/18/23	Moss Creek, BDNF-MT	Management	Removed (202331)	WS
Unm202310	Unknown	Cub	08/18/23	Timber Creek, BLM-ID	Management	On site	IDFG
1096	Male	Subadult	08/26/23	Buffalo Fork, BTNF-WY	Management	Transported	WGFD
Unm202311	Female	Adult	08/29/23	Clarks Fork Yellowstone River, PR-WY	Management	Removed (202332)	WGFD
Unm202312	Female	Yearling	8/30/2023	Fall River, PR-ID	Management	Removed (202334)	IDFG
Unm202313	Male	Yearling		Fall River, PR-ID	Management	Removed (202335)	IDFG
552	Male	Adult	09/01/23	Clarks Fork Yellowstone River, PR-WY	Management	Removed (202336)	WGFD
909	Female	Adult	09/03/23	Buttermilk Creek, PR-MT	Management	Removed (202337)	MTFWP
Unm202310	Male	Cub	09/03/23	Buttermilk Creek, PR-MT	Management	Removed (202338)	MTFWP
1097	Female	Subadult	09/05/23	Clarks Fork Yellowstone River, PR-WY	Management	Transported	WGFD
1098	Female	Subadult	09/08/23	Stephens Creek, YNP	Research	On site	IGBST
1099	Male	Adult	09/08/23	Carter Creek, PR-WY	Management	Transported	WGFD
Unm202314	Male	Subadult	09/10/23	Iron Creek, PR-WY	Management	Removed (202340)	WGFD

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site[b]	Handler[c]
1100	Male	Adult	09/15/23	Stephens Creek, YNP	Research	On site	IGBST
1101	Male	Yearling	09/20/23	Clarks Fork Yellowstone River, State-WY	Management	Transported	WGFD
G282	Male	Yearling	09/20/23	Clarks Fork Yellowstone River, State-WY	Management	Transported	WGFD
1102	Male	Adult	09/26/23	Tower Creek, YNP	Research	On site	IGBST
688	Male	Adult	09/28/23	Flat Mountain Arm, YNP	Research	On site	IGBST
Unm202316	Male	Adult	09/30/23	June Creek, SNF-WY	Management	Removed (202346)	WGFD
Unm202317	Unknown	Yearling	10/08/23	Flat Mountain Arm of Yellowstone Lake, YNP	Research	On site	IGBST
Unm202318	Unknown	Yearling	10/08/23	Flat Mountain Arm of Yellowstone Lake , YNP	Research	On site	IGBST
566	Male	Adult	10/15/23	Firehole River, YNP	Research	On site	IGBST

[a] BDNF = Beaverhead-Deerlodge National Forest, BLM = Bureau of Land Management, BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, CGNF = Custer Gallatin National Forest, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, YNP = Yellowstone National Park, WRIR = Wind River Reservation, PR = private.

[b] Numbers in parentheses are assigned mortality numbers.

[c] IDFG = Idaho Department of Fish and Game; IGBST = Interagency Grizzly Bear Study Team, USGS; GTNP = Grand Teton National Park; MTFWP = Montana Fish, Wildlife and Parks; WS = Wildlife Services; WGFD = Wyoming Game and Fish Department; WRIR = Wind River Reservation, YNP = Yellowstone National Park.

Table 2. Annual number of grizzly bears monitored, captured, and transported in the Greater Yellowstone Ecosystem, 1980–2023.					
Year	Number monitored	Individuals trapped	Total captures		Transported
			Research	Management	
1980	34	28	32	0	0
1981	43	36	30	35	31
1982	46	30	27	25	17
1983	26	14	0	18	13
1984	35	33	20	22	16
1985	21	4	0	5	2
1986	29	36	19	31	19
1987	30	21	15	10	8
1988	46	36	23	21	15
1989	40	15	14	3	3
1990	35	15	4	13	9
1991	42	27	28	3	4
1992	41	16	15	1	0
1993	43	21	13	8	6
1994	60	43	23	31	28
1995	71	39	26	28	22
1996	76	36	25	15	10
1997	70	24	20	8	6
1998	58	35	32	8	5
1999	65	42	31	16	13
2000	84	54	38	27	12
2001	82	63	41	32	15
2002	81	54	50	22	15
2003	80	44	40	14	11
2004	78	58	38	29	20
2005	91	63	47	27	20
2006	92	54	36	25	23
2007	86	65	54	19	8
2008	87	66	39	40	30
2009	97	79	63	34	25
2010	85	95	36	75	52
2011	92	86	61	46	24
2012	112	88	47	56	35
2013	88	65	58	30	20
2014	94	70	51	30	20
2015	101	89	34	72	41
2016	106	96	59	49	18
2017	99	87	62	37	15
2018	106	112	57	72	27
2019	98	81	59	39	16
2020	104	95	72	41	13
2021	120	110	51	59	19
2022	112	84	60	40	12
2023	84	48	16	34	10

Table 3. Grizzly bears radio monitored in the Greater Yellowstone Ecosystem, 2023.						
				Monitored		
Bear	Sex	Age	Offspring	Out of den	Into den	Current status
373	M	25		No	No	Cast[a]
419	M	22		Yes	No	Cast
476	F	24	2 cubs	Yes	No	Probable battery failure
468	M	21		No	Yes	Active
499	F	26	1 yearling	Yes	No	Cast
520	M	24		Yes	Yes	Active
566	M	19		No	Yes	Active
688	M	13		No	Yes	Active
700	M	20		No	No	Cast
706	F	20	None	No	Yes	Active
747	F	13	1 yearling	Yes	Yes	Active
769	M	14		Yes	No	Cast
804	M	13		Yes	No	Cast
847	M	11		No	No	Cast
864	F	11	2 yearlings	Yes	No	Cast
883	F	10	2 yearlings	Yes	Yes	Active
886	F	9	1 2-year-old, weaned	Yes	Yes	Active
889	M	7		No	No	Cast
896	F	9	2 cubs	Yes	No	Cast
908	M	9		Yes	No	Cast
912	F	9	2 yearlings, 2 lost	Yes	Yes	Active
938	M	12		Yes	No	Cast
942	F	9	2 2-year-old, weaned	Yes	No	Cast
948	F	11	2 cubs, 1 lost	Yes	Yes	Active
949	F	7	None	Yes	No	Cast
952	F	15	2 cubs, 1 lost	Yes	No	Cast
967	M	28		Yes	No	Cast
980	F	16	2 cubs	Yes	Yes	Active
981	F	6	None	Yes	No	Cast
994	M	6		Yes	No	Cast
999	F	6	2 cubs	Yes	Yes	Active
1007	M	9		Yes	No	Probable battery failure
1019	M	7		Yes	No	Cast
1025	F	10	3 cubs	Yes	Yes	Active
1027	F	10	2 cubs	Yes	No	Cast
1031	F	6	None	Yes	No	Cast
1032	F	7	1 yearling	Yes	No	Cast
1033	M	6		Yes	No	Probable battery failure
1035	F	6	2 cubs, 2 lost	Yes	Yes	Active
1038	F	4	None	Yes	No	Cast
1041	F	6	None	Yes	No	Cast
1044	F	5	None	Yes	Yes	Active
1045	M	8		No	Yes	Active
1046	F	4	None	Yes	Yes	Active
1051	M	4		No	No	Cast
1053	M	8		Yes	No	Cast
1054	F	10	2 2-yearr-old, weaned	Yes	Yes	Active
1059	M	10		Yes	No	Cast
1060	M	15		Yes	Yes	Active

Table 3. Continued.

Bear	Sex	Age	Offspring	Monitored		Current status
				Out of den	Into den	
1061	M	10		Yes	Yes	Active
1062	F	12	None	Yes	Yes	Active
1063	F	5	None	Yes	Yes	Active
1065	F	4	None	Yes	Yes	Active
1066	M	6		Yes	No	Cast
1067	M	8		Yes	No	Cast
1068	M	4		Yes	Yes	Active
1069	M	3		Yes	Yes	Active
1070	F	7	1 cub, 1 lost	Yes	Yes	Active
1071	F	5	None	Yes	Yes	Active
1072	F	4	None	Yes	Yes	Active
1073	F	4	None	Yes	No	Cast
1074	M	4		Yes	Yes	Active
1075	M	7		Yes	Yes	Active
1076	F	8	2 2-year-old, weaned	Yes	Yes	Active
1077	M	4		Yes	Yes	Active
1078	M	9		Yes	No	Removed
1079	M	4		Yes	Yes	Active
1080	M	12		Yes	Yes	Active
1083	M	10		Yes	No	Cast
1084	F	6	None	Yes	Yes	Active
1085	M	8		Yes	No	Cast
1086	F	8	3 cubs	Yes	No	Cast
1087	M	9		Yes	Yes	Active
1092	F	5	None	No	Yes	Active
1093	F	4	None	No	Yes	Active
1094	F	4	None	No	Yes	Active
1095	M	7		No	Yes	Active
1096	M	4		No	No	Cast
1097	F	3	None	No	Yes	Active
1098	F	4	None	No	Yes	Active
1099	M	12		No	Yes	Active
1100	M	8		No	Yes	Active
1101	M	3		No	Yes	Active
1102	M	6		No	Yes	Active

[a] Includes all instances in which a radio collar was pre-programmed to drop off, the cotton spacer deteriorated, or the collar was removed by the animal.

Estimating Number of Females with Cubs *(Bryn E. Karabensh, Matthew Gould, Mark A. Haroldson, and Frank T. van Manen, U.S. Geological Survey, Interagency Grizzly Bear Study Team)*

I. Estimating Population Size and Assessing Trend from Observations of Unique Females with Cubs

Background

Under the 2017 Revised Demographic Criteria for the GYE, which were amended to the Grizzly Bear Recovery Plan (USFWS 1993, 2017), the IGBST is tasked with annually estimating the number and trend of female grizzly bears with cubs (0–1 years old) in the GYE population and estimating the sizes of specific population segments to assess annual mortalities relative to population size. We present our 2023 findings for counts of unique females with cubs and the total population estimate derived from numbers of females with cubs observed within the DMA.

Methods

Traditionally, we used a technique developed by Knight et al. (1995) to estimate the number of unique females with cubs and tabulate sighting frequencies for each family. An important component of the original rule set was a distance criterion of > (greater than) 30 km to distinguish sightings as belonging to unique females with cubs. Findings from Schwartz et al. (2008), however, indicated the Knight et al. (1995) rule set underestimated the number of unique females with cubs and this underestimation bias increased with increasing population size. During 2021–2022, the IGBST completed a comprehensive reassessment, using extensive simulations to evaluate a distance criterion that resulted in relatively unbiased estimates for the number of females with cubs (IGBST 2021, van Manen et al. 2022). An important outcome of the study was that a 16-km distance criterion resulted in more accurate estimates while minimizing the risk of overestimation. The IGBST started implementing this change in the rule set in 2021.

Using the number of unique females with cubs observed from aerial surveys conducted during June–August (see section "***Observation Flights***") and ground-based sightings, we obtain a nonparametric, bias-corrected estimate that accounts for individual sighting heterogeneity to estimate the total number of females with cubs in the population (denoted as $Chao2$; Chao 1989, Wilson and Collins 1992, Keating et al. 2002, Cherry et al. 2007). The raw $Chao2$ estimates are an important input to the newly implemented IPM (Gould et al. 2024).

2023 Sightings of Females with Cubs

We documented 194 verified sightings of females with cubs during 2023 in the GYE. Unlike in previous years where most observations were obtained from aerial sources, in 2023 aerial observations were less than half (45%, Table 4). We differentiated 64 unique females with cubs from the 194 sightings using the Knight et al. (1995) rule set with the 16-km distance criterion. Five sightings (2.5%) of 5 unique females occurred outside the DMA (Fig. 2). All five of the females were only observed once outside the DMA. Therefore, we identified 59 unique females with cubs inside the DMA. Thirty-seven (19%) observations from an estimated 11 unique females with cubs based on 16-km distance criterion occurred within the boundary of Yellowstone National Park (YNP).

The total number of cubs observed during initial sightings of the 64 unique females with cubs was 138 and mean litter size was 2.05 (Table 5). There were 9 single cub litters, 36 litters of twins, and 19 litters of triplets (Table 5). Using only the initial sightings of all females with cubs observed within the DMA, there were a total of 126 cubs, with a mean litter size of 2.02.

2023 DMA Chao2

Excluding the 5 sightings (5 females) observed outside the DMA and sightings of 6 family groups based on telemetry only, which are not independent observations, we obtained 129 observations of 53 unique females with cubs (Table 6) within the DMA. Using the sighting frequencies, our estimate of the number of unique females with cubs within the DMA was $Chao2 = 73$. We used this estimate as an input to the IPM (see "***Population Size and Vital Rates***").

Table 4. Method of observation for female grizzly bears with cubs sighted in the Greater Yellowstone Ecosystem, 2023.

Method of observation	Frequency	%	Cumulative %
Fixed wing aircraft–incidental	3	1.5	1.5
Fixed wing aircraft–observation flight	29	14.9	16.5
Fixed wing aircraft–telemetry flight	56	28.9	45.4
Fixed wing aircraft–ferry time	0	0	45.4
Helicopter–other researcher	0	0	45.4
Ground sighting	103	53.1	98.5
Trap	3	1.5	100
Total	194	100	

Table 5. Number of unique females with cubs ($\hat{N}_{Obs}$), litter frequencies, total number of cubs, and average litter size at initial observation using the Knight et al. (1995) rule set based on the 16-km distance criterion for differentiating unique females with cubs, Greater Yellowstone Ecosystem, 2021–2023.

Year	$\hat{N}_{Obs}$	Total no. of sightings	Litter size				Total no. of cubs	Mean litter size
			1 cub	2 cubs	3 cubs	4 cubs		
2021	73	203	23	36	14	0	137	1.88
2022	61	206	16	31	14	0	120	1.97
2023	64	194	9	36	19	0	138	2.05

Table 6. Annual Chao2 estimates for the numbers of female grizzly bears with cubs in the Demographic Monitoring Area of Greater Yellowstone Ecosystem, 2021–2023. The number of unique females observed ($\hat{N}_{Obs}$) includes those located using radio telemetry; *m* is the number of unique females observed using random sightings only and *Chao2* gives the nonparametric, bias-corrected estimate per Chao (1989). Also included are the number of females with cubs sighted once (f_1) or twice (f_2) and the annual estimate of relative sample size (*n*/*Chao2*), where *n* is the total number of observations obtained without the aid of telemetry. Females with cubs sighted ≥3 times can be derived ($f_{3+} = m–(f_1 + f_2)$).

Year	$\hat{N}_{Obs}$	*m*	f_1	f_2	*Chao2*	*n*	*n*/*Chao2*
2021	71	63	30	20	84	130	1.55
2022	61	49	20	17	60	140	2.33
2023	64	53	26	15	73	129	1.77

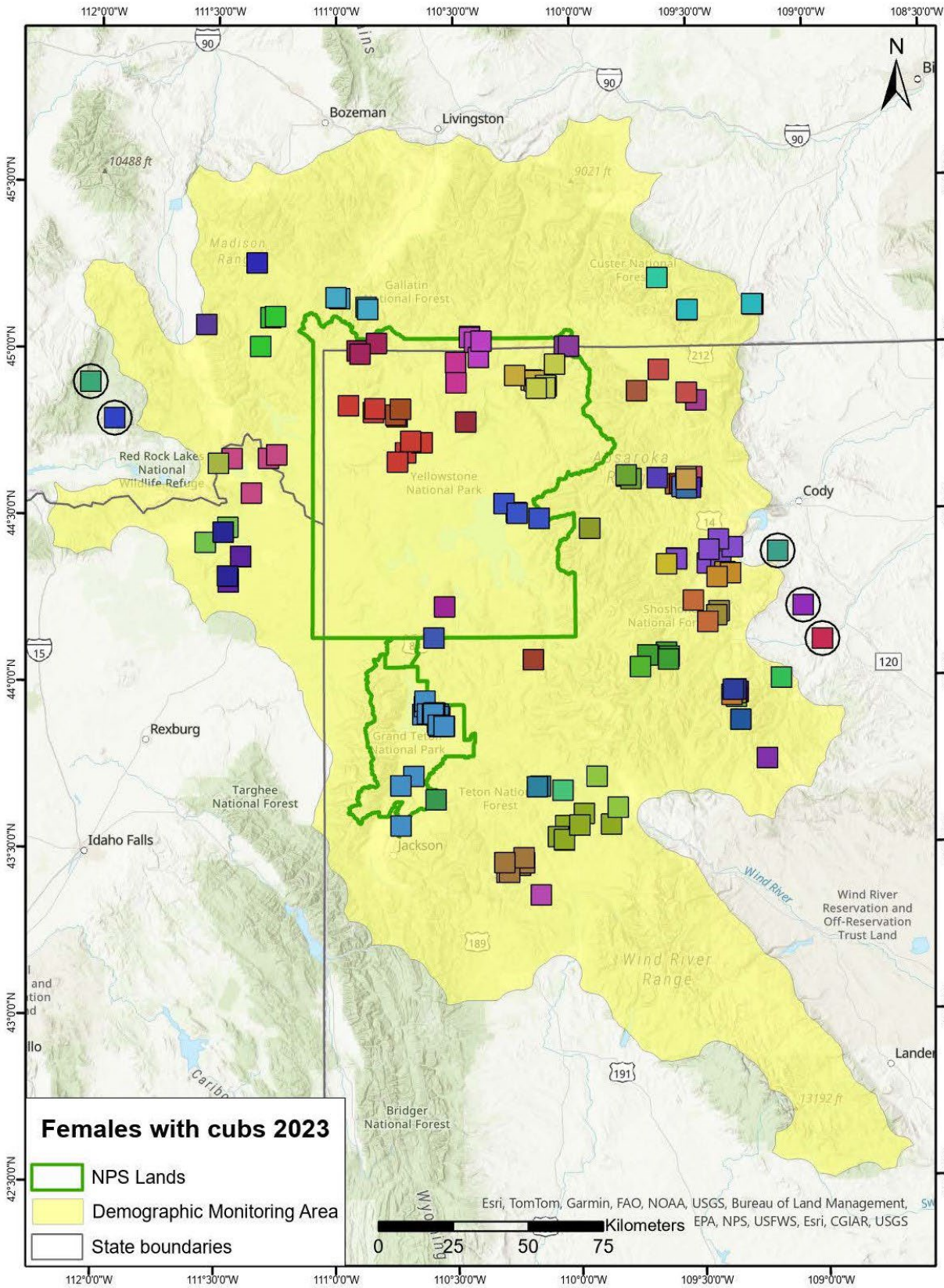

Fig. 2. Distribution of 194 sightings of 64 (indicated by colors) unique female grizzly bears with cubs observed based on the 16-km distance criterion in the Knight et al. (1995) rule set, Greater Yellowstone Ecosystem, 2023. Only sightings from females with cubs occurring within the Demographic Monitoring Area (DMA) are used for population estimation. During 2023, 5 sightings (black circles around symbols) from 5 unique females with cubs occurred outside the DMA. All five of these females were only observed outside the DMA.

II. Mark-Resight Technique to Estimate Females with Cubs

Schwartz et al. (2008) demonstrated biases inherent in the method of estimating population size based on the Chao2 estimator (see previous section) using counts of unique females with cubs and the associated rule set of Knight et al. (1995). The IGBST invited partner agencies and quantitative ecologists to participate in 3 workshops held in 2011–2012 to consider alternative approaches. A product of these workshops was a recommendation to use systematic flight observation data collected since 1997. The mark-resight estimator yields an annual estimate of the number of females with cubs based on the presence of a radio-marked sample and 2 rounds of systematic observation flights/year per Bear Observation Area (see "***Observation Flights***"), during which all bears observed are recorded and, following observation, checked for marks (i.e., radio collar) using telemetry. Pilots note whether family groups observed include cubs, yearlings, or 2-year-old offspring. Mark-resight designs for population estimation are commonly used for wildlife monitoring because they can provide a cost-efficient and reliable monitoring tool. However, inference from such designs is limited when data are sparse, either from a low number of marked animals, a low probability of detection, or both. In the GYE, annual mark-resight data collected for female grizzly bears with cubs suffer from both limitations. As an important outcome of the 3 workshops, Higgs et al. (2013) developed a technique to overcome difficulties due to data sparseness by assuming homogeneity in sighting probabilities over 16 years (1997–2012) of the biannual aerial surveys (see section "***Observation Flights***"). They modeled counts of marked and unmarked grizzly bears with cubs as multinomial random variables, using the capture frequencies of marked females with cubs for inference regarding the latent multinomial frequencies for unmarked females with cubs (Fig. 3).

One important assumption of the mark-resight technique is the geographic distribution of radio-marked female bears is generally representative of the geographic distribution and relative density of female bears in the population. Conclusions from workshop discussions were that this assumption is likely not violated within the GYE, with one exception. A subset of bears in the southeastern portion of the GYE annually spend 6 to 10 weeks in late summer (mid-Jul to late Sep) in alpine scree slopes feeding on army cutworm moths (Mattson et al. 1991*b*, Bjornlie and Haroldson 2011). These bears are highly visible and constitute a substantial proportion of bears seen during observation flights. However, capturing and marking of bears is difficult because these remote, high-elevation areas are snow-covered early in the capture season and access is limited due to high spring runoff. When access improves later in the season, most bears have already begun feeding on army cutworm moths and are difficult to capture. Thus, the proportion of radio-marked females with cubs among those feeding on these high-visibility sites is lower than in the remainder of the ecosystem. Applying mark-resight estimates to the entire ecosystem without considering these moth sites would result in overestimation bias. However, moth sites are now well defined, and the study team annually monitors these sites. Thus, the decision was made to exclude confirmed moth sites (defined as areas within 500 meters (m) from sites where multiple observations of bears feeding occurred >1 year) from the mark-resight analyses. In place of this metric, counts of females with cubs only (marked and unmarked) from independent aerial census surveys of confirmed moth sites are added to the mark-resight estimate for a given year.

Higgs et al. (2013) performed simulations based on a known population of 50 females with cubs and resighting frequencies and proportions of bears sighted 0, 1, and 2 times from the observation flight data to determine accuracy and precision of the mark-resight technique. Accuracy was high, indicating this technique addressed the bias concerns associated with estimates based on the Chao2 estimator. However, the simulations also indicated that precision was low. Peck (2016) reported on the poor ability of the mark-resight technique to detect declines of 1 and 2% in annual estimates of the number of females with cubs but moderate effectiveness to detect a 5% annual decline. Although the IGBST concluded this technique was insufficient for effective monitoring of population trend, it does produce relatively unbiased estimates. Because mark-resight estimates are used in our evaluation of IPMs, we continue to report these estimates.

2023 Mark-Resight Results

Similar to the last 3 years, in 2023 we were only able to conduct 1 round of observation flights and no mark-resight estimation was feasible (Tables 7–9, Fig. 3). We did not conduct moth site-only flights to count females with cubs during 2023.

Table 7. Data used in mark-resight analysis on female grizzly bears with cubs, Greater Yellowstone Ecosystem, 1998–2023, including number of radio-marked female grizzly bears available for sighting during observation flights (m), the number not sighted (Y_0), seen once (Y_1), the number seen twice (Y_2), and the number of unmarked females bears with cubs (S). Estimates exclude females with cubs observed <500 meters from army cutworm moth aggregation sites.

Year	m	Y_0	Y_1	Y_2	S
1998	4	2	2	0	7
1999	6	5	1	0	7
2000	7	7	0	0	11
2001	8	4	4	0	17[a]
2002	5	5	0	0	29[a]
2003	4	3	1	0	7
2004	4	2	2	0	20
2005	3	3	0	0	14
2006	7	7	0	0	23[a]
2007	5	3	2	0	23[b]
2008	5	3	1	1	19[a]
2009	6	6	0	0	14
2010	3	3	0	0	23[a]
2011	3	2	1	0	16
2012	5	3	2	0	12
2013	10	10	0	0	28
2014	5	4	1	0	12
2015	1	0	1	0	22
2016	2	1	1	0	19
2017	6	4	2	0	18
2018	7	6	1	0	19
2019	8	6	2	0	16
2020[c]	No data for mark-resight estimation				
2021[c]	No data for mark-resight estimation				
2022[c]	No data for mark-resight estimation				
2023[c]	No data for mark-resight estimation				

[a] Numbers decreased from 2013 data due to boundary changes of moth sites.

[b] Numbers increased from 20 to 23 due to boundary changes of moth sites.

[c] Mark-resight estimation was not feasible because of only 1 round of observation flights.

Table 8. Results from mark-resight analysis of the number of female grizzly bears with cubs, Greater Yellowstone Ecosystem, 1998–2023. Data from all years were used to inform sightability, and previous years' posterior distributions were updated based on data from radio-marked females with cubs in 2017. Mean, median, and quartile values were derived from the posterior distributions of estimates of the number of female bears with cubs, excluding those observed <500 meters from army cutworm moth aggregation sites.

					Quartile	
Year	Sighted	Marked	Mean	Median	0.025	0.975
1998	7	4	29	27	12	57
1999	7	6	29	27	12	57
2000	11	7	46	44	22	83
2001	17	8	71	68	38	119
2002	29	5	121	117	72	192
2003	7	4	29	27	12	57
2004	20	4	83	80	47	138
2005	14	3	58	56	30	101
2006	23	7	96	92	55	156
2007	23	5	96	93	55	156
2008	19	5	79	76	44	132
2009	14	6	58	56	30	101
2010	23	3	96	93	55	155
2011	16	3	67	64	36	113
2012	12	5	50	48	25	88
2013	28	10	117	113	69	186
2014	12	5	50	48	25	88
2015	22	1	92	88	52	150
2016	19	2	79	76	44	132
2017	18	6	75	72	41	126
2018	19	7	81	78	45	137
2019	16	8	68	65	37	114
2020[a]	No estimate					
2021[a]	No estimate					
2022[a]	No estimate					
2023[a]	No estimate					

[a] Mark-resight estimation was not feasible because of only 1 round of observation flights.

Table 9. Three-year moving average for mark-resight estimates of the number of female grizzly bears with cubs, Greater Yellowstone Ecosystem, 1998–2023. Mean, median, and quartile values were derived from the posterior distributions of estimates of the number of female bears with cubs, excluding those observed <500 meters from army cutworm moth aggregation sites.

				Quartile	
Year	Mean	Median	Mode	0.025	0.975
1998	25	24	23	14	42
1999	35	34	31	20	56
2000	49	47	44	30	76
2001	79	77	75	51	120
2002	74	72	67	47	112
2003	78	76	70	50	118
2004	57	55	53	36	88
2005	79	77	71	51	120
2006	83	81	76	54	126
2007	90	88	81	59	136
2008	78	76	72	50	118
2009	78	76	72	50	117
2010	74	72	70	47	111
2011	71	69	68	45	108
2012	78	76	72	50	118
2013	72	70	65	46	110
2014	86	84	81	56	130
2015	74	72	68	47	112
2016	82	80	79	53	124
2017	80	77	73	52	123
2018	75	73	69	49	112
2019	Insufficient data for 3-year moving average				
2020	Insufficient data for 3-year moving average				
2021	Insufficient data for 3-year moving average				
2022	Insufficient data for 3-year moving average				
2023	Insufficient data for 3-year moving average				

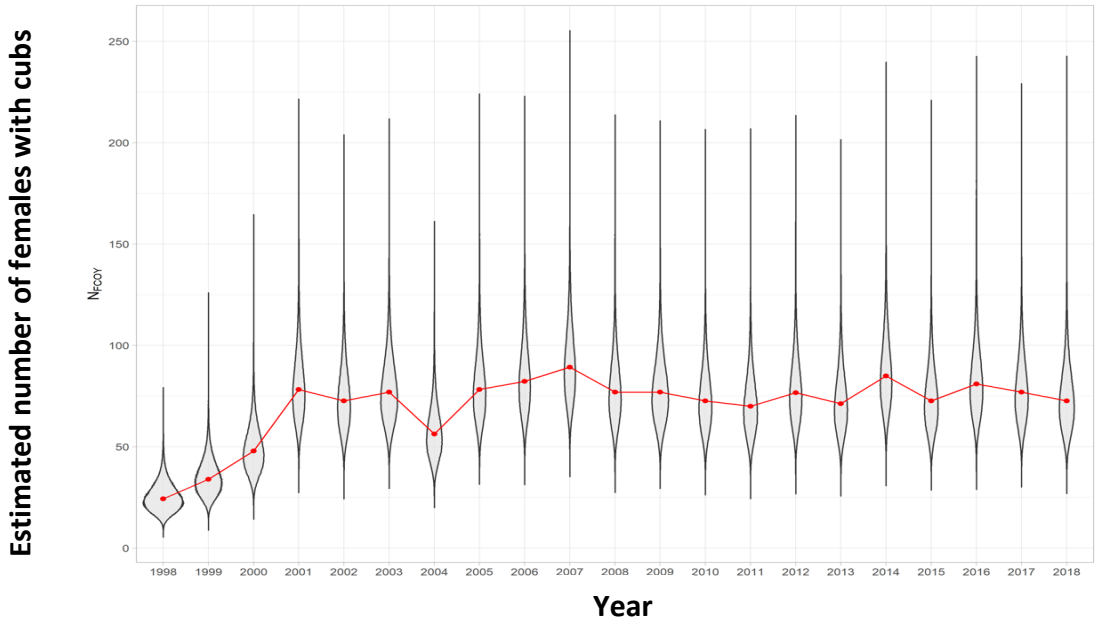

Fig. 3. Annual mark-resight estimates (3-year moving average [red dots], 95% inter quartile [gray area]) of the number of female grizzly bears with cubs (N_{FCOY}), Greater Yellowstone Ecosystem, 1998–2018. Estimates exclude females with cubs observed <500 meters from army cutworm moth aggregation sites. No mark-resight estimates were obtained in 2020, 2021, 2022, and 2023.

Occupancy of Bear Management Units by Females with Young *(Mark A. Haroldson and Bryn E. Karabensh, U.S. Geological Survey, Interagency Grizzly Bear Study Team)*

Dispersion of reproductive females throughout the ecosystem is assessed by verified observations of female grizzly bears with young (cubs, yearlings, 2-year-olds, or young of unknown age) by bear management unit (BMU). The requirements specified in the Demographic Recovery Criteria (USFWS 2007*b*) state that 16 of the 18 BMUs must be occupied by females with young on a running 6-year sum with no 2 adjacent BMUs unoccupied. All 18 BMUs had verified observations of female grizzly bears with young during 2023 (Table 10). Eighteen of 18 BMUs contained verified observations of females with young in at least 6 years of the last 6-year (2018–2023) period.

Table 10. Bear Management Units in the Greater Yellowstone Ecosystem occupied by females with young (cubs, yearlings, 2-year-olds, or young of unknown age), as determined by verified reports, 2018–2023.

Bear Management Unit	2018	2019	2020	2021	2022	2023	Years occupied
1) Hilgard	X	X	X	X	X	X	6
2) Gallatin	X	X	X	X	X	X	6
3) Hellroaring/Bear	X	X	X	X	X	X	6
4) Boulder/Slough	X	X	X	X	X	X	6
5) Lamar	X	X	X	X	X	X	6
6) Crandall/Sunlight	X	X	X	X	X	X	6
7) Shoshone	X	X	X	X	X	X	6
8) Pelican/Clear	X	X	X	X	X	X	6
9) Washburn	X	X	X	X	X	X	6
10) Firehole/Hayden	X	X	X	X	X	X	6
11) Madison	X	X	X	X	X	X	6
12) Henrys Lake	X	X	X	X	X	X	6
13) Plateau	X	X	X	X	X	X	6
14) Two Ocean/Lake	X	X	X	X	X	X	6
15) Thorofare	X	X	X	X	X	X	6
16) South Absaroka	X	X	X	X	X	X	6
17) Buffalo/Spread Creek	X	X	X	X	X	X	6
18) Bechler/Teton	X	X	X	X	X	X	6
Total	18	18	18	18	18	18	

Observation Flights *(Bryn E. Karabensh, U.S. Geological Survey, Interagency Grizzly Bear Study Team)*

Fifty-four Bear Observation Areas (Fig. 4) were established in 2014. In 2023, 1 round of observation flights was conducted: 36 BOAs were surveyed during this round over a time period (6 Jun–16 Aug) that helped optimize sightability. Total duration of observation flight time was 78 hours; average duration of individual flights was 2.2 hours (Table 11). Excluding dependent young, 317 bear sightings were recorded during observation flights. Of the 317 sightings, 6 were radio-marked bears (2 females with young, 4 females without young, and 1 male), 253 were solitary unmarked bears, and 58 were unmarked females with young (Table 11). Our observation rate was 4.04 bears per hour for all bears. A total of 110 young (57 cubs, 49 yearlings, and 4 2-year-olds) were observed (Table 12). Observation rates for females with dependent young were 0.75 females with young per hour and 0.37 females with cubs per hour (Table 11).

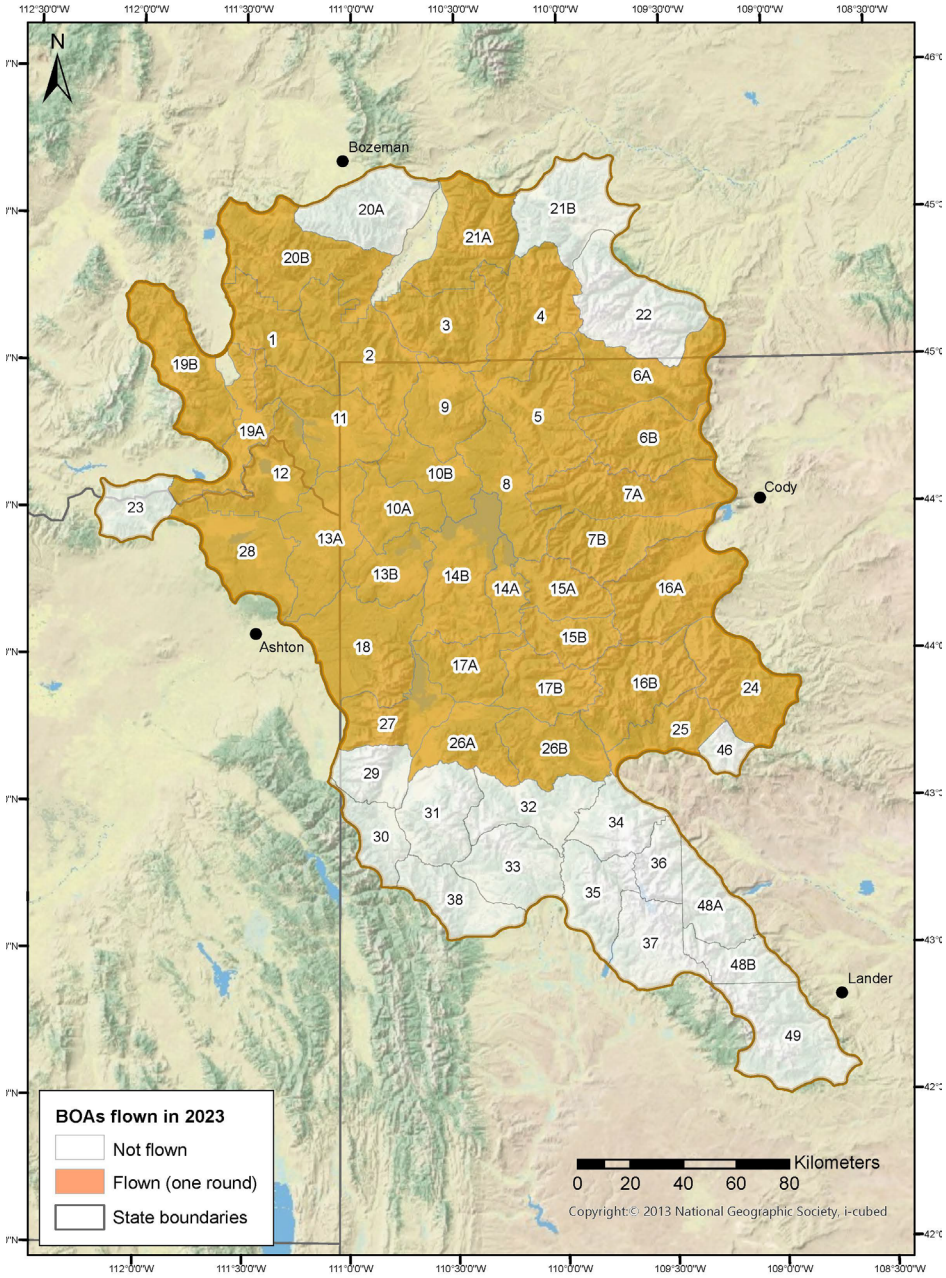

Fig. 4. Grizzly bear observation areas for aerial surveys, Greater Yellowstone Ecosystem, 2023. Areas in orange were surveyed in 2023, areas in white shading were not surveyed. Numbers represent the 54 Bear Observation Areas (BOAs), with several larger areas split into 2 subsections (A and B). Base map source: 2013 National Geographic Society, i-cubed, Washington, D.C.

Table 11. Annual summary statistics for grizzly bear observation flights, Greater Yellowstone Ecosystem, 2009–2023.

Year[a]	Observation period	Total hours	Number of flights	Average hours/flight	Bears seen					Observation rate (bears/hour)		
					Marked		Unmarked		Total number of groups	All groups	With young	With cubs
					Lone	With young	Lone	With young				
2009	Round 1	90.3	47	1.9	1	0	85	21	107	1.2		
	Round 2	93.6	47	2	2	0	157	34	193	2.1		
	Total	183.9	94	2	3	0	242	55	300	1.6	0.3	0.2
2010	Round 1	101.1	48	2.1	0	2	93	22	117	1.2		
	Round 2	93.3	46	2	0	0	161	41	202	2.2		
	Total	194.4	94	2.1	0	2	254	63	319	1.6	0.3	0.2
2011	Round 1	88.9	47	1.9	2	1	153	31	187	2.1		
	Round 2	71	35	2	4	0	109	23	136	1.9		
	Total	159.8	82	1.9	6	1	262	54	323	2	0.3	0.2
2012	Round 1	95.4	48	2	4	2	178	35	219	2.3		
	Round 2	73.7	35	2.1	2	1	117	30	150	2		
	Total	169.1	83	2	6	3	295	65	369	2.2	0.4	0.2
2013	Round 1	97	48	2	2	1	152	44	199	2.1		
	Round 2	72.8	35	2.1	4	1	171	48	224	3.1		
	Total	169.8	83	2.1	6	2	323	92	423	2.5	0.6	0.4
2014	Round 1	104	52	2	2	2	170	47	221	2.1		
	Round 2	88.6	43	2.1	3	1	188	60	252	2.8		
	Total	192.6	95	2	5	3	358	107	473	2.5	0.6	0.3
2015	Round 1	104	52	2	4	1	126	34	165	1.6		
	Round 2	88.6	44	2	1	2	142	41	186	2.1		
	Total	192.7	96	2	5	3	268	75	351	1.8	0.4	0.2
2016	Round 1	106.8	53	2	5	3	133	36	177	1.7		
	Round 2	86.5	42	2.1	1	2	95	32	130	1.5		
	Total	193.3	95	2	6	8	228	68	307	1.6	0.4	0.2
2017a	Round 1	105.5	54	2	7	2	153	36	198	1.9		
	Round 2	79	40	2	8	2	127	36	173	2.2		
	Total	184.5	94	2	15	4	280	72	371	2	0.4	0.3
2018	Round 1	105.8	54	2	6	3	185	58	252	2.4		
	Round 2	73.6	40	1.8	1	1	105	35	142	1.9		
	Total	179.4	94	1.9	7	4	290	93	394	2.2	0.5	0.3
2019	Round 1	107.8	54	2	7	4	183	56	251b	2.3		
	Round 2	91	42	2.2	9	1	188	43	242c	2.7		
	Total	198.8	96	2.1	16	5	371	99	493	2.5	0.5	0.2
2020	Round 1	78.5	36	2.2	7	2	222	72	303	3.9		
	Round 2											
	Total	78.5	36	2.2	7	2	222	72	303	3.9	0.9	0.5
2021	Round 1	69.9	33	2.1	8	4	214	71	297	4.3		
	Round 2											
	Total	69.9	33	2.1	8	4	214	71	297	4.3	1.1	0.6
2022	Round 1	75	36	2.1	12	2	240	71	299	4		
	Round 2											
	Total	75	36	2.1	12	2	240	71	299	4	0.79	0.43
2023	Round 1	78.4	36	2.2	5	1	258	59	317	4		
	Round 2											
	Total	78.4	36	2.2	5	1	258	59	317	4	0.75	0.37

[a] Dates of flights (Round 1, Round 2): 2006 (5 Jun–9 Aug, 30 Jun–28 Aug); 2007 (24 May–2 Aug, 21 Jun–14 Aug); 2008 (12 Jun–26 Jul, 1 Jul–23 Aug); 2009 (26 May–17 Jul, 8 Jul–27 Aug); 2010 (8 Jun–22 Jul, 10 Jul–24 Aug); 2011 (15 Jun–17 Aug, 21 Jul–29 Aug); 2012 (29 May–30 Jul, 9 Jul–23 Aug); 2013 (6 Jun–25 Jul, 7 Jul–20 Aug); 2014 (10 Jun–25 Jul, 7 Jul–29 Aug); 2015 (1 Jun–21 Jul, 1 Jul–31 Aug); 2016 (2 Jun–24 Jul, 7 Jul–28 Aug); 2017 (1 Jun–31 Aug, 4 Jul–28 Aug); 2018 (12 Jun-13 Aug, 10 Jul-29 Aug); 2019 (4 Jun–6 Aug, 4 Jul–28 Aug); 2020 (10 Jun–16 Aug, not flown); 2021 (11 Jun–15 Aug, not flown); 2022 (26 Jun-23 Aug, not flown); 2023 (6 Jun-16 Aug, not flown).

[b] Includes observation of 3 cubs of the year without adult female present.

[c] Includes observation of 2 cubs of the year without adult female present.

Table 12. Size and age composition of grizzly bear family groups seen during observation flights, Greater Yellowstone Ecosystem, 2009–2023.

		No. of females with cubs by litter size			No. of females with yearlings by litter size			No. of females with 2-year-olds or young of unknown age by litter size		
Year[a]	Round	1	2	3	1	2	3	1	2	3
2009	Round 1	0	6	4	2	3	1	3	1	0
	Round 2	6	11	1	3	7	1	4	1	1
	Total	6	17	5	5	10	2	7	1	1
2010	Round 1	2	7	2	2	6	1	4	0	0
	Round 2	10	10	7	5	4	3	1	4	3
	Total	12	17	9	7	10	4	5	4	3
2011	Round 1	4	8	3	3	6	1	2	2	3
	Round 2	2	8	4	2	2	1	1	3	0
	Total	6	16	7	5	8	2	3	5	3
2012	Round 1	5	19	1	2	3	4	0	2	1
	Round 2	5	9	0	4	6	2	1	3	1
	Total	10	28	1	6	9	6	1	5	2
2013	Round 1	8	20	4	1	5	0	3	4	0
	Round 2	11	21	3[c]	2	7	0	0	5	0
	Total	19	41	7[c]	3	12	0	3	9	0
2014	Round 1	8	17	3	6	14	0	1	0	0
	Round 2	1	15	8	11	18	3	2	2	1
	Total	9	32	11	17	32	3	3	2	1
2015	Round 1	6	18	15	2	20	6	0	2	0
	Round 2	9	22	12	2	24	6	2	0	4[d]
	Total	15	40	27	4	44	12	2	2	4[d]
2016	Round 1	3	16	2	5	8	1	2	2	0
	Round 2	8	11	6	2	4	1	1	1	0
	Total	11	27	8	7	12	2	3	3	0
2017	Round 1	6	14	3	4	7	2	0	2	0
	Round 2	5	20	2	5	3	0	1	1	1
	Total	11	34	5	9	10	2	1	3	1
2018	Round 1	7	24	10	5	7	2[b]	3	3	0
	Round 2	5	8	4	6	11	2	0	0	0
	Total	12	32	14	11	18	4	3	3	0
2019	Round 1	11	10	2c	9	16	5	6	0	1
	Round 2	2	14	3	8	14	2	0	1	0
	Total	13	24	5	17	30	7	6	1	1
2020	Round 1	10	29	1	12	18	2	0	2	0
	Round 2									
	Total	10	29	1	12	18	2	0	2	0
2021	Round 1	10	21	10	9	21	3	1	0	0
	Round 2									
	Total	10	21	10	9	21	3	1	0	0
2022	Round 1	11	18	3	8	16	2	0	1	0
	Round 2									
	Total	11	18	3	8	16	2	0	1	0
2023	Round 1	5	11	5	7	12	2	2	1	0
	Round 2									
	Total	5	11	5	7	12	2	2	1	0

[a] Dates of flights (Round 1, Round 2): 2006 (5 Jun–9 Aug, 30 Jun–28 Aug); 2007 (24 May–2 Aug, 21 Jun–14 Aug); 2008 (12 Jun–26 Jul, 1 Jul–23 Aug); 2009 (26 May–17 Jul, 8 Jul–27 Aug); 2010 (8 Jun–22 Jul, 10 Jul–24 Aug); 2011 (15 Jun–17 Aug, 21 Jul–29 Aug); 2012 (29 May–30 Jul, 9 Jul–23 Aug); 2013 (6 Jun–25 Jul, 7 Jul–20 Aug); 2014 (10 Jun–25 Jul, 7 Jul–29 Aug); 2015 (1 Jun–21 Jul, 1 Jul–31 Aug); 2016 (2 Jun–24 Jul, 7 Jul–28 Aug); 2017 (1 Jun–31 Aug, 4 Jul–28 Aug); 2018 (12 Jun-13 Aug, 10 Jul-29 Aug); 2019 (4 Jun–6 Aug, 4 Jul–28 Aug); 2020 (10 Jun–16 Aug); 2021 (11 Jun–15 Aug, not flown); 2022 (26 Jun-23 Aug, not flown); 2023 (6 Jun-16 Aug, not flown).

[b] Includes 1 female with 4 yearlings.

[c] Includes 1 female with 4 cubs.

[d] Includes 1 female with 4 young of unknown age.

Telemetry Location Flights *(Bryn E. Karabensh, U.S. Geological Survey, Interagency Grizzly Bear Study Team)*

We conduct telemetry flights to locate grizzly bears and, if possible, obtain visual confirmation of their status. Additionally, for females, telemetry flights allow us to document when they reproduce and the age and number of offspring. Changes in litter size over the active season provides important data for estimation of cub and yearling survival. Eighty-seven telemetry location flights were conducted during 2023, resulting in 254 hours of search time (excluding ferry time to and from airports; Table 13). Flights were conducted at least once during all months, with 67% of telemetry flights from May–November. During telemetry flights, 882 locations of bears equipped with radio transmitters were collected, 233 (26%) of which included a visual sighting. Fifty-two sightings of unmarked bears were also obtained during telemetry flights, including 38 solitary bears, 8 adult females with cubs, and 6 adult females with yearlings. No 2-year-old bears were observed during these flights. Rate of observation for all unmarked bears (i.e., bears without radio transmitters) during telemetry flights was 0.06 bears per hour, and 0.26 bears per hour for marked bears. The observation rate during telemetry flights for unmarked adult females with cubs was 0.01 females with cubs per hour.

To reduce flight time and costs associated with aerial telemetry and obtain higher-frequency data, we began deploying satellite GPS collars in 2012 using Argos and Iridium platforms. Since 2014, only Iridium satellite collars have been deployed. These GPS collars are different from those that store GPS locations onboard, which we have deployed since 2000, by providing the ability to download GPS location data via satellites at will or on a fixed schedule. We deployed 16 Iridium GPS collars in 2023 and monitored an additional 34 GPS collars that were deployed in previous years. We obtained over 102,590 GPS locations from the 50 individual grizzly bears we monitored with satellite collars.

Table 13. Summary statistics for radio-telemetry flights to locate grizzly bears, Greater Yellowstone Ecosystem, 2023.

				Radio-marked bears			Unmarked bears observed					
								Number of females			Observation rate (groups/hour)	
Month	No. hours	No. flights	Mean no. hours/flight	No. locations	No. seen	Observation rate (no. groups/hr)	Lone bears	With cubs	With yearlings	With young	All groups	Females with cubs
Jan	12.5	3	4.2	68	0	---	0	0	0	0	---	---
Feb	8.1	2	4.1	57	0	---	0	0	0	0	---	---
Mar	19.0	5	3.8	125	3	0.2	1	0	0	0	0.05	---
Apr	31.7	7	4.5	105	26	0.8	0	0	0	0	---	---
May	33.0	8	4.1	88	56	1.7	3	0	0	0	0.09	---
Jun	31.5	7	4.5	81	50	1.6	13	0	0	0	0.41	---
Jul	33.1	10	3.3	87	46	1.4	43	7	1	0	1.54	0.21
Aug	29.8	8	3.7	78	37	1.2	3	5	0	0	0.27	0.17
Sep	26.0	6	4.3	78	35	1.3	1	3	0	0	0.15	0.12
Oct	29.5	8	3.7	72	18	0.6	0	1	0	0	0.03	0.03
Nov	33.9	9	3.8	113	11	0.3	0	0	0	0	---	---
Dec	11.6	4	2.9	66	0	---	0	0	0	0	---	---
Total	299.7	77	46.9	1018	282	0.94	64	16	1	0	0.27	0.05

Documented Grizzly Bear Mortalities *(Matthew J. Gould, Mark A. Haroldson, U.S. Geological Survey, Interagency Grizzly Bear Study Team; and Jeremiah Smith, Montana Fish, Wildlife and Parks)*

Under the 2017 Revised Demographic Criteria for the GYE, which were amended to the Grizzly Bear Recovery Plan (USFWS 1993, 2017), the IGBST is tasked with documenting grizzly bear mortalities in the DMA and evaluating mortality levels (Demographic Recovery Criterion 3). We evaluate mortalities for population segments within the DMA by deriving known and probable mortalities for independent-age (≥2 years old) females and independent-age males and estimating unknown/unreported mortalities (Cherry et al. 2002). We used these data as input for the IPM to determine the total annual mortality rate for these segments as a percent of their respective population estimates. For dependent bears (<2 years old), we determine human-caused mortality but do not include estimates of unknown and unreported mortality. We report numbers of known and probable mortalities in the GYE and numbers by sex and age class inside and outside the DMA.

We use the definitions provided in Craighead et al. (1988) to classify grizzly bear mortalities in the GYE relative to the degree of certainty regarding each event. Cases in which a carcass is physically inspected or when a management removal occurs are classified as "known" mortalities. Instances are classified as "probable" where evidence strongly suggests a mortality has occurred, but no carcass is recovered. When evidence is circumstantial, with no prospect for additional information, a "possible" mortality is designated. Possible mortalities are not included in the assessment of percent annual mortalities. We continue to tabulate possible mortalities because they provide an additional source of location information for grizzly bears and possible causes of mortalities in the GYE.

2023 Mortality Results

We documented 50 known and probable mortalities in the GYE during 2023, of which 3 (Table 14, #202301, #202306, and# 202311) were estimated to have died prior to 2023. Of the 47 known and probable mortalities for bears that died during 2023, 5 (#202309, #202310, #202333, #202345, #202349) remain under investigation by USFWS and state law enforcement agencies. Specific information related to these mortalities cannot be provided (Table 14, Fig. 5). However, these 5 mortalities are included in the following summaries of all documented mortalities for bears that died during 2023.

Forty-two of the 47 known and probable mortalities during 2023 were attributed to human causes. Among these 42 mortalities, 12 (26%) were due to management removals for livestock depredations. Eleven (26%) were related to anthropogenic site conflicts. Eight (19%) of the 42 human-caused mortalities were the result of reported self-defense kills: 6 from hunting-related incidents and 2 from hiking-related incidents. Other human-caused mortalities included 7 (17%) accidental mortalities (6 vehicle strikes and 1 drowning) and 4 (10%) illegal mortalities.

We documented 3 natural mortalities in 2023 (Table 14). Two of those bears (#202319, #202320, Table 14) died while in their den, likely from starvation or exposure. The cubs were relocated and released in fall 2022 after their mother was removed for human safety concerns. One of the natural mortalities (#202350, Table 14) involved an unmarked male found dead in the South Fork Shoshone River drainage of Wyoming in November. The bear appeared to have died from being impaled with no indication that the wound was human-caused, and no specific cause was evident. There were 5 probable mortalities of cubs from 4 different radio-marked females who lost 1 to 2 cubs each. We documented 2 possible mortalities during 2023 one of which is under investigation (Table 14).

Of the 47 known and probable documented mortalities occurring in 2023, 33 (70%) occurred within the boundaries of the DMA and 14 (30%) occurred outside (Table 15, Fig. 5). During 2023, we documented 10 mortalities of independent-age female bears within the DMA (Table 15). There were 5 management removals, 0 radio-marked mortalities, and 10 reported mortalities (Table 16). Seventeen known and probable mortalities of independent-age males occurred within the DMA (Table 15). We documented 7 management removals, 0 radio-marked mortalities, and 5 reported losses of independent-age males within the DMA (Table 15). There were 6 known or probable human-caused mortalities of dependent young documented in the DMA during 2023 (Table 16). The human-caused mortality rate was 2% for dependent-age males and 2% for dependent-age females.

Specific information pertaining to closed mortality investigations since 2015 will be updated on the IGBST Mortality Lists (Gould et al. 2022) as they become available. We remind readers that some cases can remain open and under investigation for extended periods. The study team cooperates with federal and state law enforcement agencies and cannot release information that could compromise ongoing investigations.

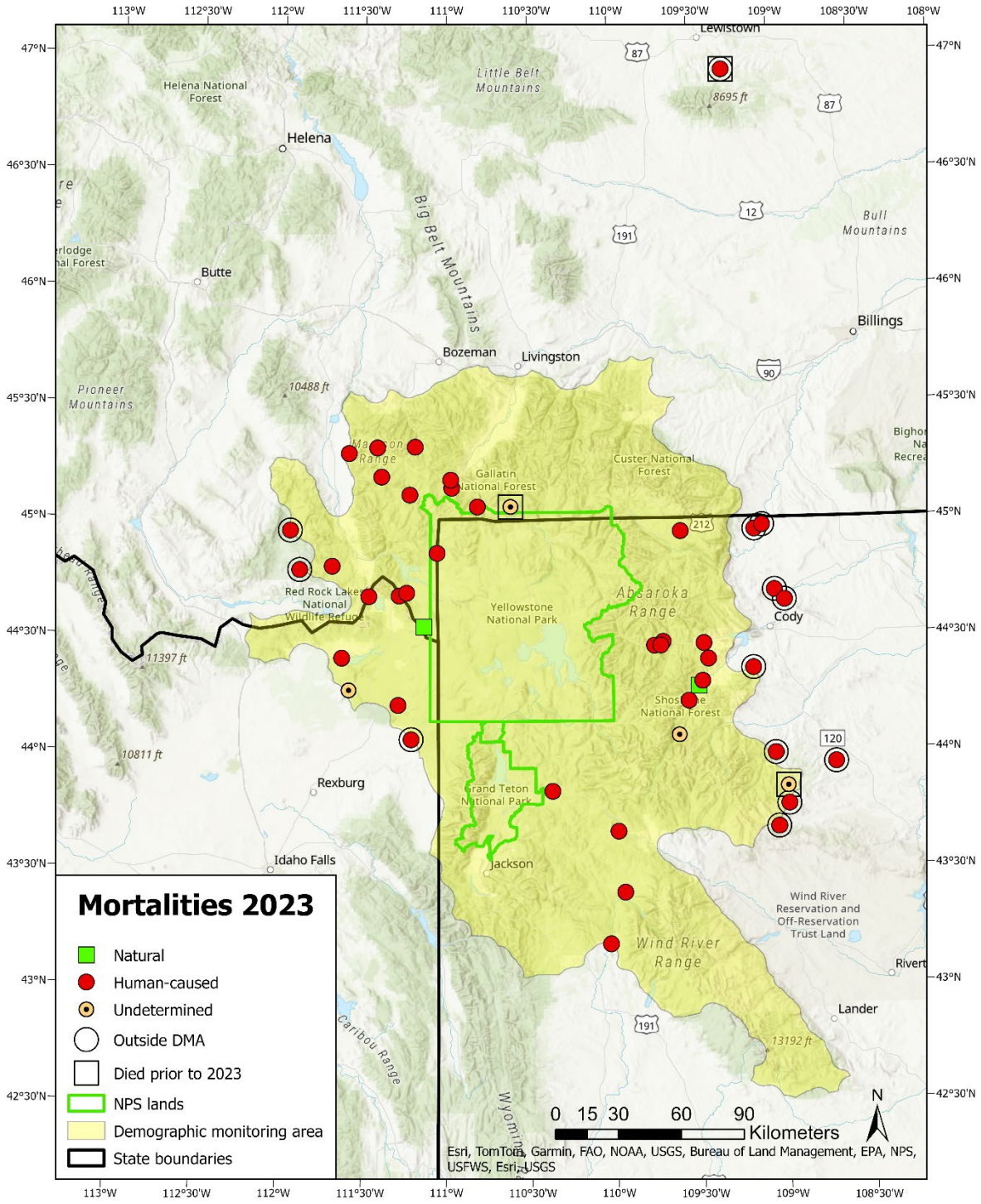

Fig. 5. Distribution of 50 known and probable grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2023, including 3 mortalities that occurred prior to 2023 (black squares around symbols). Thirty-three of the documented mortalities in 2023 were within the Demographic Monitoring Area (DMA), of which 28 were attributed to human causes. Fourteen mortalities in 2023 were outside the DMA (black circles around symbols), all of which were attributed to human causes. Because of multiple bear mortalities at a specific location or separate mortalities occurring close to one another, not all 50 locations are visible on this map. Base map source: Esri, TomTom, Garmin, FAO, NOAA, USGS, Bureau of Land Management, EPA, NPS, USFWS, Esri-USGS.

Table. 14. Grizzly bear mortalities documented in the Greater Yellowstone Ecosystem, 2023.								
Unique #	**Bear[a]**	**Sex[b]**	**Age[c]**	**Date**	**Location[d]**	**Monitoring Area[e]**	**Certainty**	**Notes**
202301	Unm	M	Adult	5/12/2021	Middle Fork Big Spring Creek, Big Snowy Mtns, PR-MT	Outside DMA	Known	Human cause; management capture and removal for cattle depredation by Wildlife Services. Removed in 2021 but genetic analysis results received in January 2023 determined it was a GYE bear.
202302	Unm	M	Adult	5/1/2023	North Fork Shoshone River, SNF-WY	Inside DMA	Known	Human cause; illegal killing of an adult male. Bear was found dead by a highway maintenance crew on the morning of 5/1/2023. The bear had been shot several times.
202303	Unm	F	Adult	5/2/2023	Buffalo Fork, BTNF-WY	Inside DMA	Known	Human cause; self-defense kill of an unmarked female with two 2-year olds by a hiker/antler hunter.
202304	Unm	M	Adult	5/12/2023	South Fork Shoshone River, SNF-WY	Inside DMA	Known	Human cause; vehicle strike of an unmarked adult male.
202305	Unm	M	Adult	5/13/2023	South Fork Shoshone River, PR-WY	Inside DMA	Known	Human cause; management capture and removal for cattle depredation.
202306	Unm	M	Adult	2019	Grass Creek, BLM-WY	Inside DMA	Known	Undetermined; bleached skull and separated lower jaw found by WGFD employee May 2023. Morphometric measurements and characteristics indicate that the bear was an adult male. No evidence to determine cause of death.
202307	Unm	F	Yearling	5/26/2023	Gallatin River, CGNF-MT	Inside DMA	Known	Human cause; vehicle strike of an unmarked yearling female.
202308				2023	MT	Outside DMA	Known	UNDER INVESTIGATION
202309				2023	WY	Outside DMA	Known	UNDER INVESTIGATION
202310				2023	WY	Outside DMA	Known	UNDER INVESTIGATION
202311	630	M	Adult	10/20/2022	Palmer Creek, CGNF-MT	Inside DMA	Known	Undetermined; carcass of bear #630 (adult male) was found by an MTFWP employee investigating if the collar was cast despite the collar not providing a mortality signal. Bear was collared at time of death.
202312	897	M	Adult	6/29/2023	Cottonwood Creek, BDNF-MT	Outside DMA	Known	Human cause; management free range lethal removal of bear #897 by Wildlife Services for chronic cattle depredation.

Table. 14. Continued.								
Unique #	**Bear[a]**	**Sex[b]**	**Age[c]**	**Date**	**Location[d]**	**Monitoring Area[e]**	**Certainty**	**Notes**
202313	G265	M	Adult	7/3/2023	Green River, PR-WY	Inside DMA	Known	Human cause; management capture and removal of bear G265 for cattle depredation.
202314	373	M	Adult	7/5/2023	Henrys Fork, CTNF-ID	Inside DMA	Known	Human cause; management capture and removal of bear #373 for cattle depredation.
202315	Unm	M	Adult	7/6/2023	Heart Mountain Canal, PR-WY	Outside DMA	Known	Human cause; unmarked male drowned in Heart Mountain Canal.
202316	Unm	F	Adult	7/8/2023	Breteche Creek, PR-WY	Inside DMA	Known	Human cause; management capture and removal of an unmarked female for cattle depredation.
202317	Unm	M	Subadult	7/11/2023	North Fork Shoshone River, PR-WY	Inside DMA	Known	Human cause; unmarked subadult male severely injured by vehicle strike. Euthanized by WYDGF.
202318	Unm	F	Subadult	7/14/2023	Little Bear Creek, SNF-WY	Inside DMA	Known	Human cause; management free range lethal removal of an unmarked subadult female for bold, food conditioned behavior around people. Conflict history dates back to summer 2022.
202319	1090	M	Cub	5/30/2023	Black Bear Canyon, CGNF-MT	Inside DMA	Known	Natural but human-influenced; bear #1090 died in den (12/16/22-5/30/23) with sibling (#1091) likely from exposure or starvation. Transported and released in fall of 2022 after removal of mother (#416) for conflict. Was wearing VHF backpack at time of death.
202320	1091	M	Cub	5/30/2023	Black Bear Canyon, CGNF-MT	Inside DMA	Known	Natural but human-influenced; bear #1091 died in den (12/16/22-5/30/23) with sibling (#1090) likely from exposure or starvation. Transported and released in fall of 2022 after removal of mother (#416) for conflict. Was wearing VHF backpack at time of death.
202321	Unm	F	Cub	7/25/2023	Howard Creek, CTNF-ID	Inside DMA	Known	Human cause; vehicle strike of an unmarked female cub (cub 1 of 2, #909).
202322	1078	M	Adult	7/20/2023	Crow Creek, BTNF-WY	Inside DMA	Known	Human cause; management capture and removal of bear #1078 for cattle depredation. Bear was collared at time of removal.

Table. 14. Continued.								
Unique #	**Bear[a]**	**Sex[b]**	**Age[c]**	**Date**	**Location[d]**	**Monitoring Area[e]**	**Certainty**	**Notes**
202323	729	M	Adult	7/25/2023	Crow Creek, BTNF-WY	Inside DMA	Known	Human cause; management capture and removal of bear #729 for chronic cattle depredation. Bear was not collared at time of removal.
202324	Unm	M	Adult	7/29/2023	Wood River, PR-WY	Outside DMA	Known	Human cause; management capture and removal of an unmarked adult male for property damage (chicken coop) and obtaining food rewards (chicken feed).
202325	Unm	F	Adult	8/6/2023	Jack Creek, PR-MT	Inside DMA	Known	Human cause; management capture and removal of an unmarked female for human food conditioned behavior.
202326	Unm	F	Subadult	8/6/2023	Meadow Creek, PR-WY	Outside DMA	Known	Human cause; management capture and removal of an unmarked female for cattle depredation.
202327	633	M	Adult	8/10/2023	Horse Creek, PR-MT	Inside DMA	Known	Human cause; management capture and removal of bear #633 for cattle depredation and old age. Bear was not collared at time of removal.
202328	Unk	Unk	Adult	8/2/2023	Boulder Creek, SNF-WY	Inside DMA	Known	Undetermined; bear was observed dead near Needle Peak above moth site during observation flight in unit 16A by WGFD employee. Mortality date estimated.
202329	Unm	M	Adult	8/12/2023	Owl Creek, PR-WY	Outside DMA	Known	Human cause; management capture and removal of an unmarked adult male for cattle depredation.
202330	Unm	M	Adult	8/17/2023	Owl Creek, PR-WY	Outside DMA	Known	Human cause; management capture and removal of an unmarked adult male for cattle depredation.
202331	Unm	F	Adult	8/18/2023	Moss Creek, BDNF-MT	Inside DMA	Known	Human cause; management free range lethal removal by Wildlife Services of an unmarked adult female for cattle depredation.
202332	Unm	F	Adult	8/29/2023	Clarks Fork Yellowstone River, PR-WY	Outside DMA	Known	Human cause; management capture and removal of an unmarked adult female for crop damage and nuisance activity in agricultural areas.

Table. 14. Continued.

Unique #	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Monitoring Area[e]	Certainty	Notes
202333				2023	MT	Inside DMA	Known	UNDER INVESTIGATION
202334	Unm	F	Yearling	8/30/2023	Fall River, PR-ID	Outside DMA	Known	Human cause; management capture and removal of an unmarked yearling female for extreme human food conditioning, habituation, and aggression.
202335	Unm	M	Yearling	8/30/2023	Fall River, PR-ID	Outside DMA	Known	Human cause; management capture and removal of an unmarked yearling male for extreme human food conditioning, habituation, and aggression.
202336	552	M	Adult	9/1/2023	Clarks Fork Yellowstone River, PR-WY	Outside DMA	Known	Human cause; management capture and removal of bear #552 for crop damage, apiary damage, and nuisance activity in agricultural areas. Bear was not collared at time of death.
202337	909	F	Adult	9/3/2023	Buttermilk Creek, PR-MT	Inside DMA	Known	Human cause; management free range lethal removal of bear #909 for immediate human safety and property damage. Bear was not collared at time of death.
202338	Unm	M	Cub	9/3/2023	Buttermilk Creek, PR-MT	Inside DMA	Known	Human cause; management capture and live removal of an unmarked male cub to a zoo (cub 2 of 2, #909) for human safety and property damage.
202339	556	M	Adult	9/1/2023	Sheridan Creek, BLM-ID	Inside DMA	Known	Human cause; self-defense kill of bear #556 by two archery hunters while hiking in thick timber. Bear was not collared at time of death.
202340	Unm	M	Subadult	9/10/2023	Iron Creek, PR-WY	Outside DMA	Known	Human cause; management capture and removal of an unmarked subadult male for crop damage, habituation to agricultural feed and fields, and living among residential area.
202341	Unm	M	Subadult	9/10/2023	Aspen Creek, SNF-WY	Inside DMA	Known	Human cause; illegally shot during a site conflict and reported by public. Illegal take.
202342	Unm	M	Subadult	9/15/2023	Blue Creek, CTNF-ID	Inside DMA	Known	Undetermined; hunter found and reported an unknown yearling male. Bear appears to have been dead for a couple of days.
202343	G269	M	Adult	9/18/2023	Lava Creek, SNF-WY	Inside DMA	Known	Human cause; self-defense kill of bear G269 by two archery hunters. Bear was not collared at time of death.
202344	Unm	M	Yearling	9/22/2023	Grayling Creek, YNP	Inside DMA	Known	Human cause; vehicle strike of an unmarked yearling male on Highway 191, MT.

Table. 14. Continued.								
Unique #	**Bear[a]**	**Sex[b]**	**Age[c]**	**Date**	**Location[d]**	**Monitoring Area[e]**	**Certainty**	**Notes**
202345				2023	MT	Inside DMA	Known	UNDER INVESTIGATION
202346	Unm	M	Adult	9/30/2023	June Creek, SNF-WY	Inside DMA	Known	Human cause; management capture and removal of an unmarked adult male for food habituation, receiving food rewards, and human-safety.
202347	620	F	Adult	9/30/2023	Timber Creek, CTNF-ID	Inside DMA	Known	Human cause; self-defense kill of bear #620 by an archery hunter. The bear was not collared at time of death. DNA results indicate this is bear #620 (was #1042).
202348	Unm	F	Subadult	10/17/2023	Gallatin River, CGNF-MT	Inside DMA	Known	Human cause; vehicle strike of an unmarked subadult female.
202349				2023	MT	Outside DMA	Known	UNDER INVESTIGATION
202350	Unm	M	Subadult	11/5/2023	South Fork Shoshone River, PR-WY	Inside DMA	Known	Natural; unmarked subadult male bear was found by ranch manager impaled behind left shoulder potentially from an elk.
202351	Unm	Unk	Subadult	5/8/2023	Buffalo Fork, BTNF-WY	Inside DMA	Possible	Human cause; 1st of 2 2-year olds of female 202304 killed in self-defense by a hiker/antler hunter. No evidence bear was wounded.
202352				2023	MT	Inside DMA	Possible	UNDER INVESTIGATION

[a] Number indicates bear number; Unm = unmarked bear; Unk = unknown if a marked or unmarked bear; Mkd = previously marked bear but identity unknown.

[b] Unk = unknown sex.

[c] Cub = <1 year old; yearling = 1–2 years old; subadult = 2–4 years old; adult = ≥5 years old; Unk = unknown age.

[d] BTNF = Bridger-Teton National Forest, BLM = Bureau of Land Management, CTNF = Caribou-Targhee National Forest, CGNF = Custer Gallatin National Forest, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, YNP = Yellowstone National Park, PR = private.

[e] Location relative to Demographic Monitoring Area.

[f] Five probable mortalities of cubs from radio-marked females were recorded.

Table 15. Counts of documented known and probable grizzly bear mortalities that occurred in 2023 by mortality cause, sex, age class, and location relative to the Demographic Monitoring Area (DMA), Greater Yellowstone Ecosystem.

Area	Mortality category	Dependent (<2 years old)	Independent (≥2 years old)			Total
			Females	Males	Unknown	
Inside DMA	Natural	2	0	1	0	3
	Site Conflict	1	3	1	0	5
	Self-defense	0	4	3	0	7
	Illegal	0	0	2	0	2
	Mistaken ID	0	0	0	0	0
	Livestock	0	2	6	0	8
	Accidental	2	1	3	0	6
	Humane removal	0	0	0	0	0
	Unknown	1	0	0	1	2
	Total	6	10	16	1	33
Outside DMA	Natural	0	0	0	0	0
	Site Conflict	2	1	3	0	6
	Self-defense	0	1	0	0	1
	Illegal	0	0	2	0	2
	Mistaken ID	0	0	0	0	0
	Livestock	0	1	3	0	4
	Accidental	0	0	1	0	1
	Humane removal	0	0	0	0	0
	Unknown	0	0	0	0	0
	Total	2	3	9	0	14

Table 16. Mean reporting rate, reported mortalities, and mean estimated combined reported and unreported mortalities along with the 95% credible intervals for the former and latter estimates by population segment for grizzly bears in the Demographic Monitoring Area, Greater Yellowstone Ecosystem, 2023. The estimated combined reported and unreported mortalities are used as inputs into the integrated population model as an additional source of population count data.

Population segment	Estimated reporting rate[a]	Reported mortalities	Estimated combined reported and unreported mortalities[b]
Independent females (≥2 years old)	0.44 (0.35–0.53)	5	13 (6–24)
Independent males (≥2 years old)	0.44 (0.35–0.53)	10[c]	22 (13–36)

[a] Estimate based on Cherry et al. (2002); estimate is developed from mortalities of radio-marked bears over the period 1983–2023 and is estimated using radio-marked females and males combined due to sample size limitations.
[b] Estimates based on Cherry et al. (2002); estimates are derived from reported mortality counts during 2023 and an estimate of the reporting rate. The value is estimated through a Bayesian estimation process and is not calculated by dividing reported mortalities by the estimated reporting rate.
[c] Includes one known mortality where the unknown sex of the bear was randomly generated and assigned as male.

Population Size and Vital Rates *(Matthew J. Gould, Frank T. van Manen, and Mark A. Haroldson, U.S. Geological Survey, Interagency Grizzly Bear Study Team; Justin G. Clapp, Justin A. Dellinger, Dan Thompson, Wyoming Game and Fish Department; and Cecily M. Costello, Montana Fish, Wildlife and Parks)*

Background

Starting in 2017, the IGBST began investigating the merits of an IPM to estimate and monitor vital rates and population abundance of grizzly bears in the GYE. Traditionally, our population modeling first derived estimates of demographic vital rates such as survival and fecundity from a sample of radio-marked individuals. These vital rates were then used in a projection or matrix model to estimate population trend. With the addition of other count data, such as estimates for numbers of females with cubs, we produced estimates of total population size (IGBST 2012). Uncertainty associated with each component was difficult to propagate throughout the process, and confidence bounds for estimates of total population size were underestimated. Because there are separate estimation processes for each parameter, interruptions in data collection for any one process could affect the ability to estimate other parameters. Additionally, preparing data sets for estimating various demographic parameters was time and labor intensive, which is why we previously only reported vital rates and population trends periodically (i.e., 1983–2001 [Schwartz et al. 2006], 2002–2011 [IGBST 2012]).

The enhanced analytical capabilities of the IPM offer important advancements to our demographic monitoring program. Collection of rigorous, long-term data has always been a key strength of the IGBST, and analytical advances now allow us to fully integrate those robust data collections. Implementation of the IPM enables us to annually update vital rates and other demographic parameters relevant to Chapter 2 of the 2024 Conservation Strategy (Yellowstone Ecosystem Subcommittee 2024).

Integrated Population Model

With recent advances in analytics and data collections in the field of wildlife science, more unified approaches allow consolidation of independent sources of data and analyses into a single, joint analysis. Based on Bayesian inference (where available knowledge about parameters in a statistical model is updated with information in observed data), this union is realized in the IPM by simultaneously linking population-level count data with individual-based survival and reproductive data, through what is termed a "state-space model." A state-space model is composed of process and observation submodels, with the former describing the true state of the population over time and the latter linking temporal changes of the population with observation data. The process submodel is a population projection matrix model whereby annual abundance is a function of abundance and population survival and fecundity rates in the preceding year. The observation data (i.e., the population count data) are conditional on the ecological process and it is assumed that changes in the observation data (affected by some degree of observation error) track changes in population abundance. The addition of the population count data provides two benefits: 1) direct information on population abundance over time and 2) indirect information on survival and productivity because these parameters inherently control population abundance. Because of limited demographic information provided by count data, additional information is needed to estimate survival and reproduction through analyses specific to each demographic parameter. By combining count, survival, and reproduction data into a single analysis, more information is available in the estimation of the parameters shared among the state-space, survival, and reproduction submodels.

Implementation of the IPM within IGBST's population monitoring program provides multiple benefits. First, because several parameters are linked across multiple submodels, there is more information available for the estimation process, resulting in what is termed "self-consistent estimates." This refers to the notion that within the IPM analytical framework, estimates from different data sources must reconcile with one another, which generally leads to greater precision and accuracy of estimates. The IPM framework improves our ability to annually update demographic parameters and assess and understand changes in population structure over time. Moreover, because of the inherent flexibility of an IPM, it can accommodate a variety of data collected over different time periods, including interruptions in efforts, and make better use of IGBST's extensive data collections. This flexibility also allows us to modify monitoring protocols and harness future analytical and technological advancements (Gould et al. 2024).

The IPM for the GYE grizzly bear population was developed by researchers at the University of Montana and SpeedGoat Wildlife Solutions, an independent research group, in conjunction with members of the IGBST. The IPM is composed of survival, reproduction, and state-space submodels, each incorporating data from the monitoring program.

Telemetry and observation flight data inform a known-fate survival model for independent-age (≥2 years old) bears. Dependent-age (<2 years old) survival and litter size are latent (i.e., unobserved) parameters while the number of cubs born is estimated based on estimated litter size and the number of adult females expected to give birth (Schwartz et al. 2006, Schwartz and White 2008, IGBST 2012). The latter parameter is based on data from annual ground observations and standardized aerial surveys to estimate the total number of females with cubs in the DMA, based on the $Chao2_{16\ km}$ estimator (Knight et al. 1995; Keating et al. 2002; Cherry et al. 2007; Schwartz et al. 2008; IGBST, 2012, 2021). Data from the aerial observation flights are also analyzed within a mark-resight framework as a second annual estimate of the total number of females with cubs (Higgs et al. 2013). With ancillary data on the annual probability of females transitioning among reproductive states (no offspring, cubs, yearlings, 2-year-old offspring), the total number of adult females can be estimated. Combined with estimates of survival for each population segment, abundance of all remaining cohorts is estimated to obtain annual estimates of total population abundance and population growth. Finally, known, probable, and estimated unknown/unreported mortality data (Cherry et al. 2002) collected since 1983 serve as additional population count data, providing information on the abundance of independent-age male and non-reproductive female population segments. We report estimates of vital rates for adults (≥3 years old), subadults (2 years old), yearlings (1 year old), and cubs (<1 year old), along with estimates of population size and growth rates during 1983–2023.

Vital Rates

Over the 1983–2023 period, median survival rates (median [95% credible interval]) were highest for adult females (0.95 [0.94–0.97]) and adult males (0.94 [0.93–0.96]) followed by subadult females (0.95 [0.93–0.96]) and subadult males (0.93 [0.91–0.95]; Fig. 6). As expected, survival rates for dependent-age bears were lower than independent-age bears: survival for yearling males (0.66 [0.05–0.99]) was slightly higher than yearling females (0.57 [0.03–0.98]) with cub survival lower than yearling survival for both male and female cubs (0.52 [0.11–0.92]; the IPM assumes cub survival for both sexes is equal). Cohort-specific survival rates were similar to those reported by Schwartz et al. (2006) and IGBST (2012) and followed a similar pattern with higher survival rates as individuals reach prime age classes. The male to female sex ratio was functionally equal (i.e., 1.02:1.00). Median proportion of adult females with cubs was 0.29 (0.26–0.31) and median litter size was 2.34 (1.85–2.86) cubs per female (Table 17).

Population Size, Growth Rate, and Mortality Rates

Estimated total abundance at den emergence in 2023 was 1,030 (865–1,230) individual grizzly bears in the DMA (Figs. 7 and 8). The median population growth rate from 2022 to 2023 was $\lambda = 1.03$ (0.91–1.15), a 3% growth from one year to the next (Table 17). Decadal growth rates were 2.3% during the 1980s, 6.4% in the 1990s, 3.0% in the 2000s, and 2.1% in the 2010s. Estimated mortality rates for 2023 were higher for independent-age males (5.8%) compared with independent-age females (4.8%). We note these estimates of total mortality are obtained through the unified framework of the IPM and are not directly comparable to estimates of total mortality rates for years prior to implementation of the IPM. We now report IPM-based estimates of total mortality because these estimates must be self-consistent with other monitoring data that directly or indirectly inform these estimates, thus providing a more robust estimation of overall mortality.

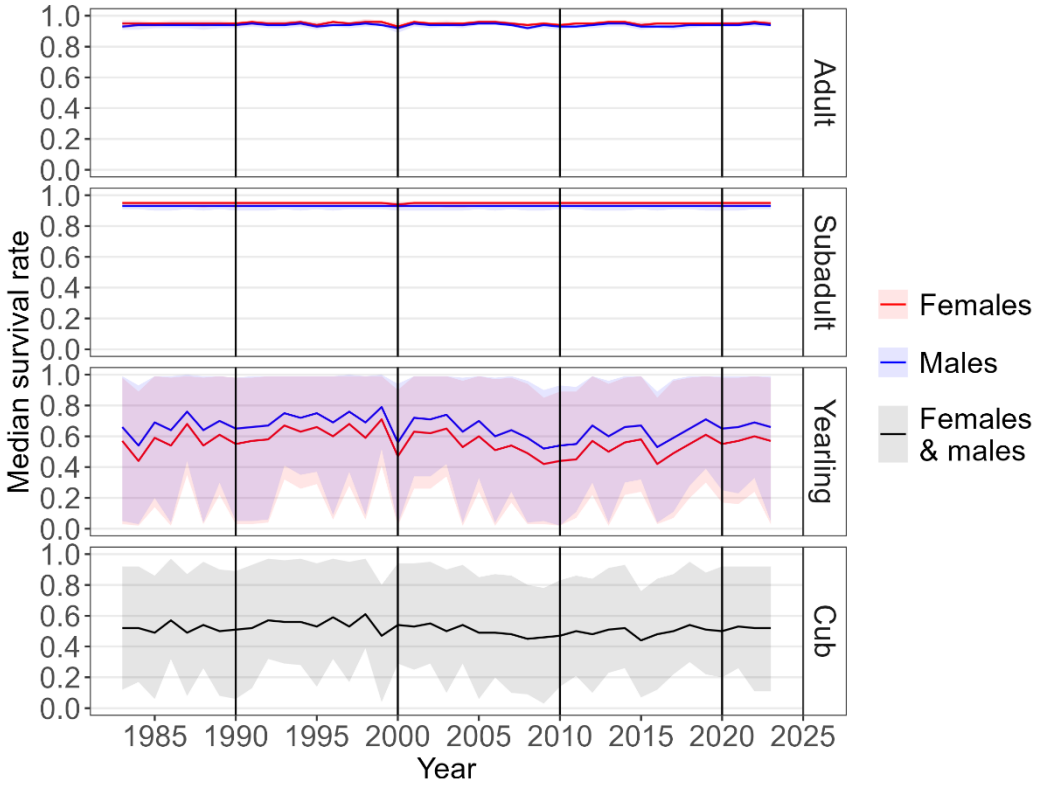

Fig. 6. Estimated median annual survival rates (solid lines) and their 95% credible intervals (shaded areas) for grizzly bears in the Demographic Monitoring Area of the Greater Yellowstone Ecosystem, 1983–2023.

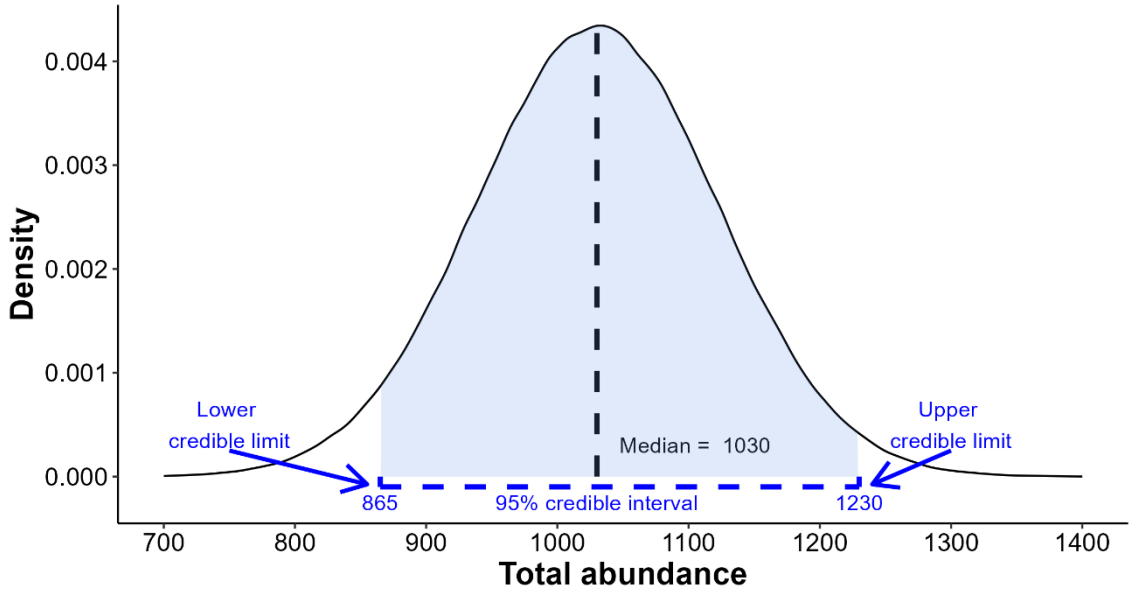

Fig. 7. Approximated posterior density plot of estimated abundance at den emergence for grizzly bears in the Demographic Monitoring Area of the Greater Yellowstone Ecosystem, 2023. The plot visualizes the distribution of potential values for the estimated parameter. The area under the curve represents all possibilities with 'peaks' representing values with a higher probability of occurrence. The distribution can be characterized by the mean (average value), median (middle value), mode (most frequent value), or percentiles (range of values, e.g., 2.5 and 97.5 percentiles [i.e., the 95% credible interval]).

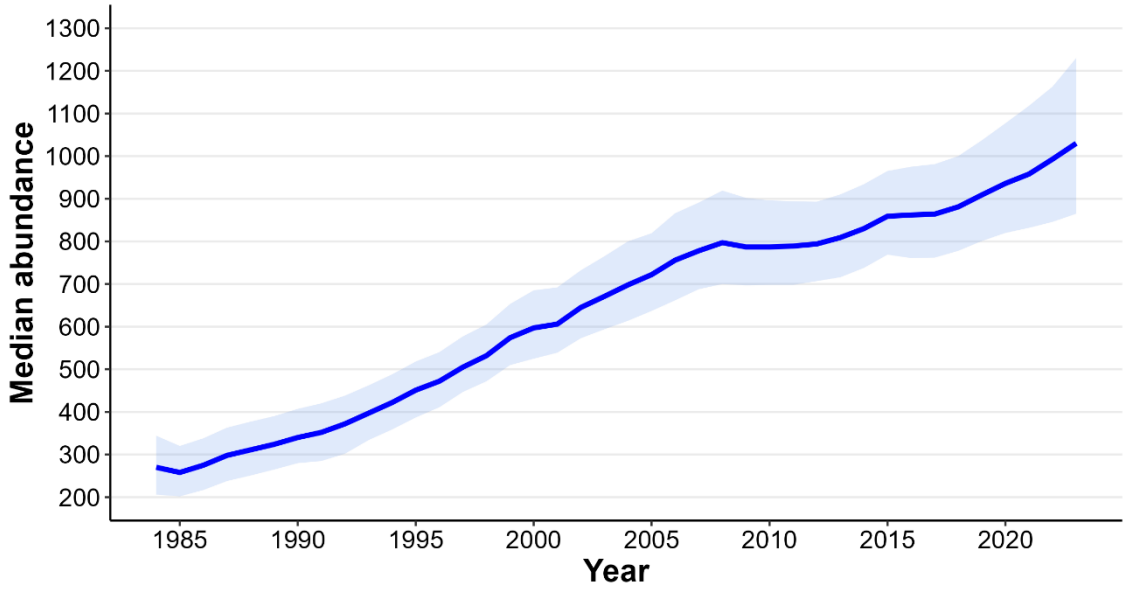

Fig. 8. Estimated median total population abundance (solid line) at den emergence and its 95% credible interval (shaded area) for grizzly bears in the Demographic Monitoring Area of the Greater Yellowstone Ecosystem, 1983–2023. Median total population size in 2023 was estimated at 1,030 grizzly bears (95% credible interval = 865–1,230).

Table 17. Estimated vital rates, population metrics, and mortality rates for grizzly bears in the Greater Yellowstone Ecosystem, 2023[a].

Demographic parameter	Median	95% credible interval
Survival by population segment		
Cubs (assumed equal for females and males)	0.52	0.11–0.92
Yearling females	0.57	0.03–0.98
Yearling males	0.66	0.05–0.99
Subadult females	0.95	0.93–0.96
Subadult males	0.93	0.91–0.95
Adult females	0.95	0.94–0.97
Adult males	0.94	0.93–0.96
Reproduction		
Litter size	2.34	1.85–2.86
Proportion of females with cubs	0.29	0.26–0.31
Population size and growth rate		
Total abundance (2023)[b]	1,030	865–1,230
Independent female abundance	353	--
Independent male abundance	365	--
Dependent female abundance	153	--
Dependent male abundance	153	--
Population growth rate (lambda, 2022–2023)	1.03	0.91–1.15
Percent mortality		
Independent females	4.80	--
Independent males	5.74	--
Dependent females (human-caused only)	2.03	--
Dependent males (human-caused only)	2.01	--

[a] Estimates are specific to the reporting year 2023, based on data inputs for the period 1983–2023.

[b] The sum of segment medians differs from the median of the posterior distribution derived by summing segment estimates each iteration of the model fitting procedure.

MONITORING OF GRIZZLY BEAR FOODS

Grizzly Bear Consumption of Ungulates in Yellowstone National Park *(Kerry A. Gunther, Travis C. Wyman, and Eric G. Reinertson, Yellowstone National Park)*

Ungulates are concentrated sources of calories and protein consumed by grizzly bears through scavenging and predation. Bears show preferential selection of ungulate meat over many other foods. Craighead et al. (1995) observed as many as 23 individual grizzly bears congregating at a single bison (*Bison bison*) carcass in YNP.

State and federal management of bison, elk, and deer populations in the GYE for recreational hunting and addressing disease, property damage, crop damage, and other factors, could influence the number of ungulates on the landscape available to grizzly bears as food. To monitor broad-scale trends in grizzly bear consumption of ungulate meat, we record opportunistic sightings of grizzly bears throughout YNP. These sighting records include information on bear activity, including consumption of bison, moose (*Alces alces*), elk *(Cervus canadensis)*, mule deer (*Odocoileus hemionus*), white-tailed deer (*Odocoileus virginianus*), pronghorn (*Antilocapra americana*), bighorn sheep (*Ovis canadensis*), and mountain goat (*Oreamnos americanus*).

In 2023, we recorded 704 opportunistic observations of grizzly bears, their tracks, and feeding sign in YNP. In 69 (10%) of these observations, grizzly bears fed on ungulate carcasses (Table 18). Grizzly bears were observed consuming ungulate carcasses from March through November (Fig. 9), with most use occurring in April (17%, n = 12), May (26%, n = 18), and July (17%, n = 12). Bison (62%, n = 43) and elk (30%, n = 21) were the species of ungulate most often consumed by grizzly bears. In contrast, black bears fed on ungulate carcasses in only 9 (1%) of 731 opportunistic observations (Table 18). Interference competition from grizzly bears and wolves likely inhibits black bear use of many ungulate carcasses.

The 69 observations of grizzly bears feeding on ungulates in 2023 was equal to the long-term average of 69.0 (± 33.3 standard deviation) recorded over the previous 46 years (1977–2022) (Fig. 10). The 10% proportion of the total number of opportunistic sightings where grizzly bears fed on ungulate carcasses in 2023 was slightly greater than the long-term average of 9% recorded from 1977–2022 (Fig. 11).

A grizzly bear scavenges a bull elk carcass usurped from the 13- member Rescue Creek wolf pack on Yellowstone National Park's northern ungulate winter range in early November.

(Photo courtesy of J. Sunderraj, National Park Service)

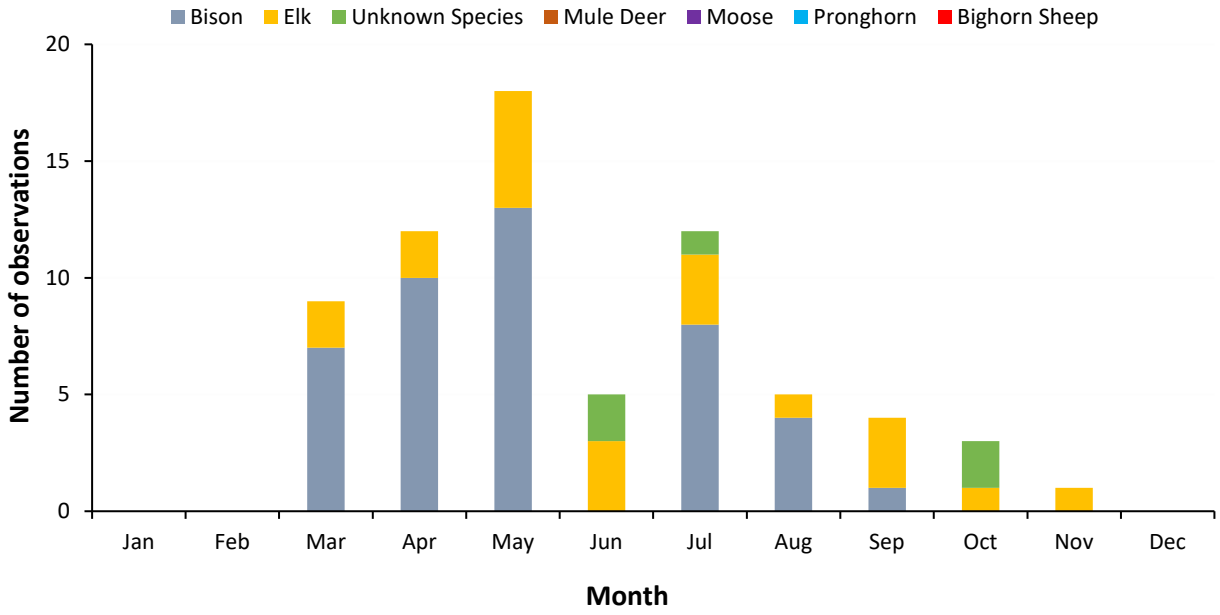

Fig. 9. Number of opportunistic observations of grizzly bears consuming ungulate meat by month in Yellowstone National Park, 2023.

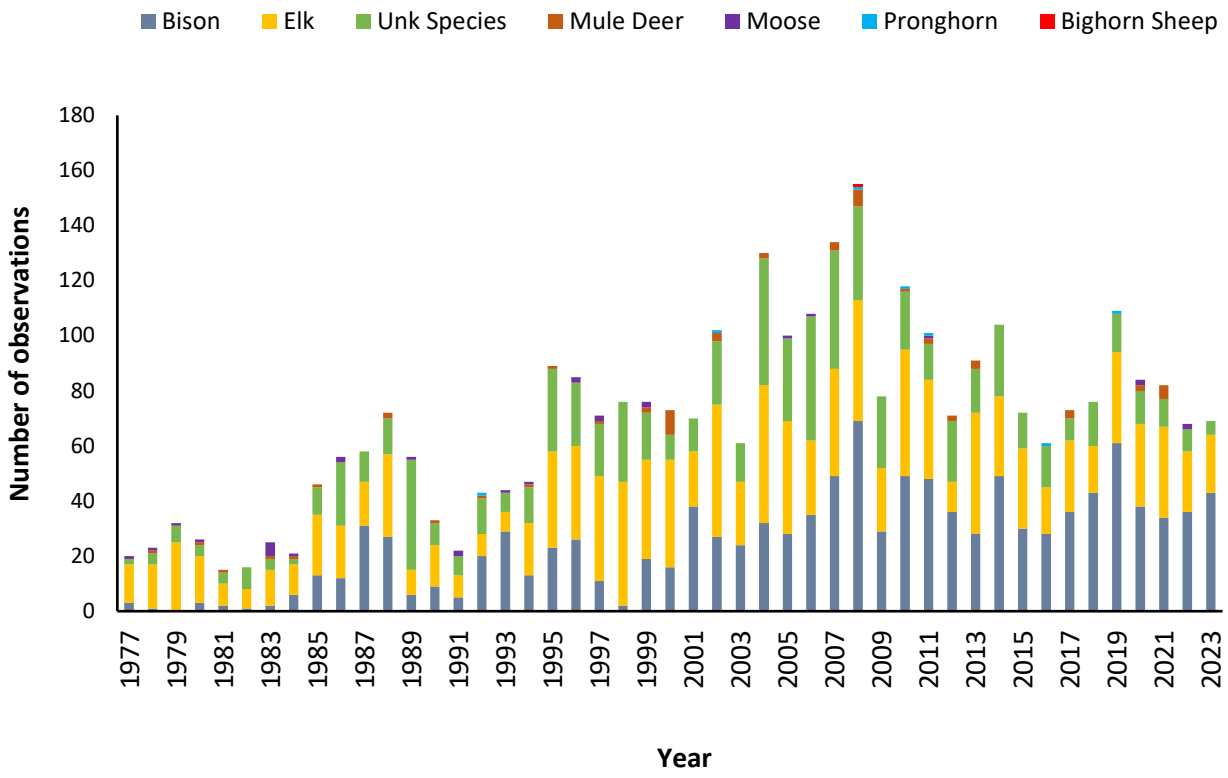

Fig. 10. Number of opportunistic observations of grizzly bears feeding on ungulate carcasses in Yellowstone National Park, 1977–2023.

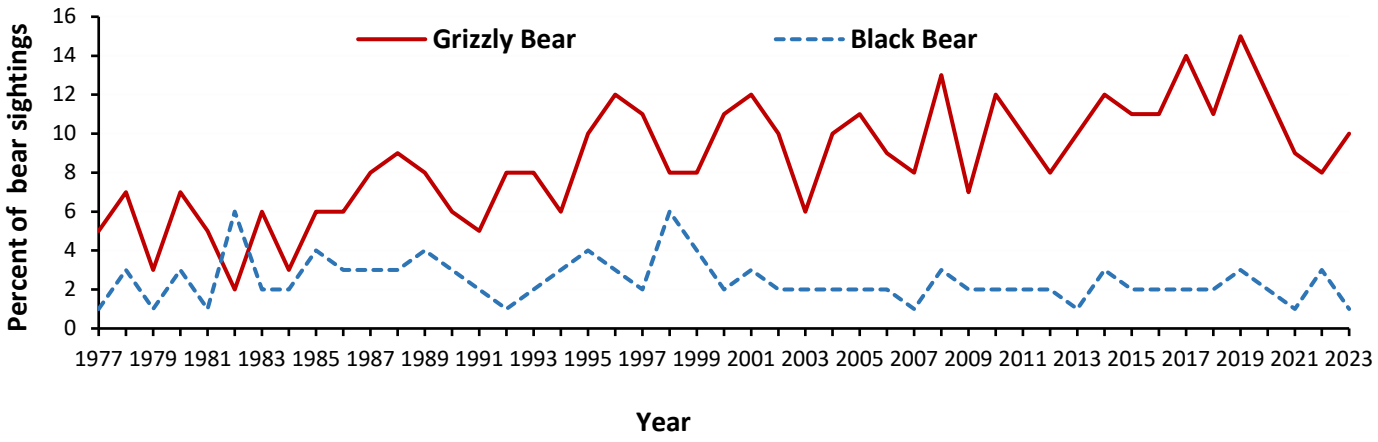

Fig. 11. Proportion of the total number of opportunistic observations of grizzly bears and American black bears where the observed bears were feeding on ungulate carcasses, Yellowstone National Park, 1977–2023.

Table 18. Number of opportunistic observations of grizzly bears and American black bears where the observed bear fed on ungulate carcasses, Yellowstone National Park, 2023.

Species of bear	Species of ungulate consumed									
	Bison	Moose	Elk	Mule Deer	White-tailed deer	Bighorn sheep	Mountain goat	Pronghorn	Unknown ungulate	Total
Grizzly	43	0	21	0	0	0	0	0	5	69
Black	2	0	5	0	0	0	0	0	2	9

Spawning Cutthroat Trout Availability and Use by Grizzly Bears in Yellowstone National Park *(Kerry A. Gunther, Eric G. Reinertson, Travis C. Wyman, Todd M. Koel, and Patricia E. Bigelow, Yellowstone National Park)*

In spring and early summer, grizzly bears with home ranges in the Yellowstone Lake watershed prey on spawning native Yellowstone cutthroat trout (*Oncorhynchus clarkii bouvieri*) in tributary streams of the lake. Bears also occasionally prey on cutthroat trout in other areas of YNP, including Fan Creek (westslope cutthroat trout [*O. clarkii lewisi*], Yellowstone cutthroat trout, or westslope × Yellowstone cutthroat trout hybrids) in the northwest section of the park and the inlet creek to Trout Lake (Yellowstone cutthroat trout or Yellowstone cutthroat trout × rainbow trout *O. mykiss* hybrids) located in the northeast section of the park.

The Yellowstone cutthroat trout population in Yellowstone Lake was substantially reduced in the late-1990s and 2000s through predation by non-native lake trout (*Salvelinus namaycush*), whirling disease caused by an exotic parasite (*Myxobolus cerebralis*), and reduced juvenile recruitment due to drought conditions (Koel et al. 2005, 2006). The combined effect reduced Yellowstone cutthroat trout abundance by >90% in some spawning tributaries (Koel et al. 2006, 2019) and resulted in a noticeable decrease in bear fishing activity around the lake (Haroldson et al. 2005). Because of the Yellowstone cutthroat trout decline and associated trophic changes, and preferential use of this food source by some grizzly bears in the Yellowstone Lake watershed, monitoring of the Yellowstone cutthroat trout population is a component of the habitat monitoring program of the 2016 Yellowstone Grizzly Bear Conservation Strategy (Yellowstone Ecosystem Subcommittee 2016).

The Yellowstone cutthroat trout spawning population was historically monitored through counts at a fish trap located on Clear Creek on the east shore of Yellowstone Lake. The Clear Creek fish weir and trap are no longer operational. A long-term netting assessment program conducted annually in August is now used to monitor lake-wide status and trends of the Yellowstone cutthroat trout population (Koel et al. 2020). Visual stream surveys of North Shore and West Thumb tributaries of the lake are used as indices of trout abundance and associated bear fishing activity. These surveys have been conducted annually since 1989 (Fig. 12). In 2014, we began visual stream surveys along 3 Yellowstone Lake backcountry spawning streams (Flat Mountain Creek, stream #1138, and stream #1141) on the west shore of Yellowstone Lake. Methods used for visual spawning stream surveys are described in Gunther at al. (2022).

Yellowstone Lake

Front-country Visual Stream Surveys

Ice-off on Yellowstone Lake occurred on May 22, 2023. In North Shore streams, 339 spawning Yellowstone cutthroat trout were counted, including 311 in Bridge Creek and 28 in Hatchery Creek (Table 19). No spawning Yellowstone cutthroat trout were observed in Lodge Creek. A black bear was observed on Hatchery Creek and grizzly bear tracks were observed on Bridge Creek. However, no evidence of bear fishing activity (i.e., observations of bears fishing for trout, bear tracks associated with fish parts, or bear scats containing fish parts) were observed along any of the monitored North Shore streams in 2023.

In West Thumb streams, 634 spawning Yellowstone cutthroat trout were counted, including 599 in Little Thumb Creek, 21 in Sandy Creek, 11 in Stream #1167, and 3 in Sewer Creek. Tracks of 2 different grizzly bears were observed along Sewer Creek. Trail camera photos indicated that both a grizzly bear and a black bear were fishing in Little Thumb Creek on multiple occasions.

The number of spawning Yellowstone cutthroat trout counted in North Shore (Fig. 13) and West Thumb (Fig. 14) streams decreased significantly after 1989. Although the increased spawning activity observed in Little Thumb and Bridge Creeks in recent years is promising for Yellowstone cutthroat trout recovery, relatively few spawning trout have been observed in all other monitored North Shore and West Thumb tributary streams.

Backcountry Visual Stream Surveys

In 2023, we surveyed 3 backcountry tributary streams, including Flat Mountain Creek, stream #1138, and stream #1141. In these streams, we counted 96 spawning Yellowstone cutthroat trout, including 43 in stream #1138, 31 in stream #1141, and 22 in Flat Mountain Creek. We observed melted out bear tracks in the snow that could not be identified to species along stream #1141 on 2 separate surveys. A set of bear tracks that could not be identified to species were also observed in the mud along Flat Mountain Creek on 1 survey. Trail camera photos documented a grizzly bear and a black bear fishing in Stream #1138.

Trout Lake

Only 2 spawning cutthroat trout were counted in the Trout Lake inlet creek in 2023. This was the lowest number of spawners counted since visual Trout Lake surveys began in 2001 (Fig. 15). No bears, bear tracks, or bear scats were observed along the Trout Lake inlet creek.

Outlook for Yellowstone Cutthroat Trout

The number of spawning Yellowstone cutthroat trout counted in all surveyed tributary streams of Yellowstone Lake reached an all-time low around 2004 (Figs. 13–15). A Native Fish Conservation Plan/Environmental Assessment was completed in 2010 (Koel et al. 2010*a*,*b*). The plan outlines an adaptive management program designed to protect the native Yellowstone cutthroat trout population through suppression of lake trout and other methods (Koel et al. 2020). As part of these management efforts, park fisheries biologists and private-sector (contracted) netters caught and removed 240,978 lake trout (236,845 in gillnets and 4,133 in trap-nets) from Yellowstone Lake in 2023. Since lake trout suppression efforts began in 1994, >4.6 million lake trout have been removed from the lake through suppression gillnetting and trap-netting. Population models indicate the removal program has slowed lake trout population growth and likely sent the population into decline beginning in 2012 (Syslo et al. 2020). Over the past decade, adult predatory lake trout (age 5+) have been reduced by about 92% (Gresswell et al. 2021, Koel et al. 2022). Adult Yellowstone cutthroat trout now weigh twice what they did prior to the lake trout invasion, probably due to reduced competition, and juveniles are again recruiting into the Yellowstone cutthroat trout population (Koel et al. 2020). Spawning adult Yellowstone cutthroat trout are returning to some tributaries and bears are once again preying on them in a few streams. If the removal program results in a significant long-term reduction in predatory lake trout, managers hope native Yellowstone cutthroat trout will reestablish at higher numbers in Yellowstone Lake and its tributary streams. If the Yellowstone cutthroat trout restoration program is successful, this species may once again become an important diet item for grizzly bears and other terrestrial, aquatic, and avian predators in the Yellowstone Lake watershed (Bergum et al. 2017).

Table 19. Summary statistics for spawning cutthroat trout surveys, Yellowstone National Park, 2023.							
Stream	**Start of spawn**	**Last day of spawn**	**Duration of spawn (days)**	**Number of surveys during spawning period**	**Number of fish counted**	**Average no. fish/survey**	**Evidence of bear fishing[b]**
North Shore Streams							
Lodge Creek			No spawn				
Hatchery Creek	05/22/2023	06/04/2023	14	3	28	9.3	No
Incinerator Creek			Not surveyed				
Wells Creek			Not surveyed				
Bridge Creek	05/22/2023	06/04/2023	14	4	311	77.8	No
West Thumb Streams							
1167 Creek	05/22/2023	05/22/2023	1	1	11	11.0	No
Sandy Creek	05/22/2023	05/29/2023	8	2	21	10.5	No
Sewer Creek	05/29/2023	05/29/2023	1	1	3	3.0	No
Little Thumb Creek	06/08/2023	06/21/2023	14	4	599	149.8	Yes
Total front-country[a]				15	973	64.9	
Backcountry Streams							
Flat Mountain Creek	05/28/2023	06/05/2023	9	2	22	11.0	No
Stream #1138	05/24/2023	06/05/2023	13	3	43	14.3	Yes
Stream #1141	05/24/2023	06/05/2023	13	3	31	10.3	No
Total backcountry				8	96	12.0	
Northern Range							
Trout Lake inlet	07/06/2023	07/06/2023	1	1	2	2.0	No

[a] Total for North Shore and West Thumb streams that had a spawn.
[b] Includes direct observations of bears fishing, trail camera evidence of bears fishing, fish parts with associated bear tracks, or bear scats containing fish parts.

Fig. 12. Locations of Yellowstone Lake cutthroat trout spawning streams surveyed in 2023. Base map: Geographic Society, i-cubed, Washington, D.C.

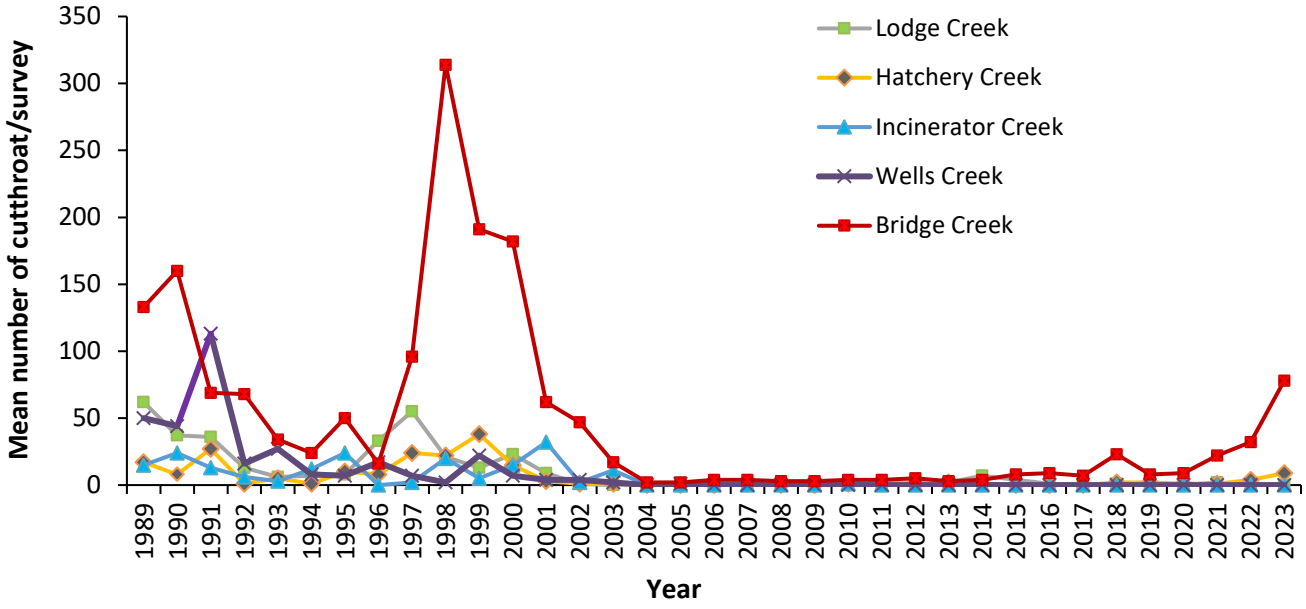

Fig. 13. Mean number of spawning Yellowstone cutthroat trout observed during weekly visual surveys of 5 North Shore spawning stream tributaries to Yellowstone Lake, Yellowstone National Park, 1989–2023.

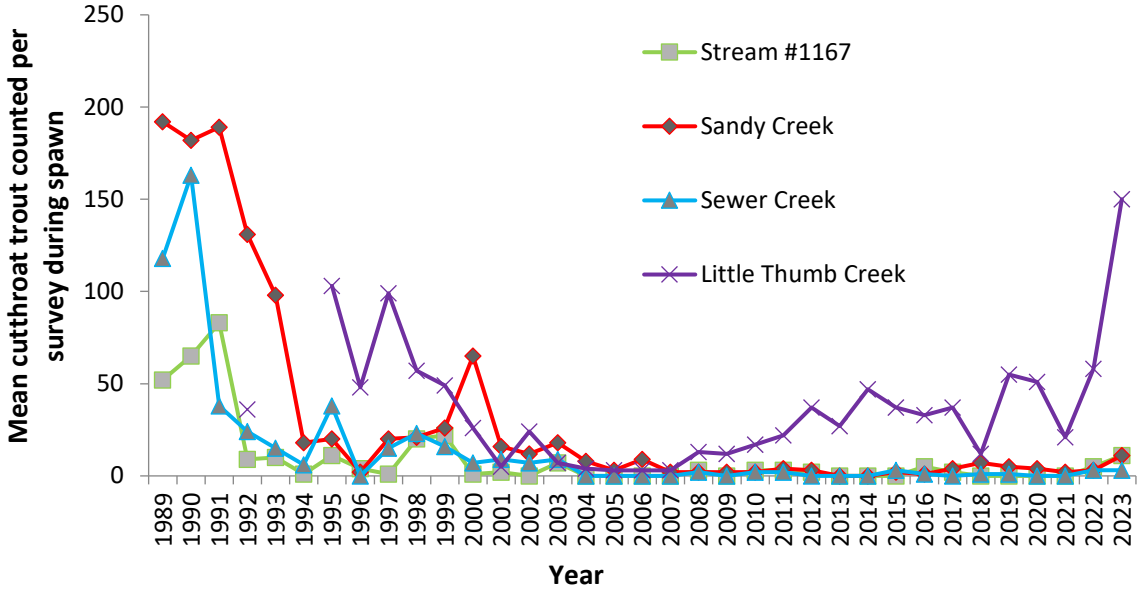

Fig. 14. Mean number of spawning Yellowstone cutthroat trout observed during weekly visual surveys of 4 West Thumb spawning stream tributaries to Yellowstone Lake, Yellowstone National Park, 1989–2023.

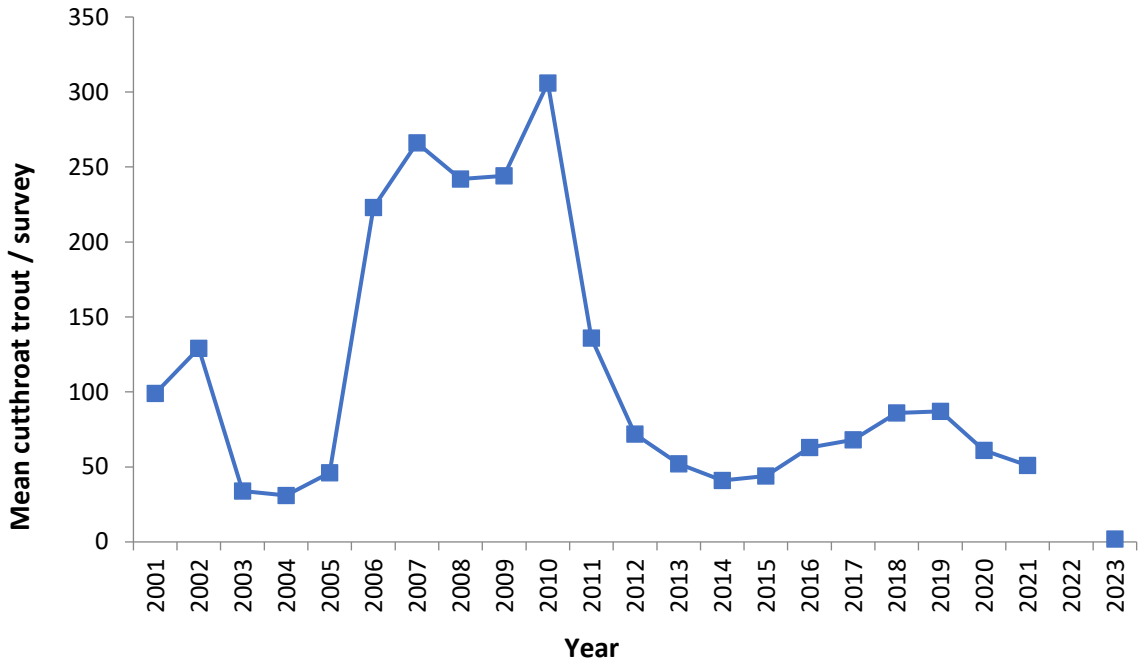

Fig. 15. Mean number of spawning Yellowstone cutthroat trout (including cutthroat × rainbow trout hybrids) observed during weekly visual surveys of the Trout Lake inlet creek, Yellowstone National Park, 1999–2023. Stream surveys were not conducted on the Trout Lake inlet creek in 2022 because the Tower to Northeast Entrance Road was washed out by a flood on June 13; the road did not reopen until November.

Grizzly Bear Use of Army Cutworm Moth Aggregation Sites *(Justin A. Dellinger, Wyoming Game and Fish Department; and Mark A. Haroldson, Interagency Grizzly Bear Study Team, U.S. Geological Survey)*

Army cutworm moths (*Euxoa auxiliaris*; moths) were first recognized as an important food source for grizzly bears in the GYE during the mid-1980s (Mattson et al. 1991*b*, French et al. 1994). Early observations indicated that moths, and subsequently bears, showed site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. We recognize that insects other than moths may be present and consumed by bears (e.g., ladybird beetles [Coccinellidae family]) as well, but within the GYE, observations indicate army cutworm moths are the primary insect food source (grizzly bears also forage on alpine vegetation at these sites).

Since the discovery of bears feeding at moth aggregation sites, numerous bears have been observed at or near these sites. Observability is high because of lack of tree cover and number of bears using the sites. However, complete tabulation of grizzly presence at moth sites is extremely difficult. Only a few sites have been investigated by ground reconnaissance and the boundaries of sites are not clearly known. In addition, it is likely that the size and location of aggregation sites fluctuate from year to year with moth abundance and variation in environmental factors such as snow cover.

Our knowledge of these sites has increased over time, and techniques for monitoring grizzly bear use of these sites have changed. We developed a technique in 2000 that delineates sites by buffering only the locations of bears observed actively feeding at moth aggregation sites by 500 m; this distance was used to account for errors in aerial locations. The borders of the overlapping buffers at individual moth sites are dissolved to produce a single polygon for each site. These sites are identified as "confirmed" sites. Because these polygons are only created around feeding locations, the resulting site conforms to the topography of the mountain or ridge top where bears feed and does not include large areas of non-talus habitat that are not suitable for moths. Records from the grizzly bear location database from July 1 through September 30 of each year are then overlaid on these polygons and enumerated. "Possible" moth aggregation sites are identified as previously confirmed sites, sites with only 1 observation of an actively feeding bear, or sites with multiple observations of bears in a single year. These sites are then monitored in subsequent years for additional observations of actively feeding bears, and if so, are added to the confirmed sites list. When the status of a site is changed to confirmed, analysis is done on all data back to 1986 to determine the historical use of that site. Therefore, the number of bears using moth aggregation sites in past years may change as new sites are added, and data from this annual report may not match those of past reports. New observations of grizzly bears actively feeding in previously undocumented areas will be added as possible sites and monitored for future use. In addition, as new observations of actively feeding bears are added along the periphery of existing sites, the polygons defining these sites increase in size and, thus, more overlaid locations fall within the site. This retrospective analysis brings us closer each year to the "true" number of bears using moth aggregation sites in past years.

As with 2022, only 1 round of grizzly bear observation flights was flown in 2023. Thus, the number of hours flown over moth aggregation sites was again reduced compared to pre-2020 flight totals. However, unlike 2020, but like 2022, most observation flights (86%) were conducted with a secondary observer in addition to the pilot.

Analysis of grizzly bear use of moth aggregation sites in 2023 from observation flights resulted in 251 observations of actively feeding grizzly bears on previously identified, confirmed sites. In conducting the analyses, we did discover that a previously identified possible site had met the qualifications for being upgraded to a confirmed site in 2017, but that change had not been implemented. Additionally, we also determined that a new possible site had been detected in 2017, but again that change had not been implemented. Thus, while there were no new confirmed or possible sites added from our 2023 efforts, assessment of the data now indicates the number of sites is 36 confirmed and 18 possible. Note that associated tables and figures have been upgraded to reflect these changes.

Overall, the number of grizzly bear locations on moth aggregation sites in 2023 (n = 354) was an increase from the 2022 and close to the record high in 2021 (Table 20). This number includes all grizzly bear locations from aerial observation flights, telemetry flights, and observations made during flights for other species. The number of grizzly bears documented on sites and the percentage of confirmed sites with documented use by grizzly bears varies from year to year, and may be an indicator that moth numbers may be greater in some years than others (Fig. 16). For example, variable snow conditions may influence the number of moths migrating from the plains, as was evident in 1993, a year with unusually high snowpack. In that year, the percentage of confirmed sites used by bears (Fig. 17) and the number of observations recorded at moth aggregation sites were very low (Table 20). In all other

years, the percentage of moth aggregation sites used by grizzly bears varied between 47 and 83% (Fig. 16). Regardless, it important to note that the relationship between annual moth abundance on moth sites and annual grizzly bear counts remains unknown, primarily because little to no data are available on moth abundance at these sites.

However, when we control for the amount of observation effort by including only bears observed during regularly conducted observation flights (see "***Observation Flights***"), the number of bears observed using moth aggregation sites per hour of flights has shown an overall increasing trend since these flights began in 1997 (Fig. 17). Whereas the number of bears observed in 2023 was near the average for the previous 10 years, the number of hours flown was 31% lower than years in which 2 rounds of flights were conducted. Thus, like in 2022, the number of observations per hour flown was higher in 2023 than in previous years when 2 flights were conducted (Fig. 17).

Table 20. Summary statistics for grizzly bear use of confirmed army cutworm moth aggregation sites, Greater Yellowstone Ecosystem, 1986–2023.

Year	Number of confirmed aggregation sites[a]	Number of sites used[b]	Number of aerial telemetry locations	Number of ground or aerial observations
1986	4	2	7	5
1987	5	3	3	17
1988	5	3	11	28
1989	9	7	9	41
1990	14	11	9	77
1991	16	13	13	169
1992	18	12	6	108
1993	19	3	1	2
1994	19	9	1	32
1995	21	12	7	40
1996	23	15	21	68
1997	24	16	17	84
1998	27	22	9	185
1999	27	14	26	156
2000	27	13	49	97
2001	28	18	23	128
2002	30	21	33	256
2003	30	20	9	163
2004	30	16	2	134
2005	32	19	16	198
2006	32	17	15	147
2007	32	19	19	162
2008	32	23	16	181
2009	34	23	12	170
2010	34	18	3	136
2011	35	22	10	165
2012	35	24	20	253
2013	35	23	27	297
2014	35	24	11	343
2015	35	21	13	211
2016	35	20	11	208
2017	36	22	20	280
2018	36	20	18	267
2019	36	30	20	336
2020	36	27	19	325
2021	36	23	30	327
2022	36	24	84	230
2023	36	21	51	303
Total			671	6,327

[a] The year of discovery was considered the first year a telemetry location or aerial observation was documented at a site. Sites were considered confirmed after additional locations or observations in a subsequent year and every year thereafter regardless of whether or not additional locations were documented.

[b] An aggregation site was considered used if ≥1 location or grizzly bear observation was documented within the site during July–September of that year.

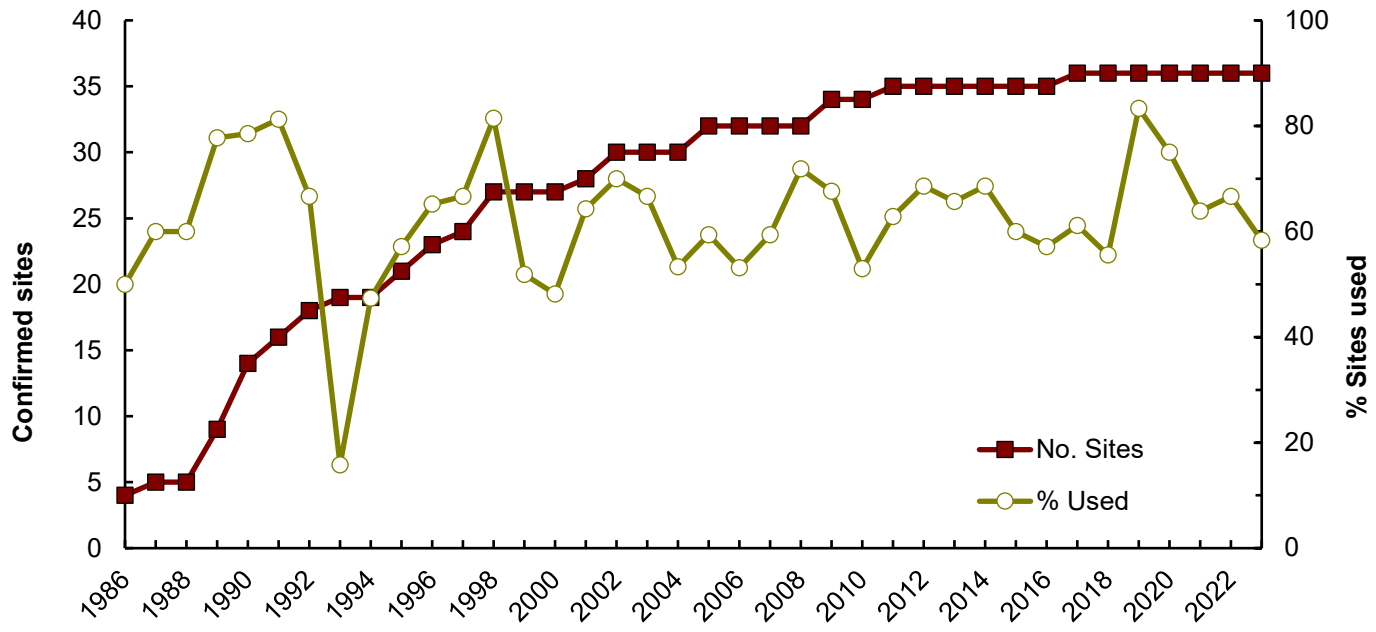

Fig. 16. Annual number of confirmed army cutworm moth aggregation sites and percent of those sites at which telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2023.

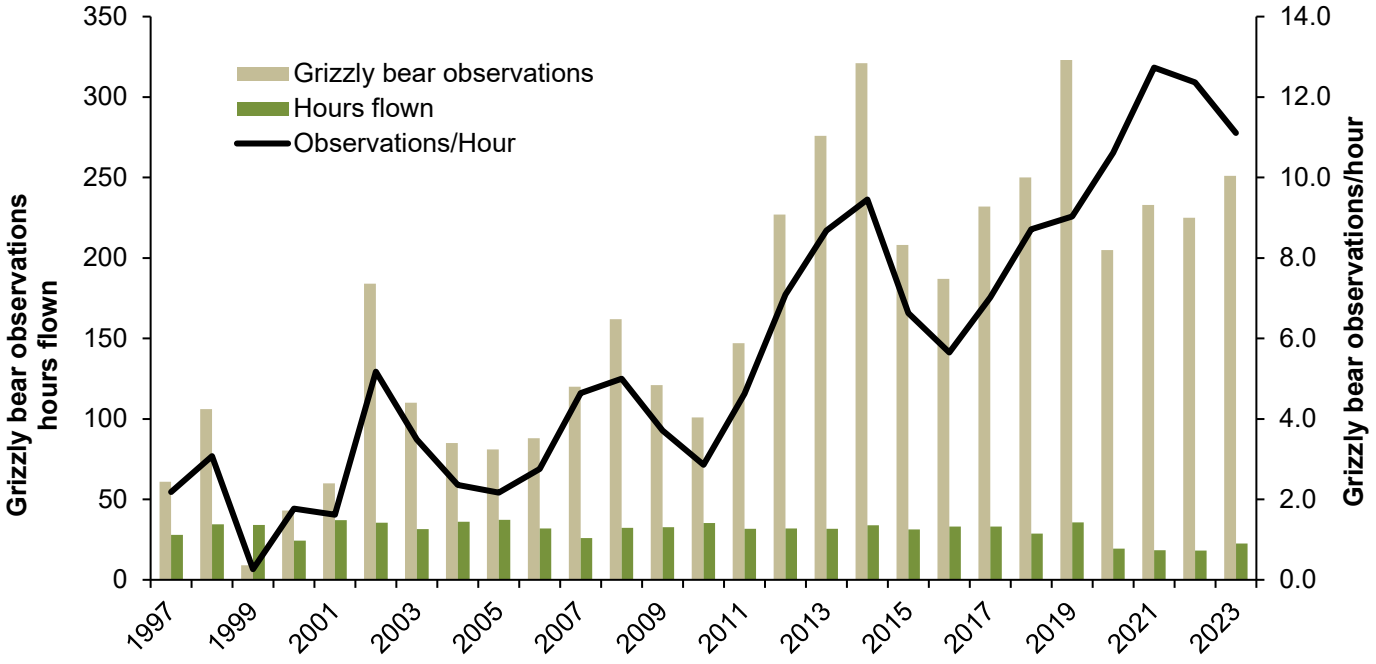

Fig. 17. Number of grizzly bears observed (tan bars) on army cutworm moth aggregation sites during observation flights only, survey hours (green bars) for these bear management units (BMU), and grizzly bear observations per survey hour (black line) during observation flights of BMUs containing all known moth aggregation sites, Greater Yellowstone Ecosystem, 1997–2023.

Whitebark Pine Cone Production *(Mark A. Haroldson and Bryn E. Karabensh, U.S. Geological Survey, Interagency Grizzly Bear Study Team)*

Whitebark pine (*Pinus albicaulis*) nuts provide a high-calorie food source for grizzly bears during late summer and fall. Whitebark pine trees have experienced substantial mortality throughout the GYE since the early 2000s, primarily due to mountain pine beetle (*Dendroctonus ponderosae*), blister rust (*Cronartium ribicola*), and fire. Whitebark pine surveys were conducted on 21 established transects and results indicated slightly above average cone production for 2023 (Fig. 18). Cone production was generally higher on northern transects than southern transects (Fig. 18, Table 21). Overall, the mean number of cones per tree was 19.5 (Table 22), whereas the long-term average for the period 1980–2023 was 17 cones per tree (Fig. 19).

Occasional tree mortality caused by mountain pine beetle may still occur in stands that contain the cone production transects. During 2023, we observed no additional beetle-caused mortality among individual trees that had been surveyed since 2002. However, we did observe 3 additional mortalities from other causes (falling adjacent tree, likely blister rust, and unknown cause). Total mortality on transect trees since 2002 is now 77.9% (148/190) with 100% (19/19) of transects containing beetle-killed trees. Cumulative mortality among the original 190 trees has been minimal for most of the last decade (Fig. 20). Similar to findings reported by the Greater Yellowstone Whitebark Pine Monitoring Working Group, these data support the interpretation that this mountain pine beetle outbreak has run its course.

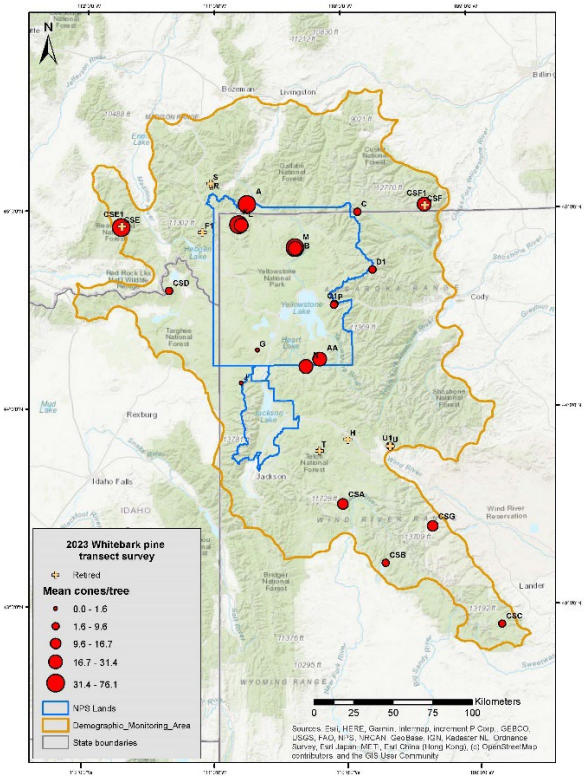

Fig. 18. Locations and mean number of cones per tree for 21 whitebark pine cone production transects, Greater Yellowstone Ecosystem, 2023. Labels reflect transect identifiers (see Table 22). Base map source: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, ©OpenStreetMap contributors, and the GIS User Community

Table 21. Results of whitebark pine cone production surveys, Greater Yellowstone Ecosystem, 2023.

Transect	No. of cones	No. of trees	Mean no. cones/tree	SD
A	227	4	56.8	99.2
B	399	10	39.9	16.3
C	91	10	9.1	7.9
D1	76	10	7.6	7.7
G	16	10	1.6	2.6
J	5	9	0.6	1.7
K	533	7	76.1	36.5
L	235	8	29.4	18.1
M	244	10	24.4	26.8
N	207	10	20.7	17.4
P	85	10	8.5	9.7
Q1	96	10	9.6	11.4
U1	48	10	4.8	4.2
AA	224	10	22.4	26.4
CSA	138	10	13.8	21.1
CSB	45	10	4.5	9.9
CSC	75	10	7.5	9.6
CSD	69	8	8.6	18.0
CSE	----Transect retired in 2022----			
CSE1[b]	522	10	52.2	43.5
CSF	----Transect retired in 2019----			
CSF1[a]	314	10	31.4	30.5
CSG	167	10	16.7	9.6

[a] Retired transect CSF replaced with CSF1 in 2020.

[b] Retired transect CSE replaced with CSE1 in 2023.

Table 22. Summary statistics for whitebark pine cone production surveys, Greater Yellowstone Ecosystem, 2023.

Total			Trees				Transect			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
3,816	196	21	19.5	28.6	0	205	181.7	150	5	533

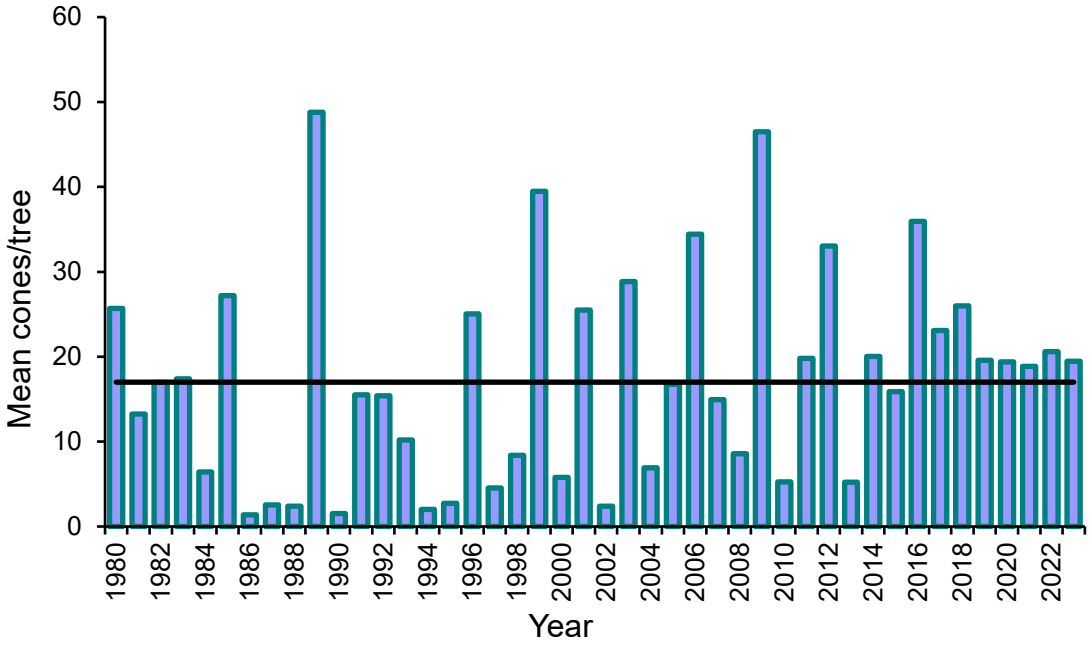

Fig. 19. Annual mean number of cones per tree observed along whitebark pine cone production transects, Greater Yellowstone Ecosystem, 1980–2023. The overall average for the time period (17 cones per tree) is shown as a solid black line.

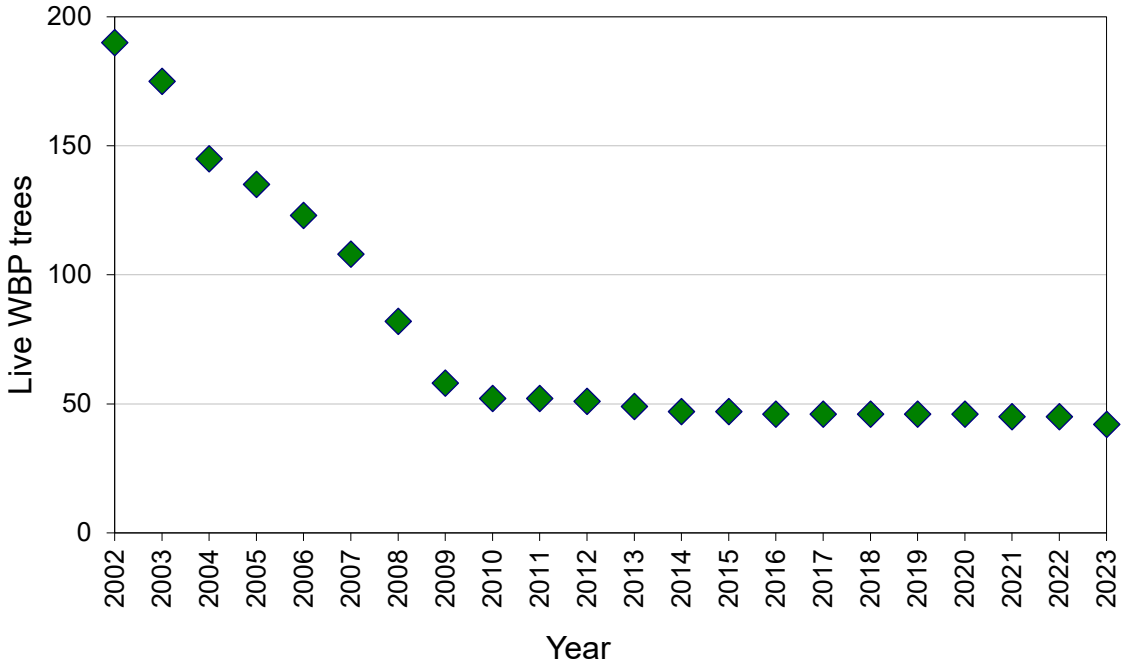

Fig. 20. Number of live whitebark pine (WBP) trees on cone production transects among 190 individual trees monitored since 2002, Greater Yellowstone Ecosystem, 2002–202

Ungulate Herd Statistics *(Dan J. Thompson, Wyoming Game and Fish Department; Cade Bowlin, Idaho Department of Fish and Game; Jeremiah Smith, Montana Fish, Wildlife and Parks; Kerry A. Gunther, National Park Service; and Katharine R. Wilmot, National Park Service)*

We provide the following agency web links for readers as a resource to obtain statistics and data regarding the status, distribution, and harvest of ungulate herds within the GYE:

Idaho Department of Fish and Game:
https://idfg.idaho.gov/ifwis/huntplanner/stats/?season=general&game=elk&yr=2023

Montana Fish, Wildlife and Parks:
https://fwp.mt.gov/binaries/content/assets/fwp/conservation/elk/2023-montana-elk-counts.pdf

(under Elk Population Status for HD 313)

Wyoming Game and Fish Department:
https://wgfd.wyo.gov/hunting-trapping/harvest-reports-surveys

https://wgfd.wyo.gov/media/29195/download?inline

Grand Teton National Park
https://www.nps.gov/grte/learn/nature/vital-signs.htm

Yellowstone National Park
Bison:
https://www.nps.gov/yell/learn/management/bison-management.htm

RECREATION MONITORING

Grand Teton National Park *(Justin K. Schwabedissen and Katharine R. Wilmot, Grand Teton National Park)*

Grand Teton National Park (GTNP) encompasses 125,452 hectares of occupied grizzly bear habitat in the GYE. Most of the land in the park is undeveloped. Over half of the park (52%) is designated as recommended wilderness and thus managed as wilderness lands in accordance with NPS policy. In addition, 33% of GTNP is included within the GBRZ established by the USFWS.

GTNP manages visitors and bears across three broad zones: developed areas, road corridors, and backcountry. Developed areas are generally managed for people to the exclusion of bears to reduce the risk of human-bear conflicts. While bears are allowed to transit through developed areas, lingering is not tolerated. Within roadway corridors, bears are allowed access to roadside habitats for foraging and other natural behaviors. When safe to do so, visitors are provided an opportunity to view bears within roadway corridors at a minimum 100-yard viewing distance. In the backcountry zone, bears are generally given priority in recreation management decisions where bear and human activities are not compatible. Park staff proactively implement seasonal recreational use restrictions and temporary closures for known high-use bear areas. Backcountry camping in the park requires a permit and is managed using a quota system.

In 2023, 4,987,951 total visits occurred in GTNP, including recreational, commercial (e.g., Jackson Hole Airport), and incidental (e.g., traveling through the park on U.S. Highway 89/191 but not recreating) use. Recreational visits totaled 3,417,106, which is the third highest year on record (Table 23). Most visitation occurred in the summer. However, as visitor use patterns continue to change in GTNP, the timing of recreational visits throughout the year is also evolving. Months of peak visitation have shifted later in the year to July, August, and September.

Using trail counters at key summer destinations, GTNP has documented an estimated 34% increase in trail use over the last ten years. Concomitantly, GTNP recorded the second highest number of backcountry user nights on record (41,705) in 2023. In addition to high recreational interest within the park's backcountry, frontcountry camping also remains popular. There were 362,545 overnight nights stays in frontcountry campgrounds in 2023, the fifth highest year on record. Long- and short-term trends of recreational visitation and backcountry user nights are shown in Table 24 and Fig. 21.

Because of slight revisions in data from previous years, visitor use numbers in this report may differ from earlier reports. The data included here are consistent with the latest, publicly available information found at: https://irma.nps.gov/STATS/Reports/Park/GRTE.

Table 23. Ten highest years for recreational visits to Grand Teton National Park, 1979–2023.

Rank	Year[a]	Recreational visits
1	2021	3,885,230
2	2018	3,491,151
3	2023	3,417,106
4	2019	3,405,614
5	2017	3,317,000
6	2020	3,289,638
7	2016	3,270,076
8	2015	3,149,921
9	2022	2,806,223
10	2014	2,791,392

[a] Grand Teton National Park did not differentiate between recreational and non-recreational visits until 1979.

Table 24. Average annual recreational visits and backcountry user nights by decade in Grand Teton National Park, 1950–2019.		
Decade	**Average annual recreational visits[a]**	**Average annual backcountry user nights**
1950s	1,102,518	Data not available
1960s	2,326,580	Data not available
1970s	2,689,306	Data not available
1980s	1,728,218	22,614
1990s	2,362,833	28,592
2000s	2,497,899	27,515
2010s	3,007,602	33,400

[a] Grand Teton National Park did not differentiate between recreational and non-recreational visitation until 1979. In 1983 and 1992, the park updated methods for counting visitation. These updates may be the cause of certain large fluctuations in visitation numbers between years. Therefore, park-wide visitation data are not strictly comparable between years of different counting methods.

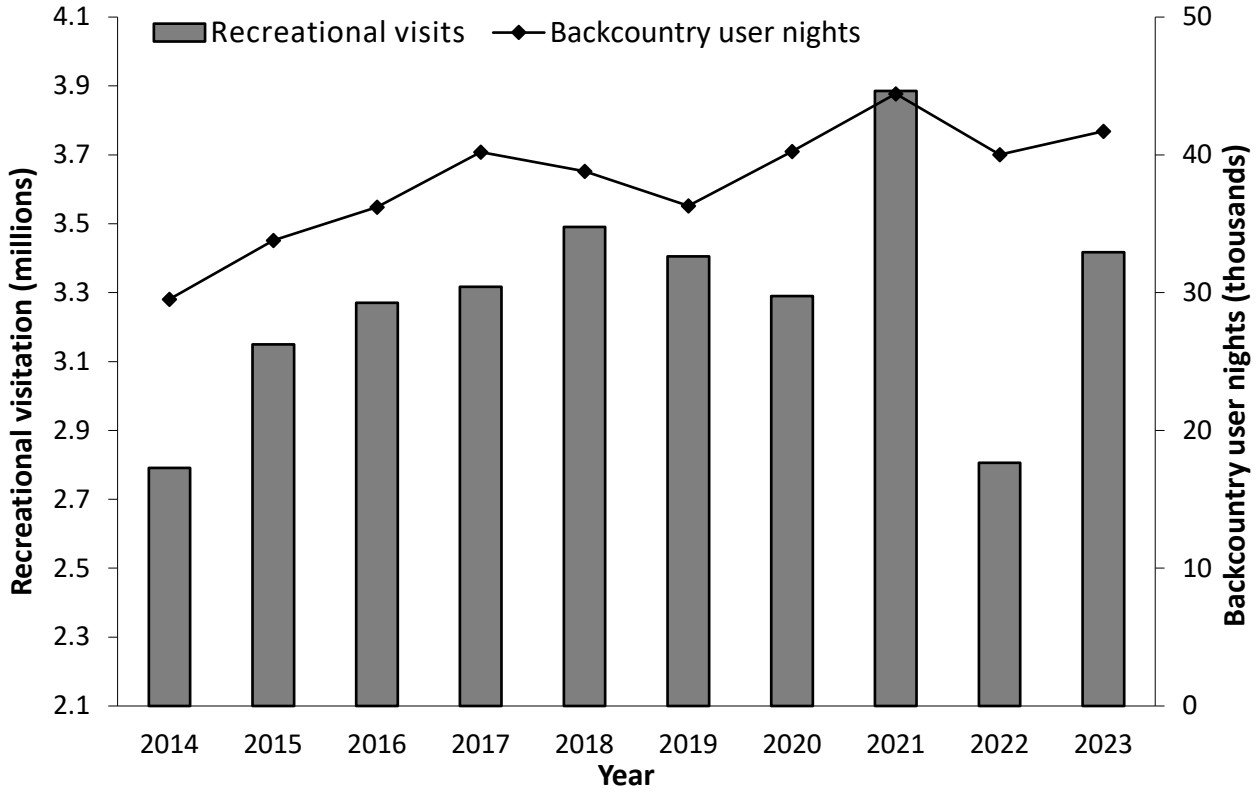

Fig. 21. Trends in recreational visitation and backcountry user nights in Grand Teton National Park, 2014–2023.

Yellowstone National Park Recreational Use *(Kerry A. Gunther, Yellowstone National Park)*

Yellowstone National Park encompasses 899,139 ha in the core of occupied grizzly bear habitat in the GYE. Most (~99%) of YNP is relatively pristine, undeveloped land; 92% of the park has been recommended for wilderness designation and, by NPS policy, is managed so as not to preclude that designation in the future (NPS 1974, 2006). Only ~1% of the park's natural landscape has been significantly altered through construction of roads, buildings, and developments. YNP is located entirely within the boundaries of the Greater Yellowstone Ecosystem GBRZ (USFWS 1993). Therefore, the habitat protections implemented through the 2016 Conservation Strategy for Grizzly Bears in the GYE apply to all lands within the park.

The NPS is mandated to preserve the cultural and natural resources of YNP unharmed for the benefit and enjoyment of future generations. This mandate requires protecting the ecological integrity of the park and providing recreational experiences for visitors on a landscape shared with grizzly bears. Visitor activities are carefully regulated to ensure minimal effects to free-ranging grizzly bears and their habitat. Visitors and bears in the park are managed in 3 broad zones: developed areas, road corridors, and backcountry/proposed wilderness. Each zone has different strategies for managing the human-bear interface (Table 25). Human activities are prioritized in developed areas, road corridors are managed for use by both visitors and bears, and bears are generally given priority in backcountry areas.

Recommended wilderness status protects 92% of the grizzly bear habitat in YNP from construction of roads and developments. To further reduce disturbance of bears in important backcountry habitat and to prevent displacement of bears from high-quality food resources, YNP has also designated 16 Bear Management Areas encompassing 188,032 ha (21% of the park) of the highest-quality bear habitats within the park. Recreational activity is limited within Bear Management Areas through a variety of seasonal trail, campsite, and area closures, no off-trail travel requirements, and time-of-day use restrictions implemented during periods when bear activity is concentrated on specific high-quality foods in predictable locations.

Backcountry recreation related disturbance of bears is further reduced by implementing a designated backcountry campsite system in the park. The designated backcountry campsite system limits the number of people and parties that can camp in the backcountry each night, thereby reducing the frequency of human-bear encounters. In addition, by making overnight recreational activity more predictable to bears, the designated backcountry campsite system reduces the potential for confrontations at campsites. The danger of bear-human confrontations and bear-inflicted human injuries decreases when grizzly bears know where to expect people (Herrero 2002). Bear-resistant food storage devices (food hanging poles or bear-proof food storage lockers) are provided at every designated backcountry campsite making bear-resistant food storage easy and convenient, thereby reducing the frequency that bears obtain human foods, cause conflicts in campsites, and need to be killed in subsequent management actions.

Total visitation to the park in 2023 was 5,808,241 visits (https://irma.nps.gov/STATS/Reports/Park/YELL), including recreational and non-recreational use. Recreational visits in 2023 totaled 4,501,382 (Table 26). Most of the park's recreational visitation in 2023 occurred during the 6-month period from May through October, the same period that all sex and age classes of grizzly bears are out of their winter dens and active on the landscape. In 2023, there were 4,255,792 recreational visits (95%) during those peak months, an average of 23,129 recreational visits per day. Park visitors spent 473,691 overnight stays in roadside campgrounds, and 38,165 overnight stays in remote backcountry campsites and dispersed camping zones in the park.

Average annual recreational visitation has increased from 7,378 visits per year during the late 1890s to 4,114,617 visits per year during 2020–2023 (Table 27, Fig. 22). Temporary park and campground closures during the 2020 COVID pandemic year and the spring flood of 2022 resulted in fewer overnight stays in roadside campgrounds during those years (Table 27, Fig. 23). Although total park recreational visitation has increased steadily over time, the average number of overnight stays in backcountry areas, the most important bear habitat in the park, has been relatively stable, ranging from 38,842 to 45,615 overnight stays per year per decade (Table 27, Fig. 24). The number of overnight stays in the backcountry is limited by the number and capacity of designated backcountry campsites in the park.

Table 25. Management zone, proportion of park within the management zone, and management prescription for the visitor-bear interface in Yellowstone National Park.

Management zone	Area	Management prescription
Developments	2,212 ha (5,467 acres) (<1% of park)	▪ Managed for people to the exclusion of bears ▪ Bears conditioned to human foods are removed (euthanized or sent to zoos) ▪ Visitors are given priority when visitor and bear activities are not compatible
Road corridors	654 ha (1,617 acres) (<1% of park)	▪ Managed for transportation, bear viewing, and bear use of roadside habitats ▪ Bears are tolerated in roadside habitats for foraging and other natural behaviors ▪ Habituation of bears to people is expected ▪ Bears conditioned to human foods are removed
Wilderness and undeveloped lands	886,552 ha (2,190,718 acres) (~99% of park)	▪ Managed primarily for bears and other wildlife ▪ Overnight visitation is capped by a limited number of designated backcountry campsites and campsite capacity limits ▪ Most recreational day use is <5 km (3 miles) from roads ▪ Implementation of seasonal recreational closures and restrictions for high use bear areas ▪ Bears are generally given priority in recreation management decisions where bear and human activities are not compatible ▪ Bears conditioned to human foods are removed

Table 26. Ten highest years for recreational visits to Yellowstone National Park, 1872–2023.

Rank	Year	Visitation
1	2021	4,860,537
2	2023	4,501,382
3	2016	4,257,177
4	2017	4,116,525
5	2018	4,114,999
6	2015	4,097,710
7	2019	4,020,287
8	2020	3,806,306
9	2010	3,640,184
10	2014	3,513,484

Table 27. Average annual recreational visitation, auto campground overnight stays, and backcountry campsite overnight stays by decade, Yellowstone National Park, 1895–2023.

Decade	Average annual number of recreational visits	Developed campground average annual overnight stays	Backcountry campsite average annual overnight stays
1890s	7,378[a]	Data not available	Data not available
1900s	17,110	Data not available	Data not available
1910s	31,746	Data not available	Data not available
1920s	157,676	Data not available	Data not available
1930s	300,564	82,331[b]	Data not available
1940s	552,227	139,659[c]	Data not available
1950s	1,355,559	331,360	Data not available
1960s	1,955,373	681,303[d]	Data not available
1970s	2,240,698	686,594[e]	45,615[f]
1980s	2,344,485	656,093	39,280
1990s	3,012,653	647,083	43,605
2000s	2,968,037	624,450	40,362
2010s	3,779,045	720,875[g]	41,637
2020–2023	4,114,617	488,705[h]	38,842

[a] Data from 1895–1899. During 1872–1894, visitation was estimated to be not fewer than 1,000 and no more than 5,000 each year.
[b] Data from 1930–1934.
[c] Average does not include data from 1940 and 1942.
[d] Data from 1960–1964.
[e] Data from 1975–1979.
[f] Backcountry campsite use data available for 1972–1979.
[g] The Fishing Bridge Recreational Vehicle Campground was closed in 2019 for remodeling.
[h] The Norris Campground was closed in 2020 - 2023. The Fishing Bridge Recreational Vehicle Campground was closed in 2020 and 2021 for remodeling. The Tower Fall Campground was closed in 2020 - 2023 due to a road reconstruction project. The Pebble Creek, Slough Creek, Mammoth, Indian Creek, and Norris Campgrounds were closed in 2022 due to flood damage to the campgrounds or associated utility infrastructure.

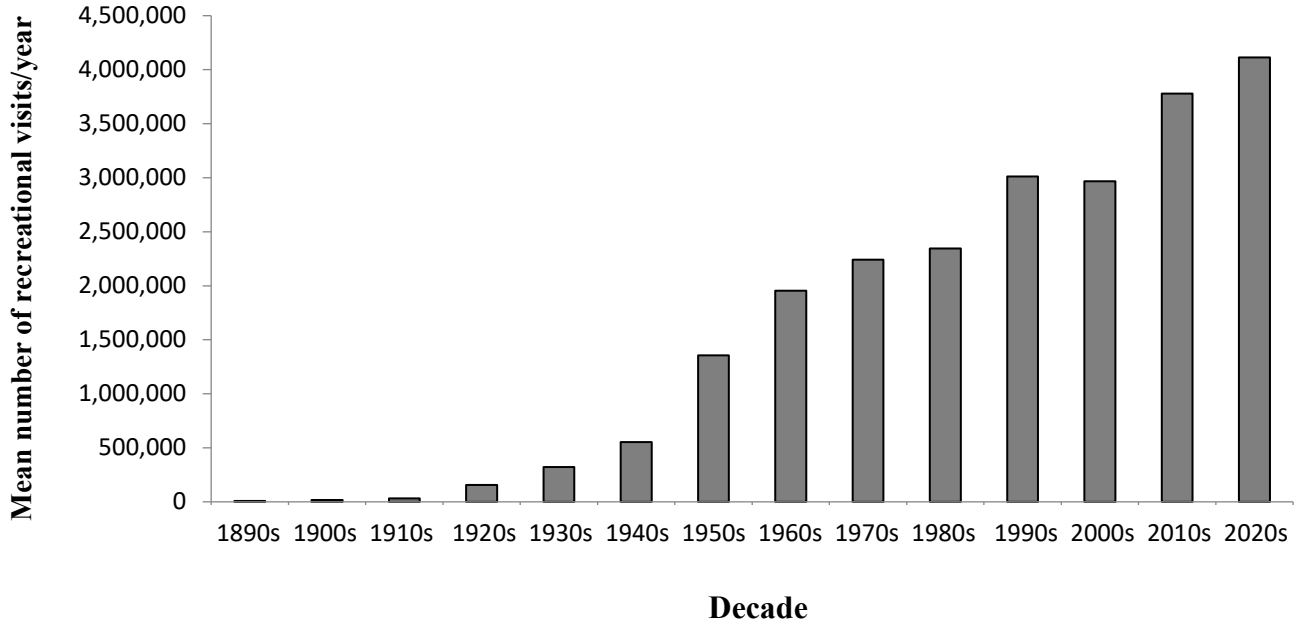

Fig. 22. Average annual number of recreational visits per year by decade, Yellowstone National Park, 1895–2023.

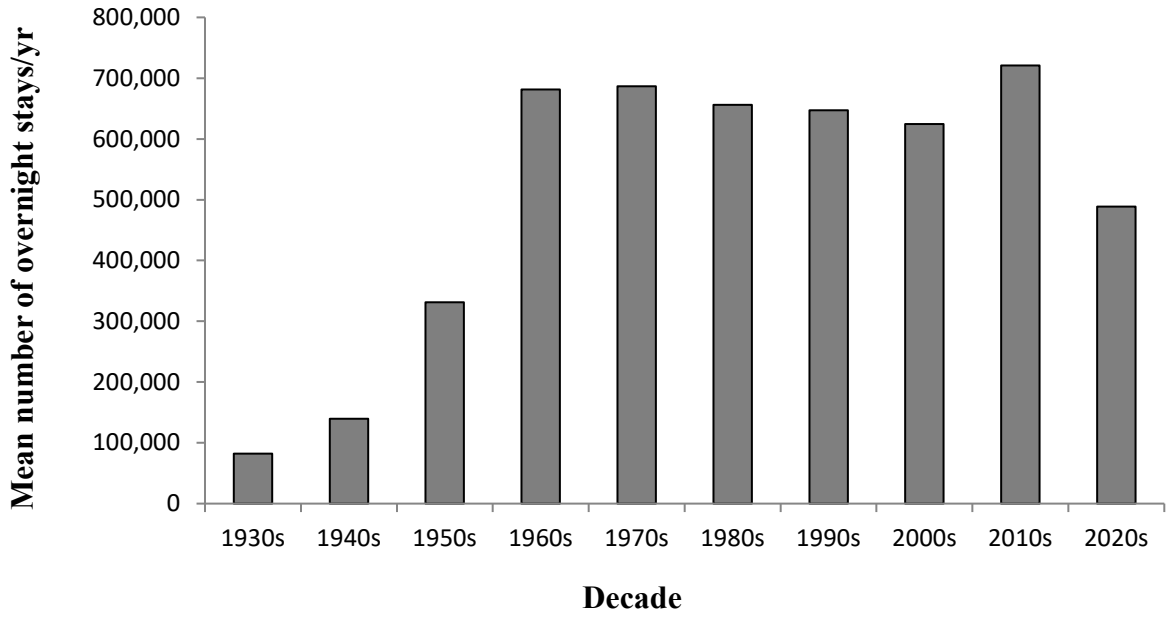

Fig. 23. Average annual number of overnight stays in roadside campgrounds per year by decade, Yellowstone National Park, 1930–2023.

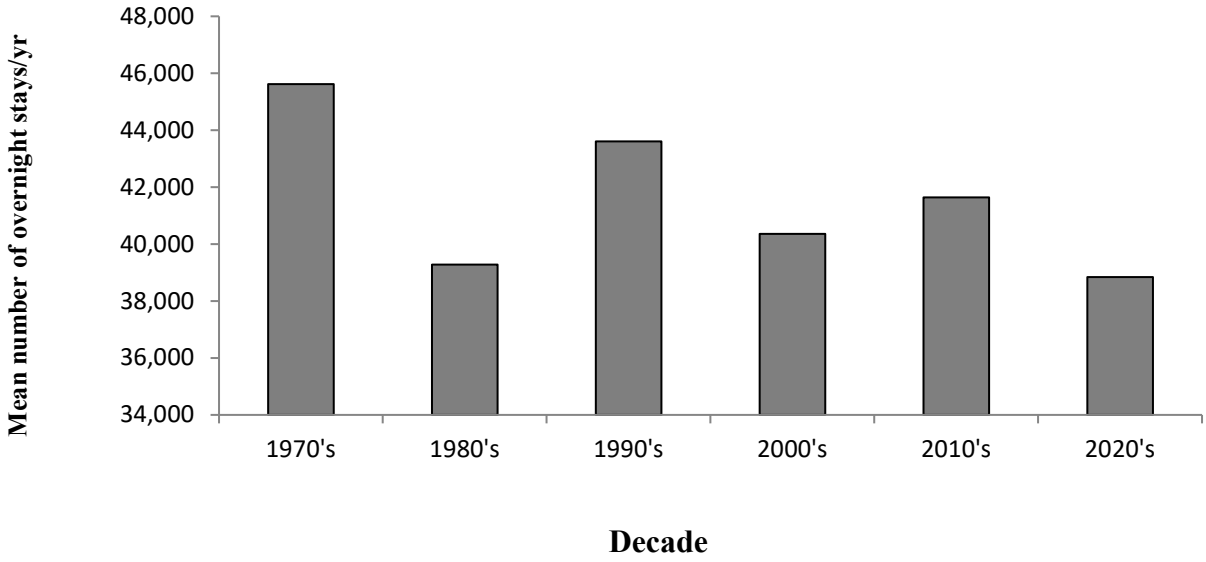

Fig. 24. Average annual number of overnight stays in backcountry campsites and dispersed camping zones per year by decade, Yellowstone National Park, 1972–2023.

HUMAN-GRIZZLY BEAR CONFLICTS IN THE GREATER YELLOWSTONE ECOSYSTEM

Human-Grizzly Bear Conflicts in Grand Teton National Park and the John D. Rockefeller, Jr. Memorial Parkway *(Justin K. Schwabedissen and Katharine R. Wilmot, Grand Teton National Park)*

Park staff recorded one human-grizzly bear conflict in Grand Teton National Park (GTNP) and the John D. Rockefeller, Jr. Memorial Parkway (JDR) in 2023. In late September, a visitor was observed throwing an apple from a car window toward a grizzly bear with three yearlings. One of the bears reportedly consumed the apple. Unable to locate the involved party, park staff increased monitoring of the grizzly bear family group, and no further action was deemed necessary.

With visitor use patterns continuing to evolve in GTNP, management of the human-bear interface requires considerable effort to minimize conflicts. To help facilitate safe interactions between visitors and wildlife, GTNP fielded the Wildlife Brigade to provide dedicated personnel to manage the human-bear interface. In 2023, the team was composed of one permanent bear biologist, two seasonal wildlife management rangers, and 33 volunteers. The Wildlife Brigade managed a minimum of 537 bear jams (262 grizzly bear, 269 black bear, and six occasions where bear species could not be determined), which resulted when non-food-conditioned, habituated bears frequented roadway corridors drawing crowds of wildlife watchers. Most grizzly bear jams occurred in late spring and early summer with a second peak during the fall. In accordance with the park's hazing policy, grizzly bears were hazed out of developed areas on five occasions and off roadways 12 times.

The Wildlife Brigade, in addition to law enforcement rangers, interpretative staff, and other volunteer teams, patrolled campgrounds, picnic areas, and other front country areas for unsecured attractants and to educate visitors about food storage requirements. Additionally, the Wildlife Brigade staffed a bear education trailer at a popular roadside turnout, educating thousands of visitors on bear ecology, safety in bear country, and proper use of bear spray. Complementing these efforts, interpretative staff provided bear safety information and bear spray demonstrations at park visitor centers. In total, Wildlife Brigade volunteers contributed 12,555 hours toward bear conservation efforts within the park in 2023.

GTNP continued its partnership with the Grand Teton National Park Foundation to cost-share expenses associated with the purchase and installation of bear-resistant food storage lockers (i.e., bear boxes). This collaboration allowed the park to acquire 66 new bear boxes in 2023. Two were installed along the Jenny Lake lakeshore, bringing the total number of modern bear boxes in campgrounds and other front country sites to 1,069. A modern bear box is available in every campsite in all front country campgrounds in GTNP and the JDR. The remaining 64 bear boxes acquired in 2023 were staged for installation in 2024.

Human-Grizzly Bear Conflicts in Yellowstone National Park *(Kerry A. Gunther, Travis C. Wyman, and Eric G. Reinertson, Yellowstone National Park)*

Management Strategy

Yellowstone National Park's management strategy for reducing grizzly bear-human conflicts and human causes of grizzly bear mortality places significant emphasis on prevention of bear-human conflicts rather than post-conflict management (e.g., capture and relocation) of bears involved in conflicts. Relocation of conflict bears was a common management practice in the park for the first 25 years after grizzly bears were listed as a federally threatened species in 1975. Although success rates were low (Brannon 1987, Craighead et al. 1995, Blanchard and Knight 1995), relocations deferred removals of some adult females long enough for completion of additional reproductive cycles, thereby contributing to population recovery and range expansion. However, because of its demonstrated low long-term efficacy, relocation was deemphasized as a management tool in the late 1990s when grizzly bears in the national park began showing signs of biological recovery and density-dependent effects on demographics (Schwartz et al. 2006, van Manen et al. 2016).

Grizzly bears have strong fidelity to their established home ranges where they know their standing in the social hierarchy and are familiar with the local food resources (Craighead et al. 1995). Grizzly bears also have a remarkable homing ability (Cole 1972, Craighead and Craighead 1972, Miller and Ballard 1982). Therefore, relocation as a management tool works best when conflict bears are moved long distances into high-quality habitats in areas with low risk for repeat conflicts (Brannon 1987, Blanchard and Knight 1995, Stenhouse et al. 2022). Choosing release sites with low densities of other bears to reduce density-dependent social intolerance and associated displacement and mortality may also improve relocation success rates (Davis 1949, Cole 1972, Rogers 1986, Riley et al. 1994). Yellowstone National Park is not geographically large enough to relocate grizzly bears far enough so that they do not return to the original conflict site (Cole 1972, Craighead and Craighead 1972) or have opportunity for further conflicts in the relocation area. Relocation distances of >100 km for males and >75 km for females, are needed to keep return rates <50% (Blanchard and Knight 1995). Those distances are not attainable within the park for grizzly bears captured at most of the parks developed areas and campgrounds, the sites where most conflicts occur. The farthest point from a road a conflict bear can be released in the park is 35 km; the farthest point from a development or campground a bear can be released is 41 km. Portions of the park also have among the highest densities of bears in the GYE and the park receives millions of human recreational visits annually, making it a poor candidate for relocation success.

Monitoring the fate of relocated bears on a long-term basis confirms very low success rates in the park. From 1980 to 2022, 28 grizzly bears involved in conflicts inside the park were captured and relocated to other areas of the park (Table 28). Of these bears, 19 (68%) were known to cause further conflicts after relocation. During the same period, an additional 94 grizzly bears involved in conflicts outside of the park were captured by state agencies and accepted for relocation into the park (Table 29). More than half (n = 50, 53%) of these bears were known to cause further conflicts after relocation. Of the 122 conflict bears relocated within or into the park, we know the final fate of 62. Of these, 53 (86%) were removed (killed or sent to zoo's) in management actions (n = 44) or killed by the public in defense of life or property incidents (n = 9). Other causes of mortality for relocated bears included illegal killings (n = 5), being killed by a black bear hunter (n = 1) and being struck and killed by a vehicle (n = 1). Only 2 (3%) of the 62 relocated conflict bears with known fates died of natural causes; most (97%, n = 60) relocated conflict bears died from human causes after relocation.

The park's current strategy to reduce conflicts and human-causes of mortality uses an aggressive, proactive program focused on conflict prevention. This strategy is accomplished by: 1) providing park visitors with information on how to hike, camp, recreate, and store anthropogenic bear attractants in a manner that reduces the chances of human-bear conflicts; 2) implementing bear-resistant human food and garbage storage requirements through the Code of Federal Regulations and Superintendents Compendium; 3) providing park visitors with bear-proof infrastructure (e.g., bear-resistant garbage cans, dumpsters, and food storage devices) so that food and garbage storage regulations are easy and convenient to comply with; 4) rigorously enforcing food and garbage storage regulations through bear-attractant security patrols in front-country developed sites, roadside campgrounds, and backcountry campsites; and 5) fostering, through removal of human food-conditioned bears rather than relocation, a population of bears in the park that generally do not seek anthropogenic attractants or test bear-proof infrastructure.

Occasionally, park visitors fail to store food or garbage appropriately, park staff fail to detect or correct

improperly stored anthropogenic attractants, or grizzly bears simply outsmart park visitors and national park staff or defeat food storage infrastructure and obtain human food rewards. In incidents where bears specifically seek out anthropogenic attractants or behave aggressively toward people, injure people, or damage property in their attempts to gain access to human foods (offensive aggression), the bears are generally killed, even if it is their first offense. However, in relatively benign incidents where bears inadvertently happen upon unsecured food, the bears are generally left to roam free on the landscape. No action is taken against bears that injure people in defensive reactions to surprise encounters occurring in backcountry areas (defensive aggression). Although killing bears conditioned to human foods after just 1 aggressive conflict with people may seem severe, on a long-term basis this management strategy results in considerably fewer bear-human conflicts overall, and equally important, considerably fewer bears being killed in management actions to address conflicts. This management strategy promotes and favors occupation of available habitat by bears that do not seek anthropogenic foods. In contrast, tolerance and overprotection of human food-conditioned bears can promulgate a population where conflict behaviors become so pervasive as to result in the development of a tradition or culture of conflict behaviors in a large segment of the bear population. Bears that supplement natural foods with anthropogenic food sources can attain larger body sizes, better body condition, better cub nutrition, faster maturation, earlier age of first reproduction, and shorter inter-birth interval, likely giving conflict bears a competitive advantage over non-conflict bears. Over the long term, that competitive advantage could result in conflict bears replacing non-conflict bears in the population.

Bears exhibit social learning behavior (Gilbert 1999, Mazur and Seher 2008, Morehouse et al. 2016). Human food-conditioned bear foraging behavior is often transmitted through social learning from mother bears to cubs, and from their grown female offspring to their cubs and future cubs (Cole 1976, Gilbert 1999, Mazur and Seher 2008). Cubs learn foods by watching their mothers and sharing their mother's food during the 1.5-3.5 years spent under her care (Meagher and Fowler 1989, Gilbert 1999). Park managers attempt to break the chain of learned conflict behavior passed from mothers to offspring and grown adult female offspring to future offspring (Cole 1976, Meagher and Fowler 1989). Breaking the sequence of learned conflict behaviors is important so that conflict behavior, such as damaging property or injuring people to obtain anthropogenic foods does not become a traditional behavior that persists across multiple generations of matriarchal linages in a large segment of the bear population (Mazur and Seher 2008). Once a conflict bear has been removed, the next bear to reoccupy that habitat, area, or general range may be an immigrating subadult that exhibits wild behaviors rather than human food-conditioned conflict behaviors (Cole 1976, Meagher and Fowler 1989). If the next bear to occupy the area exhibits conflict behaviors, it is also removed. With a foundation of bear-proof infrastructure, effective educational efforts, and enforcement of food and garbage storage regulations, eventually the area will be re-occupied by a dispersing subadult exhibiting wild behaviors. By consistently implementing this strategy over the long term, a population of bears once dominated by a culture of conflict behaviors, such as bears in YNP during the 1930s–1960s (Cole 1971, 1976, Meagher and Phillips 1983, Schullery 1992, Wondrak Biel 2006), can be converted to and maintained as a population composed of individuals exhibiting primarily wild behaviors (Cole 1976), such as bears in the park from the 1980s to the present (Meagher and Phillips 1983, Gunther 1994, Garshelis et al. 2017). The removal of bears conditioned to human foods and exhibiting conflict behaviors allows young bears that are not conditioned to human foods to recruit into and progressively replace conflict bears in the local population (Cole 1976, Meagher and Fowler 1989). Occasional removal of food-conditioned bears will still sometimes be necessary, as the opportunistic behavior of bears can periodically reestablish conflict behaviors (Mazur and Seher 2008).

The described management strategy has been highly successful at reducing grizzly bear-human conflicts and management removals of grizzly bears on national park lands where bear-proof infrastructure is provided and there is rigorous enforcement of food and garbage storage regulations (Meagher and Phillips 1983, Gunther 1994, Garshelis et al. 2017, White et al. 2017).

Limiting management removals of bears to sustainable rates while operating under the park's aggressive bear management strategy requires significant investment of resources into conflict prevention. To efficiently and effectively allocate resources for implementing management actions designed to prevent grizzly bear-human conflicts, park managers need baseline information regarding the types, causes, locations, and recent trends of conflicts. To address this need, all reported grizzly bear-human conflicts are recorded annually. Conflicts are grouped

into broad categories using standard definitions (Table 30).

Management Actions

In 2023, park staff dedicated considerable management effort toward preventing grizzly bear-human conflicts from occurring (Table 31). In response to grizzly bear activity in visitor use areas, park staff posted bear warning signs at 11 locations and implemented temporary trail or area closures at 22 locations. To prevent grizzly bears from being attracted into visitor use areas by animal carcasses, park staff removed 110 large mammal carcasses from developments, roadside campgrounds, road corridors, trails, backcountry campsites, and other visitor use areas. Animal carcasses removed from visitor use areas included 58 bison, 24 mule deer, 13 elk, 4 pronghorn, 3 black bear, 3 coyotes, 2 bighorn sheep, 1 grizzly bear, 1 wolf, and 1 river otter. To discourage grizzly bears from entering areas of concentrated visitor use, park staff hazed grizzly bears out of human use areas 29 times. Staff hazed grizzly bears out of primary road corridors 18 times and out of park developments 11 times. In addition, as part of the park's strategy for preventing bears from obtaining human foods, 184 bear-proof food storage lockers (30 cubic feet; ft^3) were purchased with donations raised by the Yellowstone Forever foundation and installed in roadside campgrounds. With the installation of 184 food storage lockers, 1,509 (79%) of the park's 1,914 roadside campground campsites now have bear-proof food storage lockers. Ten of the parks 11 campgrounds, including Pebble Creek, Slough Creek, Tower Fall, Mammoth, Indian Creek, Norris, Canyon, Bridge Bay, Madison, and Lewis Lake, have food storage lockers in every campsite. As part of the program, some food storage lockers have also been installed in the Grant Village (8% of sites) campgrounds. It is the park's goal to provide visitors with bear-proof food storage lockers in every roadside campsite in the park. All 300 designated backcountry campsites in YNP currently have a food storage device (food hanging poles in 260 campsites and bear-proof food storage lockers in 40 campsites). When camping in non-designated sites in dispersed camping zones, backcountry campers are required to use Interagency Grizzly Bear Committee approved hard-sided food storage canisters or rig their own food-hanging device.

Management of Roadside Bear Viewing

The objectives of managing visitors at roadside bear-viewing opportunities include: 1) preventing visitors from feeding roadside bears; 2) keeping visitor behavior as predictable as possible to bears; 3) keeping visitors at least 100 yards from bears; and 4) preventing visitors from approaching, encircling, or following roadside bears. The habituation of some bears to people combined with the presence of large areas of non-forested habitat with good visibility in YNP has created exceptional bear viewing opportunities, resulting in significant growth of bear viewing as a local industry in park gateway communities. Bear viewing is now one of the primary activities of visitors to the park (Taylor et al. 2014, Richardson et al. 2015) and contributes millions of dollars to the economies of gateway communities annually (Richardson et al. 2014).

Park staff spent considerable time managing visitors at roadside bear-viewing opportunities in 2023. Staff and visitors reported 330 roadside traffic-jams caused by visitors stopping to view human-habituated (but not food-conditioned) grizzly bears along park roads. Thousands of visitors viewed bears at these traffic jams. Park staff responded to 223 (68%) of the grizzly bear jams and spent 1,020 personnel hours managing habituated grizzly bears, the traffic associated with the bear jams, and the visitors that stopped to view and photograph habituated grizzly bears along roads. On average, park personnel spent 4.6 staff-hours managing each grizzly bear-jam.

Human-Bear Conflicts

There were 5 human-grizzly bear conflicts reported in YNP in 2023 (Table 32). On July 30 at approximately 4 a.m., a grizzly bear (determined by tracks) attempted to break into a bear-proof dumpster behind the Mammoth General Store and the recycle bins near the Juniper Dorm. A bear scat was also found outside of the restroom at the Service Station. The bear did not get into the dumpster but left hair and paw prints on it. The bear knocked over a connected row of recycle bins onto a car parked in front of them. A few empty plastic bottles were found scattered on the ground so the bear likely got a food reward of residue from the bottles.

On July 30 at approximately 5:30 a.m., a Montana Conservation Corps work crew camping at the Indian Creek administrative campground heard banging noises on their Bear Box and then heard sniffing noises around their tents. When they got out of their tents later that morning, they found grizzly bear muddy paw prints all over the bear box, a water jug left out on top of the bear box had been bitten, and their folding table had been knocked over. The bear did not receive a food reward. The incident was reported several days after it had occurred and the MCC crew camping at the site had

no further incidents. No action was taken against the bear.

On August 18 a grizzly bear (based on video) got into a bag of garbage left outside in the Canyon Village Contractor Employee Trailer Court. The bear also opened a tote left outside of a trailer and ate a pack of ramen noodles that were inside. This incident was not reported to Bear Management staff until August 20.

On August 20 a grizzly bear (based on video) was investigating trailers in the Canyon Village Contractor Employee Trailer Court. The bear knocked over grills and got some food from some coolers left outside of an RV. Food security patrols and education efforts with residents in the RV camp were increased, trail cameras were set up to get a better identification of the bear, and Bear Management staff spent several evenings monitoring the RV park. However, the bear did not return.

On September 12 at approximately 12:30 p.m. 2 anglers were fishing along Slough Creek near campsite 2S8 when they saw a female grizzly bear with 1 yearling playing in the creek about 150 yards away. The anglers got worried and backed away from the creek to put more distance between them and the bears, but left their packs behind on the ground. The bears wandered up stream and found the packs. The adult female rummaged through the packs and ate the 2 lunches which each consisted of a sandwich, chips, and a Gatorade. After eating the peoples lunches the bears walked away. Bear Warnings were put on the trail, and nearby campsites. Bear Management staff spent 2 days in the backcountry monitoring the area but the bears did not return. No action was taken against the bear.

Many factors, including the availability of natural bear foods, grizzly bear population numbers, and park visitation, influence the annual number of bear-human conflicts occurring in YNP. The annual number of conflicts in the park has decreased substantially after efforts to prevent bears from obtaining anthropogenic foods were implemented in the late 1960s and early 1970s (Fig. 25, Meagher and Phillips 1983, Gunther 1994, Garshelis et al. 2017).

Grizzly Bear Mortality

Only 1 grizzly bear mortality was discovered in 2023 in the YNP portion of the GYE. Sometime during the late evening of September 21 or early morning of September 22, a vehicle struck and killed a male yearling grizzly bear near mile marker 15 on Highway #191 in the Grayling Creek drainage. The accident was not reported by the vehicle that struck the bear. The bear was found in the roadside ditch and had died from blunt force trauma to the right side of its head and rib cage, which fractured its skull and broke several ribs.

Trends in causes of grizzly bear mortality inside YNP have changed considerably over time. From the late 1950s through the 1970s, most grizzly bear mortality in the park was from human causes (Fig. 26), primarily management removals of bears involved in bear-human conflicts (Craighead et al. 1988). Over the last 4+ decades (1980–2023), most grizzly mortality in the park has been from natural causes, primarily complications of old age and intra- and inter-specific strife and predation involving other grizzly bears and wolves.

Table 28. Long-term fate of 28 unique grizzly bears involved in bear-human conflicts inside of Yellowstone National Park that were captured and relocated to remote areas of the park, 1980–2023.

Fate	Number
Caused further conflicts after relocation, later removed in management action	10
Caused further conflicts after relocation, later killed in defense of life or property incident outside of park	2
Caused further conflicts after relocation, later killed illegally outside of park	1
Caused further conflicts after relocation, later killed by black bear hunter (mistaken identification) outside of park	1
Caused further conflicts after relocation, later struck and killed by a vehicle outside of park	1
Caused further conflicts after relocation, final fate unknown	4
No known conflicts after relocation, final fate unknown	9
No known conflicts after relocation, died of natural causes	0
Total	28

Table 29. Long-term fate of 94 unique grizzly bears involved in bear-human conflicts outside of Yellowstone National Park that were captured and accepted for relocation into the park, 1980–2023.

Fate	Number
Caused further conflicts after relocation, later removed in management action	34
Caused further conflicts after relocation, later killed in defense of life or property incident outside of park	7
Caused further conflicts after relocation, later killed illegally outside of park	2
No known conflicts after relocation, later killed illegally outside of park	2
Killed by black bear hunter (mistaken identification)	0
Struck and killed by vehicle	0
Caused further conflicts after relocation, final fate unknown	7
No known conflicts after relocation, final fate unknown	40
No known conflicts after relocation, died of natural causes	2
Total	94

Table 30. Definition of terms used in human-bear conflict management in Yellowstone National Park.

Term	Definition
Human-bear conflict	Incidents where bears injured or killed people, damaged property, obtained human foods, garbage, or other anthropogenic attractants, or injured or killed livestock or pets.
Property damage–without food reward	Incidents where bears damaged property, including vehicles, buildings, tents, and camping equipment, etc., but did not obtain human-food rewards.
Anthropogenic food reward	Incidents where grizzly bears obtained human-related foods, including garbage, groceries, grease, pet foods, livestock feed or other edible human-related attractants.
Human injury	Incidents where bears injured 1 or more people, including minor scratches, bites, and contusions.
Human fatality	Incidents where bears killed people intentionally or unintentionally in offensive encounters or during defensive reactions to encounters.
Livestock depredation	Incidents where bears killed or injured domestic horses, mules, burro's, donkeys, or llamas.

Table 31. Number of management actions taken to reduce the potential for human-grizzly bear conflicts in Yellowstone National Park, 2023.

Management action	Number of incidents
Bear warnings posted	11
Temporary area closures implemented	22
Wildlife carcass removal from visitor use areas	110
Bear-jam management	223
Management hazing	29
Attempted capture–unsuccessful	0
Captured, marked, and released on site	0
Captured and relocated	0
Captured and removed (euthanized or live placement in zoo)	0
Captured for humane reasons	0
Total management actions	395

Table 32. Number of incidents of human-grizzly bear conflict reported in Yellowstone National Park, 2023.

Conflict type	Number of conflicts
Property damage–without food reward	1
Anthropogenic food reward	4
Human injury	0
Human fatality	0
Livestock depredation[a]	0
Total conflict incidents	5

[a] There are no cattle or sheep grazing allotments inside of Yellowstone National Park. Horses, mules, and llamas used as riding or pack stock are the only domestic livestock in the park that can potentially be killed by grizzly bears. Forty commercial outfitters have contracts to provide stock day rides and overnight pack trips in the park. Stock animals (horses, mules, llamas) spend from 3,800 – 8,400 nights annually, on overnight pack trips in Yellowstone National Park's backcountry.

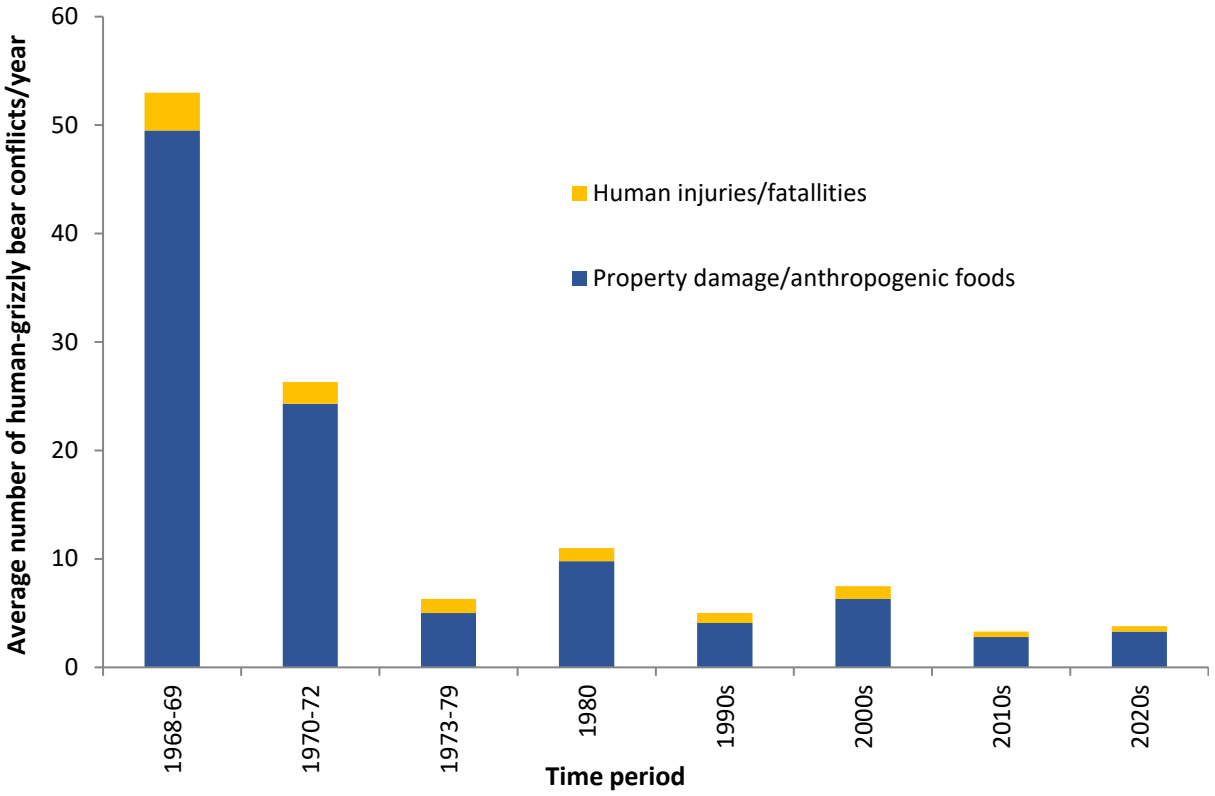

Fig. 25. Average number of human-grizzly bear conflicts per year by time-period, Yellowstone National Park, 1968–2023.

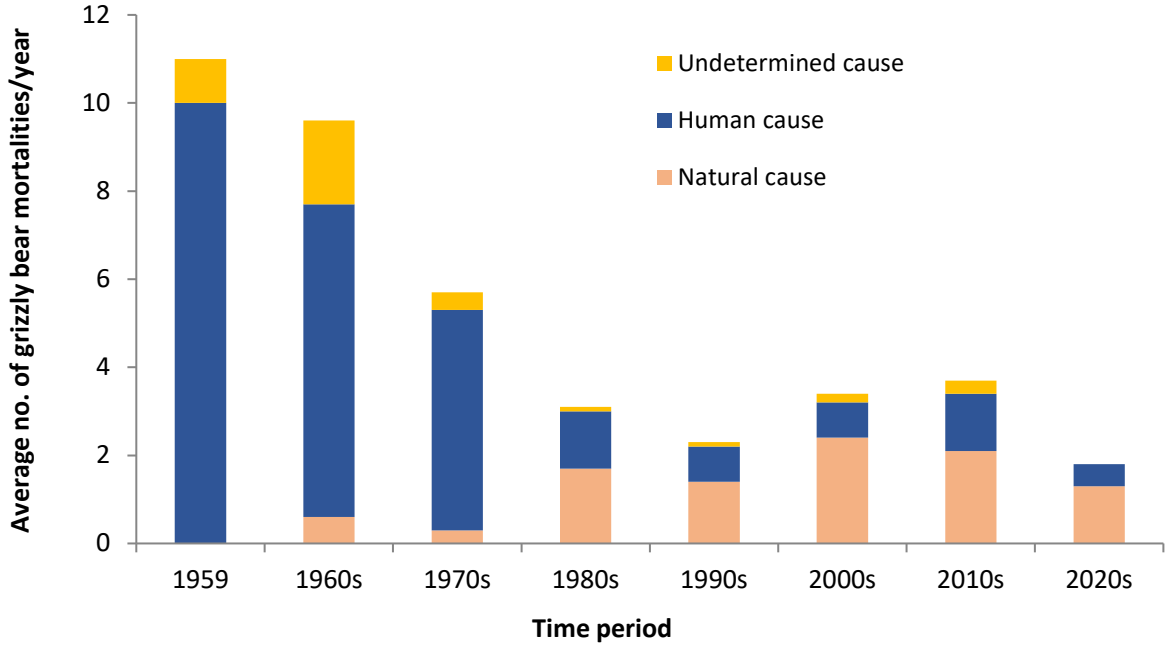

Fig. 26. Average number of known and probable grizzly bear mortalities per year by time-period, Yellowstone National Park, 1959–2023.

Human-Grizzly Bear Conflicts in Idaho *(Cade Bowlin, Idaho Department of Fish and Game)*

Human-grizzly bear conflicts have consistently occurred across Idaho's portion of the GYE since 2005 (Fig. 27). During the 2023 season, grizzly bear conflicts in eastern Idaho were the highest to date. Idaho Department of Fish and Game (IDFG) personnel responded to 64 human-grizzly bear conflicts in 2023 (Table 33, Fig. 28). Two individual grizzly bears (1 yearling male, 1 yearling female) were responsible for 20 of the 64 conflicts. Most conflict incidents occurred on private land with additional conflicts on state and federal lands (Fig. 28). Conflict locations ranged from Teton Basin to as far north as Henrys Lake and Targhee Pass. These conflicts included public safety threats, grizzly bears obtaining anthropogenic foods, encounter situations, property damage, human-caused bear mortalities, and bears obtaining non-natural foods. Conflict resolution actions by IDFG personnel included electric fencing, securing/removing attractants, hazing, public education, and management captures (Fig. 29). In 2023 IDFG confirmed 7 grizzly bear mortalities in the GYE portion of Idaho during 2023 (Table 34, Fig. 30.).

Three grizzly bears were captured in 2023 by IDFG for conflict management purposes. One male cub of the year grizzly bear was captured and released on site

Fig. 27. Number of grizzly bear conflicts and grizzly bear mortalities in the Idaho portion of the Greater Yellowstone Ecosystem, 2005-2023.

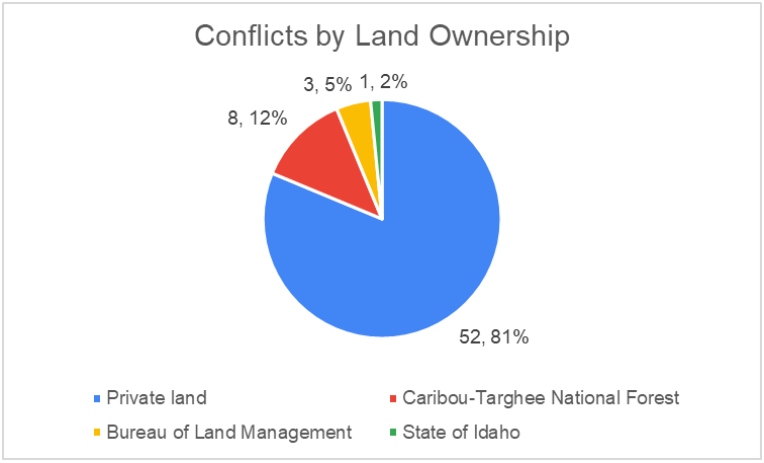

Fig. 28. Number of documented human-grizzly bear conflicts by land ownership in the Idaho portion of the Greater Yellowstone Ecosystem, 2023.

while attempting to capture a sow grizzly bear involved in conflict. Two sibling yearling grizzly bears (1M, 1F) were captured and removed by IDFG for repeated conflicts, habituation to humans, and several dangerous encounter situations. Additionally, one adult male grizzly bear was captured by Wildlife Services in relation to confirmed livestock depredation. The bear was immobilized and removed by IDFG personnel.

In 2023, IDFG Enforcement and Wildlife personnel responded to and investigated two separate defense of life incidents. Both events resulted in grizzly bear mortalities, one adult male and one adult female. Additional grizzly bear mortalities included one mortality due to vehicle strike (1M), and 1 unknown-cause (found dead) mortality (1M).

In an effort to reduce and prevent human-grizzly bear conflicts, Idaho Fish and Game staff continued outreach and education efforts across the Idaho portion of the GYE. IDFG staff and volunteers conducted and participated in 20 outreach/education events from March to September 2023. A total of 3,130 people attended these events and received training on bear safety, ecology, and identification in eastern Idaho. An additional 189 people were contacted while canvassing neighborhoods and campgrounds in the Island Park/Ashton area.

Table 33. Human-grizzly bear conflicts in the Idaho portion of the Greater Yellowstone Ecosystem, 2023.	
Conflict type	**Number of conflicts**
Encounter situation	16
Public safety threat (habituated, near developed sites, etc.)	12
Unnatural foods-garbage	12
Other conflict types	10
Unnatural foods-other	5
Livestock depredation-cattle	3
Unnatural foods-human foods	2
Unnatural foods-livestock/pet foods	1
Property damage-building	1
Property damage-other	1
Beehives	1
Human Injuries	0
Total conflicts	64

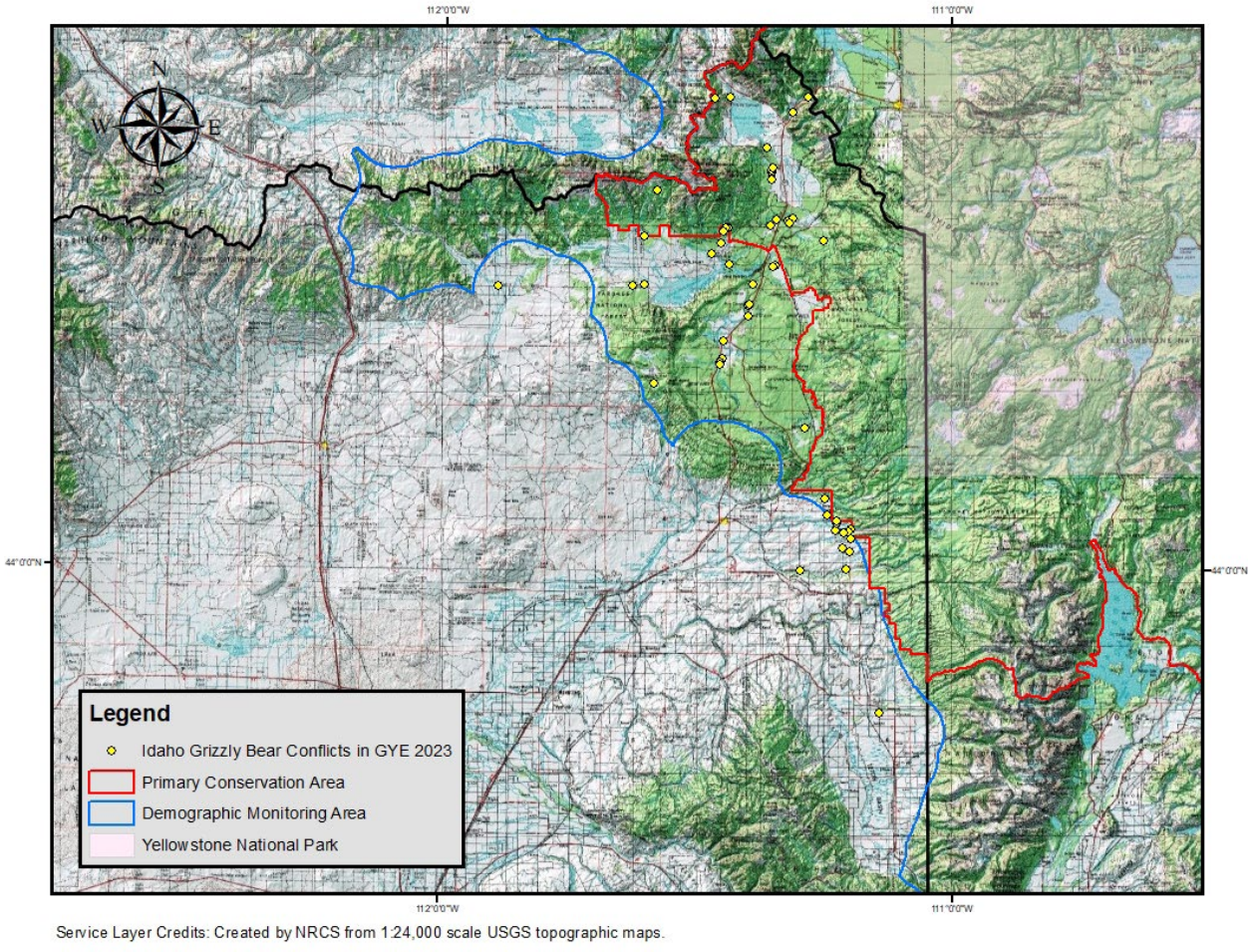

Fig. 29. Locations of human-grizzly bear conflicts in the Idaho portion of the Greater Yellowstone Ecosystem, 2023.

Table 34. Known grizzly bear mortalities in the Idaho portion of the Greater Yellowstone Ecosystem, 2023.	
Mortality Type	**Number**
Management removal	3
Defense of life	2
Vehicle strike	1
Unknown cause	1
Total Mortalities	7

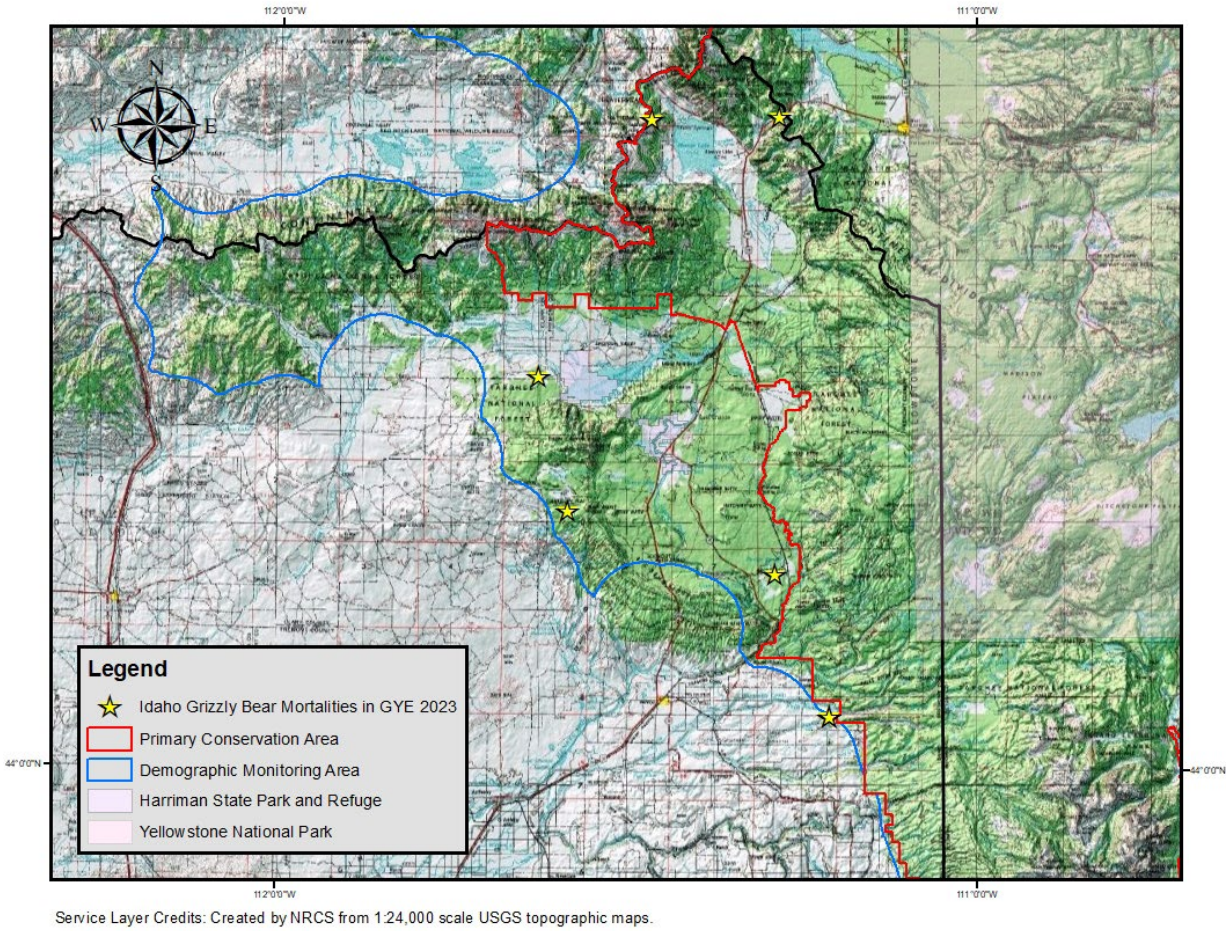

Fig. 30. Locations of known grizzly bear mortalities in the Idaho portion of the Greater Yellowstone Ecosystem, 2023.

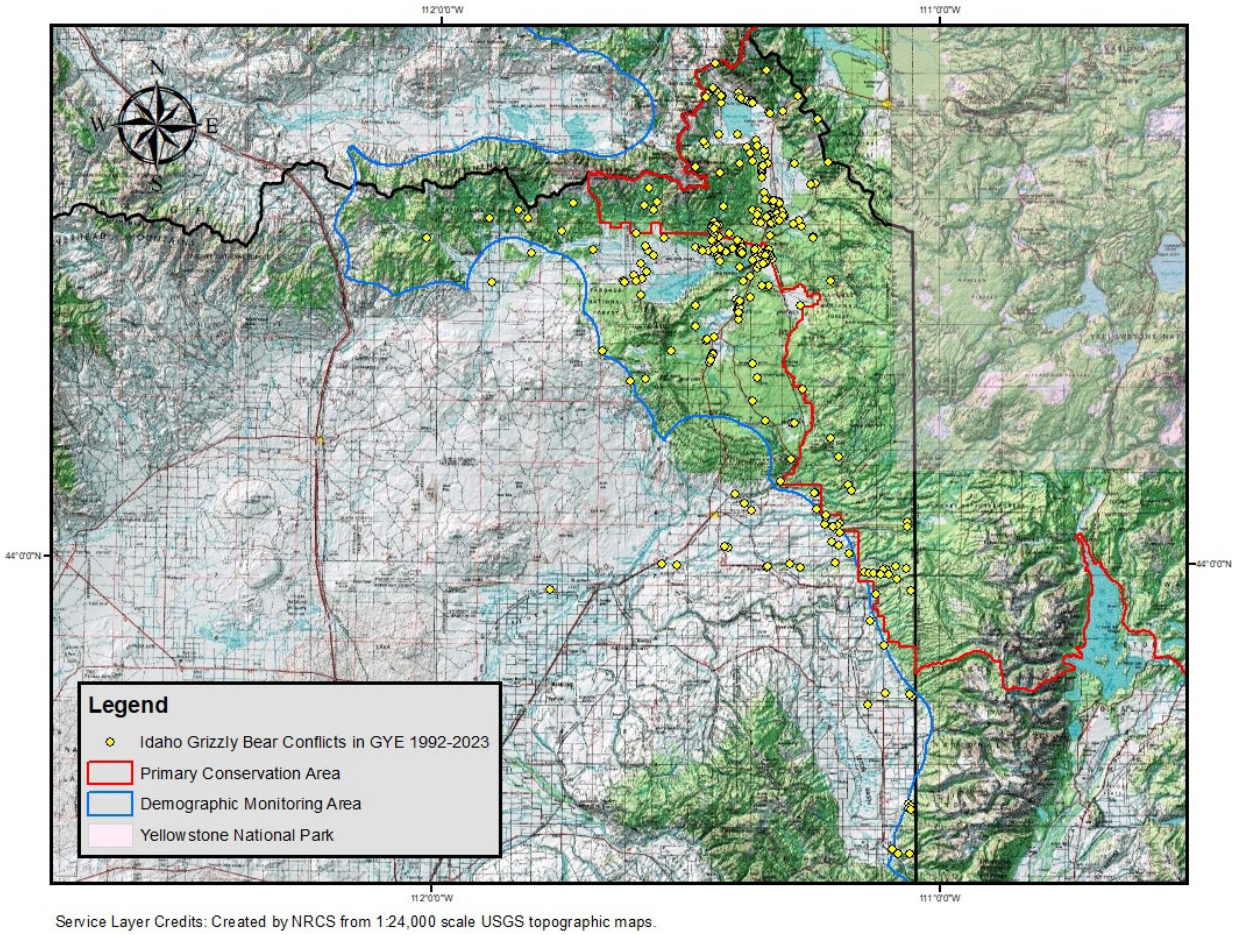

Fig. 31. Locations of all documented human-grizzly bear conflicts in the Idaho portion of the Greater Yellowstone Ecosystem, 1992–2023.

Human-Grizzly Bear Conflicts in Montana *(Jeremiah Smith, Kyle Orozco Montana Fish, Wildlife and Parks)*

During 2023 in Montana's portion of the GYE, there were a total of 97 investigated human-bear conflicts and 15 documented grizzly bear mortalities. The number of conflicts is shown by type in Table 35.

Annual variation in conflicts and grizzly bear mortalities are shown in Fig. 32. For 2014–2023, the average number of grizzly bear conflicts was 102.5 per year and 11.5 grizzly bear mortalities per year.

Table 35. Human-grizzly bear conflict types in the Montana portion of the Greater Yellowstone Ecosystem, 2023.

Conflict type	Number of conflicts
Livestock - cattle	30 cattle killed or injured
Livestock - sheep	0 sheep killed
Livestock - poultry	3 (20ish)
Other property loss	Region 3: 6; Region 5: 1
Anthropogenic foods	Region 3: 10; Region 5: 2
Anthropogenic foods with property damage	6
At developed sites–safety concerns	Region 3: 12; Region 5: 1
Bear mortalities	15 (6 management, 4 defense of life, 2 natural, 2 vehicle strike, 1 unknown)
Encounters and human injuries	Region 3: 10 (including 1 fatality and 1 human injury) Region 5: 4 encounters
Total	97 conflicts, including an additional 2 natural and 1 unknown mortality

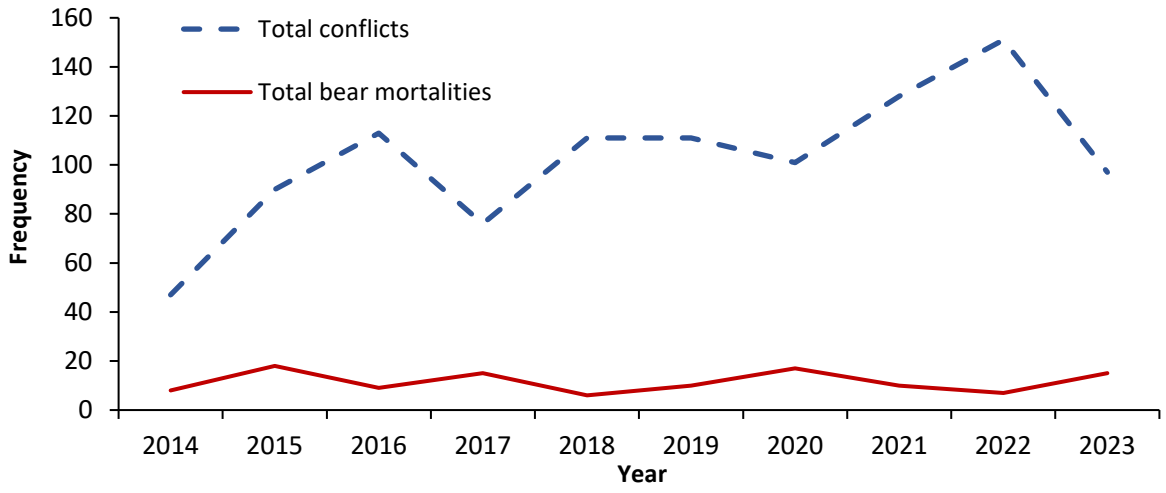

Fig. 32. Frequency of total grizzly bear conflicts and bear mortalities in the Montana portion of the Greater Yellowstone Ecosystem, 2014–2023.

The distribution of grizzly bear conflicts by land jurisdiction is shown in Table 36. During 2023, the largest percentage (54.6%) of conflicts occurred on private land.

The trend in close encounters that can lead to human injuries or defense of life grizzly bear mortalities from 2014 through 2023 are shown in Fig. 33. The yearly average of these conflicts is 13.6 close encounters, 2.3 human injuries, and 3 defense of life grizzly bear mortalities. During 2023, there were 14 close encounters resulting in 1 human injuries, 1 human fatality, and 4 grizzly bear mortality.

Cattle depredations are increasing as grizzly bear numbers and geographic distribution increases. The annual variation and overall increases in Montana Fish, Wildlife and Parks Region 3 and Region 5 are shown in Fig. 34. From 2014 through 2023, the yearly average for the geographic portions are 22.5 depredations in Region 3 and 14.7 in Region 5. During 2023, there were 30 documented cattle depredations in Region 3 and 0 in Region 5.

Fig. 35 displays a map of all 2023 grizzly bear mortalities in Montana's portion of the GYE. Fig. 36 displays a map of all 2023 conflict types and grizzly bear mortalities showing the distribution of management efforts and grizzly bear distribution. There is annual variation in these distributions and the numbers of conflicts in any geographic area.

Table 36. Total conflicts by land jurisdiction in the Montana portion of the Greater Yellowstone Ecosystem, 2023.

Jurisdiction	Number of conflicts
Private	53
State	0
County or local government	4
Federal	2
Bureau of Land Management	0
Custer Gallatin National Forest	10
Beaverhead-Deerlodge National Forest	28
USFWS–National Wildlife Refuge	0
Total	97

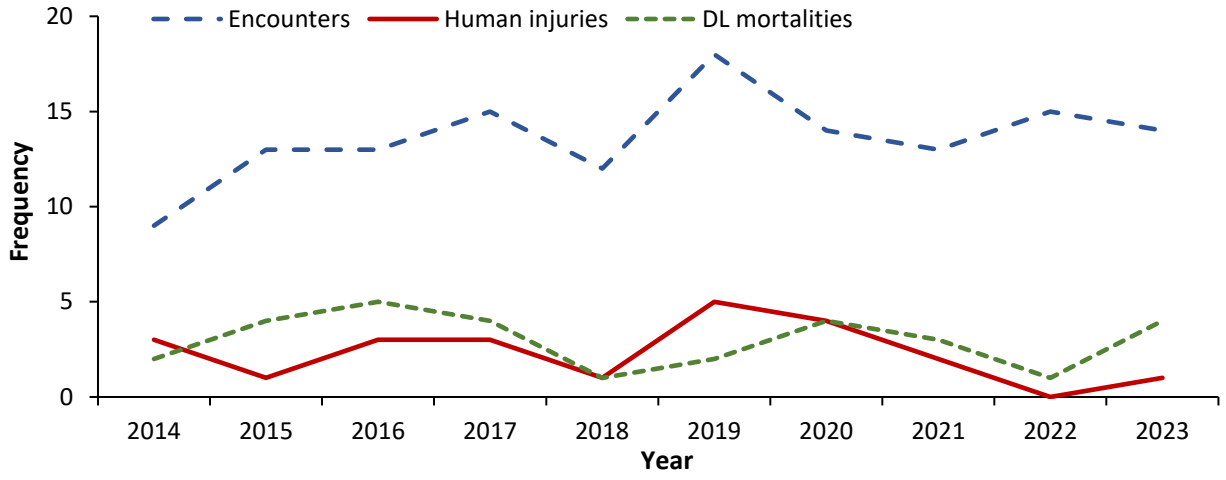

Fig. 33. Frequency of bear encounters resulting human injuries and defense of life (DL) bear mortalities in the Montana portion of the Greater Yellowstone Ecosystem, 2014–2023.

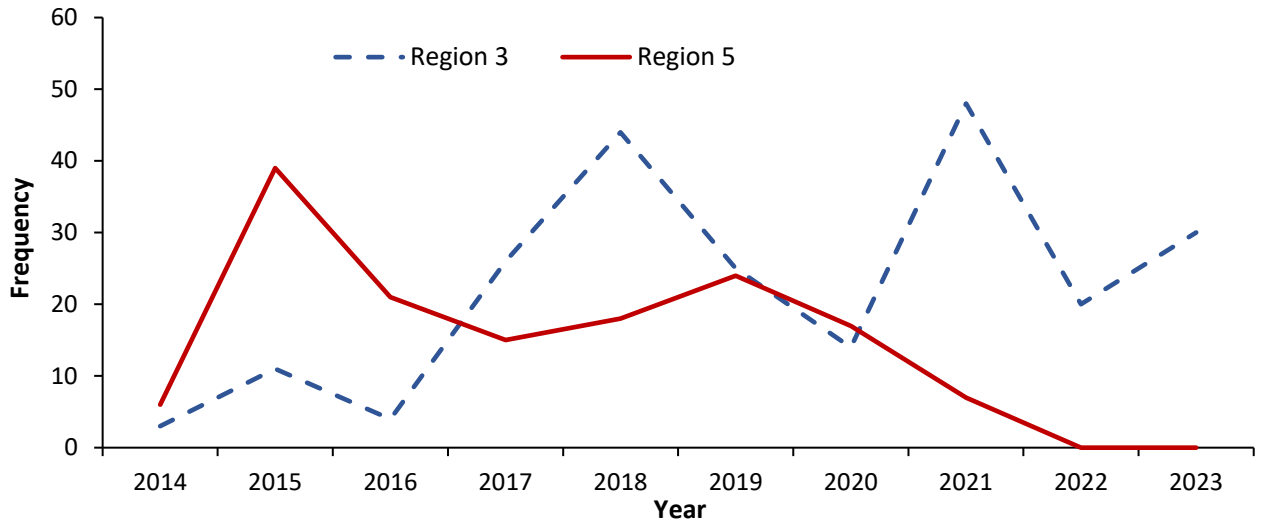

Fig. 34. Frequency of cattle depredation conflicts in the Montana portion of the Greater Yellowstone Ecosystem, 2014–2023.

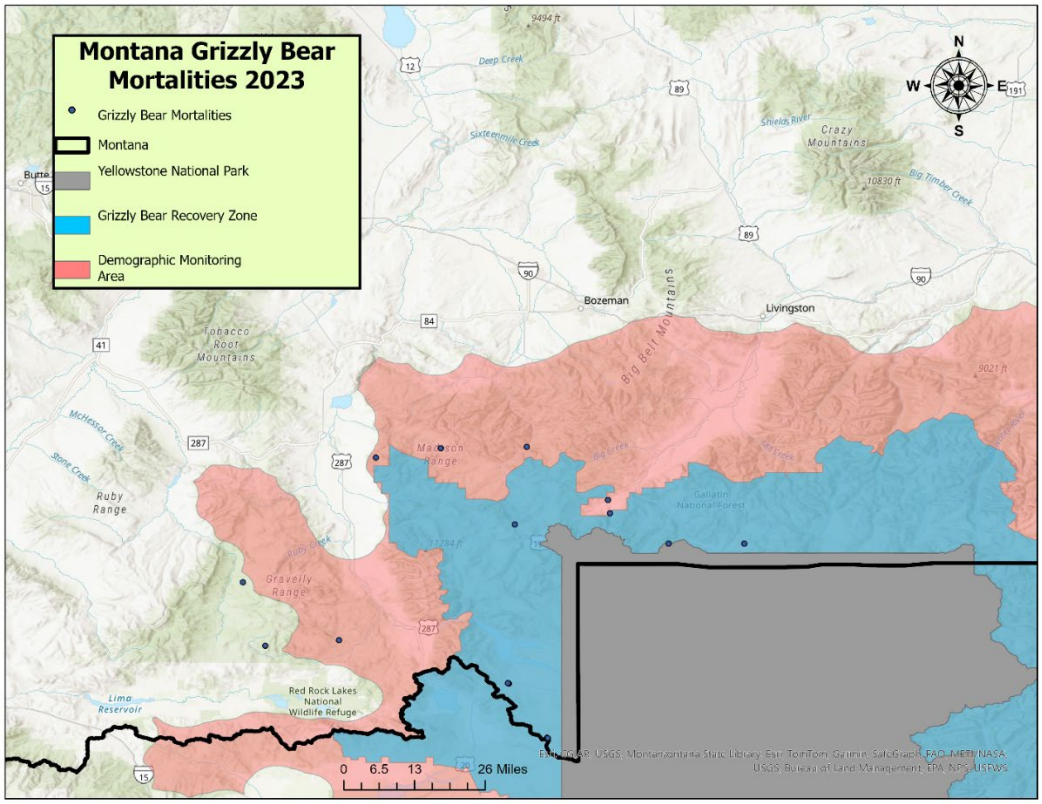

Fig. 35. Locations of all grizzly bear mortalities in the Montana portion of the Greater Yellowstone Ecosystem, 2023. Base Map: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL.

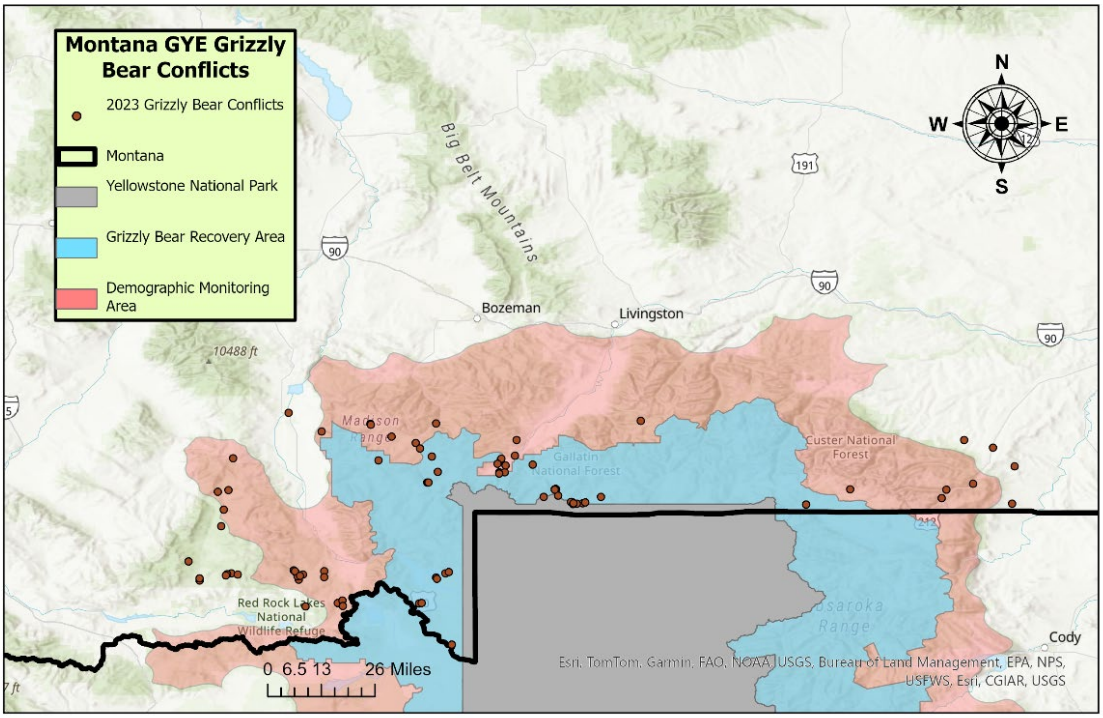

Fig. 36. Locations of all conflict types and grizzly bear mortalities in the Montana portion of the Greater Yellowstone Ecosystem, 2023. Base Map: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community.

Human-Grizzly Bear Conflicts in Wyoming *(Brian DeBolt, Luke Ellsbury, Michael Boyce, Phil Quick, Scott Stingley, Mark Aughton, Kesley Secrist, Justin Dellinger, Thomas Kelly, Josiah Crump, Justin Clapp, Brady Roberts, Clint Atkinson, Ken Mills, Ryan Kindermann, and Daniel J. Thompson; Large Carnivore Section, Wyoming Game and Fish Department)*

In Wyoming, grizzly bear conflicts are defined as "interactions between grizzly bears, people and their property, resulting in damage to pets, livestock or bees, non-natural food rewards, animal caused human injury or death, and human caused injury or death to an animal other than legal hunting or a management action." Human-grizzly bear interactions and conflicts in Wyoming are a result abundance, and in some areas, an over-abundance of bears seeking unnatural foods in association with people and property, close encounters with humans, or when bears kill livestock. Proactive prevention is the goal of the Wyoming Game and Fish Department (Department) in minimizing conflicts. However, the number and location of human-grizzly bear conflicts is influenced by the availability of unsecured unnatural attractants (e.g., human foods and garbage), seasonal distribution and abundance of natural foods, grizzly bear density and distribution, and human and livestock use patterns on the landscape. For purposes of this report, we will be referring directly to grizzly bears regarding any management actions and numbers provided therein. Any relocation or removal of grizzly bears in Wyoming is dependent upon authorization from the U.S. Fish and Wildlife Service after careful and thorough deliberation, taking into account multiple factors unique to each conflict situation.

Management techniques used around the world to reduce human-grizzly bear conflicts are employed by the Department, including the capture and relocation of problem individuals. While proactive outreach, education, and preventative measures are the foundation of grizzly bear conflict management, hands-on mitigation techniques are a requisite in many conflicts. Relocation achieves several social and conservation functions: (a) it reduces the chance of property damage, livestock damage, or human interactions in areas where the potential for conflict is high; (b) it reduces the potential for grizzly bears to become food conditioned and/or human habituated which often results in destructive and/or dangerous behaviors; (c) it allows grizzly bears the opportunity to forage on natural foods and remain wary of people; and (d) it could prevent removing grizzly bears from the population which may be beneficial in maintaining recovery criteria and population management objectives.

In addition to capture and relocation, the Department also removes grizzly bears (lethally or by live placement into a zoo or other facility) in response to human-grizzly bear conflicts, when necessary, as part of routine management operations. All grizzly bear management actions were conducted in coordination with the U.S. Forest Service and the U.S. Fish and Wildlife Service. The decision to relocate or remove a grizzly bear is made after considering a number of factors, including the age and sex of the animal, behavioral traits, health status, physical injuries or abnormalities, type of conflict, severity of conflict, known history of the animal, human safety concerns, availability of suitable relocation sites, and population management objectives. Grizzly bears are relocated or removed in accordance with federal and state law, regulation, and policy.

In 2005, the Wyoming Legislature enacted House Bill 203, which created Wyoming Statute §23-1-1001 that requires the Department to:

(a) Upon relocating a grizzly bear or upon receiving notification that a grizzly bear is being relocated, the Department shall provide notification to the county sheriff of the county to which the grizzly bear is relocated within five (5) days of each grizzly bear relocation and shall issue a press release to the media and sheriff in the county where each grizzly bear is relocated;

(b) The notice and press release shall provide the following information:

(i) The date of the grizzly bear relocation;

(ii) The number of grizzly bears relocated; and

(iii) The location of the grizzly bear relocation, as provided by commission rule and regulation;

(c) No later than January 15 of each year the Department shall submit an annual report to the

Joint Travel, Recreation, Wildlife, and Cultural Resources Interim committee. The annual report shall include the total number and relocation area of each grizzly bear relocated during the previous calendar year. The Department shall also make available the annual report to the public.

Grizzly Bear Management Captures, Relocations, and Removals

During 2023, the Department captured 23 individual grizzly bears in an attempt to prevent or resolve conflicts (Table 37, Fig. 37). Of the 23 individual captures, 7 were female (4 adults, 2 sub-adults and 1 two year old) and 16 were male (10 adults, 2 sub-adults, 2 two year olds and 2 yearling) grizzly bears.

Of the 23 capture events, 11 captures were a result of bears killing livestock (cattle, sheep, and chickens), and 12 were captures involving bears that obtained food rewards (pet, livestock food, garbage, fruit trees), or were frequenting developed sites or human populated areas unsuitable for grizzly bear occupancy. Of the 23 capture events, 16 (69%) were in Park County, 3 (13%) were in Hot Springs County, 3 (13%) were in Sublette County, and 1 (5%) was in Teton County (Table 38).

Of the 23 capture events, there were 9 relocation events (Table 38, Fig. 38). All relocated grizzly bears were released on U.S. Forest Service lands in or adjacent to the Primary Conservation Area/Recovery Zone. Of the 9 relocation events, 4 were conducted in Park County (45%) and 5 (55%) in Teton County (Table 38).

Grizzly bears are removed from the population due to a history of previous conflicts, a known history of close association with humans, or if they are deemed unsuitable for release into the wild (e.g., orphaned cubs, poor physical condition, or human safety concern). Of the 23 grizzly bears captured, 14 bears were removed from the population. Of these 14 removals, 6 (43%) were outside of the Demographic Monitoring Area, which is the area considered suitable for the long term viability of grizzly bears in the GYE.

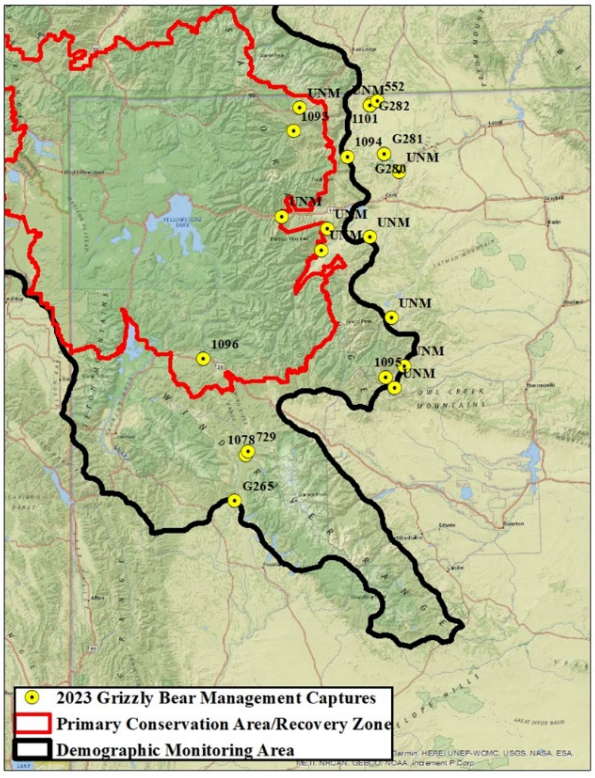

Fig. 37. Capture locations (n = 23) for grizzly bears captured in conflict management efforts in the Wyoming portion of the Greater Yellowstone Ecosystem, 2023. Because of the mapping scale, some locations are combined at one symbol. A complete list is provided in Table 37. Base Map Source: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

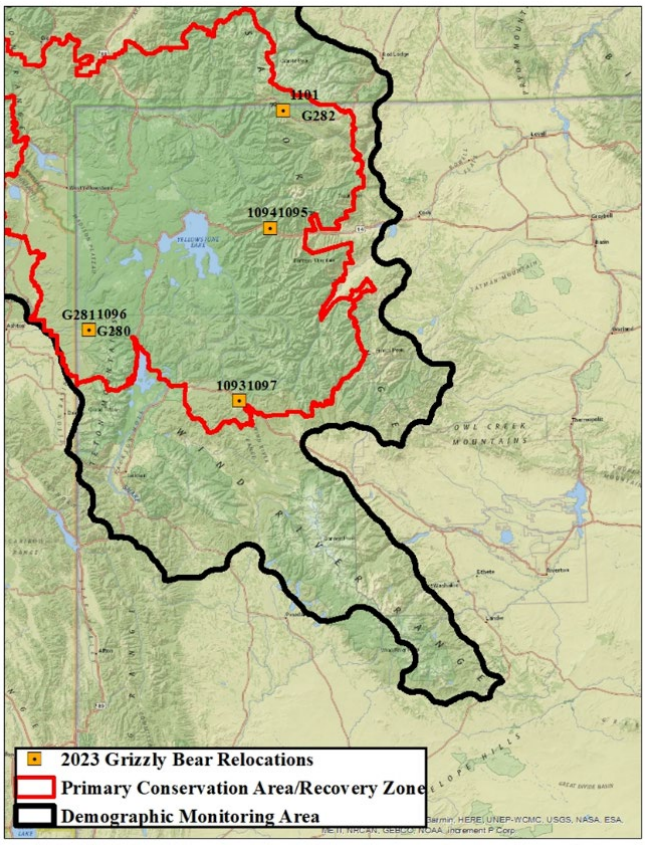

Fig. 38. Release locations (n = 9) for grizzly bears captured, relocated, or released on site in conflict management efforts in Wyoming portion of the Greater Yellowstone Ecosystem, 2023. A complete list is provided in Table 37. Base Map Source: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Table 37. Capture date, grizzly bear identification number (ID), capture county, relocation site, release county, and reason for capture for all 2023 grizzly bear conflict management captures (n = 23) in Wyoming. Grizzly bear ID labeled as "N/A" were grizzly bears removed from the population without being given a chronological capture number.

Date	ID	Capture county	Relocation site	Release county	Reason for capture
5/13/2023	N/A	Park			Captured and removed for cattle depredation
6/28/2023	G280	Park	Boone Creek	Teton	Captured and relocated for frequenting agricultural and developed areas
6/28/2023	G281	Park	Boone Creek	Teton	Captured and relocated for frequenting agricultural and developed areas
7/3/2023	G265	Sublette			Captured and removed for cattle depredation
7/8/2023	N/A	Park			Captured and removed for cattle depredation
7/9/2023	1093	Park	Blackrock Creek	Teton	Captured and relocated for cattle depredation
7/14/2023	N/A	Park			Captured and removed for habituated and food conditioned behavior on roadside and in campgrounds
7/20/2023	1078	Sublette			Captured and removed for cattle depredation
7/25/2023	729	Sublette			Captured and removed for cattle depredation
7/29/2023	N/A	Park			Captured and removed for damaging a chicken coop and obtaining food rewards
8/6/2023	1094	Park	Five Mile Creek	Park	Captured and relocated for cattle depredation
8/6/2023	N/A	Park			Captured and removed for cattle depredation
8/12/2023	N/A	Hot Springs			Captured and removed for cattle depredation
8/15/2023	1095	Hot Springs	Five Mile Creek	Park	Captured and relocated for sheep depredation
8/17/2023	N/A	Hot Springs			Captured and removed for cattle depredation
8/26/2023	1096	Teton	Squirrel Meadows	Teton	Captured and relocated for habituated roadside behavior
8/29/2023	N/A	Park			Captured and removed for frequenting corn field and human safety concerns
9/1/2023	552	Park			Captured and removed for crop and apiary damage
9/5/2023	1097	Park	Blackrock Creek	Teton	Captured and relocated for crop damage and close proximity to human occupied areas
9/10/2023	N/A	Park			Captured and removed for frequenting agricultural areas and crop damage
9/20/2023	1101	Park	Fox Creek	Park	Captured and relocated for crop damage and close proximity to human occupied areas
9/20/2023	G282	Park	Fox Creek	Park	Captured and relocated for crop damage and close proximity to human occupied areas
9/30/2023	N/A	Park			Captured and removed for multiple food rewards and property damage

Department personnel investigated and recorded 192 human-grizzly bear conflicts in 2023 (Table 37, Fig. 39). As a result of constant painstaking education and conflict prevention efforts, the general pattern of conflicts is relatively steady within currently occupied habitat (Fig. 40). The low number of conflicts in 2023 was likely a result of abundant natural foods and localized social tolerance of grizzly bears. Although the joint efforts of the WGFD, USFS, non-governmental organizations, and particularly the public, have resulted in reducing conflicts through education and attractant storage in many areas, the distribution of grizzly bear conflicts in Wyoming continues to expand with the population. Bears frequent lower elevations and developed areas regularly during the non-denning period. Grizzly bear-cattle depredation was the most frequent type of conflict documented in 2023. This has been the trend for decades, simply because there is no effective method to reduce livestock depredation on large, open-range areas. Although the annual variation in most human-bear conflicts are correlated with natural food abundance, the numbers of cattle and sheep killed annually do not follow the same pattern. As grizzly bears expand farther into human-dominated landscapes outside the DMA, the potential for conflict between bears and humans increases, resulting in negative outcomes for both grizzly bears and people. The WGFD continues to explore and use multiple options to reduce grizzly bear-livestock conflicts and expand our education and outreach efforts (see Bear Wise Wyoming Report, Appendix C).

Thirty-eight (38%) percent of the grizzly bear conflicts in Wyoming occurred on private lands and the majority were outside of the GBRZ. The increasing distribution of grizzly bears is reflected in the annual documentation of conflicts farther from suitable habitat and continued expansion outside the DMA.

Long-term trends in the number of conflicts are likely a result of grizzly bears increasing in numbers and distribution and expanding into areas used by humans, including livestock production, on public and private lands, as well as increased human-use of grizzly bear habitat in recent years. There is also a growing interest in roadside bear viewing. Some people engage in unethical wildlife viewing practices, often resulting in habituated or food-conditioned grizzly bears. Bears are also anthropomorphized on social media, where some bears are elevated to celebrity status. These situations focus on individuals instead of all grizzly bears in the population and continue to present difficult challenges for bear managers. Based on evidence of density-dependent effects in the early 2000s (van Manen et al. 2016, Corradini et al. 2023), the GYE grizzly bear population may have reached or exceeded its biological carrying capacity in portions of the ecosystem; individual bears continue to disperse into less suitable habitat beyond the DMA. Therefore, bears are more likely to encounter food sources such as garbage, pet food, livestock and livestock feed, and myriad other attractants, resulting in increased property damage and threats to human safety. Conflict prevention measures such as attractant storage, deterrence, and education are a priority for the WGFD. Nevertheless, conflict management is often reactive. Even with the most stringent food and attractant control, the increasing and expanding grizzly bear numbers will lead to conflicts between bears and people. Particularly in areas where females are teaching their young to be habituated to humans, there will be young bears venturing out and struggling to find food and survive. This situation emphasizes the importance of bears remaining wary of people and not becoming conditioned to human foods and other attractants, thus avoiding the need to be relocated or euthanized.

In general, social tolerance and biological suitability for bear occupancy declines farther from the GRBZ because of development, land use patterns, and various forms of recreation. Although prevention is the preferred option to reduce conflicts, each situation is managed on a case-by-case basis with education, securing of attractants, relocation or removal of individual bears, or a combination of methods applicable for long-term conflict resolution and conservation of grizzly bears. Conflicts will continue to increase, especially in areas not biologically suitable for grizzly bear occupancy, and bears will be relocated and removed as a result. Recovery criteria have been consistently achieved since the early 2000s and the population segment inside the DMA is still increasing. The current scenario of human-caused mortality for the population inside and outside the DMA will continue to contribute to the long-term viability of the grizzly bear population in Wyoming.

Table 38. Type and number of human-grizzly bear conflicts in the Wyoming portion of the Greater Yellowstone Ecosystem, 2023.		
Conflict type	**Number**	**Percent (%)**
Cattle	153	79.7
Pet-livestock-birdfeed	9	4.7
Property damage	9	4.7
Animal death	5	2.6
Garbage	4	2.1
Sheep	3	1.6
Animal Injury	2	1.0
Other	2	1.0
Beehive	2	1.0
Poultry	1	0.5
Aggression toward humans	1	0.5
Human injury	1	0.5
Total	192	100

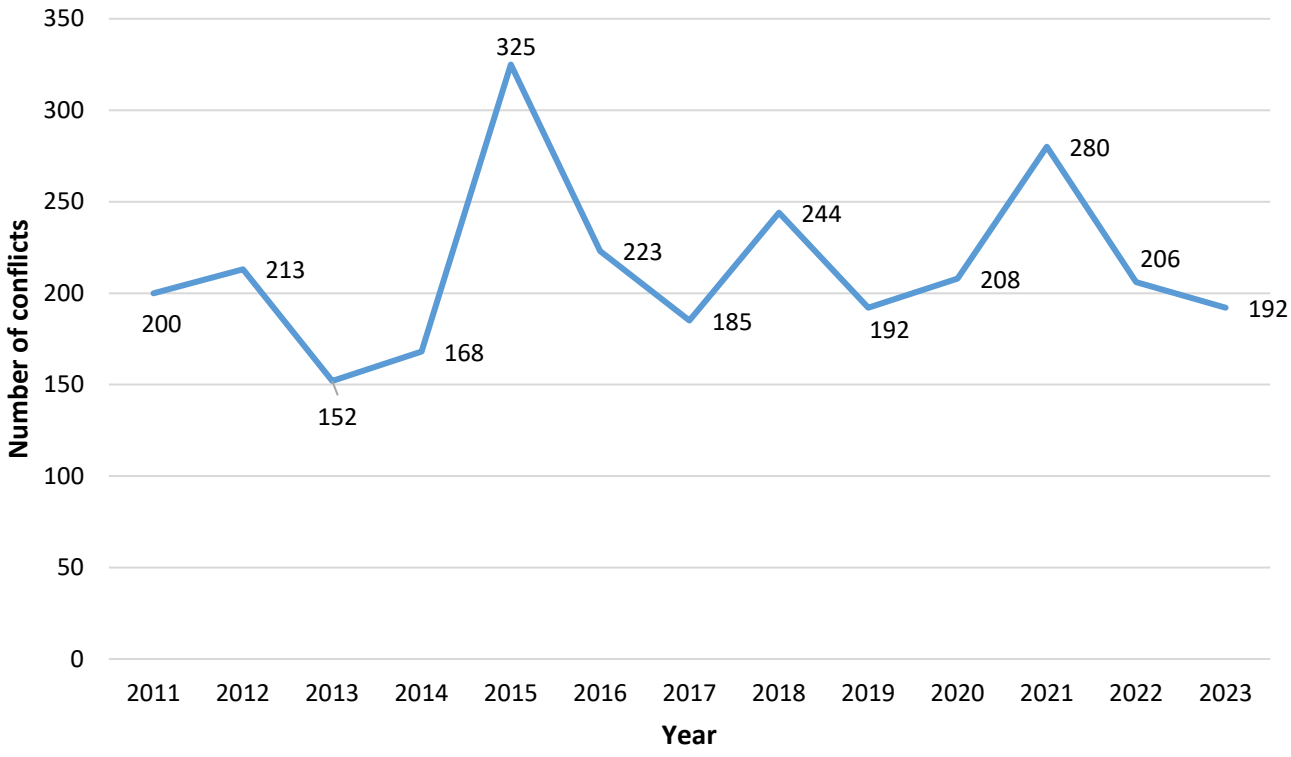

Fig. 39. Number of human-grizzly bear conflicts in the Wyoming portion of the Greater Yellowstone Ecosystem, 2011–2023.

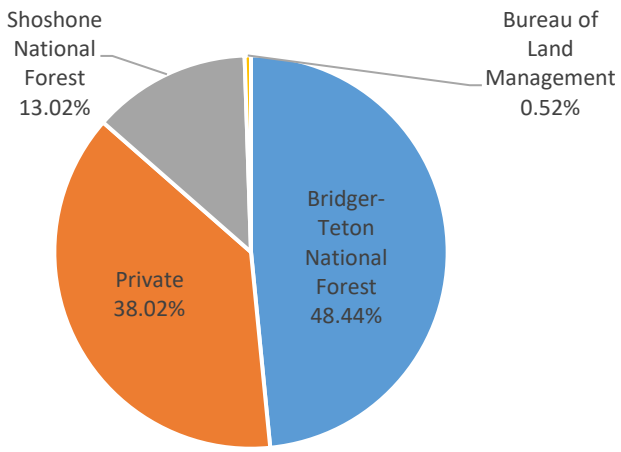

Fig. 40. Percent of human-grizzly bear conflicts on private and public lands in the Wyoming portion of the Greater Yellowstone Ecosystem, 2023.

Human-Grizzly Bear Conflicts on the Wind River Reservation (*Patrick Hnilicka, Lander Fish and Wildlife Conservation Office, U.S. Fish and Wildlife Service; and Art Lawson, Eastern Shoshone and Northern Arapaho Fish and Game Department*)

Two encounters and 3 conflicts were reported on the Wind River Reservation in 2023 (Fig. 41). Encounters occur when bears and people meet and are both aware of each other's presence, but with no ensuing conflict. Conflicts are defined as incidents where bears cause a human safety issue (habituated, in developed areas), damage property, kill or injure livestock, obtain human foods or garbage, or injure people.

The 2 Encounters and 3 Conflicts were likely caused by 1 large grizzly bear in the Wilson Creek and North Fork Little Wind drainages during a 3-week period in late July and early August. Both areas are very popular backcountry destinations. On 3 occasions, several large parties reported a large grizzly bear entering camps occupied by people and displaying habituated behavior in close proximity. These occurred at Tigee Lake (2) and Sonnicant Lake (1). No reports of charges or physical contact were received.

Upon recommendation by the Shoshone and Arapaho Fish and Game and US Fish & Wildlife Service, the Inter-tribal Council closed the Wilson Creek drainage to human presence within several days of receiving conflict reports. At the time of closure, we were aware of conflicts within only the Wilson Creek drainage. Social media, and multiple signage at the trailhead and trail junction into Wilson Creek were posted. The area remained closed for 3.5 weeks. The closure appeared to be effective. No further encounters or conflicts were reported following the re-opening of the drainage.

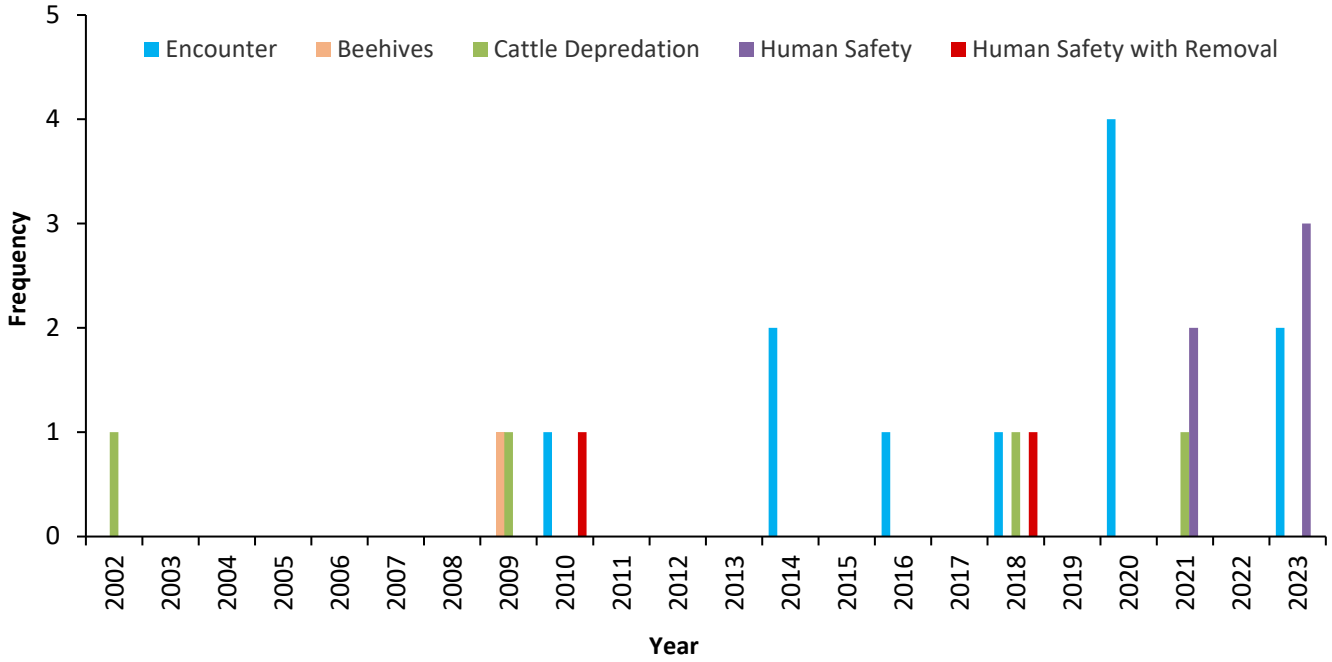

Fig. 41. Reported grizzly bear encounters and conflicts on the Wind River Reservation in the Greater Yellowstone Ecosystem, 2002-2023.

Human-Grizzly Bear Interactions in Yellowstone National Park *(Kerry A. Gunther, Travis C. Wyman, and Eric G. Reinertson, Yellowstone National Park)*

Knowledge of the relative risk of bear attack assists park managers in prioritizing bear safety messages for different types of recreational activities occurring in the park. Knowing the probability of attack also provides managers with quantitative information on the significance of risk when making decisions on implementing voluntary versus regulatory mechanisms designed to reduce the frequency of bear attacks. To address this need, we began recording information on human-bear interactions in YNP in 1991. Because the risk of bear attack varies depending on visitor location and activity, we grouped human-bear interactions into 6 broad categories based on the locations where they occurred, including: 1) within front-country developments; 2) along road corridors; 3) along front-country trails; 4) within backcountry campsites; 5) along backcountry trails; and 6) in off-trail backcountry areas. We considered all human-grizzly bear encounters where the person involved believed the bear was mutually aware of their presence as an interaction.

Human-Bear Interactions within Developed Front-country Sites

Bears enter front-country developments in the park for a variety of reasons, including travel, foraging for natural foods, and avoiding more dominant bears. In addition, human food-conditioned bears sometimes enter park developments seeking human foods or garbage. However, since implementation of a new bear management program in 1970, it is rare for bears to obtain anthropogenic food rewards in park developments. Under the park's Bear Management Plan, front-country developments are managed for people and bears are actively excluded through removal of natural and anthropogenic attractants, hazing, capture and relocation, and capture and removal.

Activity of Bears in Front-country Developed Sites

In 2023, there were 27 incidents where grizzly bears entered park developments (Table 39). In 48% (n = 13) of the incidents, bears foraged for natural foods within developments, and in 15% (n = 4) it appeared the bear was just traveling through the development. In 3 incidents bears were investigating anthropogenic foods but did not obtain food rewards, in 2 incidents bears investigated and obtained food rewards, and in one incident a bear damaged property but did not obtain a food reward. In 4 incidents the bears behavior was not reported.

Reactions of Bears to the Presence of People in Front-country Developments

Grizzly bears were known to have encountered people in 18 of the 27 incidents where they entered developments (Table 40). Bears fled in 61% (n = 11) of the encounters and exhibited no overt reaction in 39% (n = 7). Grizzly bears did not injure any visitors within park developments in 2023. The last grizzly bear inflicted human injury within a park developed area occurred 21 years ago in 2002. In that incident, a woman initially reacted passively (stood still and looked up toward the sky) to a subadult grizzly that curiously approached her. After the bear bit her on the thigh, the woman changed her response, became aggressive toward the bear, and it immediately left.

Human-Bear Interactions along Roads

Bears frequent habitats adjacent to roads in the park for many reasons, including traveling, foraging for natural foods, avoiding more dominant bears, and occasionally seeking discarded food scraps or human food handouts. In the past (1910–1969), bears commonly panhandled along park roads for food handouts from visitors (Schullery 1992). Strict enforcement of regulations prohibiting the feeding of bears after 1970 has mostly eliminated this behavior in park bears. However, bears are still regularly observed near park roads traveling and foraging for native foods. Unlike park developments that are managed solely for people and bears are actively excluded, roadside habitats are managed for both human and bear uses. Although bears are not allowed to remain or linger on the paved road, road shoulder, roadside pull-outs, or adjacent drainage ditch, they are tolerated in roadside meadows and are not actively discouraged from using roadside habitats to forage for natural foods as long as park visitors maintain a 90-m (100-yard) distance from them and do not feed them.

Bear Activity along Roadsides

In 2023, 330 reports of grizzly bears frequenting habitat along park roads were recorded (Table 41). In most of these incidents, the bears primary activity was foraging for natural foods (69%, n = 229) or traveling (28%, n = 92). Other activities reported included swimming (1%, n = 3), sleeping (1%, n = 2), investigating vehicles without obtaining a food reward (<1%, n = 1), and

aggressively approaching people (<1%, *n* = 1). In 2 incidents the bears reaction to people was not reported.

Bear Reactions to the Presence of People Along Roadsides

Grizzly bears were noticeably aware of the presence of people in 232 of the 330 reports of bear activity along roads (Table 41). Bears reacted with neutral behaviors in 72% (*n* = 167) of the encounters and fled in 24% (*n* = 56). Grizzly bears displayed curious behavior and walked toward people in 2% (*n* = 4) of the roadside encounters. In 1 incident (<1%) a grizzly bear charged toward people without making contact. Grizzly bears did not injure any visitors along park roads in 2023. No park visitors have been injured by grizzly bears along park roads during the 33-year study period (1991–2023).

Human-Bear Interactions on Front-country Trails

Yellowstone National Park contains approximately 24 kilometers of front-country trails. Front-country trails are short trails located adjacent to roads and developments that contain interpretive signs providing visitors with information about geysers or other natural features. Front-country trails often have boardwalks to provide a stable walking surface with gentle grades or steps to get up and down hills, allowing use by visitors of wide-ranging ages, physical abilities, and hiking experience. During the peak visitor season, hundreds to thousands of visitors walk the front-country trails each day. Bears sometimes travel or forage on or adjacent to front-country trails.

In 2023, there were 2 incidents where people encountered grizzly bears on front-country trails. In both incidents the bear had no noticeable overt reaction to the encounter (Table 40). The last grizzly bear inflicted human injury on a front-country trail occurred 20 years ago in 2003. In that incident, a woman initially reacted passively (dropped to the ground and played dead) to a subadult grizzly that curiously approached her. After the bear pounced on and bit her, her husband aggressively ran at the bear while yelling loudly, which scared the bear away. The woman received only very minor injuries.

Human-Bear Interactions in Backcountry Areas

Bears are generally given priority in recreation management decisions where bear and human activities are not compatible in backcountry areas of the park. Yellowstone National Park implements seasonal closures and restrictions on recreational use of backcountry areas during periods when bear activity is concentrated on specific foods in predictable locations. In addition, backcountry trails, campsites, and off-trail areas are sometimes temporarily closed to recreational use for short periods when human activities conflict with natural bear activities and behaviors.

Bear Activity in Occupied Backcountry Campsites

In 2023, there were 6 reports of grizzly bears entering occupied backcountry campsites. In 2 incidents grizzlies walked past the edge of the core camp, and in 2 incidents they walked through the core camp. In 2 incidents the bears activity in the core camp was not reported.

Bear Reactions to Encounters with People in Occupied Backcountry Campsites

Grizzly bears were noticeably aware of the presence of people in 5 of the 6 incidents in backcountry campsites. In 4 of the incidents the bears exhibited no overt reaction to the encounters, and in 1 incident the grizzly fled after detecting the presence of people. Grizzly bears did not injure any visitors in backcountry campsites in 2023. The last grizzly bear-inflicted human injury in a backcountry campsite occurred 39 years ago in 1984. In that incident, a woman, camping alone, was pulled from her tent, killed, and consumed by a grizzly bear.

Bear Reactions to Encounters with People on Backcountry Trails

In 2023, there were 18 incidents reported where people encountered grizzly bears on backcountry trails (Table 40). Grizzly bears reacted to encounters with people on backcountry trails by charging without making contact (39%; *n* = 7), flight behaviors (28%; *n* = 5), neutral behaviors (22%; *n* = 4), and curiously approaching the people they encountered (5%; *n* = 2). Grizzly bears did not injure any visitors during encounters along backcountry trails in 2023.

Bear Reactions to Encounters with People in Off-Trail Backcountry Areas

In 2023, there were 6 incidents reported where people encountered grizzly bears while traveling off-trail in backcountry areas (Table 40). Grizzly bear reactions to encounters in off-trail backcountry areas included neutrality (n=3), fleeing (*n* = 2), and curiously

approaching without making contact (n = 1). Grizzly bears did not injure any people during off-trail encounters in 2023.

Risk of Bear Attack

Because most attacks from 1991 to 2023 (93%, 25 of 27) occurred in backcountry areas, we evaluated the probability of being attacked and injured by a grizzly bear while recreating in the backcountry. We calculated the number of backcountry human-grizzly bear encounters that occurred per grizzly bear-inflicted human injury. From 1991 to 2023, there were 2,218 encounters between grizzly bears and backcountry recreationists where the bears reaction behavior was reported. In 25 of those encounters grizzly bears made physical contact with people, causing injury in 24 of the incidents. In 1 incident a hiker climbed a tree during an encounter and the bear bit his boot and tried to pull him from the tree. The hikers boot came off and his foot was not injured. Therefore, the risk of grizzly bears making physical contact was ~ 1 incident of contact for every 89 backcountry encounters. The risk of being injured by a grizzly bear was ~ 1 injury for every 92 backcountry encounters. These estimates are likely biased high, because benign encounters where bears fled or behaved in a neutral or unaggressive manner were less likely to be reported than injurious or aggressive encounters, likely skewing the data toward more aggressive interactions.

Discussion

The grizzly bear-human interactions reported in 2023 (Table 42) were typical of those observed since 1991 (Table 43). In 7,660 encounters between grizzly bears and people reported from 1991–2023, grizzly bears reacted with neutral behaviors (no overt reaction) in 56% (n = 4,264) of instances, by fleeing (running or walking away) in 33% (n = 2,524), with curious behaviors (approaching or following) in 3% (n = 238), and with stress, agitation, bluster, threat, or warning behaviors (blowing, huffing, woofing, vocalizing, teeth clacking, paw-slap lunging, hop charging, and charging without contact) in 4% (n = 314). The bears behavioral reaction was not reported in 4% (n = 293) of the interactions. Grizzly bears injured people in <1% (n = 27) of the encounters. Attacks occurred at a higher rate during off-trail backcountry interactions (1 attack for every 53 off-trail backcountry encounters) than during on-trail interactions (1 attack for every 100 on-trail backcountry encounters). Grizzly bears rarely attacked during encounters with people in front-country areas where human presence was spatially predictable by bears, such as along primary roads (0 attacks in 4,509 encounters), within developments (1 attack in 767 encounters), and along front-country trails (1 attack in 80 encounters). The only 2 attacks in front-country areas both involved people that reacted passively to subadult grizzly bears that approached them in a curious manner. Neutral reactions to encounters with people were most common along roads (71%, 3,187 of 4,509 roadside encounters), whereas flight was the most common response during off-trail encounters in backcountry areas (53%, 256 of 479 off-trail backcountry encounters).

Despite their ferocious reputations, long-term monitoring of human-grizzly bear interactions in YNP indicates grizzly bears were tolerant of people in most encounters, especially those that occurred in areas where human activity was spatially predictable. Overall, grizzly bears reacted with neutral behaviors in more than half of reported encounters parkwide. Neutral responses to encounters may be more common in national parks where human-bear interactions are frequent and rarely result in the bear being harmed or killed, leading to higher levels of habituation to people in national parks compared to non-park areas (Herrero et al. 2005, Gunther et al. 2018). Grizzly bears seldom displayed threat or warning behaviors and only very rarely made contact or injured people during encounters in the park. However, in rare incidents, where contact was made, injuries were sometimes severe or fatal. Most injuries involved people hiking in backcountry areas. To reduce the chances of grizzly bear attack, we recommend backcountry recreationists: 1) hike in groups of 3 or more people as bears rarely attack large groups; 2) stay on designated trails where bears are more likely to expect encounters with people; 3) make noise in areas with limited visibility to warn bears of their presence; 4) remain vigilant when hiking to reduce the chances of surprise encounters with bears; 5) not run from bears during encounters as running may trigger a chase response; 6) back away slowly from nervous bears to give them space; 7) stand their ground when charged by bears during surprise encounters as most bears will stop short or veer off when hikers stand their ground when being charged; and, 8) play dead when grizzly bears make contact during surprise encounters because bears will generally stop the attack and leave once the perceived threat to themselves, their cubs, or their food has been neutralized (Herrero 2002,

Gunther and Haroldson 2020). We also recommend that all backcountry recreationists in YNP and other areas inhabited by grizzly bears carry a bear deterrent. Although the type of deterrent to carry (bear spray, bear bells, firearm, air horn) is a personal choice (Smith et al. 2008, 2012), bear spray requires little training, has proven easy to use, and has been highly effective at stopping or reducing the length and severity of most grizzly bear attacks, while also conserving the lives of bears (Herrero and Higgins 1998, Herrero 2002, Smith et al. 2008, 2020).

Table 39. Primary activity of grizzly bears that entered front-country developments, Yellowstone National Park, 2023.

Activity of bear while inside development	Number of incidents
Not reported or unknown	4
Travel through	4
Forage for natural foods	13
Investigate anthropogenic foods but no food reward and no property damage	3
Investigate and damage property but no food reward	1
Investigate and obtain anthropogenic foods	2
Total	27

Table 40. Reactions of grizzly bears to encounters with people reported in Yellowstone National Park, 2023.

Reaction of bear	Development	Along roadside	Front-country trail	Backcountry campsite	On trail	Off trail	Total
Not reported/not known	0	4	0	0	0	0	4
Flight response							
Run away	4	15	0	0	2	2	23
Walk away	7	41	0	1	3	0	52
Adult climb tree	0	0	0	0	0	0	0
Cubs climb tree/adult remain	0	0	0	0	0	0	0
Flight behavior subtotal	11	56	0	1	5	2	75
Neutral behaviors							
No overt reaction	7	167	2	4	4	2	186
Stand up on hind legs	0	0	0	0	0	1	1
Circle down wind	0	0	0	0	0	0	0
Neutral behavior subtotal	7	167	2	4	4	3	187
Curious behaviors							
Approach stationary person	0	4	0	0	0	1	5
Follow mobile person	0	0	0	0	2	0	2
Investigate vehicle	0	0	-	-	-	-	0
Curious behavior subtotal	0	4	0	0	2	1	7
Stress/agitation/warning signals							
Salivate	0	0	0	0	0	0	0
Sway head side to side	0	0	0	0	0	0	0
Make huffing noises	0	0	0	0	0	0	0
Pop jaws/teeth clacking noises	0	0	0	0	0	0	0
Stood ground watched/stared	0	0	0	0	0	0	0
Slap ground with paw	0	0	0	0	0	0	0
Flatten ears/erect spinal hairs	0	0	0	0	0	0	0
Stiff legged walk/hop	0	0	0	0	0	0	0
Stress/warning behavior subtotal	0	0	0	0	0	0	0
Aggressive behaviors							
Growl/vocalization	0	0	0	0	0	0	0
Stalk	0	0	0	0	0	0	0
Run toward/aggressive charge	0	1	0	0	7	0	8
Aggressive behavior subtotal	0	1	0	0	7	0	8
Attack behaviors							
Defensive attack	0	0	0	0	0	0	0
Predatory attack	0	0	0	0	0	0	0
Attack unknown cause	0	0	0	0	0	0	0
Attack behavior subtotal	0	0	0	0	0	0	0
Total	18	232	2	5	18	6	281

Table 41. Primary activity of grizzly bears observed along roadsides, Yellowstone National Park, 2023.

Activity of bear	Number of incidents
Not reported/unknown	2
Traveling	92
Foraging natural foods	229
Courtship	0
Swimming	3
Nursing young	0
Playing	0
Bedded/sleeping	2
Investigating vehicles/seeking anthropogenic foods; no food reward	1
Obtain anthropogenic foods	0
Damage property	0
Aggressive approach/posture toward people	1
Attack people	0
Other	0
Total	330

Table 42. Grizzly bear reactions reported in 281 interactions with people in different location settings, Yellowstone National Park, 2023.

Location of encounter	Reaction of bear											
	Reaction not reported		Flee		Neutral behavior		Curious		Stress, warning, agitation without contact		Attack	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Park development	0	0	11	61	7	39	0	0	0	0	0	0
Roadside corridor	4	2	56	24	167	72	4	2	1	<1	0	0
Front-country trail	0	0	0	0	2	100	0	0	0	0	0	0
Backcountry campsite	0	0	1	20	4	80	0	0	0	0	0	0
Backcountry trail	0	0	5	28	4	22	2	11	7	39	0	0
Backcountry off-trail	0	0	2	33	3	50	1	17	0	0	0	0
Total	4	1	75	27	187	67	7	2	8	3	0	0

Table 43. Grizzly bear reactions to interactions with people (*n* = 7,660) in different location settings, Yellowstone National Park, 1991–2023.

Location of encounter	Reaction of bear											
	Reaction not reported		Flee		Neutral behavior		Curious behavior		Stress, warning, agitation		Attack	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Park development	26	3	357	47	353	46	17	2	13	2	1	<1
Roadside corridor	149	3	1,035	23	3,187	71	62	1	76	2	0	0
Front-country trail	32	40	32	40	3	4	6	8	6	8	1	1
Backcountry Campsite	10	4	89	40	93	42	20	9	11	5	0	0
Backcountry trail	63	4	755	47	485	30	116	7	167	10	16	1
Backcountry Off-trail	13	3	256	53	143	30	17	4	41	9	9	2
Total	293	4	2,524	33	4,264	56	238	3	314	4	27	<1

Visitor Compliance with Bear Safety Recommendations in Yellowstone National Park

(Kerry A. Gunther, Eric G. Reinertson, and Travis C. Wyman, Yellowstone National Park)

Improvements in information and education efforts aimed at recreational safety in bear country are paramount in the face of significant increases in human occupation and recreation, combined with increasing grizzly bear numbers and distribution in the GYE. Two human behaviors that can reduce the risk of bear attack include hiking with large party sizes that are rarely attacked by bears (Herrero 2002) and carrying bear deterrent spray to deter bears that react aggressively to encounters (Herrero and Higgins 1998, Smith et al. 2008). To reduce the risk of bear attack in YNP, park managers distribute safety information to visitors recommending that backcountry recreationists traveling by foot maintain group sizes of ≥3 people and carry bear spray. To evaluate visitor compliance with these safety recommendations, we conduct annual surveys to determine the proportion of recreationists that hike in groups of ≥3 people and the proportion that carry bear spray or use other deterrents, such as firearms, or warning devices such as bear bells.

Data were collected by Bear Management Office staff and instructors and students from Ecology Project International. Due to time, budget, and staffing constraints, surveys are conducted opportunistically. While working on other bear research, monitoring, and management projects throughout the park, we recorded how many recreationists encountered at trailheads and on trails and boardwalks were carrying bear spray or other deterrents. We also recorded information on group size and type of recreational activity. We grouped recreational activity into 6 broad categories: 1) day hikers (including anglers and photographers); 2) overnight backpackers; 3) boardwalk trail users; 4) stock (horse or mule) day riders; 5) stock overnight riders; and 6) day-use bicyclist trail riders. We conducted our surveys visually. We recorded the presence of bear spray and other deterrents that were visible and, therefore, quickly retrievable. Bear spray or other deterrents stored in backpacks, saddlebags, panniers, or carried under coats would likely not be retrievable fast enough for use during surprise encounters with bears.

In 2023, we surveyed 2,896 people in 1,000 groups at 28 different backcountry trails and 2 boardwalk trails. Our surveys included 1,695 backcountry day hikers, 1,062 people on boardwalk trails, 85 overnight backpackers, 30 day-use bicyclists, and 24 overnight stock riders.

Day Hikers

Yellowstone National Park contains >1,600 km (1,000 miles) of backcountry hiking trails accessible from 92 trailheads located throughout the park. We surveyed 1,695-day hikers traveling in 612 groups on 24 different trails. Average party size was 2.8 people (Table 44). The most common (mode) group size and the median group size were 2 people per party. Sixty-four percent (n = 394) of day hiking parties had less than the recommended party size of 3 people and 15% (n = 89) hiked alone. Of the 1,695-day hikers, 400 (24%) carried bear spray, 11 (1%) had bear bells, and 4 (<1%) carried firearms (Table 45). Of the 612 groups of day hikers, 285 (47%) had at least 1 member that carried bear spray, 8 groups (1%) had at least 1 person with bear bells, and 4 groups (1%) had at least 1 person carrying a firearm.

Overnight Backpackers

Yellowstone National Park has 300 designated backcountry campsites. We surveyed 85 backpackers in 29 groups on 9 different trails. Average party size was 2.9 people (Table 44). The most common group size (mode) and the median group size were 1 and 2 people per party, respectively. Seventy-two percent (n = 21) of the backpacking groups had fewer than the recommended party size of 3 people and 38% (n = 11) hiked alone. Of the 85 backpackers, 57 (67%) carried bear spray. None of the backpackers carried bear bells or firearm (Table 45). Of the 29 groups of backpackers, 25 (86%) had at least 1 person in the party that carried bear spray.

Stock Day Riders

No stock day riders were surveyed in 2023 (Table 44).

Stock Overnight Riders

We surveyed 24 people in 6 groups on 4 backcountry trails that were riding stock on an overnight camping trips. Average party size was 4.0 people (Table 44). The most common group size (mode) and the median group size were 1 and 3 people per party, respectively. Ten (42%) of the overnight stock riders carried bear spray and 1 (4%) had a firearm (Table 45). Of the 6 groups of overnight stock riders, 5 (83%) had at least 1 person in the party that carried bear spray.

Day Use Bicycle Trail Riders

Yellowstone National Park contains 13 designated bike trails. We surveyed 30 people in 8 groups on 2 trails riding bicycles on day trips. Average party size was 3.8 people (Table 44). The most common group size (mode) and the median group size were 2 people per

party. Of the 30 bicyclists, none carried bear spray, bear bells, or firearms (Table 45).

Boardwalk Trails

Yellowstone National Park contains approximately 15 miles of front-country boardwalk trails adjacent to park roads that contain interpretive signs providing visitors with information about geysers or other natural features. Park regulations prohibit stock animals and overnight camping on or along boardwalk trails. We surveyed 1,062 people in 345 groups on 2 boardwalk trails. Average party size was 3.1 people (Table 44). The most common group size (mode) and the median group size were 2 people per party. Only 2% (n = 18) of the individuals and 5% (n = 18) of the groups observed, carried bear spray (Table 45). Three people (<1%) in 2 (1%) parties had bear bells. None of the people observed walking on boardwalk trails carried firearms.

Use of Bear Spray

In 2023, there were 6 incidents reported where people deployed bear spray during encounters with bears. Grizzly bears were involved in 5 of the incidents and black bears in 1.

On May 14 at approximately 7:45 a.m., a lone photographer observed an elk carcass near the Daily Creek trail. After investigating the elk carcass, he began following bear tracks in the snow he found nearby. While bent down examining the bear tracks, he heard grunting, looked up and saw a 400 – 500 lbs. grizzly 80 feet away swaying from side to side. The photographer stood up and yelled "hey bear" and the bear began to charge. The photographer deployed his bear spray then turned and ran away in the direction he had come from. He stated that the bear hit the cloud of spray and stopped its charge.

On May 22 at approximately 6:30 p.m., a hiker encountered a grizzly bear about 25 yards on the side-hill above the Bunsen Peak trail. After encountering the bear, the hiker left the trail and began walking down downhill away from the bear. When the hiker noticed the bear was following behind him, he sprayed the bear with bear spray. The hiker then continued walking down slope and noticed the bear was still following behind him and so sprayed the bear again. Shortly thereafter the hiker saw the bear walking away down the trail below him. The hiker made his way back to the trail and called 911 because the bear had left in the direction the hiker wanted to go. Park rangers hiked in on the trail and escorted the hiker out to the trailhead.

On July 8, a group of people were hiking on the Riverside trail near Barns Hole when they were charged by an adult female grizzly bear accompanied by 2 cubs. They sprayed the charging bear with bear spray but did not know what affect it had on the bear, although the bear did not follow through with the charge.

On July 20, hikers on the Beaver Ponds trail encountered a 200 – 400 lbs. grizzly bear ripping open a log a short distance off the trail. The bear did not react to the hikers, so they sprayed the bear with bear spray. After being sprayed, the bear looked up at the hikers and then went back to digging in the log.

On September 26, 2 people hiking on the Cache Creek Trail heard a branch snap, looked up and saw a grizzly bear charging them from about 30 yards away. The bear stopped short, then charged again. The hikers tried getting "large and loud" but the bear continued its charge. When the bear was 15 feet from them, they deployed bear spray and the bear veered to the left and into the forest.

On July 5, a 50 – 100 lbs. reddish brown colored black bear approached to less than 60 feet of a group of people at the Bacon Rind Trailhead. A member of the party sprayed the bear with bear spray which caused the bear to run away.

Discussion

In 2023, overnight backpackers had the highest level of compliance with the park's bear spray recommendation; 67% of individual backpackers carried bear spray and 86% of backpacking groups had at least 1 member that carried bear spray. Overnight backpackers have had the highest proportion of individuals and groups traveling on foot that carried bear spray during all 13 years surveys have been conducted (Tables 46 and 47). We suspect the high level of compliance by this type of recreationist is due to the methods used to convey bear safety information to overnight backpackers. In YNP, permits are required for camping in the backcountry. During the permitting process, backpackers receive face-to-face verbal information about bears and bear spray from the ranger issuing the permit and are required to watch a safety video containing information on hiking and camping in bear country and how to use bear spray. Backpackers also receive the "Beyond Roads End" booklet containing information on use of bear spray and safety recommendations for hiking and camping in bear country. Surveys indicate YNP visitors retain verbal information from uniformed park staff better than written information from signs or brochures (Taylor et al. 2014). Although the average party size for backpackers was 2.9 people per group, 72% of the backpacking groups had fewer than the recommended party size of 3 people and 38% hiked alone. Therefore, a high proportion of observed backpackers did not follow the park's recommended group size of 3 or more

people for hiking in bear country. The most common party size (mode) for overnight backpackers during all 13 years of the study has been <3 people per party (Table 48).

Only 24% of day hikers carried bear spray in 2023; however, 47% of day hiking groups had at least 1 member that carried bear spray. Fewer than 25% of day hikers have carried bear spray in each of the 13 years surveys have been conducted (Table 48). Permits are not required for day hiking so day hikers may not receive the same level of bear safety information as backpackers. Visitors day hiking in the park can seek and obtain bear safety information from the YNP web page, park app, park newspaper, day hike trip planning handouts, safety cards and brochures, and from rangers at visitor centers. However, the only bear safety information day hikers receive if they do not seek it out themselves is from signs posted at trailheads. We speculate many day hikers that arrive at trailheads without bear spray are unlikely to go obtain bear spray before starting their hikes even after reading the trailhead information sign. The most frequently observed group size among day hikers was 2 people per group, indicating many day hikers did not comply with the recommended group size of ≥3 for hiking in bear country. Because most (68%) grizzly bear attacks in YNP involve day hikers (32 of 47 backcountry attacks since 1970), the low level of compliance with bear safety recommendations among day hikers is a concern of park managers.

Forty-two percent of the overnight stock riders and 83% of overnight stock parties observed in 2023 carried bear spray. Bear spray may not be very useful while in the saddle, as deploying it from horseback could result in the rider being bucked off their horse. In general, people riding stock are less likely to be involved in surprise encounters and bear attacks. Horses usually sense a bear's presence before a person does (Herrero 2002), alerting the rider and reducing the chances of surprise encounters at close distances. The large size of horses is also more intimidating to bears, making them less likely to charge and initiate contact with a person on horseback during a surprise encounter. In addition, unlike humans, when charged by bears, horses have enough speed and agility to outrun bears, thus providing an added margin of safety if the rider can stay in the saddle. Although stock users are less likely to have surprise encounters with bears, bear spray is useful and encouraged for carry by stock groups for use during lunch and rest stops along the trail and when in camp.

None of the bicyclists we encountered on our surveys carried bear spray. Bicyclists incur greater risk of surprise encounters because bicycles are fast and relatively quiet, therefore increasing the odds of surprise encounters.

Although some backcountry recreationists in YNP carry firearms, and it is legal to do so, it is illegal to discharge them within the park, so they are not considered a viable bear deterrent. Only a small proportion of all types of recreationists openly carried firearms in the 13 years we conducted our surveys. Firearms were openly carried by <1% of the recreationists we observed in 2023. Day hikers (1%) had the highest frequency of firearms carry. Recreationists riding horses often carry firearms for euthanizing injured stock; however, if these firearms were carried in saddle bags or pannier's they would not have been visible during our surveys and would not have been readily available as a bear deterrent during surprise encounters.

Bear bells were carried by 1% of all recreationists surveyed in YNP in 2023. Day hikers and people on boardwalks had the highest frequency of bear bell use. The low use of bear bells likely reflects their lack of demonstrated effectiveness as an auditory warning device (Herrero 2002). Although bear bells may provide some benefit in alerting bears to the presence of approaching hikers (Jope 1985), they are generally not effective at preventing surprise encounters when hiking in strong winds, near fast moving water, or in dense brush or thick forest which muffles the bells sound (Herrero 2002).

Table 44. Group size characteristics observed for different types of recreational activities in Yellowstone National Park, 2023.

Type of recreational activity	Total people	Total groups	Average group size	Median group size	Mode group size
Boardwalk trail (foot travel walking)	1,062	345	3.1	2	2
Day hiker (e.g., day use foot travel–hiker, angler, photographer)	1,695	612	2.8	2	2
Overnight backpacker (foot travel camping overnight)	85	29	2.9	2	1
Stock–day use	0	0			
Stock–overnight use	24	6	4.0	3	1
Day bicycle trip	30	8	3.8	2	2
Total	2,896	1,000	2.9	2	2

Table 45. Number and percent (%) of people and groups of recreationists surveyed that carried bear spray, firearms, or bear bells, Yellowstone National Park, 2023.

	Type of recreation/mode of travel						
	Boardwalk trail	Day hiker	Day use bicycle	Overnight backpacker	Stock day use	Stock overnight use	Total (all types)
Total people surveyed	1,062	1,695	30	85	0	24	2,896
(No. of parties surveyed)	345	612	8	29	0	6	1000
People with bear spray							
Total	18	400	0	57		10	485
Percent	1.7	23.6	0	67.1		41.7	16.7
Parties with bear spray							
Total	18	285	0	25		5	333
Percent	5.2	46.6	0	86.2		83.3	33.3
People with firearms							
Total	0	4	0	0		1	5
Percent	0	0.2	0	0.0		4.2	0.2
Parties with firearms							
Total	0	4	0	0		1	5
Percent	0	0.7	0	0.0		16.7	0.5
People with bear bells							
Total	3	11	0	0		0	14
Percent	0.3	0.6	0	0.0		0	0.5
Parties with bear bells							
Total	2	8	0	0		0	10
Percent	0.6	1.3	0	0.0		0	1.0

Table 46. Percent (%) of people engaged in different types of backcountry recreational activities that carried bear spray, Yellowstone National Park, 2011–2023.

Year	Overnight backpackers	Day hiker	Boardwalk	Stock day use	Stock overnight use	Bicycle day use
2011	53	15	Not surveyed	0	60	Not surveyed
2012	47	11	0	9	44	0
2013	60	16	0	11	22	0
2014	48	14	<1	0	35	33
2015	50	14	1	Not surveyed	14	0
2016	52	19	1	0	100	0
2017	62	21	1	0	0	43
2018	47	21	1	0	25	0
2019	75	21	2	14	0	50
2020	64	19	Not surveyed	0	11	4
2021	53	23	7	0	0	18
2022	91	30	1	60	20	0
2023	67	24	2	Not surveyed	42	0
2011–2023 combined data	58	19	1	7	29	13

Table 47. Percent (%) of groups engaged in different types of backcountry recreational activities that had at least 1 member that carried bear spray, Yellowstone National Park, 2011–2023.

Year	Overnight backpackers	Day hiker	Boardwalk	Stock day use	Stock overnight use	Bicycle day use
2011	64	34	Not surveyed	0	50	Not surveyed
2012	73	27	0	67	50	0
2013	82	33	0	33	60	0
2014	73	29	1	0	60	67
2015	100	35	2	Not surveyed	100	0
2016	79	43	2	0	100	0
2017	93	46	3	0	0	67
2018	81	46	3	0	50	0
2019	92	51	4	50	0	60
2020	84	44	Not surveyed	0	50	13
2021	83	52	10	0	0	33
2022	97	54	3	100	100	0
2023	86	47	5	Not surveyed	83	0
2011–2023 combined data	84	41	3	25	58	21

Table 48. Group size characteristics observed for different types of recreational activities, Yellowstone National Park, 2011–2023.

Type of recreational activity	Total people	Total groups	Average group size	Median group size	Mode group size
Boardwalk	11,285	3,997	2.8	2	2
Day hiker (e.g., day foot travel–hiker, angler, photographer)	21,514	7,269	3.0	2	2
Overnight backpacker (overnight-foot travel)	1,408	473	3.0	2	2
Horse–day use	142	28	5.1	4	3
Horse–overnight use	158	31	5.1	5	2
Day bicycle trip	152	58	2.6	2	2
Total	34,659	11,856	2.9	2	2

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Appendix A

2023 Grizzly Bear Habitat Monitoring Report

Grizzly Bear Habitat Modeling Team, Greater Yellowstone Ecosystem

Background

This report is the collective response from the national forests and national parks within the Greater Yellowstone Ecosystem (GYE) to monitoring and reporting obligations established in the 2016 Conservation Strategy *for the Grizzly Bear in the Greater Yellowstone Area* (Conservation Strategy; Yellowstone Ecosystem Subcommittee 2016). The Conservation Strategy and habitat standards therein provide management direction for a recovered grizzly bear population once it has been removed from federal protection under the Endangered Species Act. The Conservation Strategy requires annual monitoring and reporting to evaluate federal adherence of habitat standards for the Yellowstone grizzly bear population. These monitoring requirements and habitat standards were formalized for the 6 national forests (now 5) in the Forest Plan Amendment for Grizzly Bear Habitat Conservation for the Greater Yellowstone Area National Forests, Record of Decision (herein referred to as Forest Plan Amendment, U.S. Department of Agriculture 2006a,b). Likewise, the Superintendents' Compendia incorporated the Conservation Strategy habitat standards into the legal plans for the 3 NPS units in the GYE. The legal status of the population has changed multiple times since the 2007 and 2017 delisting rules and subsequent litigation. However, regardless of the legal status of the Yellowstone grizzly bear, land managers throughout the GYE are committed to abiding by habitat standards identified in the Conservation Strategy for the long-term protection and health of the grizzly bear population.

Introduction

The primary intent of habitat standards established in the Conservation Strategy is to preserve adequate and secure habitat to sustain a viable grizzly bear population into the foreseeable future. Three distinct habitat standards were enumerated in the Conservation Strategy pertaining to secure habitat (roadless areas), human development, and commercial livestock grazing. All three factors are surrogate measures of human presence (or absence) on the land. Research identifies humans as the driving factor of grizzly bear mortality and displacement in occupied areas across the landscape. These standards impose measurable sideboards on levels of human activity to reduce the negative impacts of human presence. The standards call for no net loss in secure habitat, and no net increase in the number of human developed sites and livestock grazing allotments with respect to that which existed in 1998. The delineation of 1998 as a meaningful baseline is predicated on evidence that habitat conditions at that time, and for the preceding decade, contributed to the 4.2–7.6% annual growth of the Yellowstone grizzly bear population observed between 1983 and 2001. Habitat standards apply only within the GBRZ[1] located at the core of the GYE (Fig. A1).

[1] The Grizzly Bear Recovery Zone (GBRZ) is a term used when the Yellowstone grizzly bear population is protected as a threatened species under the Endangered Species Act. The same area is referred to as the Primary Conservation Area when the grizzly bear is de-listed or removed from federal protection. The GBRZ term is used in this 2022 report to reflect the current protected status of the Yellowstone grizzly bear population.

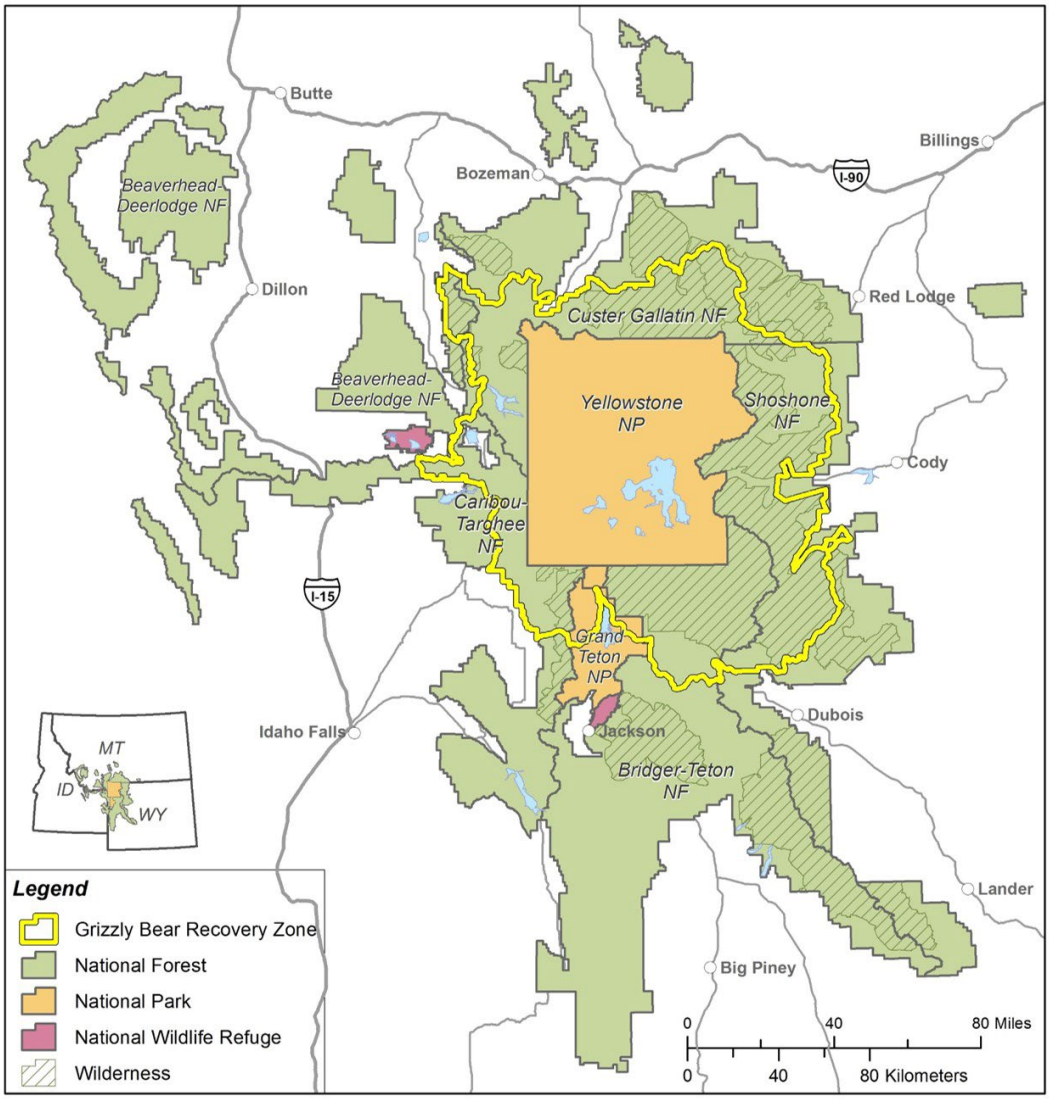


Fig. A1. Federal lands comprising the Greater Yellowstone Ecosystem and the Grizzly Bear Recovery Zone.

Annual Monitoring Requirements inside the Grizzly Bear Recovery Zone

In compliance with annual habitat monitoring protocol, this report summarizes habitat changes incurred annually inside the GBRZ and compares current habitat status with that of 1998 for the following monitored parameters: 1) number and acreage of commercial livestock grazing allotments and permitted domestic sheep animal months; 2) number of developed sites; 3) percent secure habitat; and 4) motorized access route densities. In addition, all grizzly bear conflicts associated with livestock allotments occurring on public land are summarized annually for the ecosystem, both inside and outside the GBRZ. Current status of secure habitat and motorized route densities are evaluated, summarized, and reported against 1998 levels annually for each of the 40 subunits within the 18 Bear Management Units (Fig. A2). The number and status of livestock allotments is annually reported against 1998 levels for each national forest and park unit inside the GBRZ. The 1998 habitat baseline represents the most current and accurate information available documenting habitat conditions inside the GBRZ during 1998. National forest and park personnel continue to improve the quality of their information to reflect more accurately what was on the landscape in 1998.

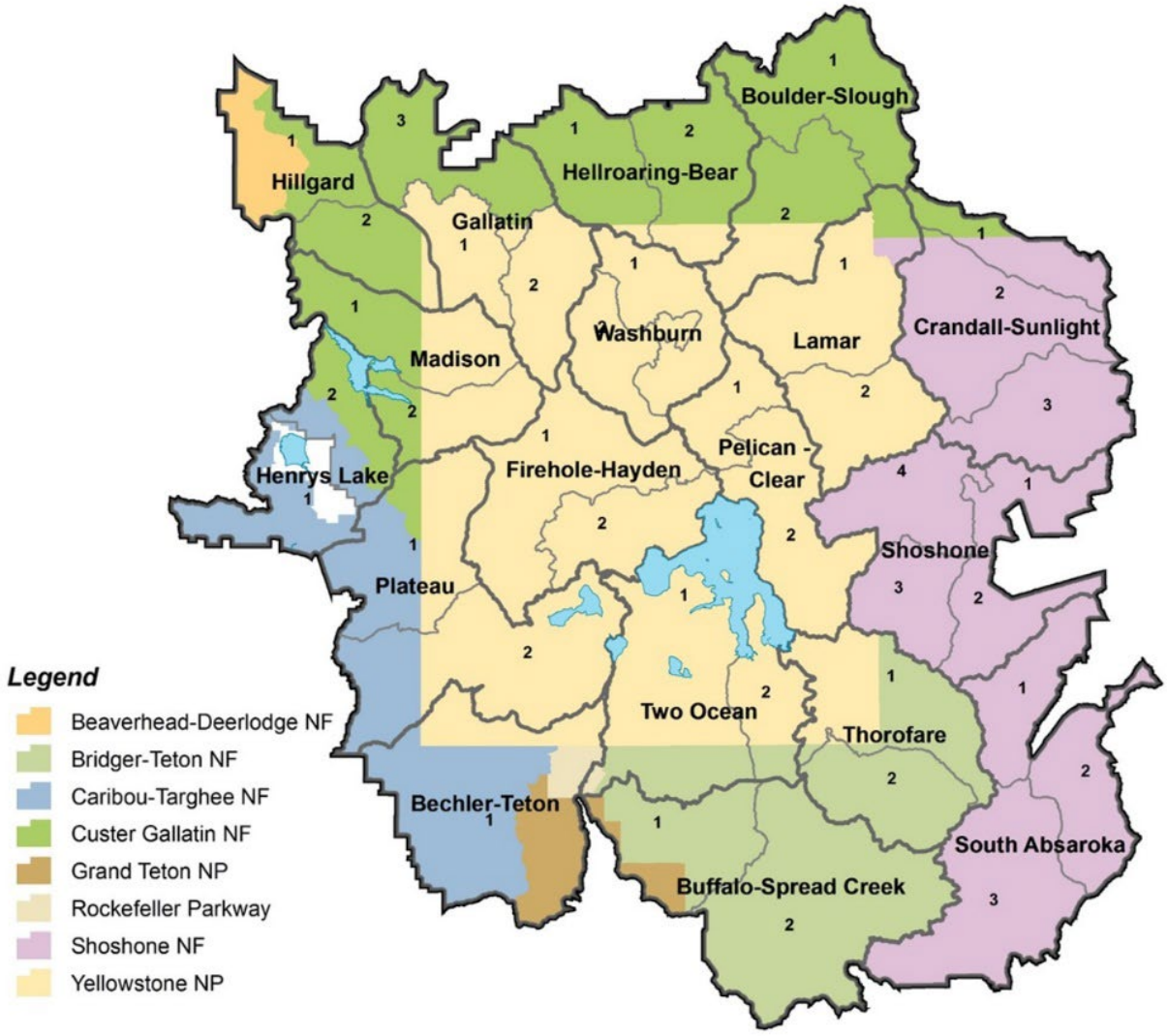


Fig. A2. Bear Management Units and subunits comprising the Grizzly Bear Recovery Zone in the Greater Yellowstone Ecosystem. NF refers to national forest (numbers refer to sub-units of the BMA).

Monitoring of Livestock Grazing

The habitat standard for livestock allotments identified in the 2016 Conservation Strategy requires there be no net increase in the number or acreage of active commercial livestock grazing allotments and no increase in permitted sheep animal months on federal lands inside the GBRZ from that which existed in 1998. Changes in active and vacant livestock allotments cited in this report account for all commercial grazing allotments occurring on federal lands within the GBRZ. Livestock grazing on private inholdings and horse grazing associated with recreational use and backcountry outfitters are not covered by the grazing standard and are not covered in this report. Operational status of allotments is categorized as active, vacant, or closed. An active allotment is one with a current grazing permit. However, an active allotment can be granted "non-use" on a year-by-year basis when a permittee chooses not to graze livestock or when management seeks a resolution to grazing conflicts. Vacant allotments are those without an associated term grazing permit, but which may be grazed periodically by other permittees at the discretion of the land management agency. Such reactivation of grazing on vacant allotments is typically on a temporary basis to resolve resource issues or other management concerns. Vacant allotments can be assumed non-grazed unless otherwise specified. A closed allotment is one that has been permanently deactivated such that commercial grazing will not be permitted to occur anytime in the future. Sheep animal months are derived by multiplying the number of permitted sheep by the number of months of permitted grazing on a given allotment. Existing sheep allotments inside the GBRZ are to be phased out as opportunity arises with willing permittees.

Commercial grazing allotments on public lands inside the GBRZ are tracked through time to evaluate adherence to the habitat standard at 1998 levels or lower. The number of commercial livestock allotments, by itself, is not a meaningful metric of change because individual allotments can be combined or divided without affecting the overall footprint of commercially grazed land. Likewise, allotment boundaries can be reconfigured or modified over time to enclose smaller or larger areas. Thus, the total acreage of grazed lands constitutes a more meaningful metric of overall change on the landscape. See Table A1 for the 2023 status of livestock allotments compared against the 1998 baseline.

Change in cattle allotments since 1998

Since 1998, the total acreage of active cattle grazing on public lands inside the GBRZ has been reduced by 32% (213,673 acres, 865 km^2). Approximately 93% of this net reduction was the result of permanent closures, and 7% was from active allotments that were vacated. With closure of the Pacific Creek cattle allotment inside GTNP in 2006, there currently is no livestock grazing on national park lands inside the GBRZ (Table A1).

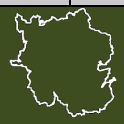
Change in sheep allotments since 1998

Domestic sheep allotments on public lands inside the GBRZ have largely been phased out since 1998. In 1998 there were 11 active sheep allotments on public lands inside the GBRZ, amounting to 148,368 acres (600 km^2). Since 1998, there has been a 98% net reduction in the acreage grazed by sheep on public lands inside the GBRZ. Of the 11 actively grazed sheep allotments, 8 have been permanently closed and 2 were converted to cattle allotments in 2003 that remain active today (the Beartooth and Pearson allotments on the Shoshone National Forest). The only active sheep allotment remaining on public lands inside the GBRZ today is the Meyers Creek allotment located on the Caribou-Targhee National Forest and part of the U.S. Department of Agriculture Sheep Experiment Station. Although "active," the Myers Creek allotment has not been issued a grazing permit since the Willow Creek fire in 2008. Consequently, there has been no domestic sheep grazing on public lands inside the GBRZ for the past 15 years (Table A1).

Change in livestock allotments during 2023

During 2023, there were no reported changes in livestock grazing allotments on federal lands inside the GBRZ.

Table A1. Number of commercial livestock grazing allotments and sheep animal months inside the GBRZ in 1998 and 2023.

Administrative unit	Cattle allotments				Sheep allotments				Sheep animal months	
	Active		Vacant		Active		Vacant			
	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023
Beaverhead-Deerlodge National Forest	3	3	2	0	0	0	0	0	0	0
Bridger-Teton National Forest	9	6	0	1	0	0	0	0	0	0
Caribou-Targhee National Forest [a]	11	7	1	1	7	1	4	0	14,163	1,970[a]
Custer Gallatin National Forest	23	14	10	5	2	0	4	0	3,540	0
Shoshone National Forest	26	24	0	1	2	0	2	2	5,387	0
Grand Teton National Park	1	0	0	0	0	0	0	0	0	0
Total count in GBRZ	73	54	13	8	11	1	10	2	23,090	1.970
Total acres in GBRZ	661,770	456,068	67,846	70,985	148,368	3,504	77,066	10,255		
Total area in GBRZ (km^2)	2,678	1,846	275	128	600	14	312	42		

[a] The Meyers Creek allotment, the only active sheep grazing unit remaining inside the GBRZ, did not request a permit in 2023.

Livestock Conflicts throughout the Greater Yellowstone Ecosystem

Conflicts between grizzly bears and livestock have historically led to the capture, relocation, and removal of grizzly bears in the GYE. This section summarizes the reported grizzly bear conflicts associated with livestock grazing on sheep and cattle grazing allotments and forage reserves on national forest lands within the GYE (Fig A3). Livestock-grizzly bear conflicts associated with outfitters in backcountry settings, and conflicts occurring on private or state lands, are not included in this report.

Livestock conflicts in 2023

In 2023, a total of 131 grizzly bear conflicts associated with livestock depredation on USFS lands were reported inside the GYE (Fig. A4). These conflicts occurred on 29 distinct commercial grazing allotments distributed throughout the ecosystem. All incidents in 2023 involved cattle depredations. Conflicts were reported on 4 national forests in the GYE, including the Beaverhead-Deerlodge (n = 24), Bridger-Teton (n = 90), Caribou-Targhee (n = 1), and Shoshone (n = 16). Approximately 97% (n = 127) of the conflicts occurred outside the GBRZ. Of the 131 livestock-related conflicts, 54% (n = 71) occurred on the Upper Green River cattle allotment located outside the GBRZ on the north portion of the Bridger-Teton National Forest. During 2023, 5 grizzly bears were removed in response to livestock depredations on USFS lands outside of the GBRZ. These included 1 adult female (West Fork allotment)

and 1 adult male (Upper Ruby allotment) on the Beaverhead-Deerlodge, 1 adult male (Grandview allotment) on the Caribou-Targhee, and 2 adult males on the Bridger-Teton (Upper Green allotment).

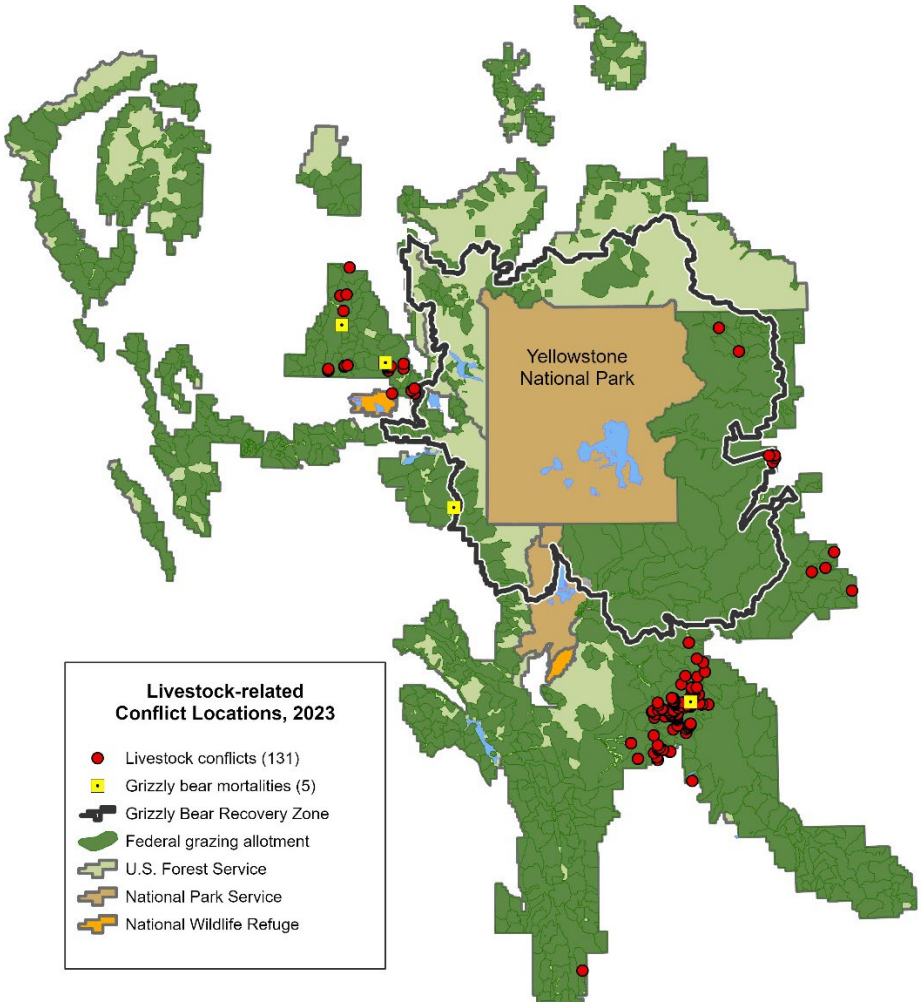


Fig. A3. Grizzly bear conflicts related to commercial livestock grazing on federal lands in the Greater Yellowstone Ecosytem during 2023.

Recurring livestock conflicts 2019–2023

Livestock conflicts are considered recurring when cattle or sheep depredation incidents involving grizzly bears are reported on a given allotment in 3 or more years during the preceding 5-year period. During 2019–2023, 591 livestock conflict incidents were reported on grazing allotments on national forest lands inside the GYE (Table A2). Approximately 94% (n = 553) of these conflicts occurred outside the GBRZ. Of the 591 conflicts, 53% (n = 314) occurred on the Upper Green River cattle allotment located outside the GBRZ on the Bridger-Teton National Forest. Twenty-three allotments experienced recurring conflicts, including 8 on the Beaverhead-Deerlodge, 3 on the Bridger-Teton, 0 on the Caribou-Targhee, 0 on the Custer Gallatin, and 12 on the Shoshone National Forest (Table A2). Over the past 5 years, 20 grizzly bears were removed from the population due to persistent livestock depredation on USFS allotments. These 23 management removals included 3 females (2 adult, 1 subadult) and 17 males (16 adult, 1 subadult). No removals occurred within the GBRZ. Ten of the 20 management-sanctioned grizzly bear removals were due to cattle depredations on the Upper Green River allotment.

Table A2. Commercial livestock allotments on public lands with documented grizzly bear conflicts during the past 5 years. Allotments with conflicts in 3 or more of the past 5 years are considered to be recurring conflicts.

U.S. Forest Service allotment name	Total acres	Livestock-related conflicts					Total conflicts (2019–2023)	Recurring conflicts
		2019	2020	2021	2022	2023		
Beaverhead–Deerlodge National Forest								
Anderson/cox	29,826	0	0	0	1	0	1	No
Antelope Basin	4,430	0	0	1	0	0	1	No
Barnett	6,454	0	1	0	0	0	1	No
Bear Wallow	8,761	0	0	0	1	0	1	No
Bufiox	13,077	0	3	5	2	3	13	Yes
Burnt Creek	2,992	1	0	2	1	0	4	Yes
Cliff Lake Bench	2,279	0	1	0	0	2	3	No
Clover Meadows	10,398	0	1	2	1	0	4	Yes
Coal Creek	5,186	0	0	1	0	0	1	No
Elk Lake	3,557	0	0	0	0	1	1	No
Elk Mountain	4,415	0	1	0	1	0	2	No
Eureka Basin	11,617	1	0	7	0	2	10	Yes
Hidden Lake Bench	6,609	0	2	0	0	1	3	No
Lobo Cascade	11,941	1	0	0	0	0	1	No
Long-pole	9,603	0	0	1	0	0	1	No
Maverick Basin	4,161	0	0	1	0	0	1	No
North Saddle	3,454	1	0	0	1	2	4	Yes
Red Rock	3,909	0	1	1	0	0	2	No
Standard Creek	12,833	4	0	0	0	0	4	No
Upper Ruby	44,395	0	2	7	3	2	14	Yes
Warm Springs	22,518	0	1	3	1	3	8	Yes
West Fork	53,096	13	1	11	6	7	38	Yes
Wigwam Trail	12,742	0	0	0	0	1	1	No
Bridger-Teton National Forest								
Badger Creek	7,254	1	0	0	0	6	7	No
Beaver-Horse	25,389	0	0	1	0	0	1	No
Beaver-Twin	22,030	1	2	4	4	7	18	Yes
Fisherman Creek	47,629	1	1	1	0	1	4	Yes
Fontenelle	7,792	0	0	0	0	1	1	No
Jack Creek	18,673	0	1	0	0	1	2	No
Little Flattop	4,739	0	0	0	0	1	1	No
Noble Pasture	762	1	0	0	0	1	2	No
Roaring Fork	8,416	1	0	0	0	0	1	No
Sherman C&H	8,287	0	0	1	0	0	1	No
Union Pass	23,800	0	2	0	0	1	3	No
Upper Green River	125,671	57	55	77	54	71	314	Yes
Upper Gros Ventre	67,497	0	2	0	0	0	2	No
Caribou-Targhee National Forest								
Buffalo	402	0	0	0	1	0	1	No
Grandview	43,478	0	0	0	0	1	1	No

Table A2. Commercial livestock allotments on public lands with documented grizzly bear conflicts during the past 5 years. Allotments with conflicts in 3 or more of the past 5 years are considered to be recurring conflicts.

U.S. Forest Service allotment name	Total acres	Livestock-related conflicts					Total conflicts (2019–2023)	Recurring conflicts
		2019	2020	2021	2022	2023		
Ripley Butte	18,533	0	0	0	2	0	2	No
Squirrel Meadows	28,797	1	0	0	0	0	1	No
Teepee Creek	22,134	0	0	0	1	0	1	No
Custer Gallatin National Forest								
Hogan Creek	1,522	0	1	0	0	0	1	No
Tom Miner/ Ramshorn	14,609	0	0	2	0	0	2	No
Wigwam	2,762	2	0	0	0	0	2	No
Shoshone National Forest								
Basin	73,119	0	1	1	2	0	4	Yes
Cottonwood	6,739	0	0	0	0	1	1	No
Crandall	18,641	3	3	0	0	2	8	Yes
Dick Creek	9,569	0	2	0	1	1	4	Yes
Dunoir	52,875	1	0	0	0	0	1	No
Fish Lake	12,743	0	2	0	2	2	6	Yes
Ghost Creek	11,579	1	2	2	0	0	5	Yes
Greybull	34,641	0	0	1	0	0	1	No
Hardpan/Table Mtn	17,575	0	1	2	3	4	10	Yes
Kirwin	17,588	0	1	0	1	1	3	Yes
Lake Creek	21,399	0	0	1	0	1	2	No
North Absaroka	146,766	0	2	0	0	0	2	No
Reef Creek	11,449	0	0	0	1	0	1	No
Rock Creek	16,833	0	0	1	0	0	1	No
Salt Creek	8,263	0	1	5	1	2	9	Yes
Sunshine	2,152	0	0	0	1	0	1	No
Table Mountain	13,895	4	0	1	1	0	6	Yes
Timber Creek	9,187	0	0	0	1	0	1	No
Union Pass	39,497	0	3	5	0	0	8	No
Warm Springs	16,875	3	1	8	1	0	13	Yes
Wiggins Fork	37,655	0	0	0	1	0	1	No
Wind River	44,158	5	1	3	4	1	14	Yes
Wood River	4,049	0	1	0	1	1	3	Yes
Total conflicts		**102**	**100**	**158**	**100**	**131**	**591**	

[a] The Fish Creek and Union Pass grazing units on the Bridger-Teton National Forest are forage reserves that are grazed only occasionally as a short-term solution to reduce conflict, protect resources, or compensate for natural landscape hazards (i.e., fire) in other grazing areas.

Monitoring of Developed Sites inside the GBRZ

Habitat standards identified in the 2016 Conservation Strategy require that the number of developed sites and capacity of human-use of developed sites on public lands inside the GBRZ be maintained at or below levels existing in 1998. Administrative site expansions are exempt from mitigation if such developments are deemed necessary for enhanced management of public lands and when other viable

alternatives are not plausible. Developed sites include all sites or facilities on public lands with infrastructure intended for human use and which accommodates administrative needs and public recreational use. Examples of developed sites include, but are not limited to, campgrounds, trailheads, lodges, administrative structures, service stations, summer homes, restaurants, visitor centers, and permitted natural resource development sites such as oil and gas exploratory wells, production wells, mining activities, and work camps. Developments on private lands inside the GBRZ are not counted against this standard.

Changes in developed sites since 1998

The number of distinct developed sites known to exist in 1998 is 594. In the intervening years, a number of sites have been condemned or permanently closed and dismantled. New sites that were built have been mitigated for by closing one or more sites of equivalent human use within the same subunit. Today, the number of known developed sites on public lands inside the GBRZ is 577, accounting for a net decrease of 17 sites between 1998 and 2023. From 1998 to present, the number of developed sites has remained at or below 1998 counts for all subunits inside the GBRZ except for the Hilgard #2 and Gallatin #3 subunits, which each increased by a count of one. In 2005 the Taylor Falls/Lightning trailhead, originally located in subunit #1 of the Hilgard Bear Management Unit, was moved from one side of a road to the other, placing it in subunit #2 of the Hilgard Bear Management Unit. In this case, the loss in one subunit yielded a gain in the other. Although this transfer technically accounted for an increase in developed sites on Hilgard #2, it was determined to have no detrimental effect on grizzly bears and did not violate the intent of the developed site standard. Table A3 shows a comparison of developed site counts between 1998 and 2023.

Changes in developed sites in 2023

There were no reported changes to developed sites on federal lands in the GBRZ in 2023.

Future review of developed sites

Since 2007, when the grizzly bear habitat standards were first implemented, the number of visitors on public lands throughout the GYE has increased significantly. In Yellowstone National Park (YNP), annual visitation increased by more than 40% during the period 2008–2018, surpassing 4 million visitors per year since 2016 (NPS 2023). However, the habitat standards have not proved to be flexible enough to allow managers the ability to adequately respond to such extraordinary increases in visitation. In direct response to this administrative challenge, federal land managers requested that the 1998-based habitat standards be re-evaluated. Consequently, a placeholder was added to the 2016 Conservation Strategy that called for an interagency technical team (Developed Sites Technical Team) to be established. The team was tasked with recommending changes to the habitat standard and application rules that would provide managers the needed flexibility for authorizing new infrastructure to accommodate the demands of increased public visitation and aging infrastructure. Imposed constraints require that these recommendations strike a balance between management needs and habitat protection and adhere to the original intent of the 1998 habitat standards. The Yellowstone Ecosystem Subcommittee of the Interagency Grizzly Bear Committee gathered public comment on the recommended changes to the habitat standard and application rules in 2021, and the committee voted to approve the changes in 2022. As of this reporting, the approved changes have not yet been published in a revised Conservation Strategy or formally amended to the land management plans of all the GYE administrative units.

Table A3. Number of developed sites in 1998 and 2023 on public lands per bear management subunit in the Greater Yellowstone Ecosystem.

Bear management subunit	Admin unit [1]	Summer home complexes		Developed campgrounds		Trailheads		Major developed sites [2]		Administrative or maintenance sites		Other		Plans of operation [3]		Total count developed sites in PCA	
		1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023
Bechler-Teton #1	CTNF	0	0	1	1	5	5	2	2	4	4	16	16	0	0	58	58
	GTNP	0	0	8	8	3	3	1	1	3	3	9	9	0	0		
	YNP	0	0	0	0	2	2	0	0	2	2	2	2	0	0		
Boulder-Slough #1	CGNF	0	0	1	1	7	7	0	0	1	1	3	3	8	2	20	14
Boulder-Slough #2	CGNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	9	9
	YNP	0	0	1	1	3	3	0	0	2	2	1	1	0	0		
Buffalo-Spread Creek #1	BTNF	0	0	1	1	1	1	0	0	0	0	2	2	0	0	18	18
	GTNP	0	0	1	1	7	7	2	2	1	1	3	3	0	0		
Buffalo-Spread Creek #2	BTNF	1	1	4	2	3	5	3	3	5	5	5	3	1	1	22	20
Crandall-Sunlight #1	CGNF	0	0	2	2	2	2	0	0	0	0	5	5	0	0	23	23
	SNF	0	0	2	2	5	5	1	1	1	1	5	5	0	0		
Crandall-Sunlight #2	CGNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	18
	SNF	0	0	5	5	4	4	1	1	2	2	5	5	1	1		
Crandall-Sunlight #3	SNF	0	0	2	2	3	3	0	0	1	1	2	2	0	0	11	11
	WG&F	0	0	2	2	0	0	0	0	1	1	0	0	0	0		
Firehole-Hayden #1	YNP	0	0	1	1	5	5	1	1	6	6	13	13	0	0	26	26
Firehole-Hayden #2	YNP	0	0	1	1	3	3	1	1	2	2	8	8	0	0	15	15
Gallatin #1	YNP	0	0	0	0	3	3	0	0	1	1	0	0	0	0	4	4
Gallatin #2	YNP	0	0	2	2	5	5	1	1	12	12	1	1	0	0	21	21
Gallatin #3	CGNF	0	0	2	2	9	10	0	0	0	0	6	6	0	0	18	19
	YNP	0	0	0	0	0	0	0	0	1	1	0	0	0	0		
Hellroaring-Bear #1 [4]	CGNF	0	0	4	4	12	12	0	0	3	3	8	8	8	8	37	37
	YNP	0	0	0	0	1	1	0	0	0	0	1	1	0	0		
Hellroaring-Bear #2	CGNF	0	0	0	0	1	1	0	0	1	1	0	0	0	0	4	4
	YNP	0	0	0	0	0	0	0	0	2	2	0	0	0	0		

Table A3. Number of developed sites in 1998 and 2023 on public lands per bear management subunit in the Greater Yellowstone Ecosystem.

Bear management subunit	Admin unit [1]	Summer home complexes		Developed campgrounds		Trailheads		Major developed sites [2]		Administrative or maintenance sites		Other		Plans of operation [3]		Total count developed sites in PCA	
		1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023
Henrys Lake #1	CTNF	2	2	3	3	1	1	0	0	3	3	11 [4]	11	1	0	21	20
Henrys Lake #2	CGNF	5	5	3	3	4	4	0	0	0	0	2	3	0	0	18	18
	CTNF	0	0	0	0	1	1	0	0	1	0	1	1	1	1		
Hilgard #1	BDNF	0	0	0	0	0	0	0	0	3	1	0	0	0	0	14	11
	CGNF	0	0	0	0	6	5	1	1	2	2	2	2	0	0		
Hilgard #2	CGNF	0	0	0	0	4	5	0	0	1	1	1	1	0	0	9	10
	YNP	0	0	0	0	3	3	0	0	0	0	0	0	0	0		
Lamar #1	CGNF	0	0	2	2	7	7	0	0	6	6	3	3	8	8	37	36
	SNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	YNP	0	0	1	1	5	5	0	0	3	3	2	1	0	0		
Lamar #2	YNP	0	0	0	0	0	0	0	0	4	4	0	0	0	0	4	4
Madison #1	CGNF	0	0	1	1	11	11	0	0	1	1	8	7	0	0	21	20
	YNP	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Madison #2	CGNF	8	8	2	2	1	1	1	1	4	4	5	5	0	0	25	25
	YNP	0	0	0	0	1	1	0	0	2	2	1	1	0	0		
Pelican-Clear #1	YNP	0	0	0	0	2	2	0	0	0	0	0	0	0	0	2	2
Pelican-Clear #2	YNP	0	0	1	1	4	4	1	1	4	4	3	3	0	0	13	13
Plateau #1	CGNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3
	CTNF	1	1	0	0	0	0	0	0	0	0	1	1	0	0		
	YNP	0	0	0	0	0	0	0	0	1	1	0	0	0	0		
Plateau #2	CTNF	0	0	0	0	1	1	0	0	1	1	1	1	0	0	7	7
	YNP	0	0	0	0	0	0	0	0	4	4	0	0	0	0		
Shoshone #1	SNF	1	1	2	2	0	0	0	0	0	0	6	5	0	0	9	8
Shoshone #2	SNF	0	0	0	0	1	1	1	1	0	0	0	0	0	0	2	2
Shoshone #3	SNF	2	2	0	0	1	0	1	1	0	0	0	0	0	0	4	3
Shoshone #4	SNF	3	3	3	2	3	3	6	6	0	0	8	9	0	0	23	23
South Absaroka #1	SNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A3. Number of developed sites in 1998 and 2023 on public lands per bear management subunit in the Greater Yellowstone Ecosystem.

Bear management subunit	Admin unit [1]	Summer home complexes		Developed campgrounds		Trailheads		Major developed sites [2]		Administrative or maintenance sites		Other		Plans of operation [3]		Total count developed sites in PCA	
		1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023	1998	2023
South Absaroka #2	SNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
South Absaroka #3	SNF	1	1	3	3	4	4	1	1	1	1	5	4	0	0	15	14
Thorofare #1	BTNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
	YNP	0	0	0	0	0	0	0	0	4	4	0	0	0	0		
Thorofare #2	BTNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	2	2
	YNP	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Two Ocean Lake #1	BTNF	0	0	1	1	0	0	0	0	0	0	0	0	0	0	14	13
	GTNP	0	0	0	0	0	0	0	0	1	1	1	0	0	0		
	YNP	0	0	2	2	3	3	1	1	3	3	2	2	0	0		
Two Ocean Lake #2	BTNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	4	4
	YNP	0	0	0	0	0	0	0	0	1	1	1	1	0	0		
Washburn #1	YNP	0	0	2	2	8	8	2	2	7	6	6	6	0	0	25	24
Washburn #2	YNP	0	0	1	1	6	6	0	0	1	1	4	4	0	0	12	12
Total count in GBRZ		**24**	**24**	**67**	**64**	**161**	**162**	**28**	**28**	**117**	**113**	**169**	**164**	**28**	**21**	**594**	**577**

Note: The 1998 baseline values in this table may vary from those tabulated in the 2007 Conservation Strategy since corrections have been made with time. The numbers in this table represent the best estimates currently available for developed sites on public lands inside the Grizzly Bear Recovery Zone of the Greater Yellowstone Ecosystem.

[1] Abbreviations for administrative units: BDNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger-Teton National Forest, CGNF = Custer Gallatin National Forest, CTNF = Caribou-Targhee, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, WG&F = Wyoming Game and Fish, YNP = Yellowstone National Park.

[2] Major developed areas such as Grant, Lake, Fishing Bridge, Old Faithful, Canyon, and Mammoth in YNP and are comprised of a combination of recreation and administrative facilities. All buildings and facilities comprising a given major developed area are tracked collectively as a single developed site.

[3] A single plan of operation may have multiple mining claims and not all plan sites have active projects.

[4] The Slip & Slide trailhead site was appended in 2020 as an exempted addition to the 1998 Baseline. This baseline correction added 1 count to the CGNF, Hellroaring-Bear subunit #1, "Trailhead" category, causing the total baseline counts to go from 593 to 594 (1998) and 576 to 577 (2020). The trailhead existed prior to 1998 and was acquired through a land exchange.

Monitoring Secure Habitat and Motorized Access inside the Grizzly Bear Recovery Zone

Habitat standards identified in the 2016 Conservation Strategy require there be no net loss in grizzly bear secure habitat with respect to levels that existed in 1998 for each of the 40 subunits inside the GBRZ. The sole exception to the 1998 baseline applies to 3 subunits identified in the 2007 Conservation Strategy (Gallatin #3, Henrys Lake #2, and Madison #2) as "*in need of improvement*" above 1998 levels. In 2016, new baseline values were established that hold these 3 subunits to improved levels of secure habitat. These increased levels were achieved in 2016 with full implementation of the Gallatin National Forest 2006 Travel Management Plan. New threshold values raise the baseline bar for these 3 subunits and supersede 1998 values for secure habitat.

Calculations of secure habitat are based entirely on proximity to motorized routes (roads and trails) and serve as a metric of human presence in grizzly bear habitat. Secure habitat is defined as any contiguous area ≥10 acres in size and more than 500 meters from an open or gated motorized route. Lakes larger than 1 mi^2 (square mile; 2.59 km^2) in size are excluded from habitat calculations.

The Conservation Strategy does not impose mandatory standards on motorized route density. However, changes in this parameter are monitored and reported annually for tracking purposes. The monitoring protocol requires that secure habitat, open motorized access route density, and total motorized access route density be reported annually against baseline levels per subunit inside the GBRZ. Open motorized access route density is a measure of the density of routes open to public motorized use at least one or more days during the non-denning portion of the year when grizzly bears are considered active (March 1–November 30). Total motorized access route density is a measure of the density of roads and trails that are open to the public or administrative personnel for motorized use on one or more days during the active season. Route densities are reported as the percent area of each subunit where open motorized access route density is greater than 1 mi/mi^2 (mile per square mile; >0.62 km/km^2) and total motorized access route density is greater than 2 mi/mi^2 (>1.2 km/km^2). Thus, values of total motorized access route density are typically lower than open motorized access route density because the threshold density is at a higher level. Table A4 shows historical and current values of secure habitat and motorized route density. Routes that are gated closed to the public yearlong but accessible to administrative personnel detract from secure habitat and contribute to total motorized access route density only.

Gains in secure habitat are achieved primarily through decommissioning of open, motorized access routes. In context to the measurement of grizzly bear secure habitat, a route is considered decommissioned when it has been treated on the ground so that motorized access by the public and administrative personnel is effectively restricted. Road decommissioning can range from complete obliteration of the road prism to physical barriers permanently and effectively blocking motorized access. Decommissioned roads do not detract from secure habitat and do not contribute to open or total motorized access route density.

Permanent changes in secure habitat since 1998 (inside the Grizzly Bear Recovery Zone)

The standard criterion for no net loss in secure habitat with respect to 1998 baseline levels has been consistently met in all 40 subunits inside the GBRZ since it was initially formalized in the 2007 Conservation Strategy. For the 3 subunits identified in the 2007 Conservation Strategy as in need of improvement above 1998 levels (Gallatin #3, Henrys Lake #2, and Madison #2), new baseline thresholds ensure secure habitat will be maintained well into the future at levels higher than what was attained in 1998. Since 1998, a net gain of approximately 131 miles^2 (339 km^2) in secure habitat has been attained inside the GBRZ. This gain is comparable in size to the area of Yellowstone Lake. The greatest improvement in secure habitat is the 17.2 % increase occurring on the Gallatin #3 Bear Management Subunit on the Custer Gallatin National Forest. The gain in secure habitat for this subunit, as well as Henrys Lake #2 (6 %) and Madison #2 (1.0%) was achieved by road closures commissioned for implementation of the Gallatin Travel Management Plan. Values achieved with full implementation of the Gallatin Travel Management Plan constitute new baselines against which future change will be measured (Table A4; see footnote). Other notable gains in secure habitat range from 3.4% on the Hellroaring-Bear #1 subunit to 13.4% on the Hilgard #1 subunit. Changes in secure habitat, when averaged over all 40 subunits, account for a mean gain of 1.4% since 1998. All gains in secure habitat throughout the GBRZ were achieved by the decommissioning of motorized routes on public lands. Permanent changes in secure habitat or open and total motorized access route density inside the GBRZ are reported with respect to baseline levels in Table A4.

Permanent changes in secure habitat during 2023 (inside the Grizzly Bear Recovery Zone)

In June of 2022, a storm system dropped unprecedented amounts of rainfall on top of melting snow across the northern parts of YNP and the Absaroka/Beartooth area of the Custer Gallatin National Forest. This rainfall resulted in substantial flooding, mudslides, and washouts which severely damaged several roads and other infrastructure. Within the GBRZ on the Custer Gallatin National Forest, road repairs were made at the Yankee Jim river access and the Joe Brown trailhead in Hellroaring-Bear #1 subunit but these did not extend any road prisms or affect secure habitat. Actions taken in YNP to re-route around the catastrophic washout on the North Entrance Road are currently considered temporary and addressed in the following section regarding temporary projects.

Table A4. *1998 and 2023 percent areas of open motorized access route density (OMARD, total motorized access route density (TMARD), and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone of the Greater Yellowstone Ecosystem.*

Bear management subunit	% OMARD (subunit % > 1 miles / mile²)			% TMARD (subunit % > 2 miles / mile²)			% Secure Habitat			Area (miles²) (excluding major lakes)		
										Subunit	Secure Habitat	
	1998	2023	% chg	1998	2023	% chg	1998	2023	% chg		1998	2023
Bechler/Teton	17.0	17.0	-0.1	5.8	5.8	0.1	78.1	78.1	0.0	534.3	417.0	417.2
Boulder/Slough #1	3.2	3.3	0.0	0.3	0.4	0.1	96.6	96.6	0.1	281.9	272.2	272.4
Boulder/Slough #2	2.1	2.1	0.0	0.0	0.0	0.0	97.7	97.7	0.0	232.4	227.1	227.1
Buffalo/Spread Creek #1	11.5	10.9	-0.6	5.3	5.6	0.3	88.3	89.0	0.7	219.9	194.1	195.6
Buffalo/Spread Creek #2	15.6	15.0	-0.5	12.7	9.5	-3.2	74.3	81.8	7.5	507.6	377.2	412.2
Crandall/Sunlight #1	19.3	18.5	-0.8	7.2	6.3	-0.9	81.1	81.9	0.8	129.8	105.2	106.2
Crandall/Sunlight #2	16.6	16.0	-0.6	11.7	9.8	-1.9	82.3	82.7	0.4	316.2	260.3	261.4
Crandall/Sunlight #3	19.2	18.5	-0.6	10.6	9.1	-1.5	80.4	81.2	0.8	221.8	178.3	180.1
Firehole/Hayden #1	10.4	10.5	0.1	1.7	1.7	0.0	88.3	88.3	0.0	339.2	299.7	299.6
Firehole/Hayden #2	9.0	9.0	0.0	1.5	1.5	0.0	88.4	88.4	0.0	172.2	152.3	152.3
Gallatin #1	3.6	2.5	-1.0	0.5	0.1	-0.4	96.3	97.0	0.7	127.7	122.9	123.9
Gallatin #2	9.5	9.1	-0.4	4.5	4.5	0.0	90.2	90.2	0.0	155.2	139.9	139.9
Gallatin #3 *	46.0	27.4	-18.5	22.9	12.6	-10.3	**55.3**	72.5	17.2	217.6	120.2	157.7
Hellroaring/Bear #1	23.1	17.8	-5.4	15.8	12.1	-3.7	77.0	80.3	3.4	184.7	142.2	148.7
Hellroaring/Bear #2	0.1	0.0	-0.1	0.0	0.0	0.0	99.5	99.6	0.1	228.9	227.8	228.0
Henry's Lake #1	49.0	49.2	0.2	31.2	31.3	0.1	45.4	46.0	0.6	191.2	86.8	88.0
Henry's Lake #2 *	49.9	40.6	-9.4	35.2	28.1	-7.1	45.7	52.0	6.3	140.2	64.1	72.9
Hilgard #1	29.0	13.3	-15.7	15.3	4.4	-10.9	69.8	83.1	13.4	201.2	140.3	167.2
Hilgard #2	21.0	16.1	-4.9	13.6	4.6	-8.9	71.4	80.2	8.8	140.5	100.4	112.7
Lamar #1	9.9	10.0	0.2	3.8	4.1	0.3	89.4	89.6	0.2	299.9	268.1	268.6
Lamar #2	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	180.8	180.8	180.8
Madison #1	29.5	20.3	-9.1	12.5	7.5	-5.0	71.5	80.7	9.2	227.9	162.9	183.9
Madison #2 *	33.7	32.0	-1.7	24.0	21.6	-2.4	**66.5**	67.5	1.0	149.4	99.4	100.9
Pelican/Clear #1	2.0	2.0	0.0	0.5	0.5	0.0	97.8	97.8	0.0	108.4	106.0	106.0

Table A4. *1998 and 2023 percent areas of open motorized access route density (OMARD, total motorized access route density (TMARD), and secure habitat per bear management subunit inside the Grizzly Bear Recovery Zone of the Greater Yellowstone Ecosystem.*

Bear management subunit	% OMARD (subunit % > 1 miles / mile²)			% TMARD (subunit % > 2 miles / mile²)			% Secure Habitat			Area (miles²) (excluding major lakes)		
										Subunit	Secure Habitat	
	1998	2023	% chg	1998	2023	% chg	1998	2023	% chg		1998	2023
Pelican/Clear #2	5.4	5.4	0.0	0.4	0.4	0.0	94.1	94.1	0.0	251.6	236.7	236.7
Plateau #1	22.2	19.0	-3.3	12.9	10.3	-2.7	68.8	70.6	1.8	286.3	197.0	202.1
Plateau #2	8.5	8.5	0.0	3.5	3.2	-0.2	88.7	88.8	0.1	419.9	372.3	372.7
Shoshone #1	1.5	1.5	0.0	1.1	1.0	-0.1	98.5	98.5	0.1	122.2	120.3	120.4
Shoshone #2	1.3	1.1	-0.2	0.7	0.6	-0.2	98.8	99.0	0.1	132.4	130.9	131.0
Shoshone #3	3.9	2.8	-1.1	2.1	1.5	-0.6	97.0	97.8	0.8	140.7	136.5	137.6
Shoshone #4	5.3	5.3	0.0	2.9	2.7	-0.2	94.9	94.9	0.0	188.8	179.1	179.1
South Absaroka #1	0.6	0.6	0.0	0.1	0.1	0.0	99.2	99.2	0.0	163.2	161.9	161.9
South Absaroka #2	0.0	0.0	0.0	0.0	0.0	0.0	99.9	99.9	0.0	190.6	190.3	190.3
South Absaroka #3	2.4	2.4	0.0	2.7	1.7	-1.1	96.8	96.8	0.0	348.3	337.1	337.2
Thorofare #1	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	273.4	273.4	273.4
Thorofare #2	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	180.1	180.1	180.1
Two Ocean/Lake #1	3.5	3.7	0.2	0.3	0.6	0.2	96.3	96.3	0.0	371.9	358.3	358.1
Two Ocean/Lake #2	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	124.9	124.9	124.9
Washburn #1	16.1	16.1	0.0	4.2	4.2	0.0	83.0	83.0	0.0	178.3	147.9	147.9
Washburn #2	7.4	7.4	0.0	1.1	1.1	0.0	92.0	92.0	0.0	144.1	132.6	132.6
GBRZ Mean / Total Area	**12.7**	**10.9**	**-1.8**	**6.7**	**5.2**	**-1.5**	**85.6**	**87.4**	**1.8**	**9,025**	**7,724**	**7,889**

**As of 2016, three subunits (Gallatin #3, Henrys Lake #2, and Madison #2) have new secure habitat baselines established at thresholds achieved with full implementation of the 2006 Gallatin National Forest Travel Management Plan. These 3 subunits were identified in the 2007 Conservation Strategy as needing improved secure habitat levels above 1998 conditions. New baseline thresholds established in 2016 raise the bar for these 3 subunits and supersede 1998 baseline values for secure habitat.*

Travel Plan Baselines (supersedes 1998 thresholds)		
Bear management subunit	**% Secure habitat baseline**	**Area (mile²) Secure habitat**
Gallatin #3	70.7	153.9
Henrys Lake # 2	51.7	72.5
Madison #2	67.5	100.9

Temporary Changes to Secure Habitat, 2023 (inside the Grizzly Bear Recovery Zone)

Reductions in secure habitat below baseline levels are allowed on a temporary basis inside the GBRZ when associated with authorized federal projects. In these cases, adherence to the "one percent" application rule and other provisions must be met. The one percent rule states that any temporary loss of secure habitat below baseline values within a given Bear Management Unit cannot exceed 1% of the total acreage of the largest subunit within that unit. Application rules allow only one temporary project to be active in a particular subunit at any given time. Six projects involving potential reductions in secure habitat within the GBRZ were operational in 2023 (Table A5). Below are brief summaries of these USFS projects.

Yale Creek Wildland-Urban-Interface: The Yale Creek Fuels Reduction Project was authorized to reduce hazardous fuels and produce a timber product on 3,161 acres of public lands interfacing with private lands in the Yale Creek and Shotgun subdivisions in the north portion of the Ashton-Island Park Ranger District on the Caribou-Targhee National Forest. Three temporary roads totaling 4.4 miles were used in 2023. The 3-year temporary project application rule for the secure habitat standard will not be met for one temporary road constructed in 2019. Use of this road will continue through 2024 because, through the contracting process, the Forest Service was legally obligated to allow timber harvest for six years instead of ceasing it at three years.

Black Mountain Salvage Project: Authorized by the Black Mountain Categorical Exclusion (2019), the purpose of this project is to salvage 138 acres of wind-thrown mature lodgepole pine on the Madison-Pitchstone Plateau of the Ashton-Island Park Ranger District on the Caribou-Targhee National Forest. Three temporary roads totaling 0.5 mile in length were used in 2023. Two of those roads totaling 0.26 mile were decommissioned in 2022, and the remaining road will be used in 2023. A contract extension was also granted to one of the contractors on this project so it will extend at least into its fourth year as well.

Budworm Response Project: The Swamp Lake Timber Sale was authorized under the Budworm Response Project Decision Notice, and 16 new temporary roads totaling 4.2 miles were installed during autumn 2022. These roads were immediately closed following use in 2023 to public or administrative travel using barricades such as rocks, fallen trees, Kelly humps, and/or deep ditches. The timber harvest contractor will re-open these roads and use them during autumn 2024. The roads will not be open to the public.

Wolf Creek Salvage Project: This timber sale was authorized under the 2015 Long Creek Project Decision Notice and is located within the South Absaroka #3 subunit near the Wolf Creek Trailhead on the Shoshone National Forest. The sale consists of live and dead sawtimber. Operations began in summer of 2020 and continued through 2023. The purchaser is using NFSR 513.3C, which is a gated administrative road and, therefore, already affects secure habitat. Three additional temporary roads totaling 0.6 mile were constructed in 2021. This project will remain open until 3/25/2025 due to Covid contract extensions.

Brooks Lake Salvage/Sanitation Project*:* Timber harvest for this project was authorized under the 2015 Long Creek Project Environmental Assessment and Decision Notice. The project is also located within the South Absaroka #3 subunit near Brooks Lake. Sale operations began in the fall of 2023 using system roads plus 3 temporary roads totaling approximately .3 miles. The contract on this sale remains open until 3/31/2026. The total reduction in secure habitat in South Absaroka #3 subunit resulting from the Wolf Creek and Brooks Lake projects was 0.0002%.

Historic spring flood damage: Flooding during June of 2022 resulted in catastrophic damage to a significant portion of YNP's North Entrance Road along the Gardner River Canyon. Sections of the road

not destroyed in the flood have not been reclaimed but are currently closed to all traffic. Decisions on future uses of those areas have not yet been made. For the purposes of this report, the original road is considered temporarily decommissioned. A temporary main park entrance road was constructed by improving 4 miles of the existing Old Gardiner Road and adding 0.3 mile of new construction. These changes will be considered temporary until permanent solutions are implemented following the appropriate land management and National Environmental Policy Act processes. With the temporary road closure, the subunit gained 0.7 square miles of secure habitat.

Table A5. *Secure habitat affected by temporary projects inside the Grizzly Bear Recovery Zone, 2023.*

Project Name and National Forest	Bear Management Unit Subunit	Secure habitat (miles^2)					Project Status
		Allowed reduction below baseline[a]	1998 Baseline	2023 (without project)	2023 (with project)	Reduction in secure habitat	
Budworm Response Project Shoshone N.F.	Crandall-Sunlight #2	3.2	260.3	261.5	261.2	0.3	Open
Yale Creek WUI Caribou-Targhee N.F.	Henrys Lake #1	1.9	86.8	88	87.2	0.8	Open
Black Mountain Salvage Caribou-Targhee N.F.	Plateau #1	3.7	197.0	202	202	0.1	Open
Wolf Creek Salvage Shoshone N.F.	South Absaroka #3	3.4	337.1	337.2	337.2	0[b]	Open
Brooks Lake Sanitation Salvage Shoshone N.F.	South Absaroka #3	3.4	337.1	337.2	337.2	0[b]	Open
Historic flood damage Yellowstone N.P.	Gallatin #2	1.4	90.2	90.2	90.9	+0.7	Open

[a] The maximum allowed temporary reduction in secure habitat below baseline is 1% of the area of the largest subunit within the Bear Management Unit.
[b] The total reduction in secure habitat in South Absaroka #3 subunit resulting from the Wolf Creek and Brooks Lake projects was 0.0002%.

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Appendix B

Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem – 2023 Annual Report

The 2023 whitebark pine monitoring report was not available at time of publication of the IGBST 2023 annual report. Once finalized, it can be obtained in digital format from the Greater Yellowstone Inventory & Monitoring Network website (https://www.nps.gov/im/gryn/reports-publications.htm) and the Natural Resource Publications Management website (https://www.nps.gov/im/publication-series.htm). If you have difficulty accessing information in this publication, particularly if using assistive technology, please email irma@nps.gov.

Appendix C

2023 Wyoming Bear Wise Wyoming Project Update

Introduction

The Bear Wise Community Program is a proactive initiative that seeks to minimize human-bear (black and grizzly) conflicts, minimize management-related bear mortalities associated with preventable conflicts, and to safeguard human communities in northwest Wyoming. The overall objective of Bear Wise is to promote individual and community ownership of ever-increasing human-bear conflict issues, moving toward creating a social conscience regarding responsible attractant management and behavior in bear habitat. This project seeks to raise awareness and proactively influence local waste management infrastructures with the specific intent of preventing conflicts from recurring. Strategies used to meet the campaign's objectives are: 1) minimize accessibility of unnatural attractants to bears in developed areas; 2) employ a public outreach and education campaign to reduce knowledge gaps about bears and the causes of conflicts; and 3) employ a bear resistant waste management system and promote bear-resistant waste management infrastructure.

This report provides a summary of program accomplishments in 2023. Past accomplishments are reported in the 2006 - 2022 annual reports of the Interagency Grizzly Bear Study Team (IGBST) and in the 2011-2022 Annual Job Completion Reports of the Wyoming Game and Fish Department (WGFD).

Background

In 2004, a subcommittee of the IGBST conducted an analysis of causes and spatial distribution of grizzly bear mortalities and conflicts in the Greater Yellowstone Ecosystem for the period of 1994–2003. The analysis identified that the majority of known, human-caused grizzly bear mortalities occurred due to agency management actions in response to conflicts (34%), self-defense killings, primarily by big game hunters (20%), and illegal killings (11%). The report made 33 recommendations to reduce human-grizzly bear conflicts and mortalities with focus on 3 actions that could be positively influenced by agency resources and personnel: 1) reduce conflicts at developed sites; 2) reduce self-defense killings; and 3) reduce vandal killings (Servheen et al. 2004).

To address action number 1, the committee recommended that a demonstration area be established to focus proactive, innovative, and enhanced management strategies where developed site conflicts and agency management actions resulting in relocation or removal of grizzly bears had historically been high. Spatial examination of conflicts identified the Wapiti area in northwest Wyoming as having one of the highest concentrations of black bear and grizzly bear conflicts in the Greater Yellowstone Ecosystem. The North Fork Shoshone River west of Cody was then chosen as the first area composed primarily of private land to have a multi-agency/public approach to reducing conflicts at developed sites.

In 2005, the Department began implementation of the Bear Wise Community Program. Although the program's efforts were focused primarily in the Wapiti area, the Department initiated a smaller scale project in Teton County to address the increasing number of black and grizzly bear conflicts in the Jackson, Wyoming, area. For the last 18 years, the Bear Wise Community Programs in northwest Wyoming have deployed a multi-faceted education and outreach campaign in an effort to minimize human-bear conflicts and promote proper attractant management. Although a wide array of challenges remain and vary between communities, many accomplishments have been made and progress is expected to continue as Bear Wise efforts gain momentum. In an effort to broaden the scope of the program, this work was rebranded as the Bear Wise Wyoming Program.

Cody Area Update

The Cody Bear Wise Community Program continues to utilize radio, television and print media, mass mailings, and the use of signing on private and public land to convey the educational messages surrounding human-bear conflict prevention. Conflict prevention information is also disseminated through public workshops and presentations and by contact with local community groups, governments, the public school system, and various youth organizations. To compliment educational initiatives, the program uses an extensive outreach campaign that assists the community in obtaining and utilizing bear-resistant products and implementing other practical methods of attractant management. Ongoing efforts and new accomplishments for 2023 are as follows:

1. The Carcass Management Program continues to provide a domestic livestock carcass removal service for livestock producers located in occupied grizzly bear habitat within Park County, Wyoming. The program has been traditionally funded by the Park County Predator Management District and Wyoming Animal Damage Management Board. In addition to those donors, the program received contributions from Bureau of Land Management, National Fish and Wildlife Foundation. The program provides livestock producers and owners with an alternative to the use of on-site carcass dumps, which are a significant bear attractant and indirectly contribute to numerous human-bear conflicts. Since June 2008, more than 2,000 domestic livestock carcasses have been removed from private lands.

2. Large Carnivore Section (LCS) personnel maintained and built many new permanent electric fences. The fences are around bee apiaries that have been in the same place long term. These projects were completed in cooperation with USDA wildlife service non-lethal specialist and funding to do livestock conflict prevention.

3. Numerous informational presentations were given that focused on human-bear conflict prevention to students at the following schools: Powell High, South Side Elementary, Cody high, middle, and elementary, Basin Library, the 8th grade expo for all Basin schools, Riverside Middle/High, Worland elementary school, Meeteetse School District, Burlington Middle, and Northwest College in Powell, Wyoming.

4. Seven-hundred canisters of bear spray and 200 canisters of inert training spray were purchased with funding from the American Bear Foundation, and Safari Club International Foundation. After a short training session with the inert spray and mechanical charging "Robobear" the cans of live bear spray were given free of charge to hunter, anglers, and the general public in late March, April, and August. (The bear spray canisters were used in a total of 7 giveaways; twice in Jackson and Lander and once in Cody, Dubois, and Pinedale; see area updates below).

5. The "Working in Large Carnivore Country" workshops were conducted for the Park County Weed and Pest District, Powell Recreation District Outdoor Kids Event, the Town of Dayton, Buffalo Bill State Park, Medicine Lodge Kids Outdoor Day, Park County Search and Rescue, and Rocky Mountain Power.

6. A permanent electric fence was erected in 2018 at the Park County Landfill. To ensure the fence is in good working order, WGFD personnel spent several days repairing and maintaining the fence in 2023. The partnerships with Wyoming Outdoorsmen, BLM, Park County Commissioners, Western Bear Foundation, and Greater Yellowstone Coalition were vital in making this project a reality.

7. Regional Hunters Ed classes, and numerous other public outreach events were held in Cody, Powell, Meeteetse, Thermopolis, Wapiti, and Burgess Junction, Newton Lakes, Basin, and Sunlight.

8. Planning in conjunction with Safari Club International Foundation has begun for a large scale advertising project. The goal is to put out Gas Pump TV ads across the state that promote safety bear safety to hunters throughout the hunting season. The project has the potential to reach many residents as well as hard to target demographics such as out of state hunters, and seasonal residents. A second project will focus on bear safety through video advertising in airport terminals in Yellowstone Regional Airport and potentially Jackson Hole Airport.

Lander Area Update

1. Participated in a biannual Bear Spray Giveaway program, giving away 200 cans of bear spray and interacting with hunters, anglers, hikers, recreationists and people with general interest of grizzly bear ecology and management.

The remote control charging "Robobear" continues to be a big hit at bear spray giveaways and other educational events throughout Wyoming.

(Photo courtesy of Wyoming Game and Fish Department)

2. LCS personnel provided numerous educational workshops and training events, including the Gannett Peak Elementary, "Lights On" after school/summer program, Baldwin Creek Elementary, Wyoming Outdoor Wildlife Day, Teton Valley Ranch Youth Camp, Lander Child Development Services.

3. Participated in Hunter Education classes that emphasize hunting safely in bear country and worked on curriculum for the classroom. Also provided Hunter Safety in conjunction with Wyoming Catholic College in Lander, Wyoming.

4. Conducted safety training for Shoshone National Forest Trail Crew, Fremont County Weed and Best, National Audubon Society, Wyoming Catholic College and seasonal Wyoming Game and Fish Employees.

5. Conducted multiple radio and television interviews regarding bear safety and being Bear Wise in Wyoming that was timed in accordance with den emergence, spring/summer human use activities and hunting seasons. Section personnel continued to promote resources to the public such as the LCS educational video, which demonstrates how to properly deploy electric fences to secure attractants.

6. Provided comment and information for numerous news releases for local, statewide, national, and international media outlets.

Pinedale Area Update

In 2011, a Bear Wise Community effort was initiated targeting residential areas north of Pinedale, Wyoming, where the occurrence of human-bear conflict has increased in recent years. Accomplishments for the Pinedale area in 2023 are as follows:

1. Hunting in Bear Country presentations were given to hunter safety classes throughout the region in an effort to educate future sportsmen and women and increase safety potential.

2. LCS personnel provided range rider safety training to local cowboys and ranches that have a high potential of encounters with grizzly bears and livestock.

3. Bear safety presentations were given to the U.S. Forest Service, and other groups throughout Sublette County.

4. LCS personnel provided training for local Sublette County Conservation District employees.

5. LCS personnel conducted the bear spray giveaway to Pinedale for the second year and gave out 100 cans of bear spray.

6. LCS personnel provided large carnivore safety training to the local Bureau of Land Management regional office.

Objectives for 2024 include continued expansion of the program into the other areas of the state where human-bear conflicts continue to be a chronic issue and the continuation of current educational and outreach efforts in the Cody area with specific focus on areas that have not adopted proper attractant management methods. LCS personnel are working with land management agencies to provide additional bear proof and bear resistant infrastructure to reduce conflict potential for black bear and grizzly bears for recreationists throughout the Wind River and Wyoming Range mountains.

The Wapiti and Pinedale area Bear Wise Community programs face the ongoing challenges of: 1) the absence of ordinances, regulations, or laws prohibiting the feeding of bears; 2) limited educational opportunities and contact with portions of the community due to a large number of summer-only residents and the lack of organized community groups and; 3) decreased public tolerance for grizzly bears due to record numbers of human-bear conflicts and continued federal legal protection. The future success of the Bear Wise program lies in continued community interest and individual participation in proper attractant management.

Jackson Area Update

The Bear Wise Jackson Hole program continues educational and outreach initiatives in an effort to minimize human-bear conflicts within the community of Jackson and surrounding areas. In 2023, the program's public outreach and educational efforts included the use of signage, public workshops and presentations, distribution of

informational pamphlets, promoting awareness about bear spray, carcass and fruit tree management, and utilizing our bear education trailer.

- Public service announcements were broadcast on local radio stations in Jackson throughout the spring, summer, and fall of 2023. The announcements focused bear safety and conflict avoidance and advertising for a Large Carnivore workshop conducted in Jackson.

- Numerous educational talks were presented to various groups, including homeowner's associations, guest ranches, youth camps, Jackson residents, tourists, school groups, Heart Six Ranch, Jackson Gun Club, and local Government employees.

- Educational workshop focusing on bear ecology and situational awareness was held at the Jackson outdoor day as part of the larger Bear Spray giveaway event in April.

- A second Bear Spray Giveaway was held in August in which 100 cans of spray were given to the public free of charge.

- A considerable amount of time was spent removing ungulate and livestock carcasses from residential areas and ranches in the Jackson Region.

- LCS personnel continued to work with a Jackson catering company, Roots Kitchen & Cannery. They have been involved in picking apples from trees that have been identified as a source of bear conflict by WGFD.

- LCS personnel assisted hunting outfitters and with the installation and maintenance of electric fence systems around their field camps located in the Bridger-Teton National Forest. Annually, personnel meet with hunters and outfitters to reduce to conflict potential between humans and grizzly bears.

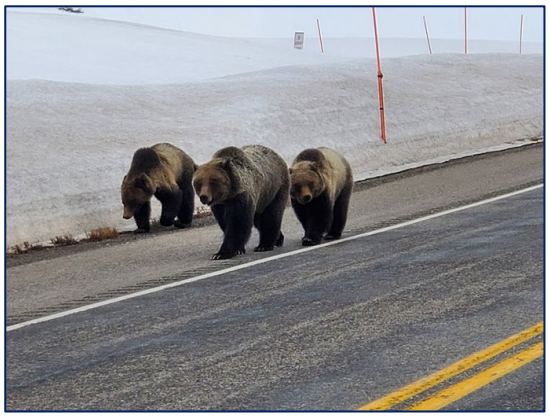
- LCS personnel worked extensively Teton County and the city of Jackson, Wyoming, on Land Development Regulation stressing the critical importance of compliance and enforcement due to a county wide bear resistant infrastructure regulation.

- Signage detailing information on hunting safely in bear country, bear identification, recent bear activity, and proper attractant storage were placed at USFS trailheads and in private residential areas throughout Teton County, including extensive work on Togwotee Pass, to deal with habituated roadside grizzly bears.

(Photo courtesy of Wyoming Game and Fish Department)

Objectives for the Bear Wise Jackson Hole program in 2023 were focused on supporting Teton County and local waste management companies with projects that will help disseminate information and achieve compliance with the recently adopted Teton County Bear Conflict Mitigation and Prevention Land Development Regulations (LDR). In addition, more work will be done to identify areas within the city limits of Jackson and Star Valley communities where better attractant management and sanitation infrastructure is needed.

The recent implementation of the Teton County Bear Conflict Mitigation and Prevention LDR has greatly reduced the amount of available attractants on the landscape and is a tremendous step forward for the Bear Wise Jackson Hole program. The new challenges faced by the Department will be achieving full compliance with this regulation, even in years with low conflict when it may appear that the conflict issues are resolved. The Bear Wise Jackson Hole Program will convey the importance of compliance and strive to maintain public support for the LDR through public outreach and education projects. In order for the Jackson program to be successful, the program must continually identify information and education needs within the community while being adaptive to changing situations across different geographic areas. This will require the Department to coordinate with other government agencies and local non-government organizations working across multiple jurisdictions to develop a uniform and consistent message. If this level of coordination is achieved, the Department will be more effective in gaining support and building enthusiasm for Bear Wise Jackson Hole, directing resources to priority areas, and reaching all demographics.



(Photos courtesy of Wyoming Game and Fish Department)

Information and Education - 2023 Accomplishments

1) Electronic and Print Media
   a) As per Wyoming Statute, grizzly bear relocation from one county to another must be announced through local media and to the local sheriff of the county into which the bear was relocated (n = 9 for 2023). Each announcement is posted in a timely fashion to the web page.
   b) Personnel issued multiple educational news releases throughout the season informing readers and listeners of bear safety, behavior, conflict avoidance, food storage and natural food availability.

2) Grizzly Bear Management Web Page
   a) The new Grizzly Bear Management and *Bear Wise Wyoming* web page are now live on the WGFD website and have been maintained and updated on a regular basis in order to provide timely information to the public regarding grizzly bear management Accessibility to the Grizzly Bear Management and Bear Wise web pages has been dramatically improved. Both web pages can now be accessed in only one click from the WGFD homepage.

3) Hunter Education
   a) Every hunter education class in Wyoming is required to discuss how to hunt safely in bear country. To assist instructors, most have been provided inert bear spray canisters for demonstration purposes and DVDs entitled Staying Safe in Bear Country. A section on bear safety is included in the student manual. Approximately 5,000 students are certified each year.

4) Bear Spray Giveaway
   a) We had a successful year training recipients on how to use bear spray at our 7 bear spray giveaway events. Public participation continues in our community events where bear spray giveaways occur and also give our personnel an excellent opportunity to talk with the public about bear ecology and safety and other wildlife issues throughout Wyoming.

Publications

The primary link to other publications, annual reports, and peer reviewed literature for the Yellowstone population of grizzly bears is summarized on the U.S. Geological Service web site at https://www.usgs.gov/science/interagency-grizzly-bear-study-team

For information specific to the Wyoming Game and Fish Department's grizzly bear management program; including links to publications, reports, updates, and plan visit: https://wgfd.wyo.gov/wyoming-wildlife/large-carnivore/grizzly-bears-wyoming