Yellowstone Grizzly Bear Investigations 2014

Report of the Interagency Grizzly Bear Study Team

USGS science for a changing world

Photo courtesy of Jake Davis

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Cover photo: Female grizzly bear with yearling offspring, Pilgrim Creek, June 2014. Photo courtesy of Jake Davis (revealedinnature.com).

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Annual Report of the Interagency Grizzly Bear Study Team

2014

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 Suzanna C. Soileau

U.S. Department of the Interior
U.S. Geological Survey
2015

IGBST Partner Websites

Interagency Grizzly Bear Study Team (USGS):
http://nrmsc.usgs.gov/research/igbst-home.htm

Grizzly Bear Recovery (U.S. Fish and Wildlife Service):
http://www.fws.gov/mountain-prairie/species/mammals/grizzly/yellowstoneindex.html

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

Wyoming of Game and Fish Department :
https://wgfd.wyo.gov/web2011/wildlife-1000674.aspx

Montana Fish, Wildlife and Parks:
http://fwp.mt.gov/fishAndWildlife/livingWithWildlife/grizzlyBears/default.html

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

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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*) monitoring and research conducted in the Greater Yellowstone Ecosystem (GYE) by the Interagency Grizzly Bear Study Team (IGBST) during 2014. The report also contains a summary of grizzly bear management actions to address conflict situations.

The Importance of Long-Term Studies

Long-term trends tend to have a disproportionate influence on variability of population parameters (Pimm and Redfearn 1988). Long-term studies are particularly important for vertebrates with relatively low reproductive potential, such as grizzly bears. Now in its 42nd year since establishment, the IGBST has documented important biological processes associated with different stages of recovery of the Yellowstone grizzly bear population. As we add new data each year and pursue new lines of scientific inquiry, our confidence in the population data and ecological insights grows accordingly.

After experiencing relatively high mortality during the 1970s, the grizzly bear population began to recover in the mid-1980s. This population recovery likely started in part due to measures to reduce mortality of adult grizzly bears in the early 1980s, which were implemented after the formation of the Interagency Grizzly Bear Committee in 1983. The population experienced robust growth from there on, particularly during the 1990s (Schwartz et al. 2006), followed by a slowing of population growth that started in the early 2000s (IGBST 2012; see "**Estimating of number of Females with Cubs**"). This slowing of population growth was primarily due to a decline in cub and yearling survival and has prompted additional research questions.

A key focus of recent studies has been whether these changes in vital rates are associated with changes in several high-calorie food resources or are driven more by changing dynamics as population density has reached high levels in portions of the ecosystem. Evidence from our analyses suggests that increased grizzly bear density, rather than a decline in food resources, may be a driver of this change in population trajectory, possibly indicating the population is nearing carrying capacity. These are key concepts in wildlife ecology that are often very difficult to study because long-term population data are required to answer these questions. Clearly, if one were to consider any 5- or even 10-year period out of this entire monitoring effort, our understanding of population status would have been much more limited and interpretations might have been different. We are fortunate to have a comprehensive, long-term dataset on grizzly bear demographics. The combined evidence from a number of studies based on years of demographic data has provided important insights into the dynamics of this grizzly bear population. We anticipate publication of these findings sometime during 2015.

Population and Habitat Monitoring

We continue to follow monitoring protocols established under 1) the Revised Demographic Recovery Criteria (U.S. Fish and Wildlife Service [USFWS] 2007*b*) and the demographic monitoring section of the Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*) and 2) updated protocols based on proposed revisions to the Demographic Recovery Criteria (USFWS 2013). The year 2013 was a peak year for observations of unique females with cubs-of-the-year (<1 yr old; hereafter referred to as "cubs" as opposed to yearlings or 2-yr-old offspring), a population segment we closely monitor to determine population trends. We observed 58 unique females with cubs during that year, the highest count since we started monitoring this population segment in 1983. We therefore did not anticipate observing quite as many females with cubs in 2014 but were surprised to find that the estimate was not much different: we observed 50 unique females with cubs, resulting in a model-averaged estimate of 62 females with cubs (see "**Estimating Number of Females with Cubs**"). The estimates are based on a technique that we refer to as the Chao2 estimator (Keating et al. 2002, Cherry et al. 2007), which essentially includes an estimate of female with cubs that are not observed based on how many times each unique female with cubs is observed. Although we observed fewer unique females with cubs

in 2014, we tended to have fewer repeat sightings of each, which increased the Chao2 estimate. Combined with a low number of known and probable mortalities for the past 2 years, these monitoring results are supportive of the conclusions of our 2013 "Food Synthesis Report", in which we documented no major population consequences in response to changing food resources (IGBST 2013). As we noted above, with each additional year of data we gain further insights. With that in mind, 2015 will provide yet another useful benchmark.

We continued our efforts towards implementation of the mark-resight technique to estimate the number of females with cubs (Higgs et al 2013; see "**Estimating Number of Females with Cubs, Mark-Resight**", p. 13) in collaboration with scientists at Montana State University, Department of Mathematical Sciences. Implementation of this technique is important because it addresses the underestimation bias associated with the Chao2 estimator, on which we have reported in previously. We have focused our recent efforts on propagating variation associated with the mark-resight estimate and ratios of different population segments to estimate overall population size. Further, we are investigating options for trend analysis and detection, an important aspect of any population estimator.

Although monitoring requirements under the Conservation Strategy (USFWS 2007*c*) developed for the 2007 delisting (USFWS 2007*a*) do not apply since the GYE grizzly bear population was relisted in 2009, the U.S. Forest Service continues to report on items identified in the Conservation Strategy including changes in secure habitat, livestock allotments, and developed sites from the 1998 baseline levels in each Bear Management Unit (BMU) subunit. This year, the 7th report detailing this monitoring program is provided by documenting: 1) changes in secure habitat, open motorized access route density, and total motorized route density inside the Primary Conservation Area (PCA; equivalent to the U.S. Fish and Wildlife Service Recovery Zone); 2) changes in number and capacity of developed sites inside the PCA; and 3) changes in number of commercial livestock allotments, changes in the number of permitted domestic sheep animal months inside the PCA, and livestock allotments with grizzly bear conflicts during the last 5 years (Appendix A).

Habitat monitoring includes documenting the abundance of 4 high-calorie foods throughout the GYE: 1) winter ungulate carcasses, 2) cutthroat trout (*Oncorhynchus clarkii*) spawning numbers, 3) bear use of army cutworm moth (*Euxoa auxiliaris*) sites, and 4) whitebark pine (*Pinus albicaulis*) cone production. These protocols have been monitored and reported by the IGBST for numerous years and are reported here. Additionally, we continued monitoring the health of whitebark pine in the ecosystem in cooperation with the Greater Yellowstone Whitebark Pine Monitoring Working Group. We referenced these monitoring efforts in Appendix B. The protocol has been modified to document mortality rate in whitebark pine from all causes, including mountain pine beetle (*Dendroctonus ponderosae*).

The annual reports of the IGBST summarize annual data collection. Because additional information can be obtained after publication, data summaries are subject to change. For that reason, data analyses and summaries presented in this report supersede all previously published data. 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).

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 a centralized research group responsible for collecting, managing, analyzing, and distributing information. To meet this need, agencies formed the IGBST, a cooperative effort among the U.S. Geological Survey, National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, and the state wildlife agencies of Idaho, Montana, and Wyoming. The Eastern Shoshone and Northern Arapaho Tribes formally joined the study team in 2009. Responsibilities of the IGBST are to: (1) conduct short- and long-term research projects addressing information needs for bear management; (2) monitor the bear population, including status and trend, numbers, reproduction, and mortality; (3) monitor grizzly bear habitats, foods, and impacts of 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 can be obtained at our web site (http://www. nrmsc.usgs.gov/research/igbst-home.htm).

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, prevents duplication of effort, and pools limited economic and personnel resources.

Previous Research

Some of the earliest research on grizzlies within Yellowstone National Park was conducted by John and Frank Craighead. Their book, "The Grizzly Bears of Yellowstone" provides a detailed summary of this early research (Craighead et al. 1995). With the closing of open-pit garbage dumps and cessation of the ungulate reduction program in Yellowstone National Park in 1967, bear demographics (Knight and Eberhardt 1985), food habits (Mattson et al. 1991*a*), and growth patterns (Blanchard 1987) for grizzly bears changed. Since 1975, the IGBST has produced annual reports and numerous scientific publications (for a complete list visit http://www.nrmsc.usgs.gov/research/igbst-home.htm) summarizing the team's monitoring and research efforts within the GYE. We have obtained substantial insights into the historic distribution of grizzly bears within the GYE (Basile 1982, Blanchard et al. 1992), movement patterns (Blanchard and Knight 1991), food habits (Mattson et al. 1991*a*, IGBST 2013), habitat use (Knight et al. 1984), and population dynamics (Knight and Eberhardt 1985, Eberhardt et al. 1994, Eberhardt 1995, Schwartz et al. 2006, IGBST 2012). Nevertheless, monitoring and updating continues so that status can be reevaluated annually. A good example includes the development of a technique to better assess changes in occupied grizzly bear range (e.g., Bjornlie et al. 2014*a*).

The year 2014 was a productive year with publications of study components that contributed to the 2013 Food Synthesis Report (IGBST 2013). Gunther et al. (2014) documented the dietary breadth of grizzly bears based on literature spanning the period of 1891 through 2014. Costello et al. (2014) examined if and how grizzly bears are changing habitat selection in association with the decline of whitebark pine. Schwartz et al. (2014*a*) compared body and diet composition of grizzly bears and black bears (*Ursus americanus*) to test hypotheses related to diet quality and carrying capacity. Bjornlie et al. (2014*b*) examined changes in home-range size before and during the period of whitebark pine decline. Finally, Schwartz et al. (2014*b*) followed up on earlier investigations and concluded that the use of isotopic sulfur to estimate grizzly bear consumption of whitebark pine seeds needs further investigation. Additionally, our rebuttal to a paper that critiqued IGBST population trend analyses appeared in *Conservation Letters* (van Manen et al. 2014).

Acknowledgments

This report is a combined effort of the partner agencies and individual members of the IGBST and many individuals contributed either directly or indirectly to its preparation. To that end, we have identified author(s). We also wish to thank the following individuals for their contributions to data collection, analysis, and other phases of IGBST research; **IDFG**: B. Aber, C. Anderson, P. Atwood, A. Blackwood, R. Cavallaro, L. Cepenzski, S. Cunningham, B. Deranleau, J. Farr, K. Guy, Hendricks, Kelsey, G. Losinski, D. Petersen, A. Sorenson, N. Walker: **MSU**: S. Cherry, M. Higgs; **MTFWP**: N. Anderson, Butler, J. Cunningham, A. Nelson, O'Reilly, J. Ramsey, J. Smith, J. Smolczynski, S. Stewart; **NPS**: B. Bennett, J. Bennett, D. Bergum, N. Bowersock, N. Buckhout, S. Cain, S. Chabak, S. Consolo-Murphy, S. Dewey, J. Erwin, S. Gunther, J. Haas, J. Harmer, D. Harris, D. Houck, E. Johnston, K. Kaiser, R. Kindermann, P. Kirchner, P. Lendrum, A. May, S. Mayberry, M. McDevitt, J. Mills, J. Mohr, J. Moul, M. Overstreet, E. Reinertson, M. Renteria, J. Roper, J. Schwabedissen, K. Shields, J. Stephenson, L. Strait, S. Stewart, G. Tabacchi, K. Vanderveer, B. Whitman, K. Wilmot, J. Wilts, G. Wilson, M. Wrigley, T. Wyman, F. Young; **Pilots and Observers**: B. Ard, S. Ard, N. Cadwell, C. Calhoun, H. Leach, K. Lutz, J. Ortman, N. Peters, D. Purcell, J. Purcell, S. Robertson, B. Scates, T. Schell, H. Seaton, M. Smith, M. Steerman, D. Stinson, A. Stradley, R. Stradley, K. Tate; **Shoshone and Arapaho Tribes**: A. Lawson, L. Shakespeare, W. Thayer; USFS: J. Brandl, S. Dersseau, S. Halman, A. Pils, S. Pils, C. Pultz, D. Tyers, L. Raadt; **USFWS**: L. Connell, M. Mazur, C. Servheen; **USGS**: M. Ebinger, K. Orozco, T. Ritter, V. Stephens, S. Schmitz, C. Whitman, K. West; **WS**: M. Foster, K. Meidtke, R. Merrell; **WGFD**: G. Anderson, C. Atkinson, B. Baker, D. Brimeyer, C.

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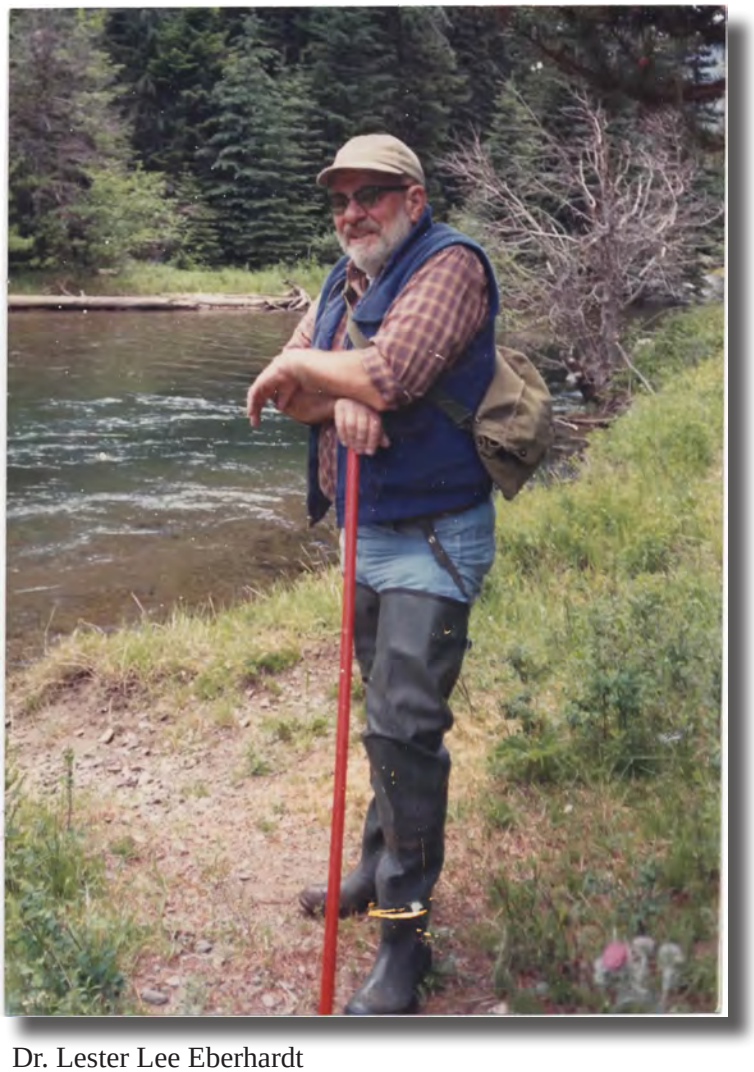
We will severely miss the contributions from Steve Cain, who retired in January 2015 after a 36-year career with the National Park Service, of which 25 years were at Grand Teton National Park. In his capacity as the Senior Wildlife Biologist for Grand Teton National Park, Steve served on the IGBST for a long time and always provided a well-reasoned voice in our scientific deliberations. Fortunately, Steve will remain active in the ecosystem as he accepted a position with the Grand Teton National Park Foundation. Another change on the Study Team was that Daryl Meints, Regional Wildlife Manager for Idaho Fish and Game, moved to a new position in Twin Falls and Curtis Hendricks, the new Regional Wildlife Manager out of Idaho Falls, now serves on the Study Team. We wish Daryl all the best in his new position.

We also want to thank Dr. Jon Swenson, Project Leader of the Scandinavian Brown Bear Project, whom we hosted for a sabbatical. The exchange of scientific ideas contributed substantially to our research program and provided us with new ideas for future investigations.

Finally, on April 22, 2015, Dr. Lester Lee Eberhardt passed away at the age of 91. Dr. Eberhardt co-authored numerous peer-reviewed papers working with former Interagency Grizzly Bear Study Team leader Dr. Richard Knight on grizzly bears demographics in the Yellowstone Ecosystem. He became world renowned for his work determining the impact of ecological changes on Yellowstone grizzly bear population, marine mammals, and long-lived vertebrates in general. Dr. Eberhardt will be sincerely missed by all his friends and colleagues in the world of grizzly bear research and management.



Dr. Lester Lee Eberhardt

BEAR MONITORING AND POPULATION TREND

Marked Animals *(Mark A. Haroldson and Chad Dickinson, U. S. Geological Survey, Interagency Grizzly Bear Study Team; and Daniel D. Bjornlie, Wyoming Game and Fish Department)*

During the 2014 field season, we captured 70 individual grizzly bears on 81 occasions (Table 1), including 16 females (8 adult), 51 males (36 adult), and 3 yearlings of unknown sex. The 3 yearlings were released without handling. Forty individuals were bears not previously marked. The percent of previously unmarked individual grizzly bears captured annually during 1998–2014 has remained relatively constant, averaging 62% although the number of individuals captured has increased (Figure 1). This result supports the notion that we are encountering new (i.e., previously unmarked) individuals at a relatively constant rate. The decline in the number of individual bears captured during 2013 and 2014 is likely related to fewer fall conflicts these last 2 years, which results in fewer management actions, and thus fewer individual bears captured annually.

We conducted research trapping for a total of 849 trap days (1 trap day = 1 trap set for 1 day) in the GYE. During research trapping operations we had 51 captures of 43 individual grizzly bears for a trapping success rate of 1 grizzly capture every 16.6 trap days.

There were 30 management captures of 29 individual bears in the GYE during 2014 (Tables 1 and 2), including 6 females (2 adults), and 23 males (15 adults). Twenty individual bears (4 females, 16 males), were relocated on 20 occasions because of conflict situations (Table 1). One yearling male was a non-target capture at a cattle depredation and was released on site. Two bears, both subadult males, were captured at research trap sites and subsequently captured at conflict sites. One of these bears was captured again at a second conflict site and was removed from the population. In total there were 9 management captures that resulted in removals (2 females, 7 males) during 2014 (Table 1).

We radio-monitored 91individual grizzly bears during the 2014 field season, including 28 adult females (Tables 2 and 3). Fifty-eight grizzly bears entered their winter dens wearing active transmitters. Three additional bears not located during the fall are considered missing (Table 3). Since 1975, 792 individual grizzly bears have been radiomarked in the GYE.

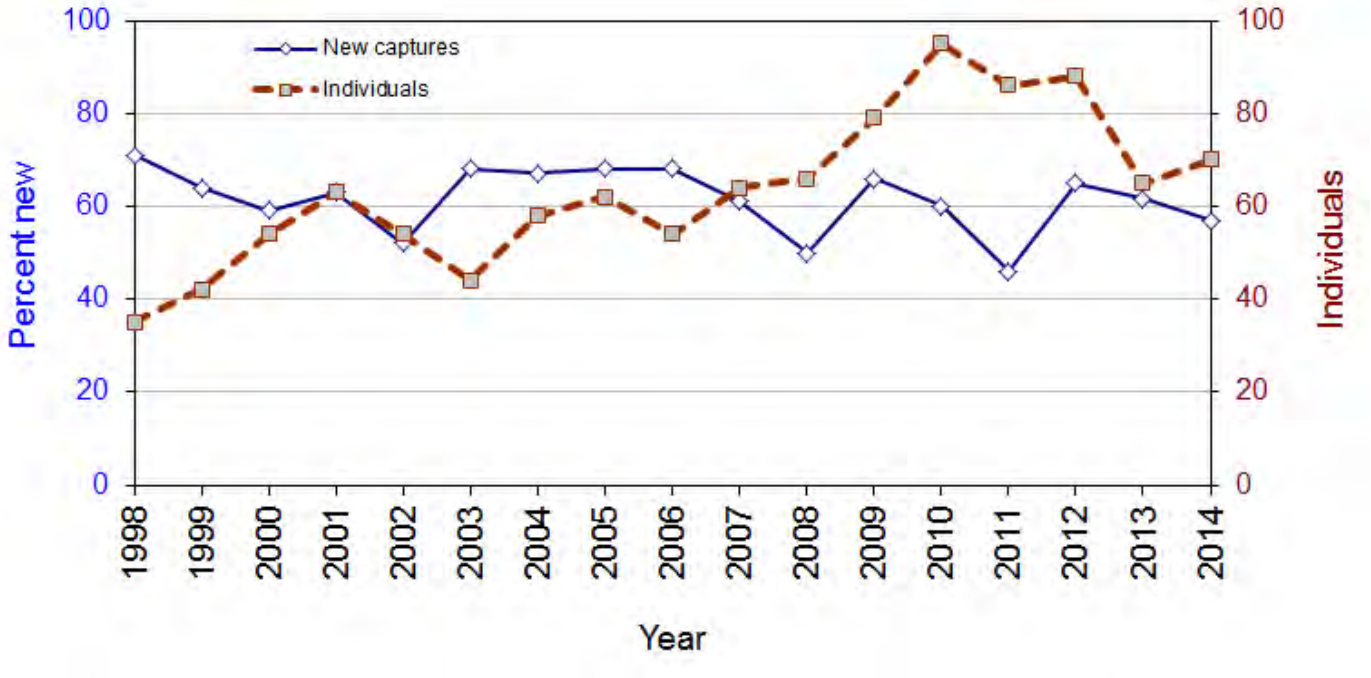


Figure 1. Percent of previously unmarked and total number of grizzly bears captured annually in the Greater Yellowstone Ecosystem, 1998–2014.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem during 2014.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site[a]	Handler[b]
369	Male	Adult	05/07/14	Cougar Crk, SNF	Research	On site	WGFD
369	Male	Adult	05/18/14	Elk Fork, SNF	Research	On site	WGFD
772	Male	Adult	05/11/14	Elk Fork, SNF	Research	On site	WGFD
773	Female	Adult	05/11/14	Cougar Crk, SNF	Research	On site	WGFD
683	Male	Adult	05/14/14	Tom Miner, PR-MT	Management	Removed	MTFWP
644	Male	Adult	05/15/14	North Fork Shoshone River, SNF	Research	On site	WGFD
774	Male	Adult	05/17/14	North Fork Shoshone River, SNF	Research	On site	WGFD
775	Male	Adult	05/19/14	Owl Crk, PR-WY	Management	Boone Crk, CTNF	WGFD
G194	Male	Adult	05/22/14	North Fork Shoshone River, SNF	Research	On site	WGFD
G195	Male	Adult	05/23/14	North Fork Shoshone River, SNF	Research	On site	WGFD
776	Male	Adult	06/05/14	Papoose Crk, PR-MT	Research	On site	IGBST
777	Male	Subadult	06/05/14	Papoose Crk, PR-MT	Research	On site	IGBST
778	Male	Adult	06/07/14	Sunlight Crk, SNF	Research	On site	WGFD
Unm1	Female	Subadult	06/08/14	Spread Crk, GTNP	Research	On site	IGBST
G196	Male	Subadult	06/09/14	Deadman Crk, SNF	Research	On site	WGFD
G196	Male	Subadult	06/11/14	Reef Crk, SNF	Research	On site	WGFD
761	Male	Adult	06/11/14	Papoose Crk, PR-MT	Research	On site	IGBST
779	Female	Subadult	06/12/14	Reef Crk, SNF	Research	On site	WGFD
760	Male	Subadult	06/25/14	Pacific Crk, GTNP	Research	On site	IGBST
760	Male	Subadult	10/10/14	Lake Crk, PR-WY	Management	North Fork Shoshone, SNF	WGFD
760	Male	Subadult	10/27/14	Clarks Fork River, ST-WY	Management	Removed	WGFD
Unm2	Unk	Subadult	06/29/14	Henry's Fork River, CTNF	Research	On site	IDFG
Unm3	Unk	Subadult	06/30/14	Henry's Fork River, CTNF	Research	On site	IDFG
713	Male	Adult	07/01/14	Henry's Fork River, CTNF	Research	On site	IDFG
Unm4	Female	Subadult	07/01/14	Henry's Fork River, CTNF	Research	On site	IDFG
780	Male	Adult	07/02/14	Crow Crk, BTNF	Management	Mormon Crk, SNF	WGFD
479	Male	Adult	07/08/14	Henry's Fork River, CTNF	Research	On site	IDFG
227	Male	Adult	07/09/14	Henry's Fork River, CTNF	Research	On site	IDFG
227	Male	Adult	07/13/14	Henry's Fork River, CTNF	Research	On site	IDFG
227	Male	Adult	07/15/14	Warm River, CTNF	Research	On site	IDFG
729	Male	Adult	07/12/14	Tepee Crk, BTNF	Management	North Fork Shoshone, SNF	WGFD
781	Male	Adult	07/15/14	Grove Crk, PR-MT	Management	Lodgepole Crk, ST-MT	MTFWP
782	Male	Subadult	07/16/14	Henrys Fork River, CTNF	Research	On site	IDFG
783	Male	Subadult	07/17/14	Pilgrim Crk, GTNP	Research	On site	IGBST
Unm5	Unk	Subadult	07/18/14	Pilgrim Crk, GTNP	Research	On site	IGBST
Unm5	Unk	Subadult	07/20/14	Pilgrim Crk, GTNP	Research	On site	IGBST

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site[a]	Handler[b]
Unm5	Unk	Subadult	07/23/14	Pilgrim Crk, GTNP	Research	On site	IGBST
Unm5	Unk	Subadult	09/24/14	Pacific Crk, GTNP	Research	On site	IGBST
784	Female	Adult	07/22/14	Antelope Crk, YNP	Research	On site	IGBST
679	Male	Adult	07/22/14	Pilgrim Crk, GTNP	Research	On site	IGBST
679	Male	Adult	09/21/14	Lizard Crk, GTNP	Research	On site	IGBST
756	Male	Adult	07/23/14	Kinky Crk, BTNF	Management	Removed	WGFD
Unm8	Male	Subadult	07/24/14	Pilgrim Crk, GTNP	Research	On site	IGBST
711	Male	Adult	07/24/14	Henrys Fork River, CTNF	Research	On site	IDFG
676	Female	Adult	07/26/14	Whiskey Crk, BTNF	Management	Fox Crk, SNF	WGFD
G197	Male	Subadult	07/27/14	Whiskey Crk, BTNF	Management	Fox Crk, SNF	WGFD
785	Male	Adult	07/28/14	Strawberry Crk, BTNF	Research	On site	WGFD
785	Male	Adult	09/08/14	Strawberry Crk, BTNF	Management	Fox Crk, SNF	WGFD
506	Male	Adult	08/02/14	Pacific Crk, GTNP	Research	On site	IGBST
G112	Male	Adult	08/02/14	South Fork Owl Crk, PR-WY	Management	Removed	WGFD
655	Male	Adult	08/03/14	Standard Crk, BDNF	Research	On site	IGBST
786	Female	Subadult	08/05/14	Papoose Crk, PR-MT	Research	On site	IGBST
610	Female	Adult	08/06/14	Pacific Crk, GTNP	Research	On site	IGBST
787	Male	Subadult	08/08/14	South Fork Fish Crk, BTNF	Management	On site	WGFD
594	Male	Adult	08/10/14	Island Park Reservior, State-ID	Management	Removed	WS/IDFG
788	Male	Subadult	08/13/14	Bull Lake Crk, WRIR	Research	On site	WGFD
789	Male	Adult	08/14/14	Wagon Crk, BTNF	Management	Sunlgiht Crk, SNF	WGFD
193	Female	Adult	08/21/14	Gibbon River, YNP	Research	On site	IGBST
790	Male	Adult	08/27/14	Gypsum Crk, BTNF	Management	Mormon Crk, SNF	WGFD
731	Male	Subadult	08/27/14	Gypsum Crk, BTNF	Management	Removed	WGFD
228	Male	Adult	08/28/14	Stephens Crk, YNP	Research	On site	YNP/IGBST
791	Male	Adult	09/07/14	Green River, BTNF	Management	North Fork Shoshone, SNF	WGFD
394	Male	Adult	09/11/14	Cascade Crk, YNP	Research	On site	IGBST
592	Male	Adult	09/11/14	Sheridan Crk, SNF	Management	Mormon Crk, SNF	WGFD
792	Male	Adult	09/18/14	Cub Crk, BTNF	Research	On site	WGFD
793	Female	Adult	09/19/14	Bailey Crk, GTNP	Research	On site	IGBST
Unm9	Female	Subadult	09/22/14	Grinnell Crk, SNF	Management	Removed	WGFD
794	Male	Adult	09/23/14	Lizard Crk, GTNP	Research	On site	IGBST
795	Male	Subadult	09/24/14	Bear Crk, PR-MT	Management	East Fork Bear Crk, GNF	WS/MTFWP
796	Male	Adult	09/28/14	Lizard Crk, GTNP	Research	On site	IGBST
G198	Male	Subadult	09/30/14	Bennett Crk, SNF	Management	North Fork Shoshone, SNF	WGFD
G199	Female	Subadult	09/30/14	Bennett Crk, SNF	Management	North Fork Shoshone, SNF	WGFD
797	Male	Adult	10/04/14	Crow Crk, BTNF	Management	Boone Crk, CTNF	WGFD
155	Male	Adult	10/06/14	North Fork Bear Crk, PR-MT	Management	Removed	MTFWP
798	Male	Subadult	10/08/14	Eaglenest Crk, PR-WY	Management	Bailey Crk, BTNF	WGFD
688	Male	Subadult	10/08/14	Cascade Crk, YNP	Research	On site	IGBST

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site[a]	Handler[b]
799	Female	Adult	10/15/14	Trout Crk, YNP	Research	On site	IGBST
800	Female	Subadult	10/23/14	Yellowstone River, PR-MT	Management	Teepee Crk, ST-MT	MTFWP
801	Female	Subadult	10/26/14	Yellowstone River, PR-MT	Management	Teepee Crk, ST-MT	MTFWP
724	Female	Adult	10/28/14	Clarks Fork River, PR-WY	Management	Removed	WGFD
G200	Male	Subadult	11/03/14	Clarks Fork River, PR-WY	Management	Blackrock Crk, BTNF	WGFD

[a] BLM = Bureau of Land Management; BTNF = Bridger-Teton National Forest; CTNF = Caribou-Targhee National Forest; GNF = Gallatin National Forest; GTNP = Grand Teton National Park; SNF = Shoshone National Forest; YNP = Yellowstone National Park; WRIR = Wind River Reservation; PR = private.
[b] IDFG = Idaho Fish and Game; IGBST = Interagency Grizzly Bear Study Team, USGS; MFWP = Montana Fish, Wildlife and Parks; WS = Wildlife Services; WGFD = Wyoming Game and Fish; YNP = Yellowstone National Park.

Biologists fit a bear with a radio collar. Photo courtesy of IGBST.

Table 2. Annual number of grizzly bears monitored, captured, and transported in the Greater Yellowstone Ecosystem, 1980–2014.

Year	Number monitored	Individuals captured	Total captures		
			Research	Management	Transports
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

Table 3. Grizzly bears radiomonitored in the Greater Yellowstone Ecosystem during 2014.

Bear	Sex	Age	Offspring	Monitored: Out of den	Monitored: Into den	Current status
741	F	Adult	1 cub	No	Yes	Active
742	M	Adult		Yes	Yes	Active
743	F	Adult	2 2-year-olds	Yes	Yes	Active
744	M	Adult		Yes	No	Cast
745	M	Subadult		Yes	No	Dead
746	M	Adult		Yes	No	Cast
750	M	Adult		Yes	No	Cast
752	M	Subadult		Yes	No	Cast
754	M	Adult		No	No	Cast
758	M	Adult		Yes	No	Cast
759	F	Adult	2 yearlings	Yes	Yes	Active
760	M	Subadult		No	No	Removed
761	M	Adult		Yes	Yes	Active
762	F	Adult	1 cub, lost	Yes	Yes	Active
763	M	Adult		No	No	Cast
766	M	Adult		Yes	No	Missing
767	F	Subadult		Yes	No	Dead
768	F	Adult	Not seen	Yes	No	Cast
769	M	Subadult		Yes	No	Cast
770	F	Adult	1 cub, lost	Yes	Yes	Active
771	F	Adult	Not seen	No	No	Cast
772	M	Adult		No	Yes	Active
773	F	Adult	None	No	Yes	Active
774	M	Adult		No	No	Cast
775	M	Adult		No	Yes	Active
776	M	Adult		No	Yes	Active
777	M	Subadult		No	Yes	Active
778	M	Adult		No	No	Cast
779	F	Subadult		No	Yes	Active
780	M	Adult		No	Yes	Active
781	M	Adult		No	No	Cast
782	M	Subadult		No	Yes	Active
783	M	Subadult		No	Yes	Active
784	F	Adult	1 yearling	No	Yes	Active
785	M	Adult		No	Yes	Active

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current status
786	F	Subadult		No	Yes	Active
787	M	Subadult		No	Yes	Active
788	M	Subadult		No	Yes	Active
789	M	Adult		No	Yes	Active
790	M	Subadult		No	Yes	Active
791	M	Subadult		No	Yes	Active
792	M	Adult		No	Yes	Active
793	F	Adult	3 cub	No	Yes	Active
794	M	Adult		No	Yes	Active
795	M	Subadult		No	Yes	Active
796	M	Adult		No	Yes	Active
797	M	Adult		No	Yes	Active
798	M	Subadult		No	Yes	Active
799	F	Adult	2 yearlings	No	Yes	Active
800	F	Subadult		No	Yes	Active
801	F	Subadult		No	Yes	Active

Estimating Number of Females with Cubs *(Mark A. Haroldson and Frank T. van Manen, U. S. Geological Survey, Interagency Grizzly Bear Study Team; and Daniel D. Bjornlie, Wyoming Game and Fish Department)*

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

Background

Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) of the Grizzly Bear Recovery Plan (USFWS 1993), IGBST is tasked with annually estimating the number of female grizzly bears with cubs in the GYE population, determining trend for this segment of the population, and estimating size of specific population segments to assess annual mortality limits. During 2011, results of our trend analysis indicated the trajectory for this annual estimate was changing (Haroldson 2012). This result triggered a demographic review (USFWS 2007*b*), which was held during February 2012. Results of this review using data from 2002–2011 indicated that several vital rates for the population had changed (IGBST 2012). A consequence of these changed vital rates was that the rate of increase for the grizzly bear population had also changed. Trend estimates using 2002–2011 vital rates suggest the population was stable to slightly increasing during the period (IGBST 2012). Because vital rates and trend had changed, it followed that age structure for the population had also changed. Thus, it is appropriate to use updated vital rates and ratios for specific population segments to estimate size of those segments and assess annual mortality limits presented in the application protocols (USFWS 2013. Here, we present our 2014 findings for the count of unique females with cubs, and the population estimate derived from that count, using the previous and updated protocols (i.e., updated protocol based on using 2002–2011 vital rates and the Demographic Monitoring Area [DMA] as the new count line).

Methods

Specific procedures used to accomplish the above-mentioned tasks under the previous protocols are presented in IGBST (2005, 2006) and Harris (2007). Under the updated protocols only females with cubs observed within the DMA (Figure 2) are counted for the Chao2 estimate. Updated vital rates and ratios for numerical estimation of specific population segments under the updated criteria are specified in IGBST (2012).

Briefly, the Knight et al. (1995) rule set is used to estimate the number of unique females with cubs and tabulate sighting frequencies for each family. We then apply the Chao2 estimator (Chao 1989, Wilson and Collins 1992, Keating et al. 2002, Cherry et al. 2007) to sighting frequencies for each unique family. This estimator accounts for individual sighting heterogeneity and produces an estimate for the total

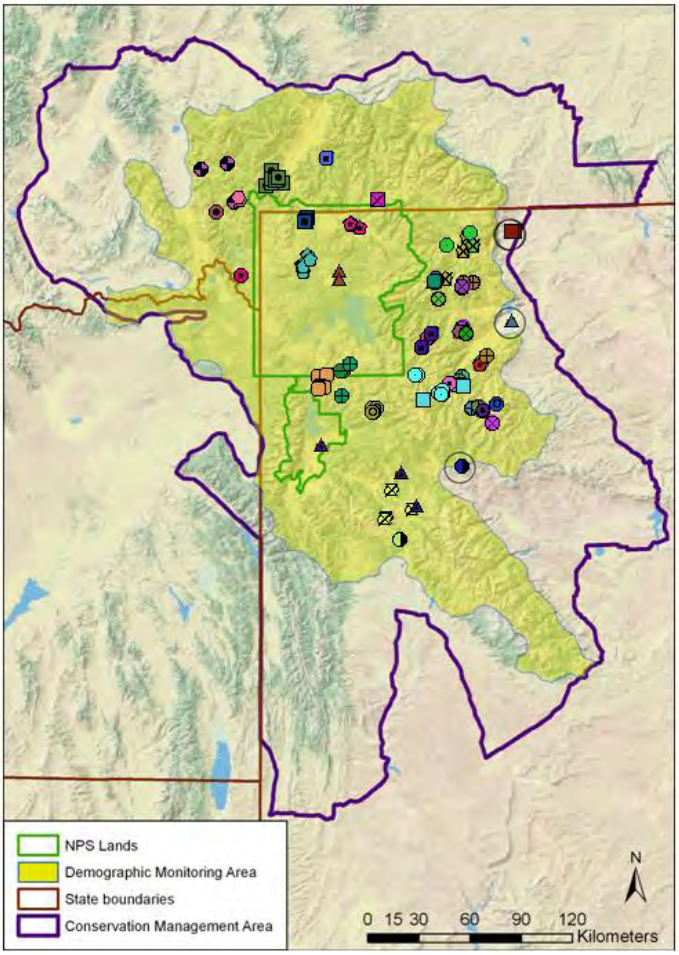


Fig. 2. Distribution of 119 sightings of 50 (indicated by unique symbols) unduplicated female grizzly bears with cubs observed in the Greater Yellowstone Ecosystem during 2014. Under previous protocols females with cubs sighted within the boundaries of the Conservation Management area are used for population estimations. Under updated protocols only sightings from females with cubs occurring within the Demographic Monitoring Area (DMA) boundary will used for population estimation. During 2014, 4 (indicated by dark circles) sightings of 3 unique females with cubs occurred outside the DMA. All 3 of these females were only observed outside the DMA and their sightings will be excluded from the Chao2 estimate of females with cubs for the DMA.

number of females with cubs present in the population. Next, we estimate trend and rate of change (λ) for the number of unique females with cubs in the population from the natural log (*Ln*) of the annual $\hat{N}_{Chao2}$ estimates using linear and quadratic regressions with model averaging (Burnham and Anderson 2002). The quadratic model is included to detect changes in trend. Model AIC (Akaike Information Criterion) will favor the quadratic model if the rate of change levels off or begins to decline (IGBST 2006, Harris et al. 2007). This process smoothes variation in annual estimates that result from sampling error or pulses in numbers of females producing cubs due to natural processes (i.e., process variation). Some changes in previous model-averaged estimates for unique females with cubs ($\hat{N}_{MAFC}$) are expected with each additional year of data. Retrospective adjustments to previous estimates are not done (IGBST 2006). Demographic Recovery Criterion 1 (USFWS 2007*b*) specifies a minimum requirement of 48 females with cubs for the current year ($\hat{N}_{MAFC}$). Model-averaged estimates below 48 for 2 consecutive years will trigger a biology and management review, as will a shift in AIC that favors the quadratic model (i.e., AIC_c weight > 0.50, USFWS 2007*b*). Given the assumption of a reasonably stable sex and age structure, trend for the females with cubs represents the rate of change for the entire population (IGBST 2006, Harris et al. 2007). It follows that estimates for specific population segments can be derived from $\hat{N}_{MAFC}$ and the estimated stable age distribution for the population. Estimates for specific population segments and associated confidence intervals follow IGBST (2005, 2006) for the previous protocol and IGBST (2012) for the updated protocol, which incorporates observed changes in vital rates during 2002–2011 and the new count line based on the DMA.

2014 Chao2 Results

We documented 119 verified sightings of females with cubs during 2014 within the previous count line (i.e., Conservation Management Area [CMA], Figure 2). Four of the sighting (3.4 %) occurred outside the DMA (Figure 2). Most observations (65.6%) were obtained from aerial sources, with ground sources contributing 34.4% of observations (Table 4). We were able to differentiate 50 unique females from the 119 sightings using the rule set described by Knight et al. (1995). Three of the 50 unique female were only observed ($n = 4$ sightings) outside the DMA. All 3 of these females had 1-cub litters. Twenty-six (21.8%) observations of 6 unique females with cubs occurred within the boundary of Yellowstone National Park (YNP). Initial observations for all 6 of these unique females were within YNP.

Total number of cubs observed during initial sightings was 96 and mean litter size was 1.92 (Table 5). There were 16 single cub litters, 22 litters of twins, and 12 litters of triplets (Table 5). No quadruplet litters were observed during 2014 (Table 5). Excluding observations that occurred outside the DMA, there were 47 unique females with a total of 93 cubs during initial sightings. Mean litters size was 1.98.

Under the previous protocol, 92 observations of 46 families were obtained without telemetry (Table 6). Using the 2014 sighting frequencies associated

Table 4. Method of observation for female grizzly bears with cubs sighted in the Greater Yellowstone Ecosystem, 2014.

Method of observation	Frequency	Percent	Cumulative percent
Fixed wing aircraft – other researcher	0	0.00	0
Fixed wing aircraft – observation flight	53	44.5	44.5
Fixed wing aircraft – telemetry flight	25	21.1	65.6
Helicopter – other researcher	0	0.0	65.6
Ground sighting	40	33.6	99.2
Trap	1	0.8	100.0
Total	119	100.0	

with these families, $\hat{N}_{Chao2}$ = 64 (Table 6). The model-averaged point estimate of females with cubs ($\hat{N}_{MAFC}$) was 62 (95% CI = 52–74) and exceeded the demographic objective of 48 specified in the demographic criteria for the GYE (USFWS 2007*b*). Our 2014 estimated population size derived from $\hat{N}_{MAFC}$ was 655 (Table 7).

Excluding the 3 families (4 sightings) that were observed on all occasions outside the DMA, there were 90 observations of 44 families obtained without the aid of telemetry. Using sighting frequencies for these families produced an estimate for unique females with cubs within the DMA of $\hat{N}_{DMAChao2}$ = 59. Using this revised estimate in our linear and quadratic regression analyses produced a model-averaged estimate of $\hat{N}_{DMAChao2}$ = 60 (95% CI 48–75). This estimate does not retrospectively exclude unique families observed outside the DMA for years prior to 2012. However, if those sighting of unique families observed outside the DMA were excluded, changes in our estimates of trend and population size would be small because nearly all females with cubs are sighted within the DMA (IGBST 2012). Applying the updated 2002–2011 vital rates to $\hat{N}_{DMAChao2}$ produces a larger estimate of population size. This is due primarily to observed increases in survival rates of independent male bears, which resulted in a 1:1 ratio of independent-aged females and males in the modeled population. Applying these updated vital rates, the resulting population estimate for the DMA was 757 (Table 7).

We used the annual $\hat{N}_{Chao2}$ for the period 1983–2014 (Table 6) to estimate the rate of population change (Figure 3) for the female with cubs segment of the population. With the 2014 addition, AIC_c weights (Table 8) exhibited essentially equal support for the linear (50.07%) and quadratic (49.93%) models. This is the first year since 2010 that model weights have shifted to slightly more support for the linear model. We do not report regression results using only the results for the DMA for 2012–2014.

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 February 2011, July 2011, and February 2012 to consider alternative approaches. An important product of these workshops was a recommendation to transition from the current protocol for estimating abundance to a mark-resight estimator using systematic flight observation data conducted since 1997. The mark-resight estimator yields an annual estimate of the number of females with cubs based on (1) the presence of a radio-marked sample, and (2) 2 systematic observation flights/year, 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 due to 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 biannual aerial surveys. 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 (Figure 4).

One important assumption of the mark-resight technique is that the geographic distribution of radio-marked females bears is generally representative of the 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 GYE annually spend 6 to 10 weeks in late summer

Table 5. Number of unique females with cubs ($\hat{N}_{Obs}$), litter frequencies, total number of cubs, and average litter size at initial observation, Greater Yellowstone Ecosystem, 1983–2014.

Year	$\hat{N}_{Obs}$	Total # sightings	Litter sizes				Total # cubs	Mean litter size
			1 cub	2 cubs	3 cubs	4 cubs		
1983	13	15	6	5	2	0	22	1.69
1984	17	41	5	10	2	0	31	1.82
1985	9	17	3	5	1	0	16	1.78
1986	25	85	6	15	4	0	48	1.92
1987	13	21	1	8	4	0	29	2.23
1988	19	39	1	14	4	0	41	2.16
1989	16	33	7	5	4	0	29	1.81
1990	25	53	4	10	10	1	58	2.32
1991[a]	24	62	6	14	3	0	43	1.87
1992	25	39	2	12	10	1	60	2.40
1993	20	32	4	11	5	0	41	2.05
1994	20	34	1	11	8	0	47	2.35
1995	17	25	2	10	5	0	37	2.18
1996	33	56	6	15	12	0	72	2.18
1997	31	80	5	21	5	0	62	2.00
1998	35	86	9	17	9	0	70	2.00
1999	33	108	11	14	8	0	63	1.91
2000	37	100	9	21	7	0	72	1.95
2001	42	105	13	22	7	0	78	1.86
2002	52	153	14	26	12	0	102	1.96
2003	38	60	6	27	5	0	75	1.97
2004	49	223	14	23	12	0	96	1.96
2005	31	93	11	14	6	0	57	1.84
2006	47	172	12	21	14	0	96	2.04
2007	50	335	10	22	18	0	108	2.16
2008	44	118	10	28	6	0	84	1.91
2009	42	117	10	19	11	2	89	2.12
2010	51	286	15	23	12	1	101	1.98
2011	39	134	13	17	9	0	74	1.90
2012	49	124	14	25	10	0	94	1.92
2013	58	183	8	35	14	3	126	2.17
2014	50	119	16	22	12	0	96	1.92

[a] One female with unknown number of cubs. Average litter size was calculated using 23 females.

Table 6. Annual estimates for the numbers of female grizzly bears with cubs, Greater Yellowstone Ecosystem, 1983–2014. 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 $\hat{N}_{Chao2}$ 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 ($n/\hat{N}_{Chao2}$), where *n* is the total number of observations obtained without the aid of telemetry.

Year	$\hat{N}_{Obs}$	m	f_1	f_2	$\hat{N}_{Chao2}$	n	$n/\hat{N}_{Chao2}$
1983	13	10	8	2	19	12	0.6
1984	17	17	7	3	22	40	1.8
1985	9	8	5	0	18	17	0.9
1986	25	24	7	5	28	82	3
1987	13	12	7	3	17	20	1.2
1988	19	17	7	4	21	36	1.7
1989	16	14	7	5	18	28	1.6
1990	25	22	7	6	25	49	2
1991	24	24	11	3	38	62	1.6
1992	25	23	15	5	41	37	0.9
1993	20	18	8	8	21	30	1.4
1994	20	18	9	7	23	29	1.3
1995	17	17	13	2	43	25	0.6
1996	33	28	15	10	38	45	1.2
1997	31	29	13	7	39	65	1.7
1998	35	33	11	13	37	75	2
1999	33	30	9	5	36	96	2.7
2000	37	34	18	8	51	76	1.5
2001	42	39	16	12	48	84	1.7
2002	52	49	17	14	58	145	2.5
2003	38	35	19	14	46	54	1.2
2004	49	48	15	10	58	202	3.5
2005	31	29	6	8	31	86	2.8
2006	47	43	8	16	45	140	3.3
2007	50	48	12	12	53	275	5.1
2008	44	43	16	8	56	102	1.8
2009	42	39	11	11	44	100	2.3
2010	51	51	11	9	56	256	4.6
2011	39	39	14	10	47	123	2.6
2012	49	44	16	7	59	110	1.9
2013	58	53	13	11	60	160	2.6
2014	50	46	23	13	64	92	1.4

Table 7. Estimates and 95% confidence intervals (CI) for population segments and total grizzly bear population size under alternative protocols, Greater Yellowstone Ecosystem, 2014.

Criteria	Segment	Estimate	95% CI	
			Lower	Upper
Previous	Independent females (≥2yrs old)	276	228	323
	Independent males (≥2yrs old)	175	135	215
	Dependent young (cubs and yearlings)	204	181	226
	Total	655	588	721
Updated	Independent females (≥2yrs old)	263	210	317
	Independent males (≥2yrs old)	263	205	321
	Dependent young (cubs and yearlings)	230	208	253
	Total	757	674	839

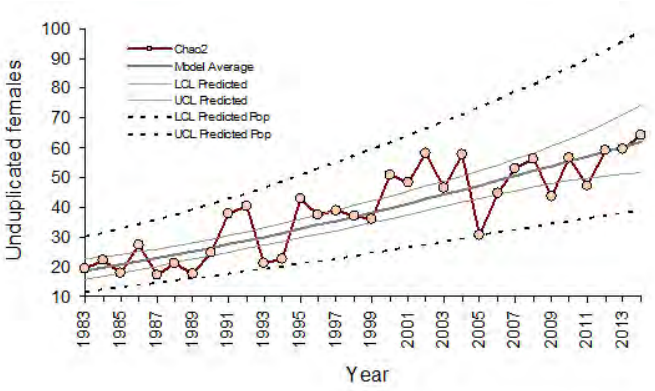


Figure 3. Model-averaged estimates for the number of unique female grizzly bears with cubs in the Greater Yellowstone Ecosystem for the period 1983–2014, where the linear and quadratic models of $Ln(\hat{N}_{Chao2})$ were fitted. The inner set of light solid lines represents a 95% confidence interval on the predicted population size, whereas the outer set of dashed lines represents a 95% confidence interval for the individual population estimates.

Table 8. Parameter estimates and model selection results from fitting the linear and quadratic models for $Ln(\hat{N}_{Chao2})$ with years for female grizzly bears with cubs-of-the-year, Greater Yellowstone Ecosystem, 1983–2014.

Model	Parameter	Estimate	Standard error	*t* value	Pr(>*t*)
Linear					
	β_0	2.95941	0.08030	35.85345	<0.0001
	β_1	0.03836	0.00425	9.03261	<0.0001
	SSE	1.47619			
	AICc	-91.58344			
	AICc weight	0.50069			
Quadratic					
	β_0	2.81154	0.12242	22.96509	<0.0001
	β_1	0.06446	0.01710	3.76861	0.00075
	β_2	-0.00079	0.00050	-1.57262	0.12665
	SSE	1.36020			
	AICc	-91.57794			
	AICc weight	0.49931			

(mid-Jul to late Sep) in alpine scree slopes feeding on army cutworm moths (*Euxoa auxiliaris*; 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 difficult. 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 m from sites where multiple observations of bears feeding occurred >1 year) from the mark-resight analyses and conduct separate aerial census surveys of confirmed moth sites to add the observed number of females with cubs (marked and unmarked) to the mark-resight estimate for that year. Here, we present 2014 mark-resight results using only sightings of females with cubs.

2014 Mark-Resight Results

Five female grizzly bears with cubs wore functioning radio-transmitters during June-August 2014 when aerial observation flights were conducted and were available for observation sighting. One of these 5 females with cubs was seen during observation flights while 12 unmarked females were observed (Table 9). Numbers of unmarked females with cubs observed (colum S, Table 9) outside of moth sites during 1997–2014 changed slightly from those used last year Table 9). This is because moth site boundaries changed slightly with the addition of the 2014 observation data, with the result that some previous observation of females with cubs were now within the updated moth site boundaries. Using the method of Higgs et al. (2013) with updated 1997–2014 data and excluding observations at army cutworm moth aggregation sites, our 2014 mark-resight estimate for unique females with cubs was 54 (95% inter-quartile range = 26–100) with a $P <$ 0.41 probability of ≤48 females with cubs (Table 10, Figure 4). Moth site only flights during 2014 yielded 19 additional unique females with cubs observed

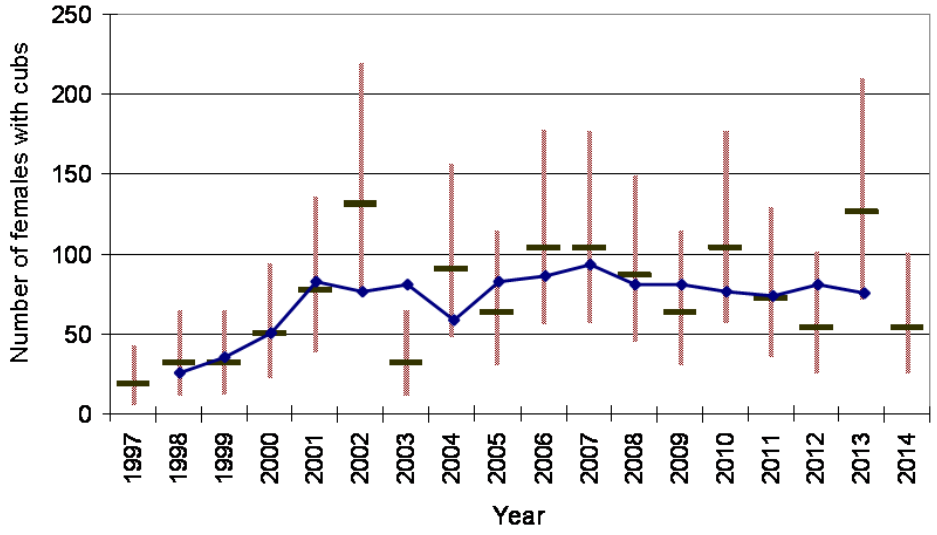


Figure 4. Annual mark-resight estimate of number (and 95 % inter quartile) of female grizzly bears with cubs, and 3-year moving average, Greater Yellowstone Ecosystem, 1997–2014. Estimates exclude females with cubs observed <500 m of army cutworm moth aggregation sites.

on moth sites, compared with 14 during 2013. The mark-resight 3-year-moving average for 2013 (using 2012–2014 results) was 78 unique females with cubs (95% inter-quartile range = 48–124), with a $P = 0.02$ probability of ≤48 females with cubs (Table 11, Figure 4).

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 our observation flight data to determine accuracy and precision of the mark-resight technique. Accuracy was high, indicating that this technique addressed the bias concerns associated with estimates based on the Chao2 estimator. However, the simulations also indicated that precision was relatively low and the authors recommended that other data sources should be considered to increase precision and decrease variability among years. One source of data that could increase sample size may be observations of females with yearlings. During the spring of 2014 we investigated the effect on precision of including observations of radio-marked and unmarked females with yearlings to the analysis. We did not observe any appreciable increase in precision, likely because of the small number of observations of both marked and unmarked females with yearlings (M. Higgs, Montana State University, personal communication, 5 May 2014). To support further implementation of the mark-resight technique, we are now focusing our research efforts on propagating different sources of variance when deriving total population estimates and determining the power of the technique to detect population trends.

Table 9. Data used in mark-resight analysis on female grizzly bears with cubs, Greater Yellowstone Ecosystem, 1997–2014, including number of radio-marked female grizzly bears available for sighting during observation flights (m), the number seen zero time (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 m of army cutworm moth aggregation sites.

Year	m	Y_0	Y_1	Y_2	S
1997	6	4	2	0	4
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[c]
2014	5	4	1	0	12

[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] Correction from previously reported value of 24.

Table 10. Results from the mark-resight analysis of female grizzly bears with cubs, Greater Yellowstone Ecosystem, 1997–2014. 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 2014. Estimates exclude females with cubs observed <500 m of army cutworm moth aggregation sites.

					Quartile		
Year	Sighted	Marked	Mean	Median	$Q_{0.025}$	$Q_{0.975}$	$P \leq 48$[a]
1997	4	6	18.1	16	6	42	0.99
1998	7	4	31.6	29	12	64	0.88
1999	7	6	31.7	29	13	64	0.88
2000	11	7	49.7	47	23	93	0.52
2001	17	8	76.9	73	40	135	0.08
2002	29	5	131.3	126	76	218	0.00
2003	7	4	31.7	29	12	64	0.88
2004	20	4	90.5	86	49	155	0.02
2005	14	3	63.3	60	31	114	0.24
2006	23	7	103.9	99	57	177	0.00
2007	23	5	104	99	58	176	0.00
2008	19	5	85.9	82	46	148	0.03
2009	14	6	63.3	60	31	114	0.24
2010	23	3	104	100	58	176	0.00
2011	16	3	72.3	69	37	128	0.12
2012	12	5	54.3	51	26	101	0.41
2013	28	10	126.5	121	72	209	0.00
2014	12	5	54.2	51	26	100	0.41

Table 11. Three-year moving average for estimated number of female grizzly bears with cubs in the Greater Yellowstone Ecosystem during 1998–2013, using the mark-resight method of Higgs et al. (2013). Estimates exclude females with cubs observed <500 m of army cutworm moth aggregation sites.

				Quartile		
Year	Mean	Median	Mode	$Q_{0.025}$	$Q_{0.975}$	$P \leq 48$[a]
1998	27.2	26	23	14	47	0.98
1999	37.7	36	33	21	63	0.84
2000	52.7	51	47	31	86	0.41
2001	85.9	83	77	53	136	0.01
2002	79.9	77	71	49	127	0.02
2003	84.4	81	78	52	134	0.01
2004	61.8	59	54	37	99	0.19
2005	85.8	83	76	53	136	0.01
2006	90.3	87	79	56	143	0
2007	97.9	94	88	61	154	0
2008	84.3	81	79	52	133	0.01
2009	84.3	81	76	52	134	0.01
2010	79.8	77	76	49	127	0.02
2011	76.8	74	73	47	123	0.03
2012	84.3	81	76	52	134	0.01
2013	78.3	76	71	48	124	0.02

Female grizzly bear with a single cub near the Clarks Fork of the Yellowstone River, Wyoming, 14 May 2014. Photo courtesy of Luke Ellsbury, WGFD.

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

Distribution 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 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. Eighteen of 18 BMUs had verified observations of female grizzly bears with young during 2014 (Table 12). Eighteen of 18 BMUs contained verified observations of females with young in at least 4 years of the last 6-year period (2009–2014).

Table 12. Bear Management Units in the Greater Yellowstone Ecosystem occupied by females with young (cubs-of-the-year, yearlings, 2-year-olds, or young of unknown age), as determined by verified reports, 2009–2014.

Bear Management Unit	2009	2010	2011	2012	2013	2014	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	5
10) Firehole/Hayden	x	x	x	x	x	x	6
11) Madison	x	x	x		x	x	5
12) Henry's Lake	x	x	x	x	x	x	6
13) Plateau	x	x			x	x	4
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	5
Totals	18	18	16	15	18	18	

Observation Flights *(Stephanie Schmitz and Karrie West, U. S. Geological Survey, Interagency Grizzly Bear Study Team)*

Fifty-four Bear Observation Areas (BOAs, Figure 5) were established in 2014 within the DMA. Two rounds of observation flights were conducted: 51 BOAs were surveyed during Round 1 (10 Jun–25 Jul) and 43 during Round 2 (7 Jul–29 Aug). Observation time was 104.0 hours for Round 1 and 88.6 hours for Round 2; average duration of flights for both rounds combined was 2.05 hours (Table 13). Four hundred seventy-three bear sightings, excluding dependent young, were recorded during observation flights. This included 8 radio-marked bears, 358 solitary unmarked bears, and 107 unmarked females with young (Table 13). Observation rate was 2.46 bears/hour for all bears. Two hundred and six young (106 cubs, 90 yearlings, and 10 2-year-olds) were observed (Table 14). Observation rates were 0.57 females with young/hour and 0.27 females with cubs/hour (Table 13).

Figure 5. Grizzly bear observation flight areas within the Greater Yellowstone Ecosystem, 2014. Numbers represent the 54 Bear Observation Areas.

Table 13. Annual summary statistics for grizzly bear observation flights conducted in the Greater Yellowstone Ecosystem, 2002–2014.

Date[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				
2002	Round 1	84.0	36	2.3	3	0	88	34	125	1.49		
	Round 2	79.3	35	2.3	6	0	117	46	169	2.13		
	Total	163.3	71	2.3	9	0	205	80	294	1.80	0.49	0.40
2003	Round 1	78.2	36	2.2	2	0	75	32	109	1.39		
	Round 2	75.8	36	2.1	1	1	72	19	93	1.23		
	Total	154.0	72	2.1	3	1	147	51	202	1.31	0.34	0.17
2004	Round 1	84.1	37	2.3	0	0	43	12	55	0.65		
	Round 2	76.6	37	2.1	1	2	94	38	135	1.76		
	Total	160.8	74	2.2	1	2	137	50	190	1.18	0.32	0.23
2005	Round 1	86.3	37	2.3	1	0	70	20	91	1.05		
	Round 2	86.2	37	2.3	0	0	72	28	100	1.16		
	Total	172.5	74	2.3	1	0	142	48	191	1.11	0.28	0.13
2006	Round 1	89.3	37	2.4	2	1	106	35	144	1.61		
	Round 2	77.0	33	2.3	3	1	76	24	104	1.35		
	Total	166.3	70	2.3	5	2	182	59	248	1.49	0.37	0.27
2007	Round 1	99.0	44	2.3	2	1	125	53	181	1.83		
	Round 2	75.1	30	2.5	0	4	96	20	120	1.60		
	Total	174.1	74	2.4	2	5	221	73	301	1.73	0.45	0.29
2008	Round 1	97.6	46	2.1	2	1	87	36	126	1.29		
	Round 2	101.5	45	2.3	2	3	185	53	243	2.39		
	Total	199.1	91	2.2	4	4	272	89	369	1.85	0.47	0.23
2009	Round 1	90.3	47	1.9	1	0	85	21	107	1.19		
	Round 2	93.6	47	2.0	2	0	157	34	193	2.06		
	Total	183.9	94	2.0	3	0	242	55	300	1.63	0.30	0.15
2010	Round 1	101.1	48	2.1	0	2	93	22	117	1.16		
	Round 2	93.3	46	2.0	0	0	161	41	202	2.16		
	Total	194.4	94	2.1	0	2	254	63	319	1.64	0.33	0.20
2011	Round 1	88.9	47	1.9	2	1	153	31	187	2.10		
	Round 2	71.0	35	2.0	4	0	109	23	136	1.92		
	Total	159.8	82	1.9	6	1	262	54	323	2.02	0.34	0.18
2012	Round 1	95.4	48	2.0	4	2	178	35	219	2.97		
	Round 2	73.7	35	2.1	2	1	117	30	150	2.04		
	Total	169.1	83	2.0	6	3	295	65	369	2.18	0.40	0.23
2013	Round 1	97.0	48	2.0	2	1	152	44	199	2.05		
	Round 2	72.8	35	2.1	4	1	171	48	224	3.08		
	Total	169.8	83	2.1	6	2	323	92	423	2.49	0.55	0.39
2014	Round 1	104.0	52	2.04	2	2	170	47	221	2.13		
	Round 2	88.6	43	2.06	3	1	188	60	252	2.84		
	Total	192.6	95	2.05	5	3	358	107	473	2.46	0.57	0.27

[a] Dates of flights (Round 1, Round 2): 2002 (12 Jun–22 Jul, 13 Jul–28 Aug); 2003 (12 Jun–28 Jul, 11 Jul–13 Sep); 2004 (12 Jun–26 Jul, 3 Jul–31 Aug); 2005 (4 Jun–26 Jul, 1 Jul–31 Aug); 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).

Table 14. Size and age composition of grizzly bear family groups seen during observation flights in the Greater Yellowstone Ecosystem, 2002–2014.

		Females with cubs (number of cubs)			Females with yearlings (number of yearlings)			Females with 2-year-olds or young of unknown age (number of young)		
Year[a]	Round	1	2	3	1	2	3	1	2	3
2002	Round 1	8	15	5	3	2	0	0	0	1
	Round 2	9	19	9	2	4	2	0	1	0
	Total	17	34	14	5	6	2	0	1	1
2003	Round 1	2	12	2	2	6	2	3	3	0
	Round 2	2	5	3	2	5	0	2	0	1
	Total	4	17	5	4	11	2	5	3	1
2004	Round 1	4	1	3	1	1	0	2	0	0
	Round 2	6	16	7	4	7	0	0	0	0
	Total	10	17	10	5	8	0	2	0	0
2005	Round 1	5	5	3	2	3	1	0	1	0
	Round 2	4	4	1	3	6	3	5	2	0
	Total	9	9	4	5	9	4	5	3	0
2006	Round 1	8	12	7	4	2	2	1	0	0
	Round 2	5	11	2	2	1	0	2	2	0
	Total	13	23	9	6	3	2	3	2	0
2007	Round 1	7	21	9	8	6	0	2	1	0
	Round 2	2	6	6	3	2	3	0	2	0
	Total	9	27	15	11	8	3	2	3	0
2008	Round 1	3	10	0	9	5	2[b]	6	2	0
	Round 2	9	21	3	7	8	3	3	2	0
	Total	12	31	3	16	13	5	9	4	0
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	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

[a] Dates of flights (Round 1, Round 2): 2002 (12 Jun–22 Jul, 13 Jul–28 Aug); 2003 (12 Jun–28 Jul, 11 Jul–13 Sep); 2004 (12 Jun–26 Jul, 3 Jul–31 Aug); 2005 (4 Jun–26 Jul, 1 Jul–31 Aug); 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).
[b] Includes 1 female with 4 yearlings.
[c] Includes 1 female with a litter of 4 cubs.

Telemetry Location Flights *(Stephanie Schmitz and Karrie West, U. S. Geological Survey, Interagency Grizzly Bear Study Team)*

Ninety-eight telemetry location flights were conducted during 2014, resulting in 312.5 hours of search time (ferry time to and from airports excluded; Table 15). Flights were conducted at least once during all months, with 77% occurring in May–November. During telemetry flights, 869 locations of bears equipped with radio transmitters were collected, 145 (16.7%) of which included a visual sighting. Thirty-four sightings of unmarked bears were also obtained during telemetry flights, including 22 solitary bears, no females with cubs, 6 females with yearlings, and 1 female with 2-year-olds. Rate of observation for all unmarked bears during telemetry flights was 0.11 bears/hour. The lack of any observations of females with cubs during telemetry flights is in contrast to the rate from the 2014 observation flights (0.27/hour).

In addition to the regular telemetry relocation flights, IGBST conducted flights to locate grizzly bears fitted with Global Positioning System (GPS) collars equipped with spread-spectrum technology (SST). These flights are not included as routine telemetry because of the additional time required to establish communication with collars and download data. From these flights, we collected 13 locations from 5 bears that were part of our regular monitoring sample. We obtained 15 locations (1 visual) from 3 grizzly bears that were part of Idaho's Department of Transportation SST project.

In an effort 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. 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. In 2014, we deployed 22 Iridium GPS collars and obtained data from an additional 7 Argos collars deployed previously, resulting in 29,867 GPS locations.

Table 15. Summary statistics for radio-telemetry flights to locate grizzly bears in the Greater Yellowstone Ecosystem, 2014.

				Radioed bears			Unmarked bears observed					
											Observation rate (groups/hour)	
								Females				
Month	Hours	Number of flights	Mean hours per flight	Number of locations	Number seen	Observation rate (groups/hr)	Lone bears	With cubs	With yearlings	With young	All groups	Females with cubs
January	13.06	5	2.61	38	0	0.00	0	0	0	0	---	---
February	6.80	3	2.27	31	0	0.00	0	0	0	0	---	---
March	17.23	5	3.45	81	1	0.01	3	0	0	0	0.05	---
April	19.44	7	2.78	77	4	0.05	1	0	0	0	0.06	---
May	41.53	13	3.19	112	24	0.21	11	0	1	1	0.30	---
June	29.93	10	3.00	74	13	0.18	1	0	1	0	0.20	---
July	34.58	11	3.14	88	28	0.32	9	0	3	0	0.40	---
August	36.92	9	4.10	71	23	0.32	2	0	0	0	0.34	---
September	37.2	10	3.72	83	19	0.23	0	0	1	0	0.24	---
October	34.60	11	3.15	96	27	0.28	0	0	0	0	---	---
November	25.57	8	3.20	80	5	0.06	2	0	0	0	0.09	---
December	15.6	5	3.12	43	0	0.00	0	0	0	0	---	---
Total	312.46	97	3.20	874	144	0.17	29	0	6	1	0.20	---

Estimating Sustainability of Annual Grizzly Bear Mortalities *(Mark A. Haroldson, Interagency Grizzly Bear Study Team; and Kevin Frey, Montana Fish, Wildlife and Parks)*

Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) of the Grizzly Bear Recovery Plan (USFWS 1993), the IGBST is tasked with evaluating the sustainability of annual grizzly bear mortalities that occur within the boundary Conservation Management Area (CMA; Figure 6). Specific procedures used to accomplish this task are presented in IGBST (2005, 2006). Briefly, the modeled-averaged annual Chao2 estimate for females with cubs and vital rates are used to estimate the size of specific population segments (see section "**Assessing Trend and Estimating Population Size from Counts of Unique Females with Cubs**", p. 11). Demographic analyses conducted by the study team indicated that several vital rates changed during 2002–2011, resulting in a slowing of population growth compared with 1983–2001 (IGBST 2012). Thus, it is important to use these updated vital rates and ratios for population segments to assess mortality limits within the Demographic Monitoring Area (DMA; see USFWS 2013). Here, we report number of mortalities inside and outside the DMA, and assess mortality limits under the previous and updated criteria.

We continue to 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 excluded from assessments of sustainability. We continue to tabulate possible mortalities because they provide an additional source of location information for grizzly bears and possible causes of mortality in the GYE.

2014 Mortality Results

We documented 28 known and probable mortalities in the GYE during 2014; 19 were attributable to human causes (Table 16). One of the documented mortalities was a cub that probably died during the fall of 2013 (Table 16). Six of the 27 known and probable losses that occurred during 2014 remain under investigation by USFWS and state law enforcement agencies (Table 16). Specific information related to these mortalities is not provided because of ongoing investigations. However, these events are included in the following summary. Nine (47.4 %) of the 19 human-caused losses involved management removals due to either livestock depredations (n = 5) or site conflicts (n = 4). Nine (47.4 %) of the human-caused losses were hunting related, including 2 mistaken identity kills by black bear hunters and 7 losses from self-defense kills, including 1 female with 2 cub. The 1 remaining human-caused loss was an adult male that was shot and left during spring black bear hunting season (Table 16). We documented 8 natural mortalities (Table 16). Three of the natural mortalities were cubs lost from 3 different radio-marked females, 3 were independent-aged bears with evidence indicating they were likely killed by other bears, 1 was apparently killed in a snow slide, and 1 likely died from a combination of maladies associated with old age and a fight with another bear (Table 16).

We evaluated mortality limits under 2 alternatives: 1) the previous protocol, which uses the CMA boundary (Figure 6) for counting mortalities and observations of females with cubs and vital rates derived during 1983–2001 for estimating size of population segments (IGBST 2005, 2006); and 2) an updated version that uses the DMA (Figure 6) for counting mortalities and females with cubs, along with vital rates derived during 2002–2011 for estimating size of population segments (IGBST 2012). All 27 of the documented known and probable mortalities during 2014 were within the CMA. Thus, for 2014, under the previous protocol of counting mortalities within the CMA there were 5 known and probable losses of independent-aged females, including 2 management removals, 1 loss of radio-instrumented bear, and 2 other reported losses (Table 17). We documented 7 management removals, 2 radioed, and 6 reported losses of independent-aged male grizzly bears within the CMA (Table 17). There were 2 documented human-caused losses of dependent young during 2014 (Table 17). Using the previous criteria specified under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and methodology presented by IGBST (2005, 2006), none of the mortality limits for the 3 population segments (i.e., dependent young from human causes,

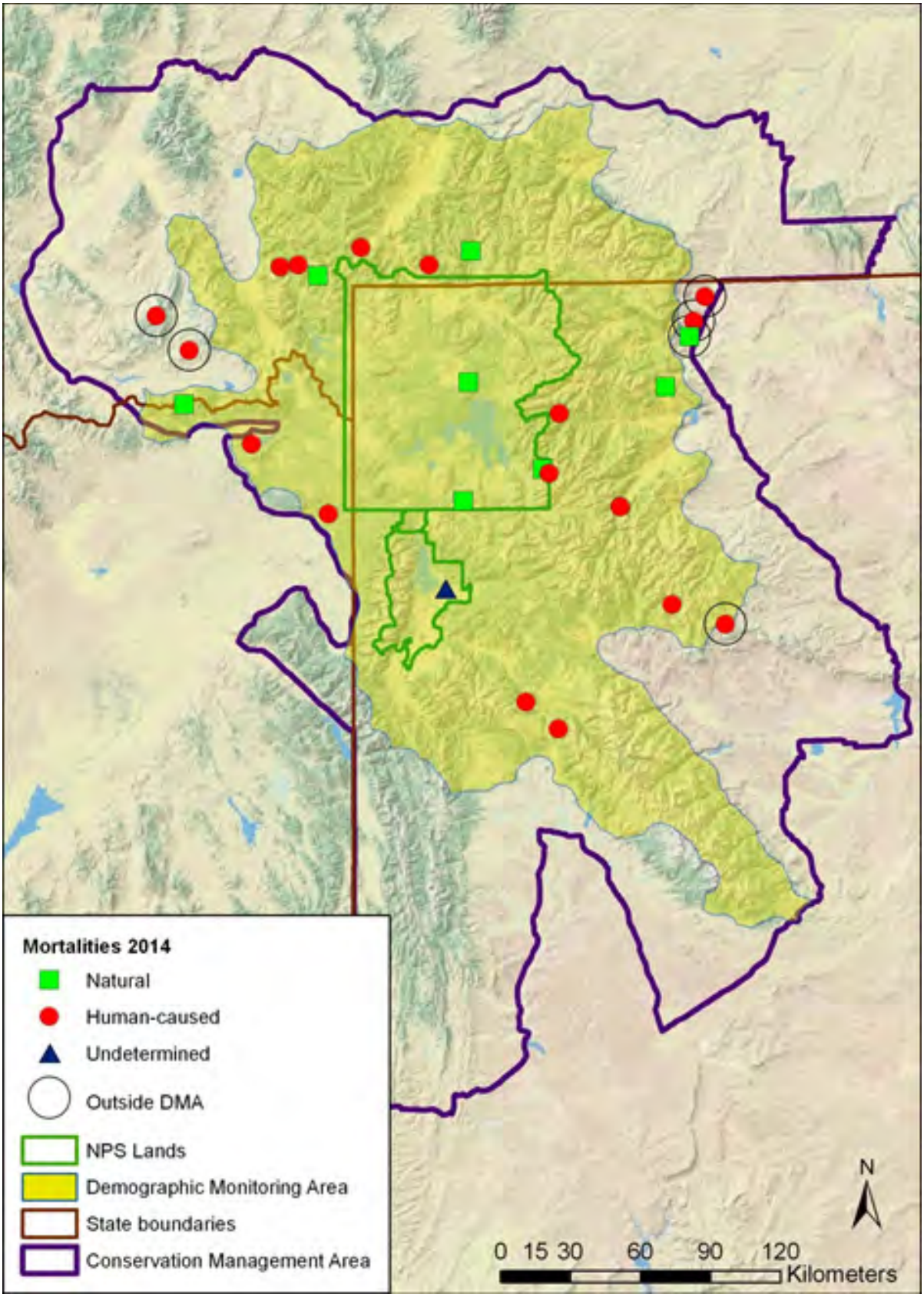


Figure 6. Distribution of 28 known and probable grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2014. Under the previous protocol mortalities occurring within the boundaries of the Conservation Management Area were counted against annual mortalities limits. Under the updated protocol known and probable mortalities occurring within the Demographic Monitoring Area (DMA) boundary will count against annual mortality limits. During 2014, 6 mortalities were documented outside the DMA, 4 were males (3 adults, 1 subadult), 1 was from an adult female, and 1 was a cub whose sex was unknown.

Table 16. Grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2014.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
201401	547	M	Adult	05/07/2014	Rock Crk, CTNF	Known	Human-caused, bear #547 killed by black bear hunter.
201402	683	M	Adult	05/14/2014	Tom Miner Crk, PR-MT	Known	Human-caused, management removal of bear #683 for numerous cattle depredations.
201403	Unm	M	Yearling	05/20/2014	Rattlesnake Crk, PR-WY	Known	Natural, killed by another bear, found by ranch manager.
201404	Unm	Unk	Cub	Fall 2013	Snake River, GTNP	Known	Undetermined cause, probably died fall 2013. Used 10/1/2013 for estimated mortality date.
201405	355	M	Adult	05/25/2014	Taylor's Fork, GNF	Known	Human-caused, malicious, shot and left.
201406				2014	MT	Known	Human-caused, hunting related, human injury. UNDER INVESTIGATION.
201407	281	M	Adult	06/04/2014	Yellowstone River, YNP	Known	Natural, bear #281died from a combination of old age and fight wounds from another bear.
201408	767	F	Subadult	06/01/2014	Howell Crk, YNP	Known	Natural, female #767 killed by another bear.
201409	756	M	Adult	07/23/2014	Kinky Crk, BTNF	Known	Human-caused, management removal of bear #756 for repeated cattle depredations.
201410	G112	M	Adult	08/02/2014	South Fork Owl Crk, PR-WY	Known	Human-caused, management removal of bear #G112 for cattle depredation.
201411	594	M	Adult	08/10/2014	Island Park Reservior, State-ID	Known	Human-caused, management removal of bear #594 for cattle depredations.
201412	731	M	Subadult	08/27/2014	Gypsum Crk, BTNF	Known	Human-caused, management removal of bear #731 for cattle depredations.
201413	745	M	Adult	Spring 2014	Spruce Crk, CTNF	Known	Natural, site evidence suggests bear #745 was caught in snow slide during spring 2014 (approximate mortality date 4/15/2014).
201414	Unm	F	Adult	09/09/2014	Shedhorn Crk, BDNF	Probable	Human-caused, self-defense kill of female with 1-2 large young.
201415				2014	WY	Known	Human-caused. UNDER INVESTIGATION
201416					Mountain Crk, BTNF	Known	Human-caused. UNDER INVESTIGATION
201417	Unm	F	Subadult	2014	WY	Known	Human-caused, live removal to zoo for repeated nuisance activities at a guest ranch.
201418	Unm	Unk	Adult	09/23/2014	Grizzly Crk, GNF	Known	Natural, likely killed by another bear. Outfitter reported dead bear Hellroaring Crk GNF, verified by MTFWP. Samples obtained for DNA determination of sex.
201419	155	M	Adult	10/06/2014	North Fork Bear Crk, PR-MT	Known	Human-caused, management removal of bear #155 for repeated property damage and food rewards.

Table 16. Continued.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
201420	760	M	Subadult	10/27/2014	Clarks Fork River, ST-WY	Known	Human-caused, management removal of bear #760 for repeated property damage and food rewards.
201421	724	F	Adult	10/28/2014	Clarks Fork River, PR-WY	Known	Human-caused, management removal of bear #724 for repeated conflicts and close proximity to developed areas and people.
201422	Unm	M	Adult	10/27/2014	West Fork Ruby River, BDNF	Known	Human-caused, reported self-defense kill by hunters.
201423				2014	WY		UNDER INVESTIGATION.
201424				2014	WY		UNDER INVESTIGATION.
201425				2014	WY		UNDER INVESTIGATION.
201426	Unm	Unk	Cub	05/26/2014	Snake River, YNP	Probable	Natural, cub of bear #770 lost between 5/20 and 6/1. Mortality date is midpoint between last date cub was seen and first date #770 was seen without her cub. Location is approximate, estimated from average telemetry location for the period last seen with cub to first seen without cub.
201427	Unm	Unk	Cub	06/02/2014	Paint Crk, PR-WY	Probable	Natural, cub of bear #724 lost between 5/14 and 6/21. Mortality date is midpoint between last date cub was seen with and first date #724 was seen without her cub. Location is approximate, estimated from average telemetry location for the period last seen with cub to first seen without cub.
201428	Unm	Unk	Cub	06/19/2014	Slide Crk, GNF	Probable	Natural, cub of bear #762 lost between 5/29 and 7/9. Mortality date is midpoint between last date her cub was seen and first date #762 was seen without cub. Location is approximate, estimated from average telemetry location for the period last seen with cub to first seen without cub.

[a] Unm = unmarked bear; number indicates bear number, Mkd = previously marked bear but identity unknown.
[b] Unk = Unknown sex
[c] Unk = Unknown age
[d] BDNF = Bridger-Teton National Forest, BLM = Bureau of Land Management, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, YNP = Yellowstone National Park, Pr = private.

independent females, or independent males) were exceeded in 2014 (Table 17). However, at this writing the sex of 1 independent aged bear from within the CMA has not yet been resolved and is pending DNA results. If this bear is determined to be male, then the male sustainable mortality limits under the previous protocol will be exceeded by 1, whereas the male mortality limit under the updated protocol would remain under the limit. If this bear is determined to be female, mortality of females would remain under the limit for both protocols.

One of the 5 documented mortalities of independent-aged females occurred outside the DMA during 2014. Four of 15 known and probable mortalities documented for independent-aged males during 2014 occurred outside the DMA count line (Figure 6). Under the updated protocols of counting mortalities against thresholds only when they occur within the DMA, there was 1 management removal, 1 radio-instrumented loss, and 2 reported losses for independent-aged females during 2014 (Table 17). We documented 5 management removals, 2 radioed, and 4 reported losses of independent-aged males within the DMA (Table 17). There were 2 human-caused losses of dependent young (Table 17). Using the DMA count line and updated estimates for population segments and sustainable levels of independent female mortality described in IGBST (2012), none of the mortality thresholds for independent females, independent males, or dependent young were exceeded in 2014 (Table 17).

Three of the documented mortalities from 2011 remain under investigation, as does 1 from 2012, and 4 from 2013. None of the mortalities documented during 2010 remain under investigation. Specific information pertaining to closed mortality investigations will be updated in the respective Mortality Lists (http://www.nrmsc.usgs.gov/science/igbst/) 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.

Table 17. Annual size estimates ($\hat{N}$) for population segments and evaluation of mortality limits for known and probable mortalities documented during 2014 under previous protocols, and using updated vital rates and the Demographic Monitoring Area boundary (DMA). Previous mortality thresholds (USFWS 2007*b*) were 9%, 9%, and 15% for dependent young and independent (≥2) females and independent males, respectively, within the Conservation Management area. Updated mortality limits are 7.6%, 7.6%, and 15% of the updated population estimates (i.e., based on updated vital rates derived using 2002–2012 data) for dependent young, independent females, and independent males, respectively, within the DMA boundary. Only human-caused losses are counted against the mortality threshold for dependent young.

Protocol	Population segment	$\hat{N}$	Human-caused loss	Sanctioned removals (a)	Radiomarked loss (b)	Reported loss	Estimated[a] reported and unreported loss (c)	Estimated total mortality (a + b + c)	Annual mortality limit	Mortality threshold status
Previous	Dependent young	204	2						18	Under
	Females 2+	276	4	2	1	2	5	8	25	Under
	Males 2+	175	13	7	2	6[b]	15	24	26	Under
Updated	Dependent young	230	2						18	Under
	Females 2+	263	3	1	1	2	5	7	20	Under
	Males 2+	263	9	5	2	4	10	17	39	Under

[a] Method of estimating unknown, unreported mortality from Cherry et al. (2002).

[b] Sex of 1 independent-aged bear from within the DMA has not yet been resolved and is pending DNA results. If sex is determined to be male, then the male sustainable mortality limits under the previous protocol will be exceeded by 1, whereas the male mortality limit under the updated protocol would remain under the limit, as would female limits under both protocols.

Key Foods Monitoring

Spring Ungulate Availability and Use by Grizzly Bears in Yellowstone National Park *(Kerry Gunther and Travis Wyman, Yellowstone Center for Resources, Yellowstone National Park)*

Ungulate carrion is frequently consumed by grizzly bears in the GYE (Mealey 1975, Green 1994, Mattson 1997). The number of ungulate carcasses available to grizzly bears during the spring is correlated with measures of snow-water equivalency (depth, density, and moisture content) in the snowpack (Podruzny et al. 2012). Competition with reintroduced wolves (*Canis lupus*) for carrion and changes in bison (*Bison bison*) and elk (*Cervus elaphus*) management policies in the GYE have the potential to affect carcass

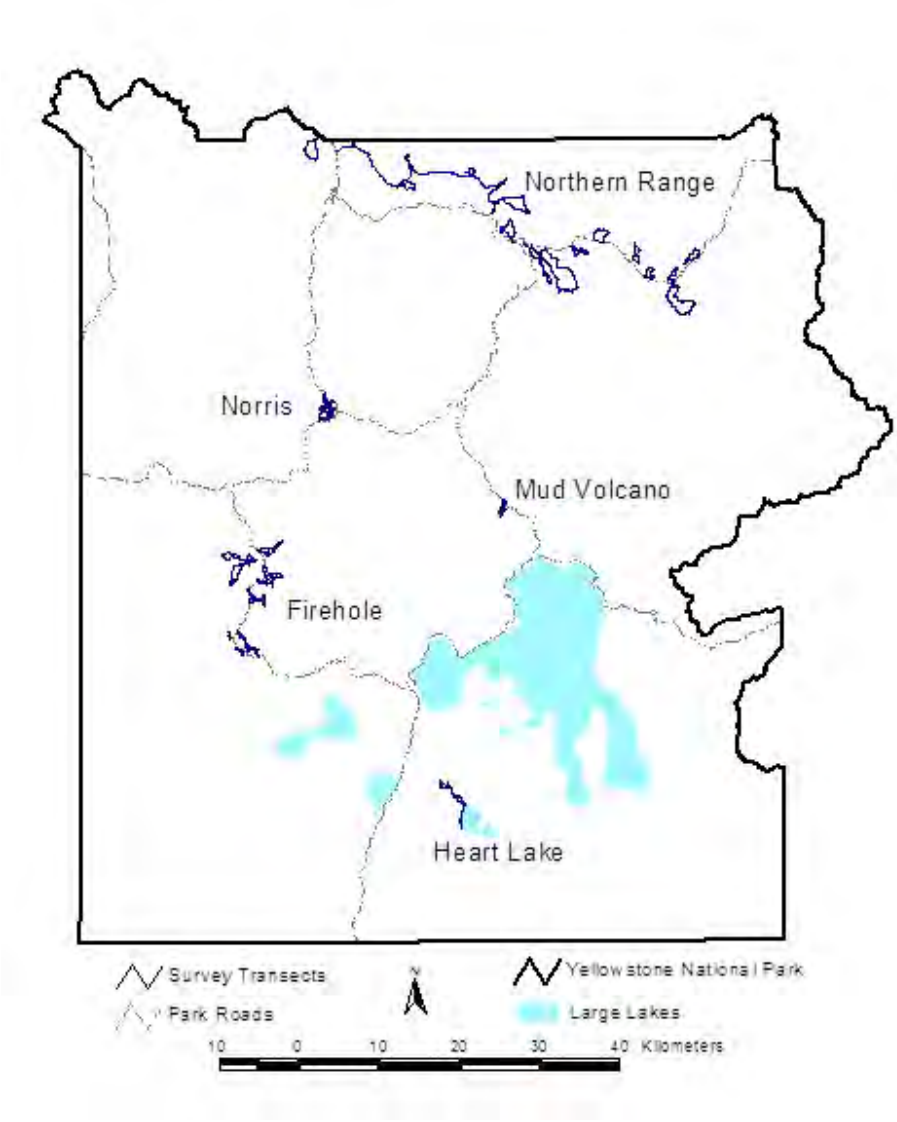


Figure 7. Spring ungulate carcass survey transects in 5 ungulate winter ranges of Yellowstone National Park, 2014.

availability and use by grizzly bears. Therefore, we continue to survey historic carcass transects in Yellowstone National Park. In 2014, we surveyed 26 routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses (Figure 7). We surveyed each route once for carcasses between 8 April and 2 June. Because spring snow depths influence ungulate distribution and the area we can survey, we use a GPS to accurately measure the actual distance traveled on each route each year. At each carcass, we collected a site description (i.e., location, aspect, slope, elevation, habitat type, distance to forest edge), carcass data (i.e., species, age, sex, cause of death), and information about scavengers using the carcasses (i.e., evidence of scavenger species present, percent of carcass consumed). We were unable to calculate the actual biomass consumed by bears, wolves, or other large scavengers with our survey methodology.

Table 18. Ungulate carcasses found and visitation of carcasses by bears, wolves, and unknown large carnivores along surveyed routes in Yellowstone National Park during spring 2014.

Survey area (# routes)	Elk				Bison				Bighorn sheep, pronghorn, and mule deer				Total carcasses/ km
	Number of carcasses	# Visited by species			Number of carcasses	# Visited by species			Number of carcasses	# Visited by species			
		Bear	Wolf	Unknown		Bear	Wolf	Unknown		Bear	Wolf	Unknown	
Northern Range (12)	18	5	3	11	6	4	3	3	13[a]	2	1	8	0.26
Firehole (8)	0	0	0	0	13	13	2	0	0	0	0	0	0.18
Norris (4)	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Heart Lake (3)	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Mud Volcano (1)	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Total all winter ranges	18	5	3	11	19	17	5	3	13	2	1	8	0.19

[a] Eleven mule deer and two pronghorn.

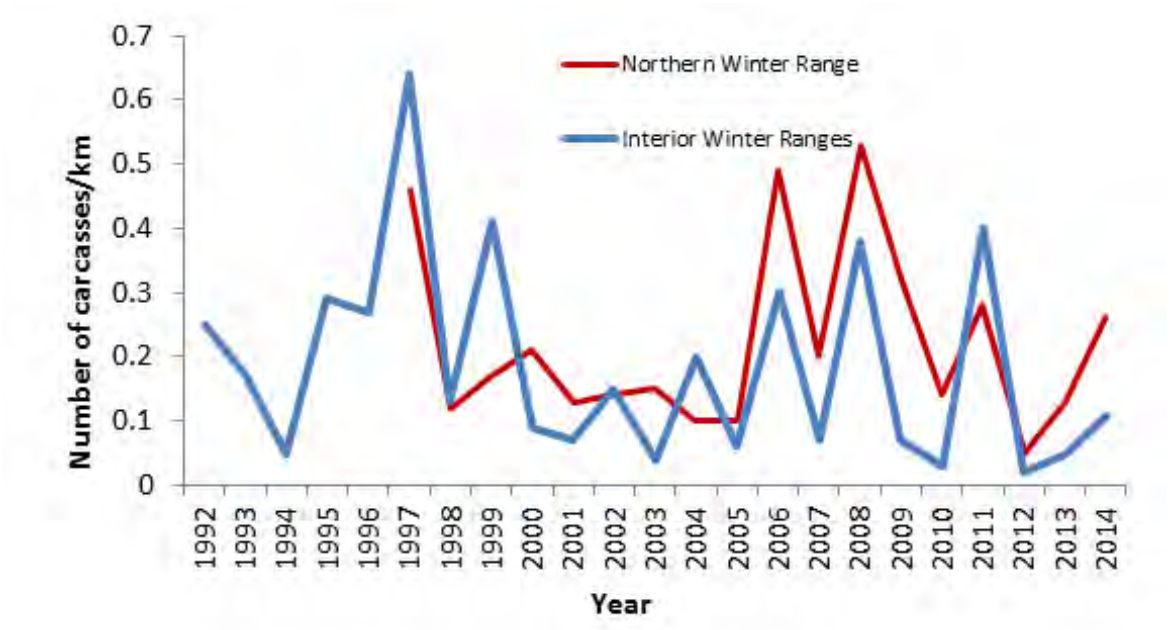


Figure 8. Annual ungulate carcasses/km found on spring survey routes on the northern winter range and interior winter ranges of Yellowstone National Park, 1992–2014.

In 2014, we recorded 50 ungulate carcasses on 265.9 km of survey routes, for a total of 0.19 ungulate carcasses/km surveyed (Table 18). The number of carcasses/km recorded in 2014 (0.19) was higher than the number counted the previous 2 years (Figure 8).

Northern Ungulate Winter Range

We surveyed 10 routes on Yellowstone's Northern Range totaling 143.9 km traveled. One route was not surveyed to avoid disturbing an active wolf den. Two additional routes were not surveyed due to time constraints. We counted 37 carcasses, including 18 elk, 6 bison, 11 mule deer (*Odocoileus hemionus*), and 2 pronghorn (*Antilocapra americana*), which equated to 0.26 ungulate carcasses/km of survey route (Table 18). Sex and age of carcasses found are shown in Table 19. Thirty-four of the 37 carcasses were 76–99% consumed by scavengers when we found them. One carcass was 51–75% consumed when found. Two carcasses were <25% consumed. Two elk carcasses had evidence of scavenging by grizzly bears, 1 elk carcasses had evidence of consumption by a black bear. Two elk carcasses were scavenged by bears but the species of bear could not be identified. Three of the elk carcasses had been scavenged by wolves. Four of the bison carcasses had been scavenged by grizzly bears, 3 of the 4 also had evidence of scavenging by wolves. Two mule deer carcass had been scavenged by bears that could not be identified to species. One mule deer carcass had been scavenged by wolves. The species that scavenged 21 of the carcasses could not be determined. A grizzly bear was observed on 1 survey route. Grizzly bear sign (e.g., tracks, scats, daybeds, rub trees, or feeding activity) was observed along 9 of the 10 survey routes. We identified 15 bear feeding sites along the survey routes. Four primary feeding activities were identified at these locations: 1) scavenging ungulate carcasses (elk, bison, and mule deer), 2) consuming geothermal soil, 3) digging spring beauty (*Claytonia* spp.) corms, and 4) grazing emergent graminoids. One bear scat containing rosehips (*Rosa* spp.) was also found.

Interior Winter Ranges

We surveyed a total of 122.0 km along 16 survey routes in 4 thermally influenced interior ungulate winter ranges including the Firehole River area, Norris Geyser Basin, Heart Lake area (Witch Creek and Rustic Geyser Basin and associated thermal areas), and Mud Volcano Geyser Basin. We documented 13 bison carcasses for a total of 0.11 carcasses/km of survey route. Grizzly bear activity was documented along 15 of the 16 survey routes.

Table 19. Age classes and sex of elk and bison carcasses found, by area, along surveyed routes in Yellowstone National Park during 2014.

	Elk						Bison					
	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total
Age												
Adult	14	0	0	0	0	14	4	11	0	0	0	15
Yearling	1	0	0	0	0	1	2	1	0	0	0	3
Calf	3	0	0	0	0	3	0	0	0	0	0	0
Unknown	0	0	0	0	0	0	0	1	0	0	0	1
Sex												
Male	5	0	0	0	0	5	1	3	0	0	0	4
Female	5	0	0	0	0	5	2	10	0	0	0	12
Unknown	8	0	0	0	0	8	2	0	0	0	0	2

Firehole River Area

We surveyed 8 routes in the Firehole drainage in the central interior of the park covering 73.0 km. We found 13 bison carcasses (0.18 carcasses/km). Sex and age of carcasses found are shown in Table 19. Ten of the carcasses were 76–99% consumed by scavengers when we found them, 1 carcass was 51–75% consumed, and 2 carcasses were <25% consumed. Twelve of the bison carcasses had evidence of being scavenged by grizzly bears and 1 carcass had been scavenged by an unknown species of bear. Two of the carcasses that had been scavenged by grizzly bears also had evidence of scavenging by wolves. A grizzly bear was observed on 1 of the 8 survey routes. Grizzly bear sign (e.g., tracks, scats, daybeds, or feeding sites) was observed along all 8 survey routes. We identified 23 bear feeding sites along the survey routes. Four primary feeding activities were identified at these locations: 1) scavenging bison carcasses, 2) digging spring beauty corms, 3) digging earthworms (*Lumbricidae*), and 4) digging pocket gophers (*Thomomys talpoides*) and their root food caches.

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin in the central interior of the park traveling 20.7 km. No ungulate carcasses were observed. Grizzly bear sign (e.g., tracks, scats, daybeds, or feeding activity) was observed along 3 of the 4 survey routes. We identified 2 feeding sites along the survey routes. Grizzly bears had dug earthworms at both sites.

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin in the south central interior of the park covering 22.1 km. No ungulate carcasses were observed. Grizzly bears were observed on 2 of the 3 surveys. Grizzly bear sign, including tracks, scats, and feeding sites were observed on all 3 survey routes. Four different individual adult grizzly bears were observed. These bears were grazing emergent graminoids and clover (*Trifolium* spp.) in areas with thermally warmed soils and digging oniongrass bulbs (*Melica* spp.) and earthworms. We identified 16 bear feeding sites along the survey routes. Six feeding activities were identified at these locations: 1) digging earthworms, 2) grazing newly emerging graminoids and clover in thermally warmed soils, 3) consuming geothermal soil, 4) digging spring beauty corms, 5) digging oniongrass bulbs, and 6) digging pocket gophers and their root food caches.

Mud Volcano

We surveyed a single route in the Mud Volcano thermal area of the central interior of the park covering 6.2 km. No ungulate carcasses were observed. A grizzly bear and grizzly sign including tracks, scats, and feeding sites were observed along the survey route. We identified 3 bear feeding sites. Three primary feeding activities were observed in the Mud Volcano area: 1) digging spring beauty bulbs, 2) digging earth worms, and 3) consuming geothermal soil.

Discussion

The number of carcasses observed per km of survey route on the northern ungulate winter range (0.26 carcasses/km) and on interior ungulate winter ranges (0.11 carcasses/km) was higher in 2014 than the previous 2 years. In addition to scavenging elk, bison, and mule deer carcasses, grizzly bears grazed emerging grasses, sedges and clover in thermally warmed soils and dug for spring beauty corms, melica bulbs, earthworms, and pocket gophers and their root food caches. Bears also consumed geothermal soil. Ingestion of geothermal soil may restore beneficial microflora to the intestines after winter dormancy, remedy post-hibernation potassium deficiency, provide high levels of magnesium, or act as an anti-diarrheal during the spring period of high ungulate tissue consumption (Mattson et al. 1999).

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

In spring and early summer, grizzly bears with home ranges around Yellowstone Lake feed on spawning Yellowstone cutthroat trout (YCT, *Oncorhynchus clarkii*) during years when trout are abundant in tributary streams (Gunther et al. 2014). Bears also occasionally prey on cutthroat trout in other areas of the park, including Fan Creek (westslope cutthroat trout, YCT, or westslope × YCT hybrid) in the northwest section of the park and the inlet creek to Trout Lake (YCT or YCT × rainbow trout hybrids) located in the northeast section of the park.

Non-native lake trout (*Salvelinus namaycush*), whirling disease caused by an exotic parasite (*Myxobolus cerebralis*), and drought have substantially reduced the native YCT population and associated bear fishing activity (Haroldson et al. 2005, Koel et al. 2005, Koel et al, 2006). The combined effect of all these factors has reduced the Yellowstone Lake cutthroat trout population by 90% (Koel et al. 2010*a*). Due to the past use of YCT as a food source by some grizzly bears, and the cutthroat trout decline caused by lake trout, whirling disease, and drought, monitoring of the cutthroat trout population is a component of the bear foods and habitat monitoring program of the Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (USFWS 2003). The cutthroat trout population is monitored through counts at a fish trap located on Clear Creek on the east-shore of Yellowstone Lake, and through visual stream surveys conducted along North Shore and West Thumb tributaries of the lake (Figure 9). Visual stream surveys are also conducted along the Trout Lake inlet creek in the northeast section of the park. In 2014, we added 4 Yellowstone Lake backcountry spawning streams to our YCT monitoring program.

Yellowstone Lake

Fish Trap Surveys—The number of spawning YCT migrating upstream are counted most years from a weir with a fish trap located at the mouth of Clear Creek on the east side of Yellowstone Lake (Figure 10 , Koel et al. 2005). The fish trap is generally installed in May, the exact date depending on winter snow accumulation, weather conditions, and spring snow melt. Fish are counted by dip netting trout that enter the upstream trap box or visually counting trout as they swim through wooden chutes attached to the trap. An electronic fish counter is also periodically used. In 2008, unusually high spring run-off damaged the Clear Creek weir and necessitated its removal. Due to removal of the weir, counts of the number of spawning cutthroat trout ascending Clear Creek have not been obtained since 2007. In the fall of 2012, the weir was removed, stream banks stabilized, and a suitable platform for an electronic sonar fish counter was installed. Installation and calibration of the sonar fish counter began in the summer 2013 and continued through 2014. It is anticipated that the sonar fish counter will be fully operational sometime in the next few years.

Front Country Visual Stream Surveys—Beginning as early as mid-April, several streams including Lodge Creek, Hatchery Creek, Incinerator Creek, Wells Creek, and Bridge Creek, on the North Shore of Yellowstone Lake, and Sandy Creek, Sewer Creek, Little Thumb Creek, and unnamed creek #1167 in the West Thumb area are checked periodically to detect the presence of adult YCT (Andrascik 1992, Olliff 1992). Once adult YCT are found (i.e., onset of spawning), weekly surveys of cutthroat trout in these streams are conducted. Sample methods follow Reinhart (1990), as modified by Andrascik (1992) and

Grizzly bear near a stream. Drawing courtesy of Donna Sullenger, USFS.

Figure 9. Map of Yellowstone Lake cutthroat trout spawning streams surveyed in 2014.

Olliff (1992). In each stream on each sample day, a minimum of two people walk from the stream mouth to the upstream extent that fish are observed and record the number of adult trout observed. Sampling continues one day per week until two consecutive weeks when no trout are observed in the creek (i.e., end of spawn). The length of the spawning season is calculated by counting the number of days from the first day spawning trout are observed through the last day spawning trout are observed. The average number of spawning cutthroat trout counted per stream survey conducted during the spawning season is used to identify annual trends in the number of cutthroat trout spawning in Yellowstone Lake tributaries.

Data collected in 2014 continued to show low numbers of spawning YCT in North Shore and West Thumb tributary streams (Table 20). In North Shore streams, only 23 spawning YCT were counted. Fourteen spawning YCT were counted in Lodge Creek, 8 in Bridge Creek, and 1 in Hatchery Creek. No spawning YCT were observed in Incinerator Creek or Wells Creek. No evidence (observations of bears fishing, fish parts, bear scats containing fish parts) of bear fishing activity was observed along any of

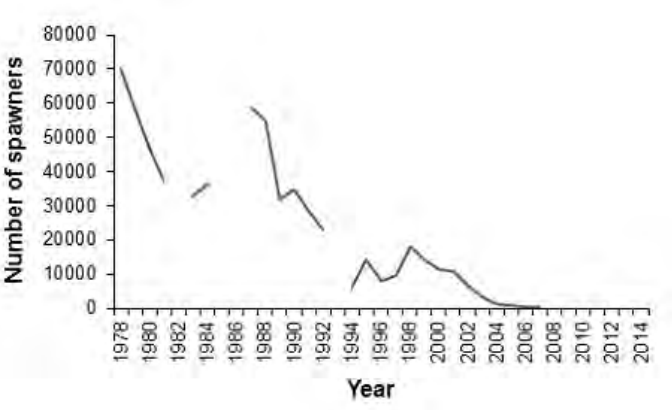


Figure 10. Number of spawning cutthroat trout counted at the Clear Creek fish trap on the east shore of Yellowstone Lake, Yellowstone National Park, 1977–2014.

the surveyed North Shore streams in 2014. On West Thumb streams, 141 spawning YCT were counted in Little Thumb Creek. No spawning cutthroat trout were observed in Sandy Creek, unnamed creek #1167, or Sewer Creek. A grizzly bear was observed along Sandy Creek on May 29. Grizzly bear tracks and a bear scat were found on Creek #1167 on May 29 and another scat on June 11. Grizzly bear tracks were observed on Little Thumb Creek on June 5 and 11. None of the bear scats observed contained fish parts. No evidence (observations of bears fishing, fish parts, bear scats containing fish parts) of grizzly bear fishing activity was observed along any of the surveyed West Thumb streams in 2014. The number of spawning YCT counted in the North Shore (Figure 11) and West Thumb (Figure 12) streams has decreased substantially since 1989. The 141 spawning YCT counted in Little Thumb Creek, is considerably higher than counts in recent years, suggesting that YCT numbers in this stream may be starting to recover.

Backcountry Visual Stream Surveys—In 2014, we added 4 backcountry tributary streams to our Yellowstone Lake spawning stream monitoring program. Backcountry stream surveys follow the same methods used on front-country streams. We surveyed Flat Mountain Creek, unnamed creek #1141, unnamed creek #1138, and Columbine Creek. We chose Flat Mountain Creek, creek #1138, and Columbine Creek because when surveyed in the late 1990s they had high numbers of spawning YCT and were frequented by more individual bears than most creeks around the lake (Haroldson et al. 2005). Creek #1141 was chosen because it is conveniently located between Flat Mountain Creek and creek #1138 making it efficient to survey. In backcountry streams 65 spawning YCT were counted. Sixty-two spawning YCT were counted in Creek #1138, 2 in Creek #1141, and 1 in Flat Mountain Creek. No spawning cutthroat trout were observed in Columbine Creek. On June 20, grizzly bear tracks were observed on Flat Mountain Creek and bear scats were found on Creek #1141 and Columbine Creek. No evidence (observations of bears fishing, fish parts, bear scats containing fish parts) of bear fishing activity was observed along any of the surveyed backcountry streams in 2014.

Trout Lake

Visual Stream Surveys—Beginning in mid-May of each year, the Trout Lake inlet creek is checked once per week for the presence of spawning cutthroat trout (or cutthroat × rainbow trout hybrids). Once spawning trout are detected, weekly surveys of adult trout in the inlet creek are conducted following the procedures for visual stream surveys described previously.

In 2014, the first movement of spawning trout from Trout Lake into the inlet creek was observed on June 13. The spawn lasted approximately 35 days with the last spawning trout being observed in the inlet

Table 20. Start of spawn, end of spawn, duration of spawn, and average number of spawning cutthroat trout counted per survey in North Shore and West Thumb spawning tributaries to Yellowstone Lake, Yellowstone National Park, 2014.

Stream	Start of spawn	Last day of spawn	Duration of spawn (days)	Number of surveys during spawning period	Number of fish counted	Average fish/survey
North Shore Streams						
Lodge Creek	05/29/14	06/04/14	7	2	14	7.0
Hotel Creek			Not surveyed			
Hatchery Creek	05/28/14	05/28/14	1	1	1	1.0
Incinerator Creek			No spawn			
Wells Creek			No spawn			
Bridge Creek	05/28/14	06/04/14	8	2	8	4.0
Weasel Creek			Not surveyed			
Sand Point Creek			Not surveyed			
West Thumb Streams						
1167 Creek			No spawn			
Sandy Creek			No spawn			
Sewer Creek			No spawn			
Little Thumb Creek	06/11/14	06/25/14	15	3	141	47.0
Total Front-Country[a]				8	164	20.5
Backcountry Streams						
Flat Mountain Creek	06/13/14	06/13/14	1	1	1	1.0
#1141 Creek	06/06/14	06/06/14	1	1	2	2.0
#1138 Creek	06/06/14	06/13/14	8	2	62	31.0
Columbine Creek			No spawn			
Total Backcountry				4	65	16.3
Northern Range Stream						
Trout Lake Inlet	06/13/14	07/17/14	35	5	204	40.8

[a] Total for North Shore and West Thumb Streams that had a spawn.

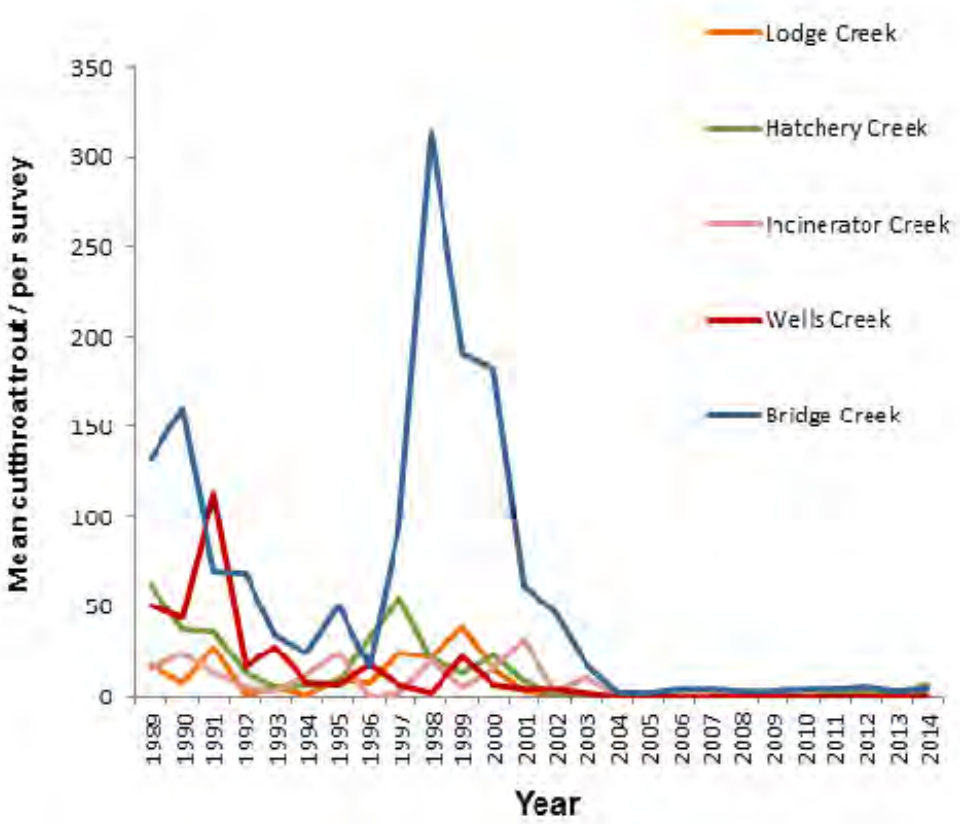


Figure 11. Mean number of spawning cutthroat trout observed during weekly visual surveys of 5 North Shore spawning streams tributary to Yellowstone Lake, Yellowstone National Park, 1989–2014.

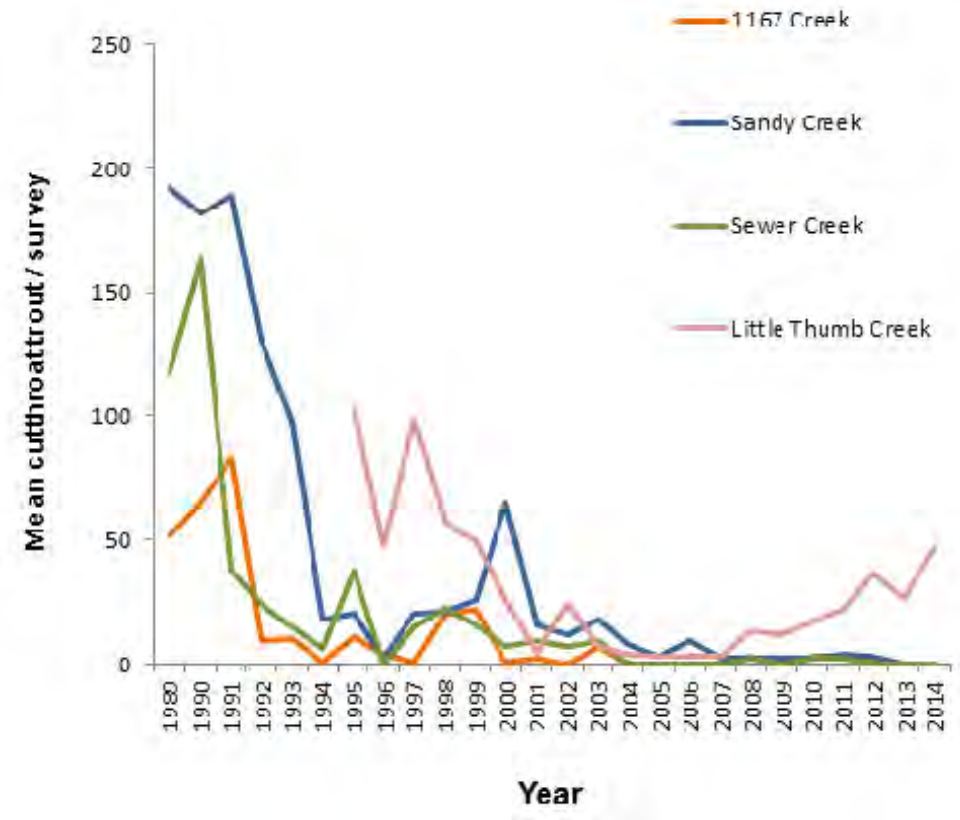


Figure 12. Mean number of spawning cutthroat trout observed during weekly visual surveys of 4 West Thumb spawning streams tributary to Yellowstone Lake, Yellowstone National Park, 1989–2014.

creek on July 17. During the weekly visual surveys, 204 spawning cutthroat (or cutthroat trout × rainbow trout hybrids) were counted, an average of 41 per visit during the spawning season (Table 20). The number of fish observed per survey has ranged from a low of 31 in 2004, to a high of 306 in 2010 (Figure 13). No grizzly bears or black bears, bear sign, or evidence of bear fishing activity was confirmed along Trout Lake or the inlet creek during the surveys in 2014.

Cutthroat Trout Outlook

The number of spawning cutthroat trout counted in all surveyed tributary streams of Yellowstone Lake reached a nadir in approximately 2004 (Figures 10, 11, and 12). A Native Fish Conservation Plan/Environmental Assessment was completed in 2011 (Koel et al. 2010*b*). The plan outlines a program of management efforts designed to protect the native YCT population through lake trout suppression and other methods. As part of these management efforts, park fisheries biologists and private-sector (contracted) netters caught and removed 277,003 lake trout from Yellowstone Lake in 2014 (Koel et al., in press). Population models indicate the removal program has slowed lake trout population growth and likely started to cause a population decline (Syslo et al. 2011; J. Syslo, personal communication, 2014). If the removal program results in a significant long-term reduction in predatory lake trout, native YCT may reestablish at greater numbers in Yellowstone Lake and its tributary streams and once again become an important diet item for grizzly bears in the Yellowstone Lake watershed.

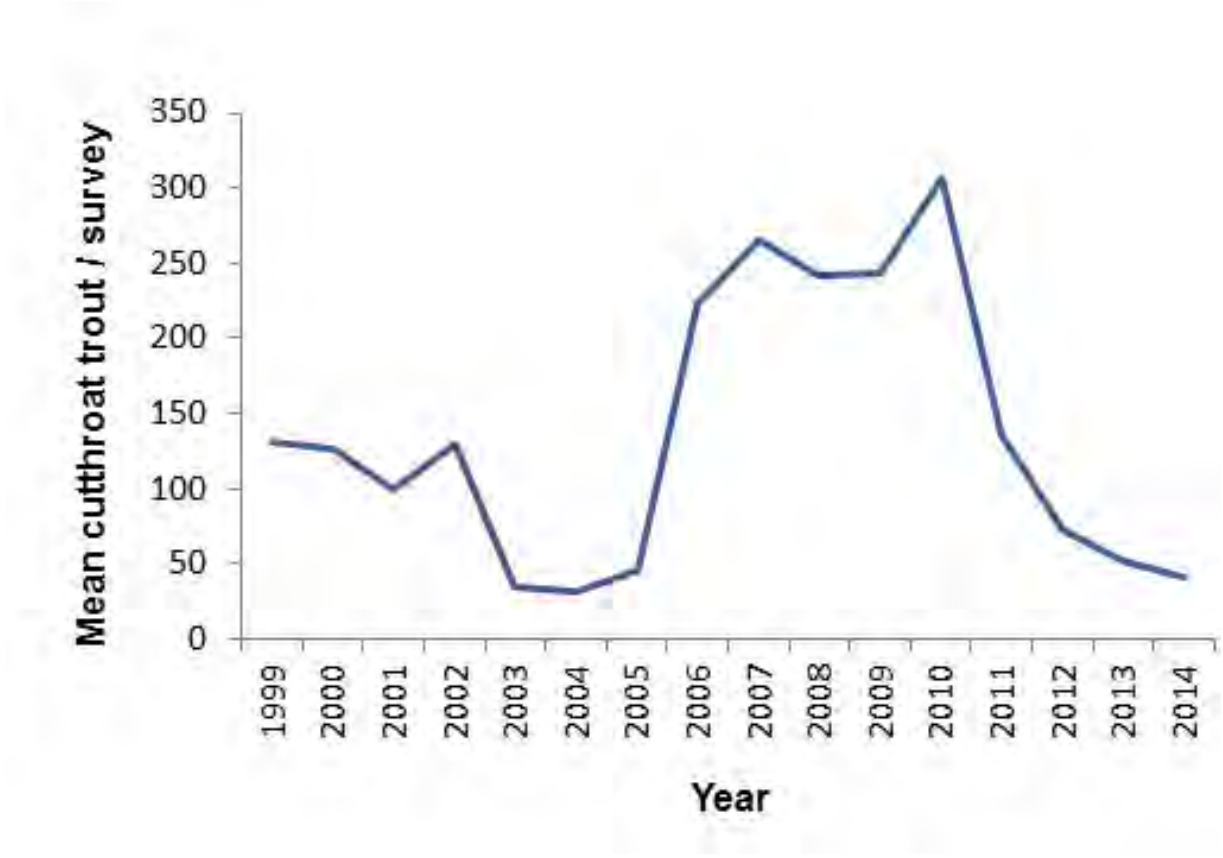


Figure 13. Mean number of spawning cutthroat (including cutthroat × rainbow trout hybrids) observed during weekly visual spawning surveys of the Trout Lake inlet creek, Yellowstone National Park, 1999–2014.

Grizzly Bear Use of Insect Aggregation Sites *(Daniel D. Bjornlie, Wyoming Game and Fish Department; and Mark A. Haroldson, U.S. Geological Survey, Interagency Grizzly Bear Study Team)*

Army cutworm moths (*Euxoa auxiliaris*) 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 specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. Because insects other than army cutworm moths may be present and consumed by bears (e.g., ladybird beetles [Coccinellidae family]), we generally refer to such areas as "insect aggregation sites." Within the GYE, observations indicate army cutworm moths are the primary food source at these sites.

Since their discovery, numerous bears have been counted on or near these aggregation sites due to excellent sightability from a lack of trees and simultaneous use by multiple bears. However, complete tabulation of grizzly presence at insect 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.

Since 1986, when insect aggregation sites were initially included in aerial observation surveys, our knowledge of these sites has increased annually. Our techniques for monitoring grizzly bear use of these sites have changed in response to this increase in knowledge. Prior to 1997, we delineated insect aggregation sites with convex polygons drawn around locations of bears seen feeding on moths and buffered these polygons by 500 m. However, this technique overlooked small sites due to the inability to create polygons around sites with fewer than 3 locations. During1997─1999, the method for defining insect aggregation sites was to inscribe a 1-km circle around the center of clusters of observations in which bears were seen feeding on insects in talus/scree habitats (Ternent and Haroldson 2000). This method allowed trend in bear use of sites to be annually monitored by recording the number of bears documented in each circle (i.e., site).

We developed a new technique in 2000 (D. Bjornlie, Wyoming Game and Fish Department, personal communication) that delineates sites by buffering only the locations of bears observed actively feeding at insect aggregation sites by 500 m; this distance was used to account for error in aerial telemetry locations. The borders of the overlapping buffers at individual insect 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 cutworm moths. Locations from the grizzly bear location database from July 1 through September 30 of each year are then overlaid on these polygons and enumerated. This new technique substantially decreased the number of sites described in prior years, in which locations from both feeding and non-feeding bears were used. Therefore, we use this technique for the annual analysis completed for all years. Areas suspected as insect aggregation sites but dropped from the list of confirmed sites using this technique, and sites with only one observation of an actively feeding bear or multiple observations in a single year, are termed "possible" sites and will be monitored in subsequent years for additional observations of actively feeding bears. These sites may then be added to the confirmed sites list. When possible sites are changed to confirmed sites, analysis is done on all data back to 1986 to determine the

Grizzly bear on moth site, 2 Aug 2012. IGBST photo.

Figure 14. Annual number of confirmed insect aggregation sites and percent of those sites at which either telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2014.

historic use of that site. Therefore, the number of bears using insect aggregation sites in past years may change as new sites are added, and data from this annual report may not match that of past reports. In addition, as new actively feeding bear observations 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 insect aggregation sites in past years.

Analysis of grizzly bear use of confirmed sites in 2014 resulted in the merging of 10 previously separate sites into 3 confirmed sites as site boundaries grew together. In addition, there were multiple observations of actively feeding grizzly bears on 2 possible sites. One of these sites was reclassified to confirmed whereas the other was merged with a nearby confirmed site. An observation of an actively feeding grizzly bear at a new location resulted in an additional possible site. The new confirmed sites, merging confirmed sites, and the new possible site produced 31 confirmed sites and 15 possible sites for 2014.

The percentage of confirmed sites with documented use by grizzly bears varies from year to year, suggesting that some years have higher moth activity than others (Figure 14), which may be due to variable snow conditions. In 1993, a year with unusually high snowpack, the percentage of confirmed sites used by bears (Figure 14) and the number of observations recorded at insect sites (Table 21) were very low. In all other years, the percentage of insect aggregation sites used by grizzly bears fluctuated between 50 and 80% and in 2014 remained above 70% for the third consecutive year (Figure 14). The total number of grizzly bear observations or telemetry locations at sites in 2014 (n = 351) was the highest recorded since moth site monitoring began (Table 21).

This increasing trend is still apparent when only bears observed during regularly-conducted observation flights (see "**Observation Flights**") are included (Figure 15). Because effort, as measured by hours flown, in the bear management units containing

Table 21. Annual number of confirmed insect aggregation sites in the Greater Yellowstone Ecosystem used by bears, and the total number of aerial telemetry relocations and ground or aerial observations of bears recorded at sites during 1986–2014.

Year	Number of confirmed moth sites[a]	Number of sites used[b]	Number of aerial telemetry relocations	Number of ground or aerial observations
1986	4	2	6	5
1987	5	3	5	10
1988	5	3	10	31
1989	9	7	9	44
1990	14	11	9	78
1991	16	12	12	168
1992	18	12	6	107
1993	19	3	1	2
1994	19	10	1	29
1995	21	11	7	39
1996	22	14	21	67
1997	23	16	17	83
1998	26	21	11	181
1999	26	14	24	156
2000	26	13	47	95
2001	27	18	23	127
2002	28	21	30	251
2003	28	21	9	163
2004	28	17	2	133
2005	30	20	15	191
2006	30	16	13	145
2007	30	20	19	160
2008	30	22	13	176
2009	31	23	6	164
2010	31	18	1	131
2011	31	20	8	158
2012	31	23	14	248
2013	31	22	24	293
2014	31	23	11	340
Total			374	3,775

[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] A site was considered used if ≥1 location or observation was documented within the site that year.

Table 22. Number of initial sightings of unique females with cubs that occurred on or near insect aggregation sites, number of sites where such sightings were documented, and the mean number of sightings per site in the Greater Yellowstone Ecosystem, 1986–2014.

Year	Unduplicated Females with cubs[a]	Number of moths sites with an initial sighting	Initial sightings			
			Within 500 m[b]		Within 1,500 m[c]	
			N	%	*N*	%
1986	25	0	0	0.0	0	0.0
1987	13	0	0	0.0	0	0.0
1988	19	1	2	10.5	2	10.5
1989	16	1	1	6.3	1	6.3
1990	25	4	4	16.0	5	20.0
1991	24	7	13	54.2	14	58.3
1992	25	5	7	28.0	9	36.0
1993	20	1	1	5.0	1	5.0
1994	20	3	5	25.0	5	25.0
1995	17	2	2	11.8	2	11.8
1996	33	7	7	21.2	8	24.2
1997	31	8	11	35.5	11	35.5
1998	35	10	13	37.1	13	37.1
1999	33	3	6	18.2	7	21.2
2000	37	6	9	24.3	10	27.0
2001	42	7	13	31.0	13	31.0
2002	52	11	18	34.6	18	34.6
2003	38	11	20	52.6	20	52.6
2004	49	11	17	34.7	17	34.7
2005	31	5	7	22.6	8	25.8
2006	47	11	15	31.9	16	34.0
2007	50	10	17	34.0	17	34.0
2008	44	7	11	25.0	14	31.8
2009	42	4	6	14.3	7	16.7
2010	51	7	9	17.6	9	17.6
2011	39	6	7	17.9	7	17.9
2012	49	6	13	26.5	13	26.5
2013	58	8	14	24.1	15	25.9
2014	50	11	21	42.0	23	46.0
Total	1015		269		285	
Mean	35.0	6.0	9.3	26.5	9.8	28.1

[a] Initial sightings of unique females with cubs; see Table 5.

[b] Insect aggregation site is defined as a 500-m buffer drawn around a cluster of observations of bears actively feeding.

[c] This distance is 3 times what is defined as an insect aggregation site for this analysis, since some observations could be made of bears traveling to and from insect aggregation sites.

all known insect aggregation sites has remained consistent since 1997, the increase suggests an increase in the number of grizzly bear using insect aggregation sites, particularly since 2010 (Figure 15). The recent increase in reported observations of grizzly bears using insect aggregation sites from a few ground-based observers and our increased use of GPS collars with satellite technology, which provide near real-time transmission of locations, has resulted in the need to censor these locations to prevent a bias in comparisons with previous years. Therefore, the number of aerial telemetry locations and observations from Table 21 reflect this change and may differ from previous annual reports.

The IGBST maintains an annual list of unique females observed with cubs (see Table 5 in section "**Estimating Number of Females with Cubs**"). Since 1986, 1,015 initial sightings of unique females with cubs have been recorded, of which 285 (28.1%) have occurred at (<500 m, $n = 269$) or near (<1,500 m, $n = 16$) insect aggregation sites (Table 22). In 2014, 21 of the 50 (42.0%) initial sightings of unique females with cubs were observed at insect aggregation sites, which was substantially higher than the 5-year mean of 20.1% from 2009─2013 (Table 22).

Survey flights at or near (<1,500 m) insect aggregation sites contribute to the count of unique females with cubs; however, it is typically low, with a 10-year mean of 12.9 initial sightings/year since 2005 (Table 22). If these sightings are excluded, a similar trend in the annual number of unique sightings of females with cubs is still evident (Figure 16), suggesting that other factors besides observation effort at insect aggregation sites are responsible for the increase in sightings of females with cubs.

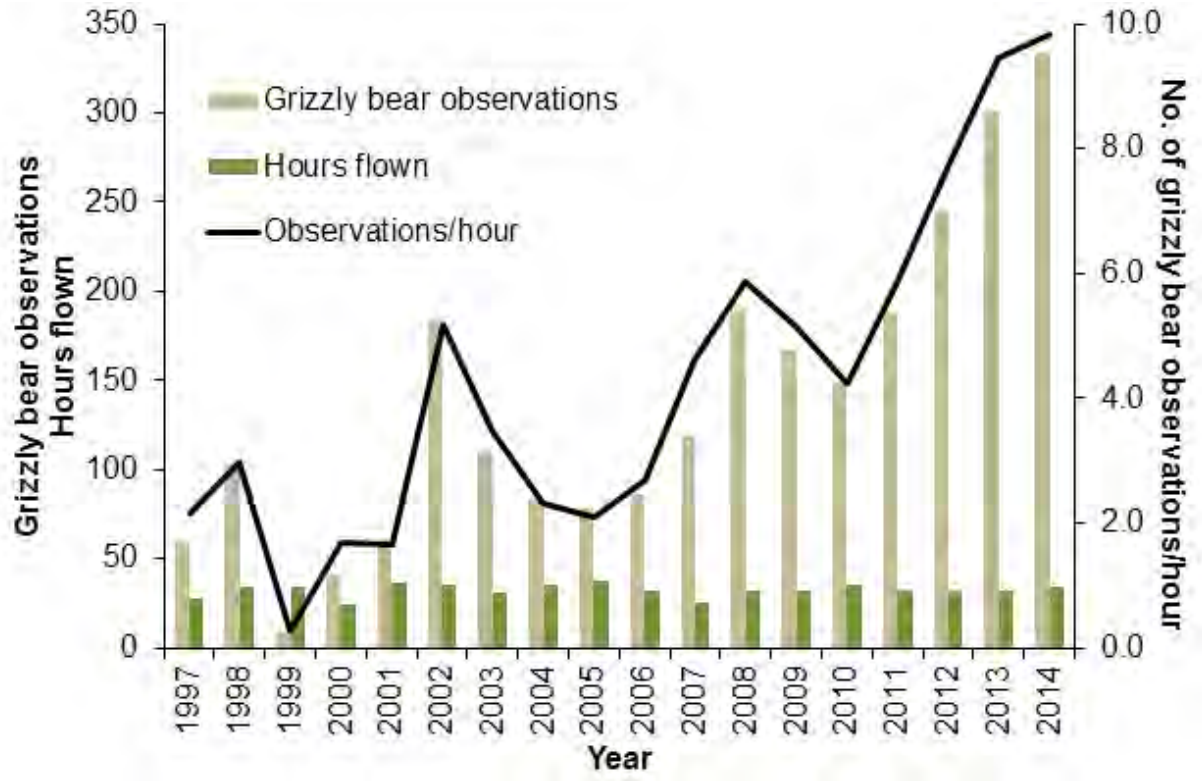


Figure 15. The number of grizzly bears observed (tan bars) on insect aggregation sites during observation flights only, hours flown (green bars) for these bear management units (BMU), and grizzly bear observations per hour (black line) during observation flights of BMUs containing all known insect aggregation sites, Greater Yellowstone Ecosystem, 1997─2014.

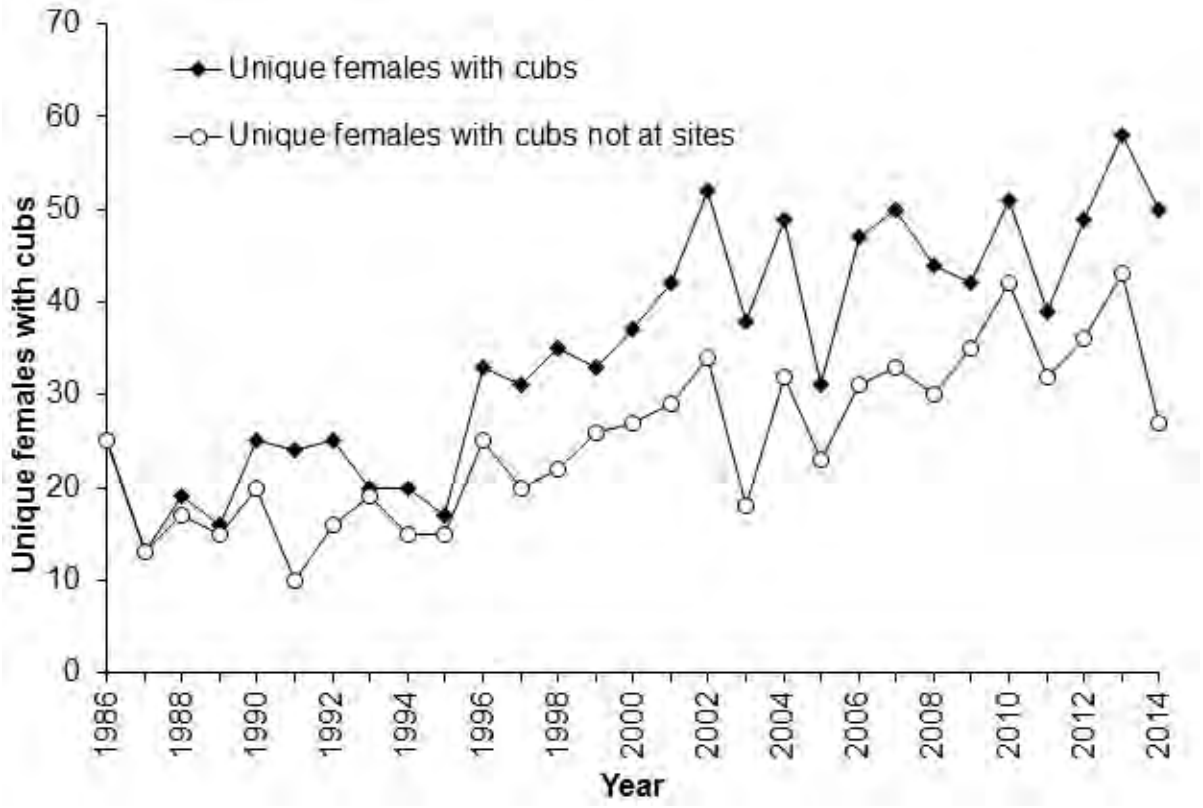


Figure 16. The total number of unique females with cubs observed annually in the Greater Yellowstone Ecosystem and the number of unique females with cubs not found within 1,500 m of known insect aggregation sites, 1986–2014.

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

Whitebark pine (*Pinus albicaulis*) surveys on established transects indicated generally above-average cone production during 2014 (Figure 17). Twenty-one transects were read. Overall, the mean number of cones/tree was 20.0 (Table 23). Cone production on most transects was above average but there were several exceptions: transects G, Q1, and CS-D, averaged ≤2 cones/tree (Table 24). Cone production among extant trees during 2014 was good compared with the 5.2 cones/tree average observed during 2013 (Figure 18).

Although we continue to observe tree mortality caused by mountain pine beetle (*Dendroctonus ponderosae*) in stands that contain our cone production transects, we observed only 2 additional beetle-caused mortalities among individual trees surveyed since 2002. Total mortality on these transect trees

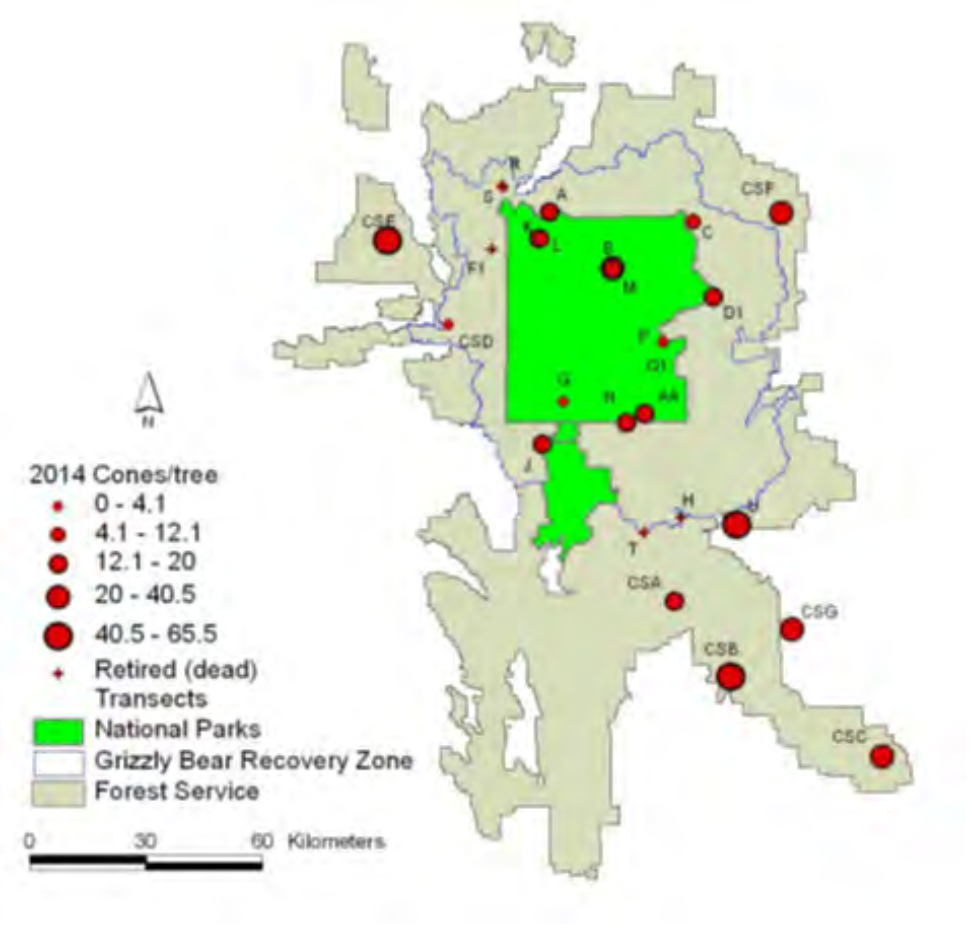


Figure 17. Locations and mean number of cones/tree for 21 whitebark pine cone production transects surveyed in the Greater Yellowstone Ecosystem during 2014.

Table 23. Summary statistics for whitebark pine cone production transects surveyed in the Greater Yellowstone Ecosystem during 2014.

Total			Trees				Transect			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
3508	175	21	20.05	28.08	0	151	167.05	151.00	5	655

Table 24. Whitebark pine cone production transect results for 2014.

Transect	# Cones	# Trees	Mean	SD
A	83	5	16.6	32.2
B	294	10	29.4	15.0
C	107	10	10.7	8.8
D1	82	5	16.4	9.8
F1		Retired in 2008		
G	20	10	2.0	5.3
H		Retired in 2008		
J	200	10	20.0	21.0
K	134	9	14.9	11.3
L	121	10	12.1	8.3
M	175	10	17.5	12.2
N	146	10	14.6	19.0
P	41	10	4.1	4.7
Q1	5	10	0.5	1.0
R		Retired in 2009		
S		Retired in 2010		
T		Retired in 2008		
U	48	1	48.0	
AA	191	10	19.1	16.6
CSA	169	10	16.9	14.3
CSB	655	10	65.5	48.7
CSC	365	10	36.5	38.8
CSD	12	9	1.3	1.7
CSE	113	2	56.5	44.5
CSF	142	4	35.5	33.7
CSG	405	10	40.5	29.7

since 2002 is 75.3% (143/190) with 100% (19/19) of transects containing beetle-killed trees. Although tree mortality from mountain pine beetle is still occurring, it appears the rate of loss among our cone production transects has slowed (Figure 19). This suggest that at least in the vicinity of these transects, the current beetle outbreak may have run its course. Six (85.7%) of the 7 transects established during 2007 also exhibit beetle-caused mortality among transect trees. Preliminary results of efforts to document the health of whitebark pine forests across the GYE are presented in Appendix B of this report.

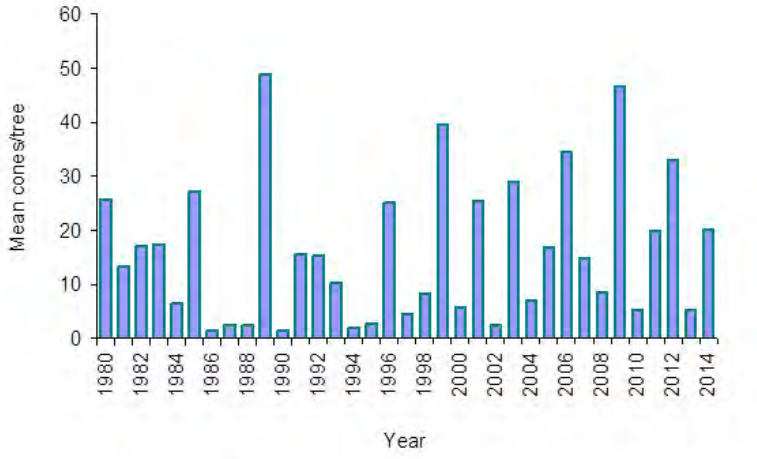


Figure 18. Annual mean cones/tree on whitebark pine cone production transects surveyed in the Greater Yellowstone Ecosystem during 1980–2014.

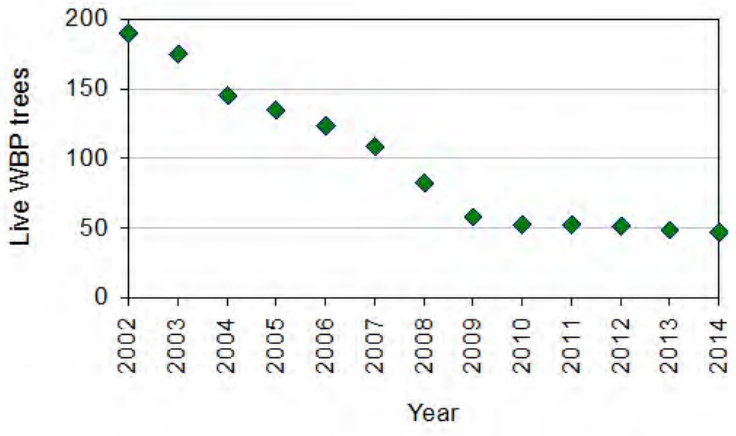


Figure 19. Number of live whitebark pine trees on cone production transects among 190 individual tress monitored since 2002.

Habitat Monitoring

Grand Teton National Park Recreational Use
(Katharine R. Wilmot, Grand Teton National Park)

In 2014, total visitation in Grand Teton National Park was 4,296,512 people, including recreational, commercial (e.g., Jackson Hole Airport), and incidental (e.g., traveling through the Park on U.S. Highway 191 but not recreating) use. Recreational visits alone totaled 2,791,392. Backcountry user nights totaled 29,524. Long- and short-term trends of recreational visitation and backcountry user nights are shown in Table 25 and Figure 20.

Table 25. Average annual visitation and average annual backcountry use nights in Grand Teton National Park by decade from 1951 through 2009, and the most recent 10-year average.

Decade	Average annual parkwide visitation[a]	Average annual backcountry use nights
1950s	1,104,357	Data not available
1960s	2,326,584	Data not available
1970s	3,357,718	25,267
1980s	2,659,852	23,420
1990s	2,662,940	20,663
2000s	2,497,847	30,049
2005–2014	2,596,681	29,056

[a] In 1983 a change in the method of calculation for parkwide visitation resulted in decreased numbers. Another change in 1992 increased numbers. Thus, parkwide visitation data for the 1980s and 1990s are not strictly comparable.

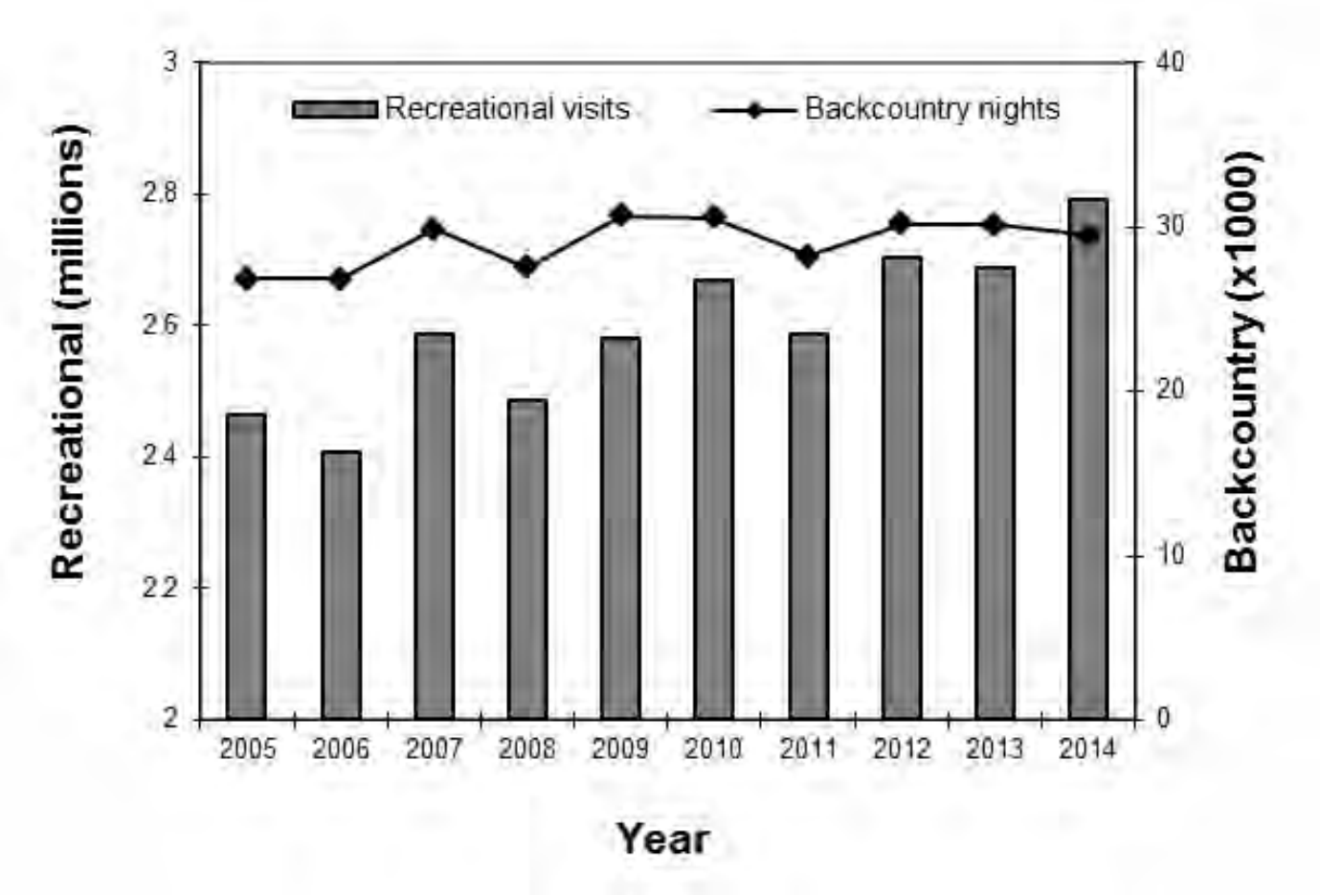


Figure 20. Trends in recreational visitation and backcountry user nights in Grand Teton National Park during 2004–2014 (data available at https://irma.nps.gov/Stats).

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

Total visitation to Yellowstone National Park (YNP) was 4,571,042 visits in 2014 (https://irma.nps.gov/Stats/SSRSReports/Yell/Yellowstone) including recreational and non-recreational (e.g., traveling through the Park on U.S. Highway 191 but not recreating) use. Recreational visits in 2014 totaled 3,513,486, the second highest visitation year on record and the eighth straight year that recreational visitation has topped the 3 million mark. Seven of the top 10 visitation years have occurred in the last decade (Table 26). Most of YNP's recreational visitation occurs during the 6 month period from May through October. In 2014, there were 3,378,463 recreational visits (96%) during those peak months, an average of 18,361 recreational visits per day. In 2014, visitors spent 711,645 overnight stays in developed area roadside campgrounds, and 41,669 overnight stays in backcountry campsites in Yellowstone Park.

Average annual recreational visitation increased each decade from an average of 7,378 visitors/year during the late 1890s to 3,012,653 visitors/year in the 1990s (Table 27, Figure 21). Average annual recreational visitation decreased slightly during 2000–2009, to an average of 2,968,037 visitors/year. The decade 2000–2009 was the first in the history of the park that visitation did not increase from the previous decade. However, the decade beginning in 2010 is on pace to set a new park record high for visitation. Four of the 5 highest years of visitation ever recorded in YNP have occurred since 2010. Although total park recreational visitation has increased steadily over time, the average number of overnight stays in roadside campgrounds in the park has remained relatively stable since the 1960s (Table 27, Figure 22). The number of overnight stays in roadside campgrounds is limited by the number and capacity of roadside campgrounds in the park. The average number of overnight stays in backcountry campsites has also been relatively stable ranging from 39,280 to 45,615 overnight stays/year (Table 27, Figure 23). The number of overnight stays in the backcountry is limited by both the number and capacity of designated backcountry campsites in the park.

Table 26. Ten highest years for visitation to Yellowstone National Park, 1895–2014.

Rank	Year	Visitation
1	2010	3,640,185
2	2014	3,513,486
3	2012	3,447,729
4	2011	3,394,326
5	2009	3,295,187
6	2013	3,188,030
7	2007	3,151,343
8	1992	3,144,405
9	1999	3,131,381
10	1995	3,125,285

Table 27. Average annual recreational visitation, auto campground overnight stays, and backcountry campsite overnight stays in Yellowstone National Park by decade, from 1895–2014.

Decade	Yellowstone Park average annual number of recreational visits	Auto campground average annual overnight stays	Backcountry campsite average annual overnight stays
1890s	7,378[a]	Not available	Not available
1900s	17,110	Not available	Not available
1910s	31,746	Not available	Not available
1920s	157,676	Not available	Not available
1930s	300,564	82,331[b]	Not available
1940s	552,227	139,659[c]	Not available
1950s	1,355,559	331,360	Not available
1960s	1,955,373	681,303[d]	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	3,436,751[g]	688,979[g]	40,876[g]

[a] Data from 1895–1899. During 1872–1894 visitation was estimated to be not less than 1,000 nor 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 use data available for 1972–1979.
[g] Data for 2010–2014.

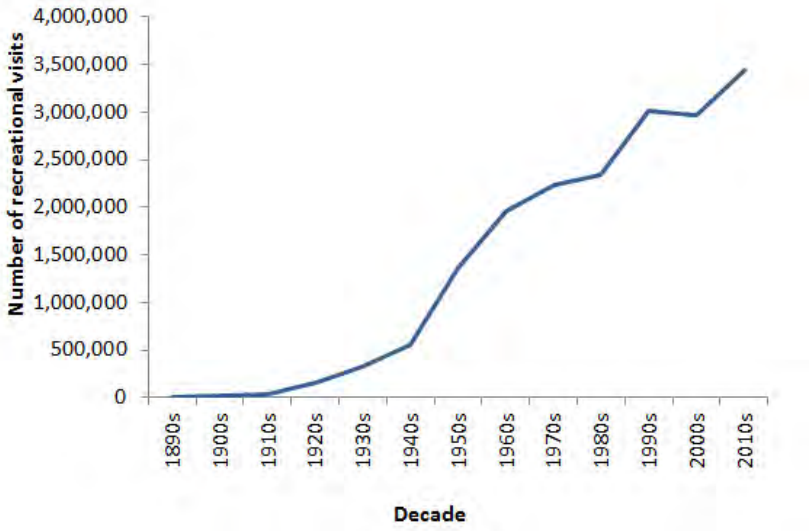


Figure 21. Average annual number of recreational visitors to Yellowstone National Park by decade, 1895–2014.

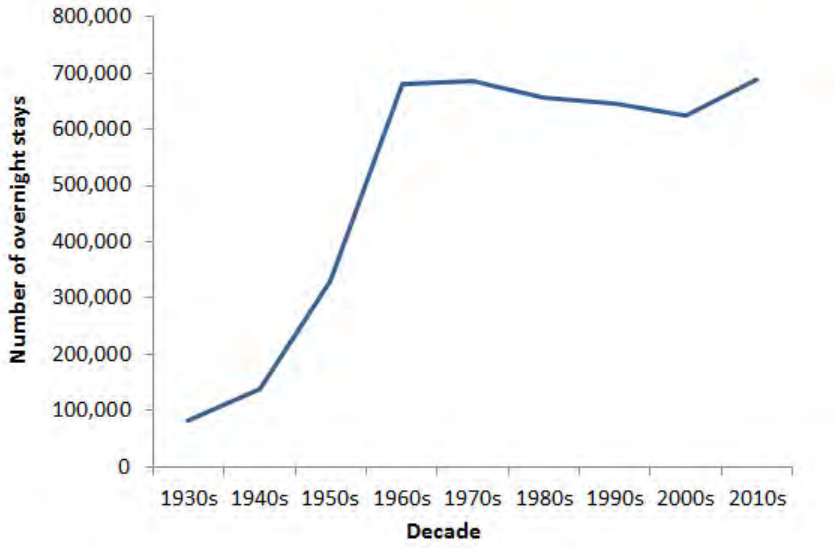


Figure 22. Average annual number of overnight stays in roadside campgrounds in Yellowstone National Park by decade, 1930–2014.

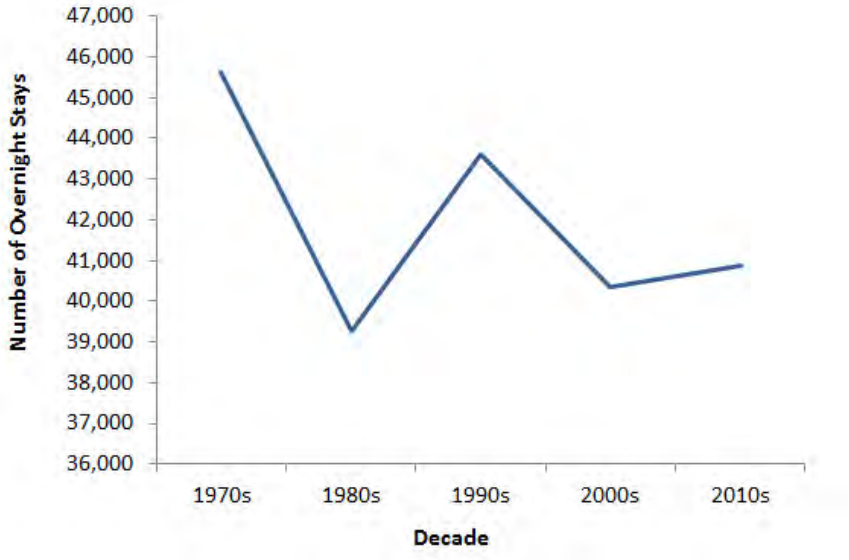


Figure 23. Average annual number of overnight stays in backcountry campsites in Yellowstone National Park by decade, 1972–2014.

Trends in Elk Hunter Numbers within the Grizzly Bear Recovery Zone Plus the 10-Mile Perimeter Area *(Justin Clapp, Wyoming Game and Fish Department; Kevin Frey, Montana Department of Fish, Wildlife and Parks; and Daryl Meints, Idaho Department of Fish and Game)*

State wildlife agencies in Idaho, Montana, and Wyoming estimate the number of hunters for each big game species. We used state estimates from surveys and contacts for the number of elk hunters by hunt area as an index of trend in hunter numbers for the Grizzly Bear Recovery Zone plus the 10-mile perimeter area. Because some hunt area boundaries do not conform exactly to the Recovery Zone and 10-mile (16-km) perimeter area regional biologists familiar with each hunt area were queried to estimate hunter numbers within the Recovery Zone plus the 10-mile perimeter area. Annually, the number of elk hunters represent the largest cohort of hunters for an individual species. Although there are sheep, moose, and deer hunters using the Recovery Zone and 10-mile perimeter area, their numbers are relatively small in relation to elk hunter numbers and many hunt these species in conjunction with elk. Elk hunter numbers represent a reasonably accurate index of trend of total hunters and hunting activity within areas occupied by grizzly bears in the GYE.

We generated data for all states from 2002 to 2014 (Table 28), with the exception of Montana, which began reporting estimated number of elk hunters on a biennial basis in 2012, resulting in no estimate for 2013. Generally, the downward trend in total hunter numbers since 2002 has started to diminish over the past few years and shows a slight increase in 2014 from a low of 20,305 estimated hunters in 2012 (Figure 24). This recent change in trend is a result of increased estimates in all three states over the past few years. There are likely several factors affecting these trends, including hunter effort, elk availability, and changes in permits or hunting opportunities. From a low of 1,763 in 2008, hunter numbers in Idaho have rebounded, increasing by approximately 43% from 2013 to 2014. Hunter numbers in Wyoming also increased from a low of 6,566 in 2011 to 8,109 in 2014. Montana experienced the largest decrease in hunter numbers since 2002, reduced to fewer than 11,000 in 2012. However, Montana also contributed to the recent trend by increased hunter numbers near 12,000 in 2014 and annually has the largest proportion of elk hunters in the Recovery Zone and 10-mile perimeter. Hunter numbers in respective states bring the total estimate of 22,805 near that of 2009, but remains considerably less (35%) than the highest estimate of 34,879 hunters in 2002.

Table 28. Estimated numbers of elk hunters within the Grizzly Bear Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming, 2002–2014.

	Year												
State	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
ID	3,262	3,285	3,454	3,619	3,016	2,592	1,763	1,819	1,904	1,860	1,803	1,937	2,771
MT	17,908	16,489	14,320	12,365	12,211	12,635	12,470	12,382	12,334	12,269	10,936	NA	11,925
WY	13,709	11,771	10,828	9,888	9,346	8,716	8,792	8,440	6,712	6,413	7,566	7,818	8,109
Total	34,879	31,545	28,602	25,872	24,573	23,943	23,025	22,641	20,950	20,542	20,305	NA	22,805

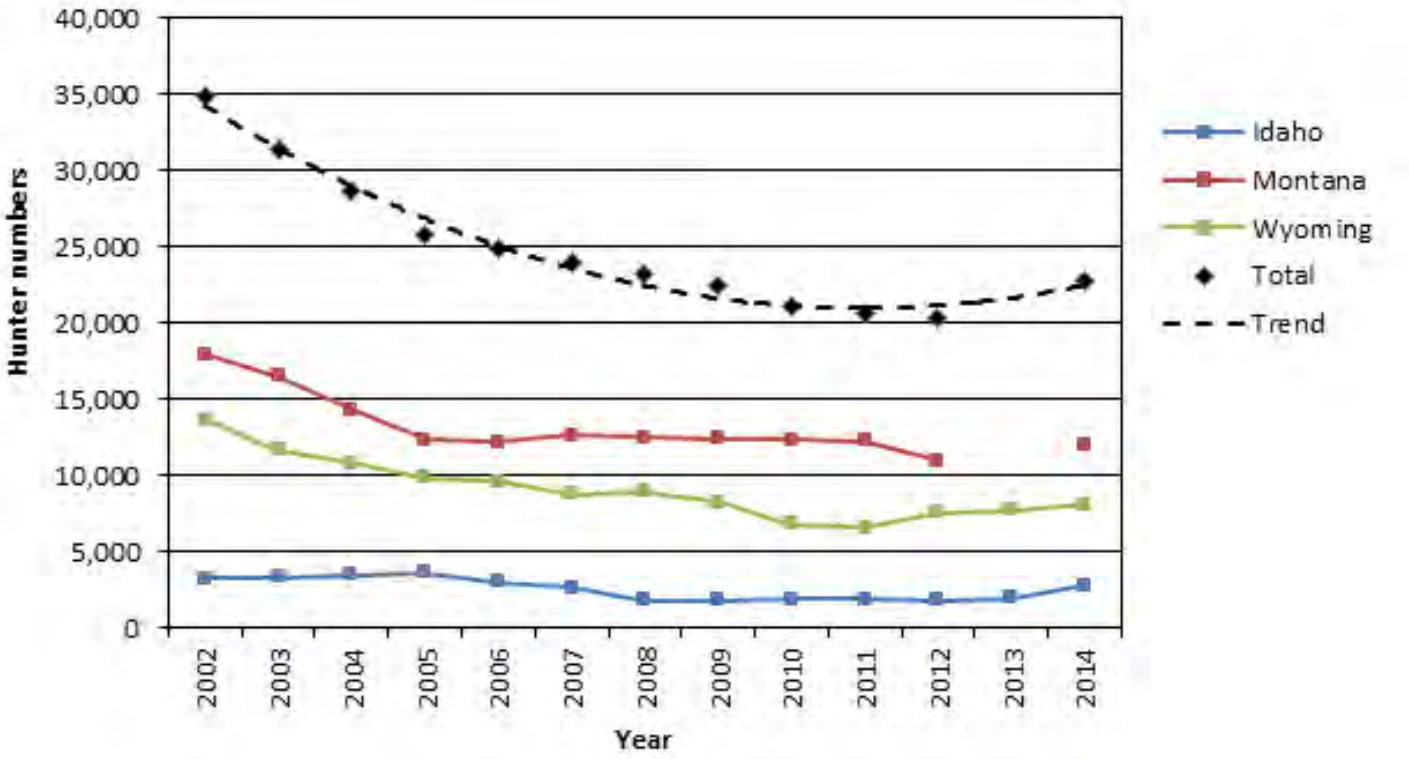


Figure 24. Trend in elk hunter numbers within the Grizzly Bear Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming, 2002−2014.

Grizzly Bear-Human Conflicts in the Greater Yellowstone Ecosystem

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

No human-bear conflicts were recorded and no management actions were taken on grizzly bears in Grand Teton National Park (GTNP) in 2014. However, nonfood-conditioned, human-habituated bears required considerable management effort to prevent conflicts from occurring. Grizzly bears were hazed out of developed areas on 2 occasions and off of primary roads 17 times. GTNP recorded a minimum of 282 bear jams (122 grizzly, 103 black, 57 species not recorded), created when habituated bears frequented roadsides or the outskirts of other developments and drew crowds of onlookers. Grizzly bear jams peaked in May and June. Black bear jams fluctuated over the summer but were highest in May, July, and September. The park's Wildlife Brigade managed most of these jams, in addition to enforcing food storage at campgrounds, picnic areas, and other developments. Wildlife Brigade volunteers contributed almost 5,000 hours towards this important bear conservation and public education program.

GTNP hosted 124 bear safety programs park-wide. These presentations highlighted safety in bear country and concluded with a bear spray (inert) demonstration. The programs were well received, with over 3,650 visitors attending over the summer. In addition, GTNP continued its partnership with the Grand Teton National Park Foundation to cost-share expenses for the purchase and installation of bear-resistant food storage lockers. Fifty-two 30 cubic-foot bear boxes were installed in 2014, bringing the total to 482 bear boxes since 2008. Three of the parks 6 roadside campgrounds, including Jenny Lake, Signal Mountain, and Lizard Creek Campgrounds, now have a food storage locker at each site.

One grizzly bear mortality was discovered on May 20, 2014, by a field crew conducting wolf predation surveys in GTNP. The condition of the carcass made it difficult to determine time of death, however, after examining tooth eruption patterns it appears the bear died in the fall of 2013 when it was a cub. Samples were collected and DNA results are pending.

Grand Teton National Park at sunset, 2009. IGBST photo.

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

To effectively allocate resources for implementing management actions designed to prevent grizzly bear-human conflicts, Yellowstone National Park (YNP) managers need baseline information regarding the types, causes, locations, and recent trends of conflict incidents. To address this need, all grizzly bear-human conflicts reported in YNP are recorded annually. Conflicts are grouped into broad categories using standard definitions described by Gunther et al. (2012).

The frequency of grizzly bear-human conflicts generally is inversely associated with abundance of natural bear foods (Gunther et al. 2004). When native bear foods are abundant, there tend to be few grizzly bear-human conflicts involving property damage and anthropogenic foods. When native bear foods are scarce, incidents of grizzly bears damaging property and obtaining anthropogenic foods increase, especially during late summer and fall when bears are hyperphagic (Gunther et al. 2004).

In 2014, the availability of high-quality, concentrated bear foods in YNP was average during the spring, estrus, and early hyperphagia seasons, and good during late hyperphagia. During spring, there were few winter-killed ungulate carcasses in thermally influenced ungulate winter ranges in the interior of the park, however carcasses were more abundant on the Northern Ungulate Winter Range (see "**Spring Ungulate Availability and Use by Grizzly Bears in Yellowstone National Park**"). During spring, sign of grizzly bears grazing succulent emerging grasses, sedges, and clover and digging up pocket gopher root food caches, earthworms, and spring beauty bulbs were encountered while conducting field work. Evidence of grizzly bear consumption of geothermal soils (geophagy, Mattson et al. 1999) was also observed during spring. During estrus, there were very few spawning cutthroat trout observed in monitored tributary streams of Yellowstone Lake (see "**Spawning Cutthroat Trout**"). However, grizzly predation on newborn elk calves, grazing of graminoids, digging up pocket gopher root-food caches, and foraging for many species of forbs were common during the estrus season. During early-hyperphagia, grizzly bears foraged for a variety of forbs and many grizzly bears were observed at high-elevation army cutworm moth aggregation sites east of the park boundary (see "**Grizzly Bear Use of Insect Aggregation Sites**"). During late hyperphagia, grizzly bears foraged for whitebark pine seeds (see "**Whitebark Pine Cone Production**"), berries, truffles, and mushroooms which were all abundant in YNP in 2014.

There were 4 grizzly bear-human conflicts reported in YNP in 2014 (Table 29). In 2 of the conflicts, grizzly bears damaged property but did not obtain anthropogenic foods. In one of these incidents a grizzly bear tore siding off a backcountry patrol cabin to get to a mouse nest between the walls. In the other incident a grizzly got up onto the loading dock of the Canyon Village General Store and bit into some cleaned, empty plastic ice cream buckets stored on the dock. In 2 other conflicts grizzly bears damaged property and obtained food rewards. In 1 of these incidents a grizzly bear accessed horse grain in the backcountry and in 1 incident a female grizzly with a cub consumed unsecured food from a picnic table in the Madison campground. The adult bear then knocked down the campers' tent. Traps were set for these bears, but the traps were shut down when the campground closed for the season a few days later. There were no incidents of bear attacks on people in YNP in 2014. The 4 conflicts in YNP were widely dispersed and no geographic concentrations of conflicts were evident (Figure 25). The annual number of human-bear conflicts occurring in YNP can vary widely from year to year and is dependent on the availability of natural bear foods, grizzly population numbers, park visitation numbers, park staffing

Table 29. Number of incidents of grizzly bear-human conflict reported in Yellowstone National Park, 2014.

Conflict type	Number of conflicts
Property damage - no food reward	2
Property damage - with food reward	2
Human injury	0
Human fatality	0
Total conflict incidents	4

levels, and other factors. The number of conflicts have decreased significantly after efforts to prevent bears from obtaining anthropogenic foods were implemented in the late 1960s and early 1970s (Figure 26).

During 2014, there were 2 known grizzly bear mortalities in the YNP portion of the GYE. In both incidents the bears died from injuries inflicted by other bears. There were no known human-caused grizzly bear mortalities in YNP in 2014. Trends in causes of grizzly bear mortality inside YNP have changed over time. From the late 1950s through the 1970s most grizzly mortality in the park was due to human causes (Figure 27), primarily management removals of bears involved in human-bear conflicts. In recent decades (1980–2014,) most grizzly bear mortality is from natural causes, primarily old age, intraspecific strife, and predation.

No grizzly bears were captured and relocated or removed in management actions in YNP in 2014 (Table 30). However, considerable management effort was dedicated toward preventing conflicts (Table 30). In an effort to prevent the need to capture and relocate or remove bears, grizzly bears were hazed out of human use areas 28 times. Grizzly bears were hazed out of park developments 21 times and away from primary roads 7 times. Additionally, as part of the park's strategy for preventing bears from obtaining human foods, 51 bear-proof food storage boxes were

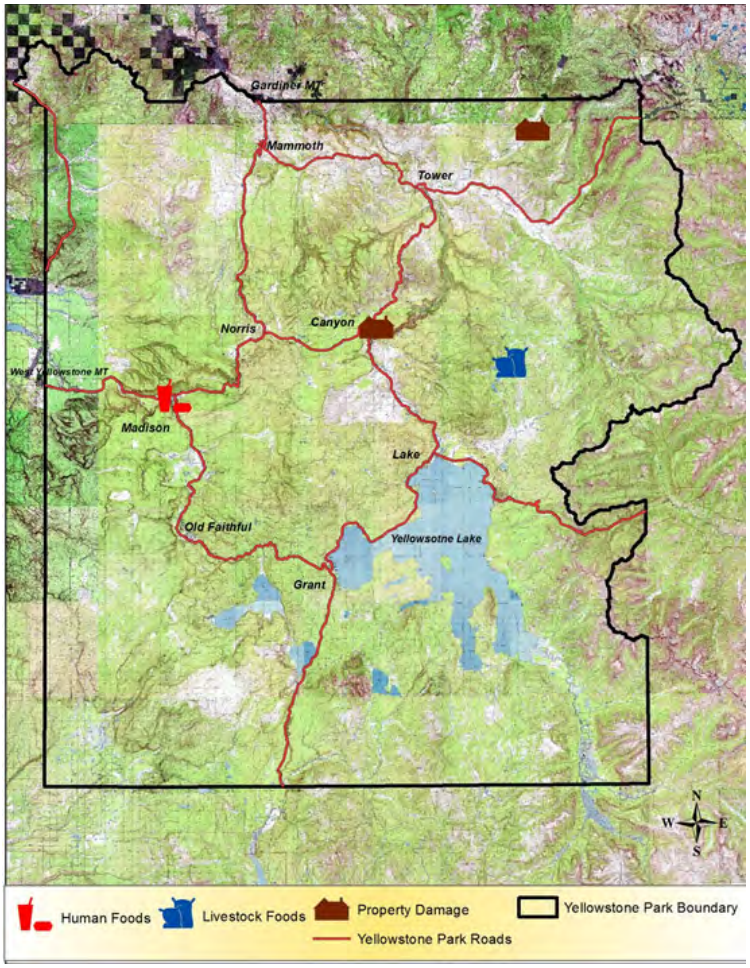


Figure 25. Locations of grizzly bear-human conflicts in Yellowstone National Park, 2014.

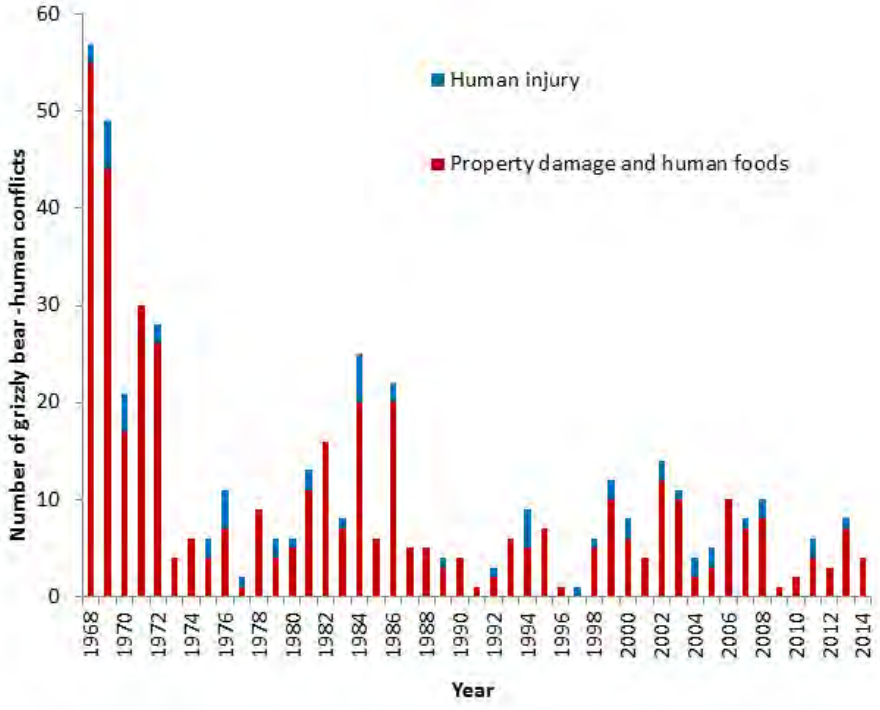


Figure 26. Number of incidents of grizzly bear-human conflict in Yellowstone National Park, 1968–2014.

purchased with donations raised by the Yellowstone Park Foundation and Yellowstone Association, and installed in roadside campgrounds. With the installation of 51 bear boxes in 2014, 562 (30%) of the parks 1,897 campground campsites now have bear boxes. Four of the parks 11 campgrounds including Pebble Creek, Slough Creek, Tower Falls, and Indian Creek have bear boxes in 100% of their campsites and the Norris Campground has bear boxes in 96% of its campsites. As part of the program some bear boxes have been installed in the Mammoth (16% of sites), Canyon (16% of sites), Bridge Bay (21% of sites), Grant (21% of sites), Madison (14% of sites), and Lewis Lake Campgrounds (23% of sites). It is the parks goal to provide park visitors with bear-proof food storage boxes in every roadside campsite. YNP already provides a food storage device (food hanging pole or bear-proof food storage box) in all 301 designated backcountry campsites in the park.

Although there were few conflicts in YNP, management of non-food conditioned, human-habituated bears required considerable management effort. Habituation is the waning of a bear's response to people (McCullough 1982, Jope 1985, Herrero et al. 2005, Hopkins et al. 2010). Habituation is adaptive and reduces energy costs by reducing irrelevant behaviors (McCullough 1982, Smith et al. 2005), such as fleeing from park visitors that are not a threat. Habituation allows bears to access and use habitat in areas with high levels of human activity, thereby increasing habitat effectiveness (Herrero et al. 2005). Habituation most commonly occurs in national parks where human-caused bear mortality is low, and exposure to humans is frequent and predictable and does not result in negative consequences for bears. Bears will readily habituate to people, human activities, roads, vehicles, traffic, and buildings. In 2014, 351 roadside traffic-jams caused by visitors stopping to view habituated grizzly bears along roadsides were reported in YNP. Park staff responded to 294 (84%) of the grizzly bear-jams and spent more than 1,325 personnel hours managing habituated bears, the traffic associated with bear-jams, and the visitors that stopped to view and photograph habituated bears. On average, 4.5 hours of park staff time were spent managing each grizzly bear jam.

Visitation to YNP increases almost every decade (see section "**Yellowstone National Park Recreational Use**"). As visitation increases, park managers should expect an increasing number of bears to become habituated to people, and a higher level of habituation among those bears, thereby causing more bear-jams and jams of longer duration. Therefore, concurrent with increasing visitation, park managers should anticipate the need for increased staff time dedicated to bear-jam management.

Table 30. Number of grizzly bear incidents where management actions were taken in Yellowstone National Park, 2014.

Management action	Number of incidents
Bear warnings posted	8
Temporary area closure	29
Bear-jam management	294
Management hazing	28
Attempt Capture - unsuccessful	1
Capture, mark, and release on site	0
Capture and relocate	0
Capture and remove	0
Capture for humane reasons	0
Total management actions	360

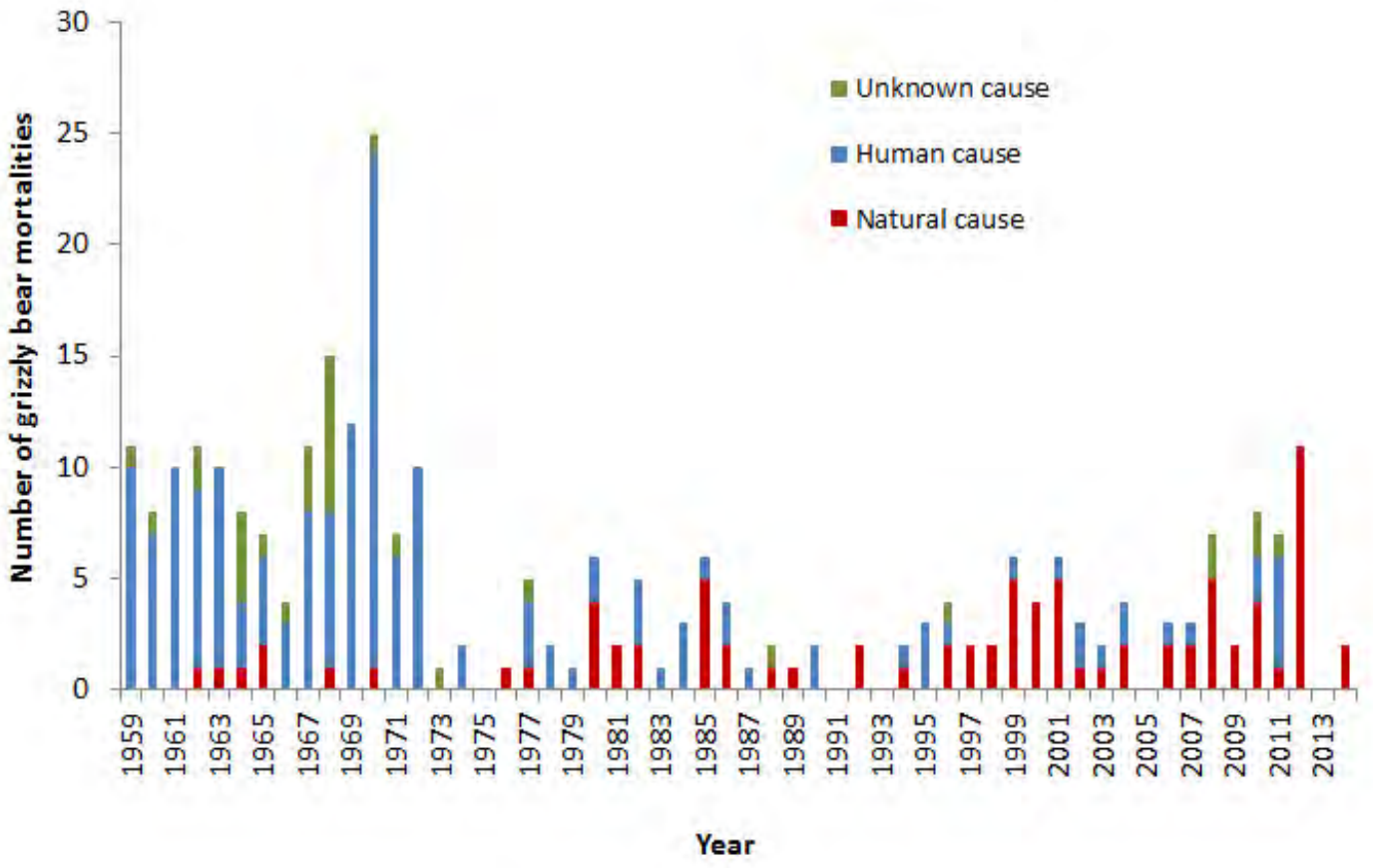


Figure 27. Number of known and probable grizzly bear mortalities in Yellowstone National Park, 1959–2014.

Grizzly Bear-Human Conflicts in Idaho *(Bryan C. Aber, Idaho Department of Fish and Game)*

Idaho Fish and Game Upper Snake Region Carnivore Biologists investigated 6 grizzly bear-human conflicts during 2014 (Table 31). Conflicts are incidents where bears injure people, damaged property, obtained anthropogenic foods, killed or injured livestock, damaged beehives, or obtained vegetables or fruit from gardens and orchards (Gunther et al. 2000). These conflicts vary from a single bear involved in a single incident to bears involved in multiple incidents before the conflict can be resolved. In Idaho, variation occurs annually in the number and location of conflicts, influenced by natural food abundance, livestock use patterns, availability of unsecured anthropogenic foods and an expanding population (both geographic and numbers) of both grizzly bears, black bears and humans. No human injuries occurred in Idaho during 2014.

Grizzly bears frequenting developed areas (e.g., subdivisions, campgrounds) were the most common conflict type in 2014. In these instances, garbage and birdfeeders provided a food reward. Public education and a cost-share program for bear resistant garbage containers in southeast Idaho, has reduced the number of incidents in which bears actually obtain human foods. The domestic elk shooting operation that has concentrated bears during the fall in previous years was not operated in 2014, thus eliminating that unnatural food source. Reported livestock depredations were low but still present.

There has been a general increasing trend in number of conflicts in the Idaho portion of the Yellowstone Ecosystem since 2005 (Figure 28). This trend would be expected with the overall increase in bear numbers and distribution that has occurred in Idaho in recent years. During 2014, there were 2 known grizzly bear mortalities in Idaho. The first mortality was by a black bear hunter during the spring bear hunt. Idaho Fish and Game investigated the incident and successfully prosecuted the case. The other mortality was a management removal of an adult male grizzly for livestock depredation. This grazing allotment on state land and the neighboring allotment on federal lands have had repeated livestock depredations for the past three years.

Climatic conditions in the Idaho portion of the Yellowstone Ecosystem were favorable for grizzly bear food production in 2014. Winter snow pack was average and spring precipitation was sufficient to produce good summer forage. This combination likely contributed to the most productive berry crops observed in two decades. There were no reported hunter encounters with bears during the archery season.

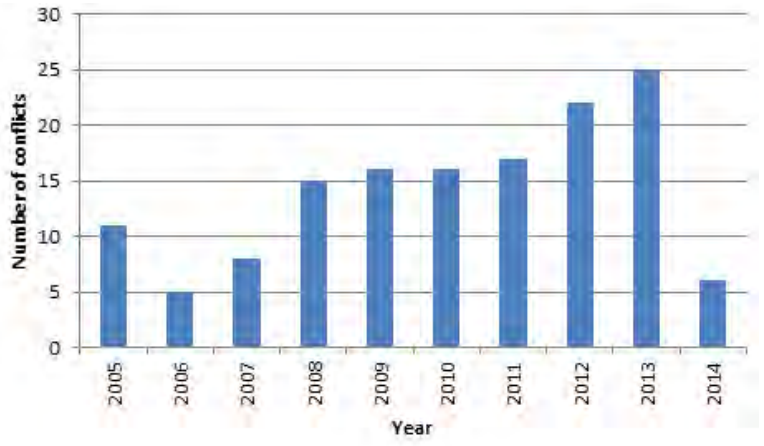


Figure 28. Number of grizzly bear-human conflicts in Idaho, 2005–2014.

Table 31. Grizzly bear/human conflicts in Idaho, Greater Yellowstone Ecosystem, 2014.

Conflict type	Number	Land ownership
Human injury	0	
Aggression towards humans	0	
Livestock – cattle	1	Idaho State land
Livestock – poultry	0	Private
Livestock – swine	0	Private
Elk ranch offal	0	
Anthropogenic foods	5	Private
Beehives/orchards	0	Private
Property damage	1	Private

Grizzly Bear-Human Conflicts in Montana *(Kevin Frey, Montana Fish, Wildlife and Parks)*

During 2014, Montana Fish Wildlife and Parks (MFWP) investigated 41 grizzly bear-human conflicts in Montana's portion of the Greater Yellowstone Ecosystem. Incidents in which grizzly bears cause public safety concerns, property damage, livestock depredations, human injuries, obtain anthropogenic foods, or grizzly bear mortalities are considered conflicts that require agency response, which may involve management action. These conflicts usually vary from one bear being involved in a single incident to multiple incidents involving one or more bears over a period of time before the conflicts can be resolved. The mean annual number of conflicts over the previous 12 years was 59. The 2014 reported and investigated grizzly bear-human conflict types and the number of each are listed in Table 32. Land ownerships of individual conflict sites are listed in Table 33. With an expanding grizzly bear population in geographic distribution and numbers, conflicts are occurring in a larger geographic area of public and private land. The 2014 geographic locations of the reported and investigated conflicts are shown on the map in Figure 29. Annually, efforts by MFWP continue to reduce conflicts, increase public safety, and reduce mortalities in areas of historic high conflicts and at individual sites.

During 2104, three people were injured during two incidents by grizzly bears in the GYE. There were two backcountry self-defense killings of grizzly bears. One of these two mortalities is currently under investigation. Bears frequenting or being near developed sites (e.g., homes, campgrounds) was the most common conflict in 2014. Bears that are near developed sites are generally investigating the possibility of obtaining foods. Education, sanitation efforts, and experience has helped reduce the number of bears obtaining human-related foods and reduces the need for management actions involving capture, relocation, or possibly removal. The majority of the livestock depredations continued to occur in the Red Lodge area. This area had no conflicts five years ago and now experiences yearly depredations because of northerly expansion of grizzly bear range from Wyoming. The depredations are occurring on private ranch lands beyond the Demographic Monitoring Area (DMA) and will remain a management challenge.

From 2004 through 2014, there were 675 reported and investigated grizzly bear-human conflicts in Montana. During the time period of 1993─2003, there were 472 grizzly bear-human conflicts investigated. Annual conflict numbers have been increasing. This increase is likely associated with the increase in grizzly bear population numbers, the expansion of grizzly bear range, and the increase in human population and activity. There was a 30% increase in conflict numbers over the most recent 11-year period. However, if taken into consideration the increase in human population (25%), the increase in GYE grizzly bear population (32%) and the increase in overall bear distribution in Montana's portion of the GYE (36%), conflicts have been occurring at a

Table 32. Grizzly bear-human conflicts in Montana portion of the Greater Yellowstone Ecosystem, 2014.

Conflict type	Number of conflicts
Human injury	3
Encounter situations	9
Livestock depredations - cattle	9 (8 cattle killed, 2 injured)
Livestock depredations - sheep	0
Property damage	0
Anthropogenic foods	8
Anthropogenic foods w/ property damage	1
Near developed sites- safety concerns	11
Total	41

Table 33. Private and public land grizzly bear conflicts in Montana portion of the Greater Yellowstone Ecosystem, 2014.

Land ownership	Number of conflicts
Private	26
State	0
County or Local jurisdiction	0
Bureau of Land Management	0
Gallatin National Forest	9
Beaverhead National Forest	5
Custer National Forest	0
USFWS – National Wildlife Refuge	1
Total	41

relatively constant rate. Conflict reduction efforts have been successful on public and private lands. Yearly variation in total conflicts during 1992–2014 is shown in Figure 30.

Historically, livestock depredations by grizzly bears have been relatively low in southwest Montana. However, as bears expand their distribution farther away from recognized suitable habitat, livestock depredations are increasing on private lands in these areas. This has mostly occurred in the northeast area of the ecosystem near Red Lodge. With an increase in grizzly bear activity on the west side of the ecosystem, livestock depredations may become more frequent. During 1993–2003, there were 15 livestock depredations investigated in southwest Montana. This conflict type increased to 64 investigated livestock depredations during 2004–2014.

During 2014, there were six management captures of grizzly bears, all on private land. The long-term average over the previous 20 years is 4 management captures per year. Three of the 2014 captures involved male bears due to livestock (cattle) depredations. One adult male bear was captured within the DMA and was removed due to numerous cattle depredations in the area. The two other males were subadults involved in livestock depredations on private land beyond the DMA. Because it was unknown if the offending bear was captured, these two bears were relocated within the DMA. One old adult male bear was captured in a property damage/ unnatural food conflict on private land within the DMA and subsequently removed due to age and physical condition. There were two sub-adult females captured on private land and relocated within the DMA. Capture of these two subadult females was preventative to address business activities on the private land. Locations of 2014 management captures are shown in Figure 31.

During 2014, there were 8 known or probable grizzly bear mortalities in the Montana portion of the GYE. Two of the mortalities occurred on private land, and 6 occurred on public land. Two adult male grizzly bears mortalities occurred due to close encounters and defense of life and property (DLP) situations on

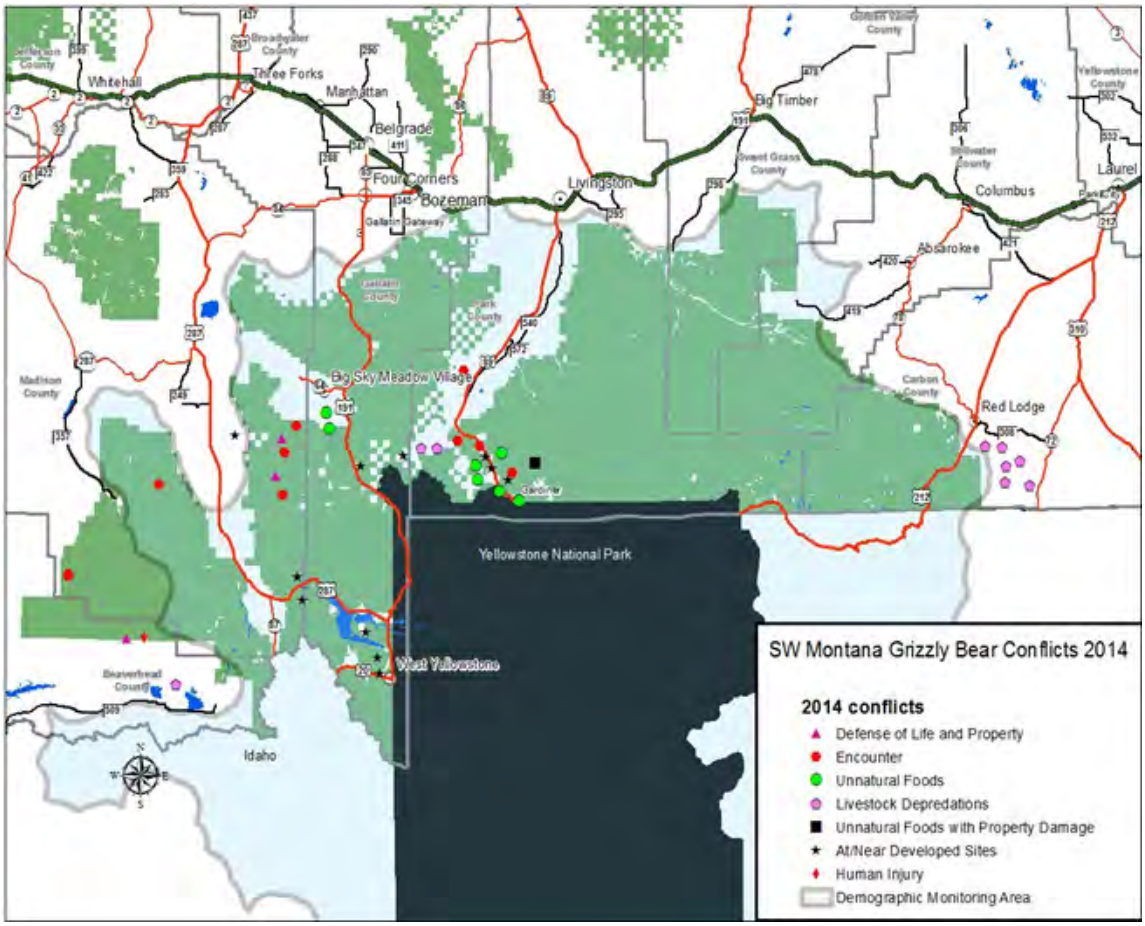


Figure 29. Locations of grizzly bear-human conflicts in the Montana portion of Greater Yellowstone Ecosystem, 2014.

public land in the far western portion of the ecosystem and beyond the DMA boundary. One adult male bear was illegally killed and one female bear was wounded (probable mortality) in a DLP situation, both on national forest land. Two adult male bear mortalities were the previously mentioned management removals for livestock conflicts on private land. There was one presumed natural mortality of an adult bear in the Absaroka-Beartooth Wilderness north of Yellowstone National Park (DNA analysis pending). This bear was discovered due to a larger grizzly bear feeding on the carcass. There was also a natural mortality of a cub in the upper Gallatin, discovered via observations of a radio-collared adult female. Locations of 2014 grizzly bear mortalities are shown in Figure 32.

Even as the Yellowstone grizzly bear population has been expanding throughout the entire ecosystem, Montana's long-term mortality trend has remained fairly constant since 1992, averaging 4 to 4.5 bear mortalities per year. Comparing time periods of

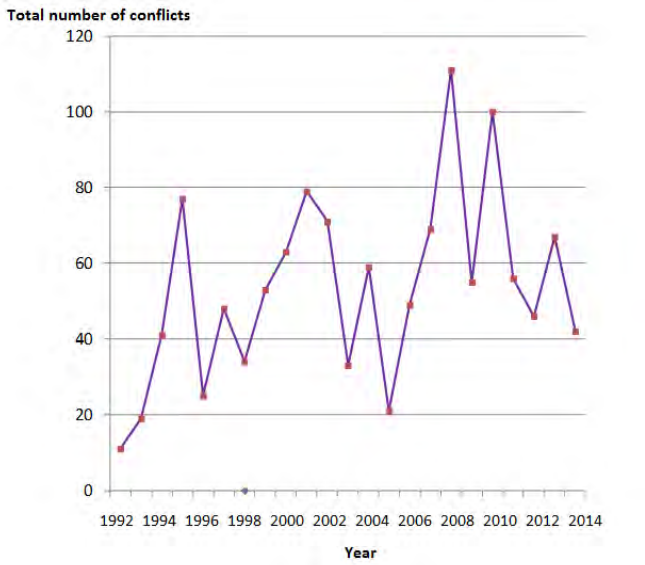


Figure 30. Yearly variation of total grizzly bear/human conflicts in the Montana portion of Greater Yellowstone Ecosystem, 1992–2014.

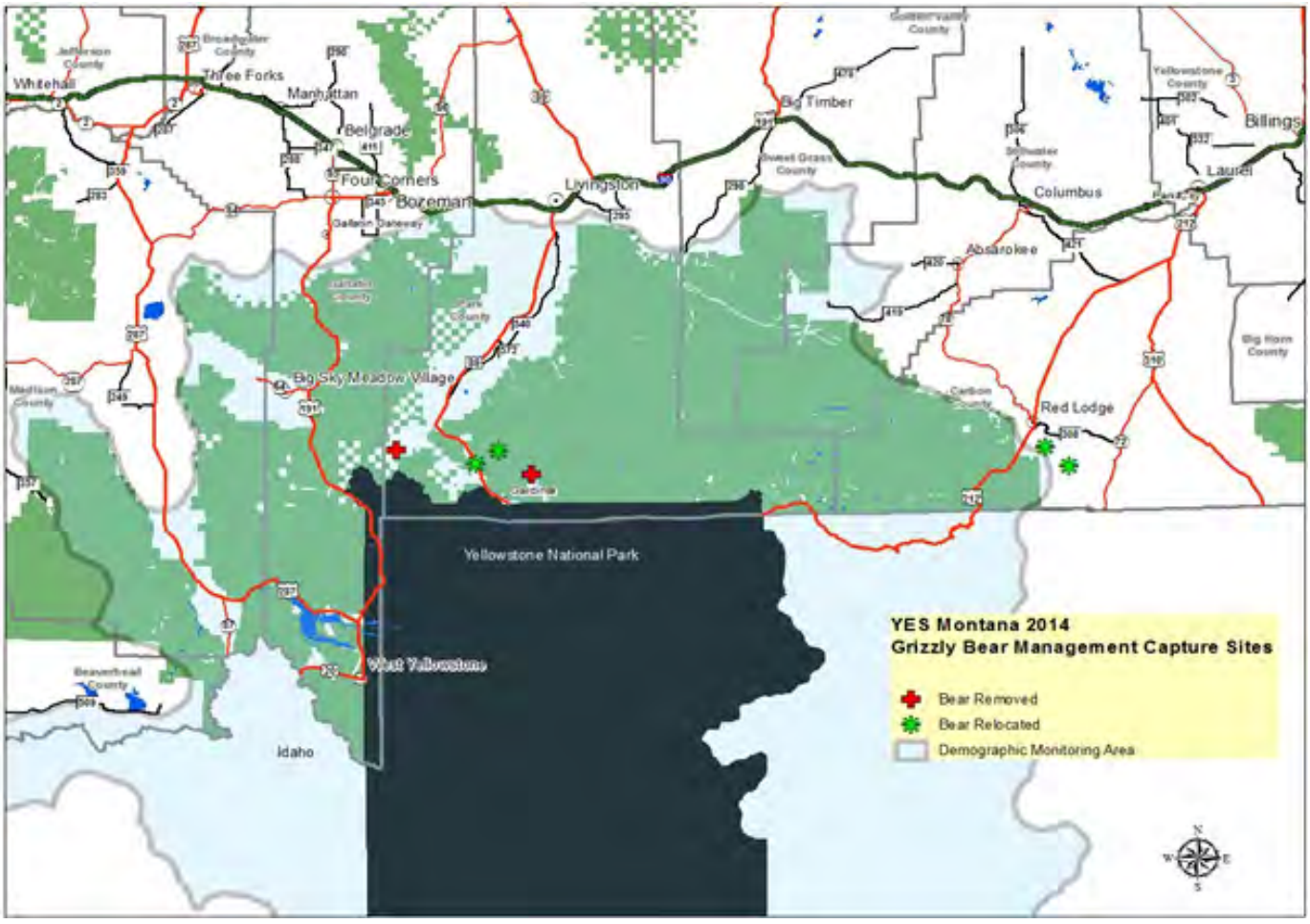


Figure 31. Locations of grizzly bear management captures in the Montana portion of Greater Yellowstone Ecosystem, 2014.

1993–2003 to 2004–2014, bear mortalities associated with anthropogenic foods have decreased from 46% down to 17% of the total annual mortality, suggesting that sanitation and education efforts have been successful. However, during this same time period, grizzly bear encounters resulting in human injuries and DLP bear mortalities has increased from 21% to 36% of the average annual bear mortality. Additionally, management removals due to livestock depredations have increased from 4% to 13% of the average annual mortalities in these same comparisons of time periods. The increase in overall mortality and shifts in mortality types can be attributed to Yellowstone grizzly bear increase in population numbers and expansion of distribution. The numbers and variations of grizzly bear management mortalities compared to all other mortality causes from 2004 through 2014 are shown in Figure 33. The expectation is that grizzly bears will continue to expand their range into areas beyond the DMA, potentially resulting in an increase of total conflicts and bear mortalities.

The 2014 summer climatic conditions resulted in slightly higher precipitation and relatively cooler temperatures compared with 2012 and 2013. The spring months had ample moisture from rain and snowpack melt. These conditions allowed for good berry production from low elevations to the alpine zones. Normally, high-elevation berry production is very limited to non-existent due to a short growing season and freezing temperatures killing the flower blossoms or the berries before maturity. Grizzly bear conflict numbers ($n = 42$) during 2014 were below the long-term conflict average ($n = 59$). Field investigations found grizzly bears using heavy shaded timber, wet areas, and open areas during the summer months. This feeding strategy likely allowed bears to find adequate vegetative and protein food sources, thereby resulting in fewer human interactions and conflicts during the summer months. Summer vegetative foods were adequate in these shaded and mesic areas and high-quality fall foods (e.g., berries, roots, seeds, carcasses) were in good quantity. No

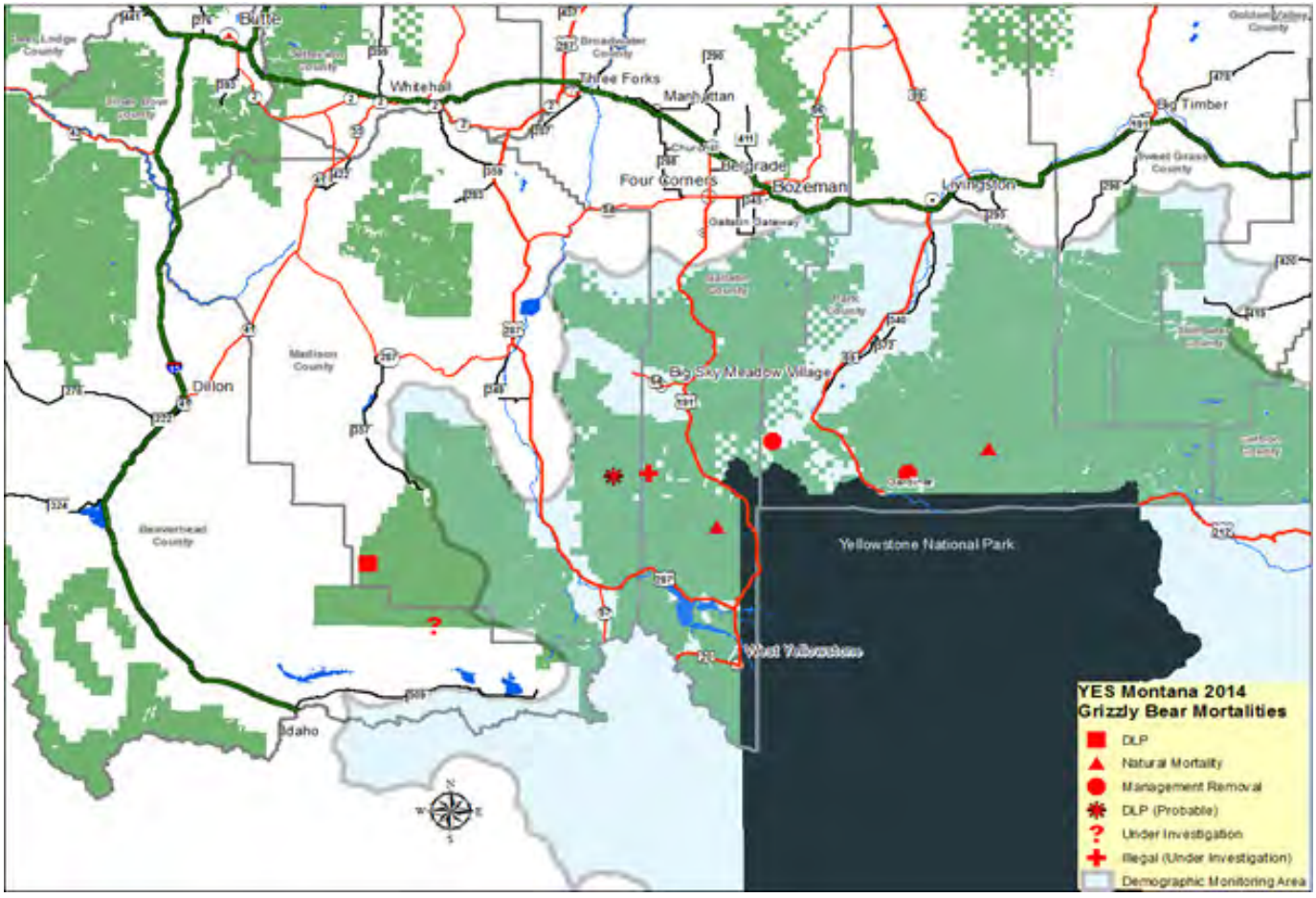


Figure 32. Locations and causes of grizzly bear mortalities in the Montana portion of Greater Yellowstone Ecosystem, 2014.

single factor can be attributed to low or high conflicts in a given year and it is always the accumulation of multiple factors. Natural food availability, climate conditions, bear numbers, previous bear removals, management efforts and human activities all factor into the annual variation in bear-human conflicts.

An extensive effort has been made to reduce all types of conflicts and a measure of success is being observed in a reduction of sanitation and anthropogenic food related conflicts and associated bear mortalities numbers. During 2014, only one conflict was related to garbage and the other anthropogenic conflicts mostly involved apples or domestic animal feeds.

Conservation Strategy funding from the USFWS provided since the initial delisting of the Yellowstone grizzly bear population has allowed the acquisition of 346 bear-resistant refuse containers for placement on private and public land within the Primary Conservation Area. Since 2006, the distribution and placement of 265 bear-resistant garbage containers in the upper Yellowstone River-Gardiner area has greatly reduced garbage related conflicts there. Additionally, with the formation of a Bear Aware Council, representing private businesses, community developments and agencies, Republic Services has distributed 730 bear-resistant garbage containers in the Big Sky area, with a total goal of 1,000 containers distributed by 2015. This sanitation effort will greatly help reduce black bear and grizzly bear conflicts in this portion of Gallatin and Madison Counties.

The most difficult conflict type to prevent is surprise encounter. Such encounters can lead to human injuries and are currently trending to be the second leading cause of grizzly bear mortalities. During 2014, there were three human injuries due

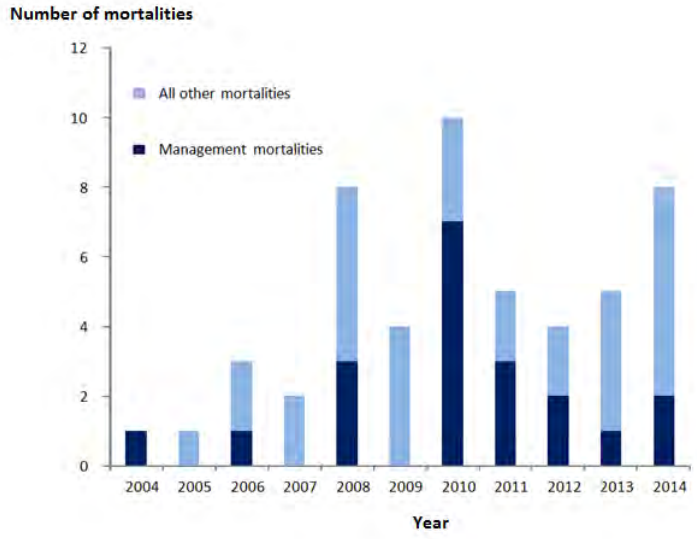


Figure 33. Mortality trend in the Montana portion of Greater Yellowstone Ecosystem, 2004-2014.ellowstone Ecosystem, 2014.

to physical encounters with bears. In one incident, two people sustained bruises and scrapes from being knocked down by a large grizzly bear but were not directly injured by the bear's teeth or claws. In the other incident a black bear hunter was severely mauled by an adult male grizzly bear. MFWP continues to distribute bear conflict information to hunters through hunter (archery and rifle) education classes, license holders, postcards, letters, personal contacts, newspapers, websites, and televised news. In general, most of the public is aware of grizzly bear presence and potential encounter situations, but due to the unpredictable random occurrence and location of surprise encounters, it is most difficult to alleviate these types of conflicts. A future challenge will be to effectively address bear management situations on lands beyond recognized suitable habitat.

Grizzly Bear-Human Conflicts in Wyoming *(Brian DeBolt, Zach Turnbull, Luke Ellsbury, Michael Boyce, Kyle Bales, Zach Gregory, Dustin Lasseter, Jason Wilmot, and Dan Thompson; Large Carnivore Section; Wyoming Game and Fish Department)*

Bear-human interactions and conflicts in Wyoming are typically a result of bears seeking unnatural foods in association with people and property, close encounters with humans, or when bears depredate livestock. The number and location of human-bear conflicts is influenced by unsecured unnatural attractants (e.g., human foods, garbage), natural food distribution and abundance, bear numbers and distribution, and human and livestock use patterns on the landscape.

The preferred approach to resolve human-bear conflicts in Wyoming is through prevention or to secure the attractant. In addition, the Wyoming Game and Fish Department (WGFD) relocates and removes grizzly bears in accordance with state and federal law, regulation, and policy. The management technique of capturing bears in areas where they may come into conflict with people and relocating them to remote locations is a common practice throughout the world. Relocating bears achieves several social and conservation functions: 1) reduces the chance of property damage, livestock damage, or human interactions in areas where the potential for conflict is high; 2) reduces the potential for bears to become food conditioned or human habituated, which can result in destructive and dangerous behaviors; 3) allows bears the opportunity to forage on natural foods and remain wary of people; and 4) could prevent removing bears from the population, which may be beneficial in meeting population management objectives. Removal refers to lethal or live removal (e.g., placement with a zoo or other captive bear facility) from the population.

During 2014, WGFD personnel captured 22 grizzly bears in 23 capture events in an attempt to prevent or resolve conflicts (Figure 34). Most captures were lone grizzly bears, but 2 family groups (one female with a cub and one with 2 yearling siblings) were also captured. Twelve (55%) of the 23 capture events occurred in Sublette County, seven (29%) in Park County, two (8%) in Hot Springs County, one (4%) in Fremont County, one (4%) in Teton County (Table 34). Of the 23 capture events, 16 captures were a result of bears killing livestock, primarily cattle. One management capture was a non-target yearling released on site in Sublette County. The remaining 6

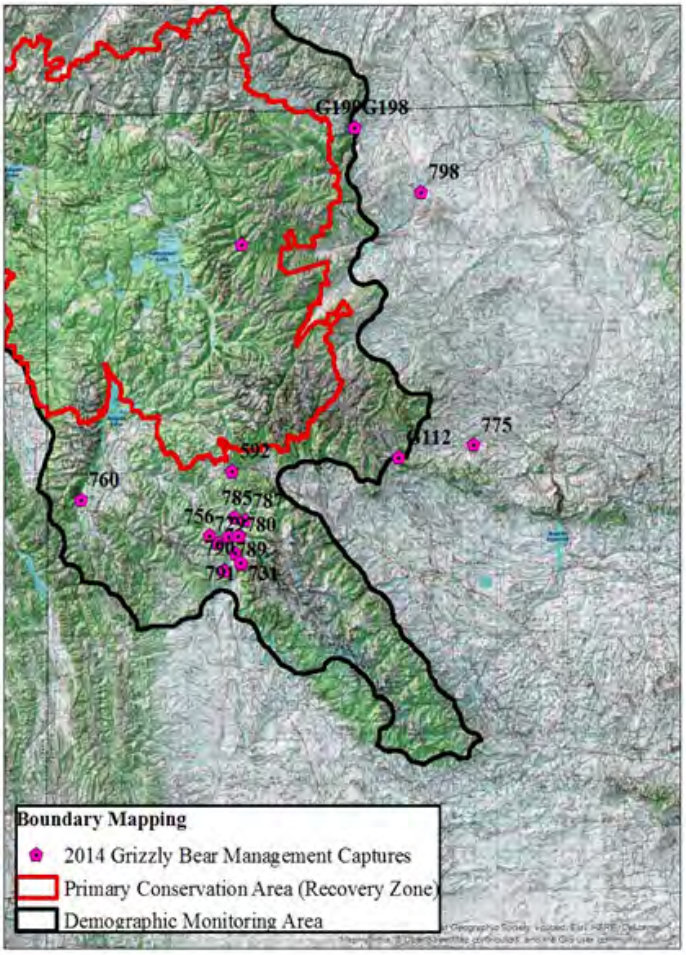


Figure 34. Management capture locations (n = 23) for grizzly bears captured, relocated, released, or removed in Wyoming, 2014. Grizzly bears with a "G" in front of their number were ear-marked but not fitted with a radio collar upon release typically because they were too young to be collared. The capture locations not marked with a number were grizzly bears removed from the population without being given an identification number.

bears were captured for exhibiting habituated behavior and being in close proximity to people. All relocated grizzly bears were released on U.S. Forest Service lands in or adjacent to the Grizzly Bear Recovery Zone (RZ), also known as the Primary Conservation Area (Figure 35). Of the 16 relocation events, 12 (75%) bears were released in Park County, and 4 (25%) were released in Teton County (Table 34). Six of the 23 capture events resulted in the removal of grizzly bears from the population by agency personnel through lethal removal or live placement. These bears were removed due to a history of previous conflicts, a known history of close association with humans, or they were deemed unsuitable for release into the wild (e.g., orphaned cubs, poor physical condition, or human safety concern).

Table 34. Capture date, grizzly bear identification number (ID), capture county, relocation site, release county, and reason for capture for all grizzly bear conflict management captures (n = 23) in Wyoming, 2014.

Date	ID	Capture county	Relocation site	Relocation county	Reason for capture
5/19/2014	775	Hot Springs	Gibson Meadows -Targhee National Forest	Teton	Relocated for sheep depredation.
7/2/2014	780	Sublette	Mormon Creek -Shoshone National Forest	Park	Relocated for cattle depredation.
7/12/2014	729	Sublette	5 Mile Creek-Shoshone National Forest	Park	Relocated for cattle depredation.
7/23/2014	756	Sublette			Removed for killing multiple cattle.
7/26/2014	676	Sublette	Fox Park -Shoshone National Forest	Park	Relocated for sheep depredation.
7/27/2014	G197	Sublette	Fox Park - Shoshone National Forest	Park	Relocated for sheep depredation.
8/2/2014	G112	Hot Springs			Removed for cattle depredation.
8/8/2014	787	Sublette	On Site		Nontarget at depredation site. Released on site.
8/14/2014	789	Sublette	Sunlight Creek -Shoshone National Forest	Park	Relocated for cattle depredation.
8/27/2014	731	Sublette			Removed for cattle depredations.
8/27/2014	790	Sublette	Mormon Creek - Shoshone National Forest	Park	Relocated for cattle depredations.
9/7/2014	791	Sublette	Five Mile Creek - Shoshone National Forest	Park	Relocated for cattle depredation.
9/8/2014	785	Sublette	Fox Creek - Shoshone National Forest	Park	Relocated for cattle depredation.
9/11/2014	592	Fremont	Mormon Ck-N Fk Shoshone River - Shoshone National Forest	Park	Relocated for cattle depredation
9/22/2014		Park			Relocated for cattle depredation
9/30/2014	G198	Park	5 Mile Creek -Shoshone National Forest	Park	Frequenting a guest ranch, unafraid of people, removed to the Pocatello zoo
9/30/2014	G199	Park	5 Mile Creek -Shoshone National Forest	Park	Relocated for cattle depredation.

Table 34. Continued.

Date	ID	Capture county	Relocation site	Relocation county	Reason for capture
10/4/2014	797	Sublette	Squirrel Meadows-Caribou-Targhee National Forest	Teton	Relocated for cattle depredation.
10/8/2014	798	Park	Bailey Creek,-Bridger-Teton National Forest	Teton	Relocated for damaging fruit trees/birdfeeders, getting grain and close to people.
10/10/2014	760	Teton	5-Mile Creek -Shoshone National Forest	Park	Captured for frequenting residential areas.
10/26/2014	760	Park			Removed for conflict history, habituation, and close association to people and developed areas.
10/28/2014	724	Park			Removed for conflict history and close association to people and developed areas.
11/3/2014	G200	Park	Lost Lake - Bridger-Teton National Forest	Teton	Relocated for being in close proximity to residences and damaging a corn field.

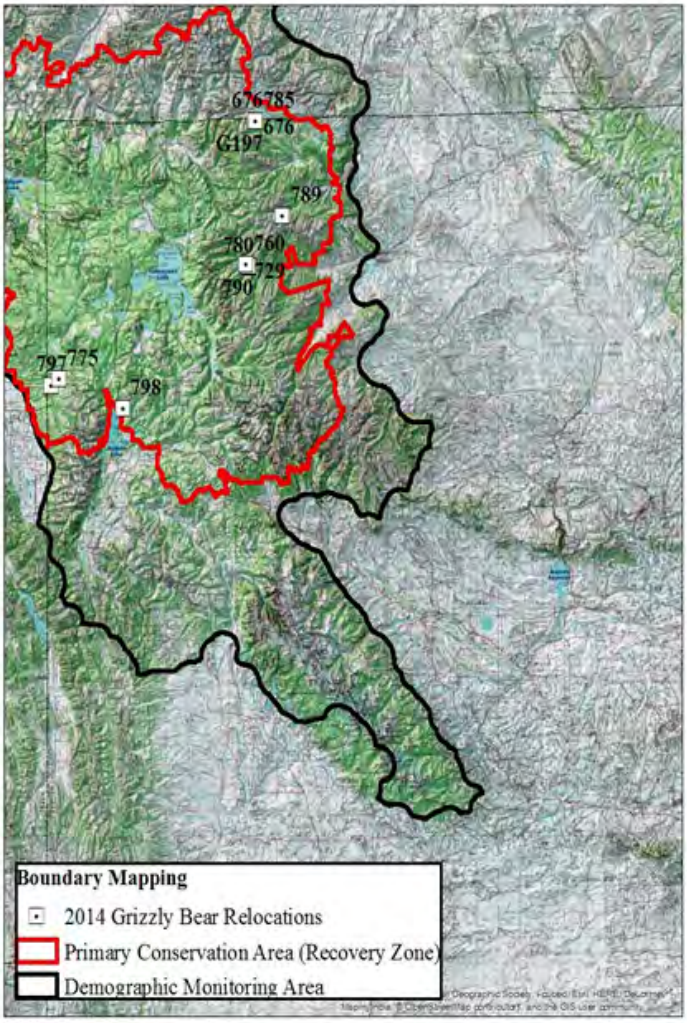


Figure 35. Release locations (n = 16) for grizzly bears captured, relocated, or released on site in conflict management efforts, Wyoming, 2014. Grizzly bears with a "G" in front of their number were ear-marked but not fitted with a radio collar upon release typically because they were too young to be collared.

Table 35. Type and number of human-grizzly bear conflicts in Wyoming, 2014.

Conflict Type	Number	Percent
Livestock	130	79
Human foods	10	6
Aggression toward human	7	4
Pet/livestock/bird feeders	4	2
Property damage	4	2
Fruit trees	3	2
Garbage	2	1
Human injury	2	1
Human death	1	1
Apiary damage	1	1
Total	164	

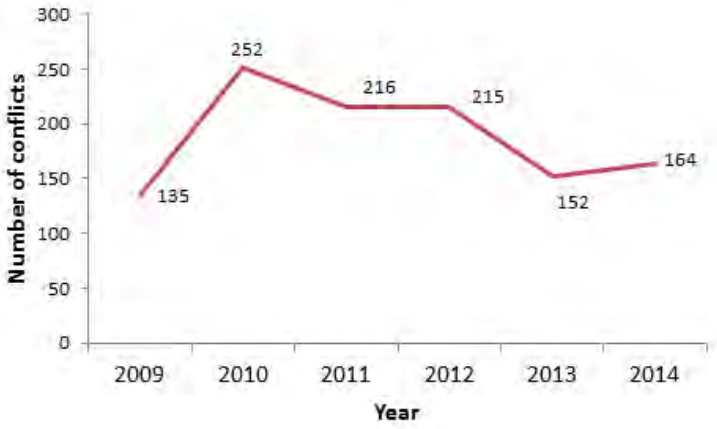


Figure 36. Number of grizzly bear-human conflicts in Wyoming, 2009–2014.

All independent grizzly bears greater than 2 years old that were relocated were fitted with a radio-telemetry collar (n = 13) to track their movements after release. Attempts to obtain locations on marked animals via aerial telemetry were made approximately every 10–14 days as part of standard monitoring techniques throughout the ecosystem. As per Wyoming Statute, within 5 days of releasing a grizzly bear, the County Sheriff was notified by e-mail and a press release was distributed to all local media contacts in the county where the grizzly bear was released. The media release contained information on the location of the grizzly bear release, the number of grizzly bears relocated, the date of the relocation, and the reason the grizzly bear was relocated (Table 34).

Department personnel investigated and recorded 164 grizzly bear-human conflicts in 2014 (Table 35, Figure 37). As a result of numerous and diligent education and conflict prevention efforts, the general pattern of conflicts is relatively steady (Figure 36). However, documentation of grizzly bears and conflicts continue to be observed in areas further from the RZ. Bears are coming into conflict with people in areas not used by grizzly bears in recent history. Grizzly bears killing cattle was the most frequent type of conflict documented in 2014. The annual variation in livestock depredation incidents is not easily explained. Although most human-bear conflicts are correlated with natural food abundance, the number of cattle and sheep killed annually do not follow the same pattern. The WGFD continues to explore options to reduce grizzly bear livestock conflicts.

The majority of conflicts in Wyoming occurred on public lands outside of the Recovery Zone (Figures

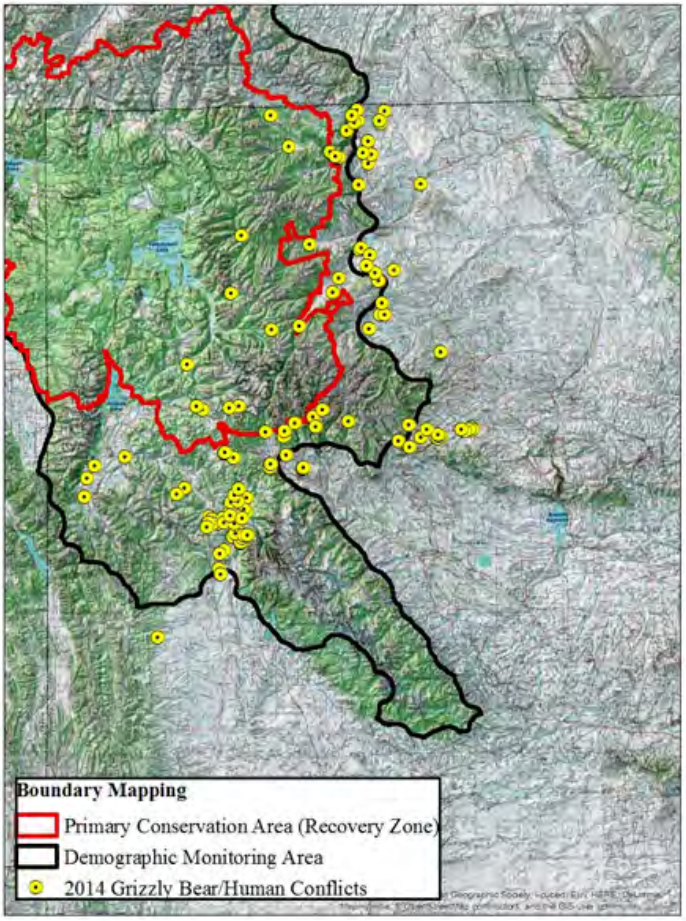


Figure 37. Location of human-grizzly bear conflicts in Wyoming outside of National Parks (*n* = 164) in relation to the Recovery Zone and the Demographic Monitoring Area, Wyoming, 2014.

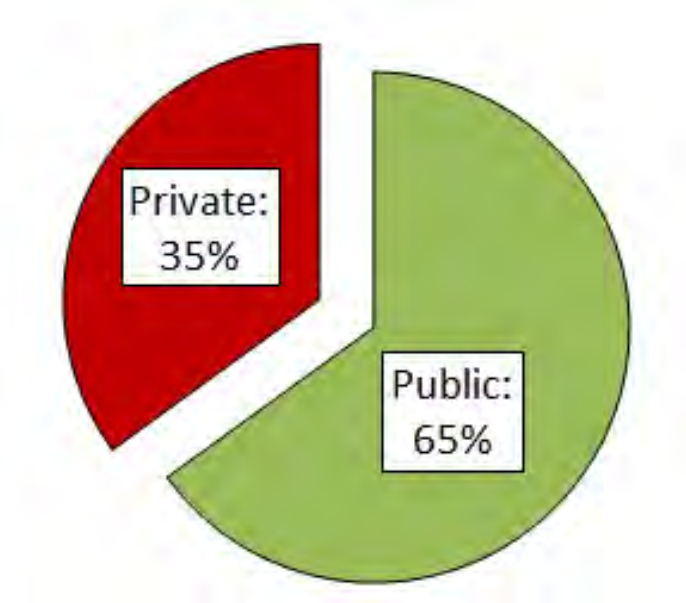


Figure 38. Percentage of human-grizzly bear conflicts on private and public lands in Wyoming, 2014.

37 and 38). The increasing distribution of grizzly bears is reflected in the annual documentation of conflicts further from this boundary. As bears expand and occupy habitats commonly used by humans, conflicts will likely increase. Education and conflict prevention efforts will be used anywhere bears and people coexist, and management actions will be a function of human values and grizzly bear population effects in those areas.

Within Wyoming, outside of the National Parks and Wind River Reservation, there were 13 known or probable human-caused mortalities in 2014. Management removals accounted for 6 mortalities in 2014. Of the 6 grizzly bears removed in management actions, 3 were removed due to livestock depredations and 3 due to property damage or human food rewards and exhibiting unnaturally bold behavior in close proximity to humans. In addition to the 6 management removals, 1 grizzly bear was killed by another grizzly bear, 1 was killed in a vehicle collision, and 5 mortalities are under investigation by law enforcement. Most grizzly bear-human conflicts in Wyoming were a result of domestic livestock depredations and food rewards from humans in the form of garbage or pet and livestock feed. Long-term trends in the number of conflicts is likely a result of grizzly bears increasing in numbers and expanding into areas used by humans, including livestock production, on public and private lands. If the GYE grizzly bear population continues to grow and expand in distribution, bears are likely to encounter food sources such as livestock and livestock feed, garbage, and pet food resulting in increased property damage and threats to human safety. Conflict prevention measures such as attractant storage, deterrence, and education are the highest priority for the WGFD (Appendix C). In general, there is an inverse relationship between social tolerance and biological suitability for bear occupancy in areas further from the Recovery Zone due to 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.

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

No depredations of livestock were reported or documented on Wind River in 2014. No grizzly bears were removed or transported to or from Wind River in 2014 for any purpose, including any related to human conflicts.

Two reports of aggression toward humans were reported in 2014. The first involved a person on foot that was chased in the Black Mountain area in April 2014. No physical contact or injuries occurred. The second involved 2 persons on ATVs that were chased by a female grizzly bear with cubs in the Washakie Park area in July 2014. Subsequent placement of remote cameras with lure on 2 occasions did not document the presence of these bears. No physical contact or injuries occurred.

The first capture and GPS collar deployment of a grizzly bear (subadult male) in the Wind River Mountain portion of the reservation Wind River Indian Reservation, 13 August, 2014. Photo courtesy of Pat Hnilicka, USFWS.

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

In an effort to make scientifically based decisions regarding the bear safety regulations required of park visitors and the bear safety recommendations provided to them, Yellowstone National Park (YNP) managers are interested in the relative risk of grizzly bear attack on the public recreating in the park. To address this need, we recorded information on human-bear interactions occurring in the park. Because the risk of bear attack varies depending on visitor location and activity, we grouped human-bear interactions into 5 broad categories including: 1) front-country developments, 2) road-side corridors, 3) backcountry campsites, 4) backcountry trails, and, 5) off-trail backcountry areas.

Bear-Human Interactions within Developed Front-country Sites

Bears may enter front-country developments in the park for a variety of reasons, including travel, foraging for natural foods, seeking human foods or garbage, or other reasons. Under YNP's Bear Management Plan, front-country developments are managed for people and bears are actively excluded through hazing, capture and relocation, or capture and removal.

Activity of Bears in Front-country Developed Sites.—In 2014, there were 50 incidents reported where grizzly bears were known to enter park developments (Table 36). The activity of the bear was reported in 46 of the 50 incidents. In 25 (54%) of the incidents where activity was reported, bears were foraging for natural foods within the front-country developments. In 19 (41%) of the incidents, it appeared that the bears were just traveling through the developments. In 2 (4%) incidents the bears were investigating sources of human foods or garbage. Bears obtained a food reward in one of these 2 incidents and damaged property without obtaining a food reward in the other incident.

Reactions of Bears to the Presence of People in Front-country Developments.— Grizzly bears were known to have encountered people in 32 of the 50 reported incidents where they entered front-country developments (Table 37). The bear's reaction to the presence of people was reported in 30 of the 32 encounters. The reaction of bears involved a flight response in 57% (n = 17) and a neutral response in 37% (n = 11) of the incidents where the reaction was reported. Bears displayed stress behaviors in 3% (n = 1) and aggressive behavior (bluff charge) in 3% (n = 1) of the incidents. There were no people attacked by grizzly bears within YNP front-country developments in 2014.

Table 36. Activity of bears that entered front-country developments in Yellowstone National Park, 2014.

Bear activity while inside development	Incidents
Not reported/unknown	4
Travel through	19
Forage natural foods	25
Investigate anthropogenic foods but no food reward and no property damage	0
Investigate and damage property but no food reward	1
Investigate and obtain anthropogenic foods	1
Attack people	0
Other	0
Total	50

Bear-human Interactions Along Roadside

Bears may frequent habitat adjacent to roads in the park for traveling, foraging for natural foods, seeking human food handouts, or other reasons. In the past (1910–1969), bears commonly panhandled along park roads for food handouts from park visitors (Schullery 1992). Strict enforcement of regulations prohibiting the hand feeding of bears since 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, under YNP's Bear Management Plan, 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, or adjacent drainage ditch, they are tolerated in roadside meadows and are not actively discouraged from using roadside habitats to forage for natural foods.

Bear Activity Along Roadsides.—In 2014, 351 reports of grizzly bears ≤ 200m from park roads were reported. The primary activity of roadside bears was recorded in 344 of these 351 reports (Table 38). In the

Table 37. Reactions of grizzly bears to encounters with people within front-country developments, along roadsides, in backcountry campsites, on trails, and in off-trail areas in Yellowstone National Park, 2014.

Reaction of bear	Development	Along roadside	Backcountry campsite	On trail	Off trail	Total
Not reported/unknown	2	2	0	2	0	6
Flight response						
Run away	9	12	3	2	7	33
Walk away	8	37	3	9	2	59
Adult climb tree	0	0	0	0	0	0
Cubs climb tree/adult remain	0	0	0	0	0	0
Flight behavior subtotal	17	49	6	11	9	92
Neutral behaviors						
No overt reaction	11	155	1	8	8	183
Stand up on hind legs	0	2	0	3	2	7
Circle down wind	0	0	0	0	0	0
Neutral behavior subtotal	11	157	1	11	10	190
Curious behaviors						
Walk towards stationary person	0	2	1	2	1	6
Follow mobile person	0	0	0	0	0	0
Investigate vehicle	0	0	0	0	0	0
Curious behavior subtotal	0	2	1	2	1	6
Stress/agitation/warning signals						
Salivate	0	0	0	0	0	0
Sway head side to side	0	0	0	0	0	0
Make huffing noises	1	0	0	0	0	1
Pop jaws/teeth clacking noises	0	0	0	0	0	0
Stood ground watched/stared	0	0	0	0	0	0
Slap ground with paw	0	0	0	0	0	0
Flatten ears/erect spinal hairs	0	0	0	0	0	0
Stiff legged walk/hop	0	0	0	0	0	0
Stress/warning behavior subtotal	1	0	0	0	0	1
Aggressive behaviors						
Growl	0	0	0	0	0	0
Stalk	0	0	0	0	0	0
Run towards/aggressive charge	1	3	0	1	0	5
Aggressive behavior subtotal	1	3	0	1	0	5
Attack behaviors						
Defensive attack	0	0	0	0	0	0
Predatory attack	0	0	0	0	0	0
Attack unknown cause	0	0	0	0	0	0
Attack behavior subtotal	0	0	0	0	0	0
Total	32	213	8	27	20	300

Table 38. Primary activity of grizzly bears along roadsides in Yellowstone National Park, 2014.

Activity of bear while inside development	Number of incidents
Not reported/unknown	7
Traveling	85
Foraging natural foods	251
Mating	3
Swimming	2
Sleeping	2
Investigating vehicles/seeking anthropogenic foods - no food reward	0
Obtain anthropogenic foods	0
Damage property	0
Attack people	0
Other	1[a]
Total	351

[a] Dying from wounds inflicted by another bear.

Table 39. Primary activity of grizzly bears that entered occupied backcountry campsites in Yellowstone National Park, 2014.

Activity of bear	Number of incidents
Not reported/unknown	1
Walked past edge of campsite	0
Walked through core camp	6
Forage native foods	1
Investigate tent without damage	0
Investigate food pole	0
Investigate fire ring	1
Attempt to get human foods (not successful)	0
Damage property	0
Obtain anthropogenic foods	0
Investigate latrine (buried human feces/toilet paper)	0
Lay down/rest in campsite	0
Aggressive approach/posture towards people in campsite	0
Total	9

majority of these incidents, the roadside bears' primary activity was foraging for natural foods (73%, *n* = 251) or traveling (25%, *n* = 85). Other activities reported included mating (1%, *n* = 3), swimming (<1%, *n* = 2), sleeping (<1%, *n* = 2), and dying from injuries inflicted by another bear (<1%, *n* = 1).

Reactions of Bears to the Presence of People Along Roadsides.—Bears were noticeably aware of the presence of people in 213 of the 351 reports of bear activity along roads. The reaction of bears to people was reported for 211 of these 213 roadside encounters (Table 37) and were classified as neutral in 74% (*n* = 157), flight response in 23% (*n* = 49), and as curious in 1% (*n* = 2) of the incidents. Bears displayed aggressive behavior in 1% (*n* = 3) of roadside encounters. There were no people attacked by grizzly bears along roadsides within YNP in 2014.

Bear-Human 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. YNP 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, short-term closures of backcountry trails, campsites, and off-trail areas to recreational use are implemented when human activities conflict with natural bear activities and behaviors.

Activity of Bears in Occupied Backcountry Campsites.—Bears occasionally enter designated backcountry campsites while the campsites are occupied by recreational users. In 2014, there were 9 incidents reported where grizzly bears entered occupied backcountry campsites (Table 39). The primary bear activity was reported for 8 of the 9 incidents and included walking through the core camp (*n* = 6), foraging on native foods (*n* = 1), and investigating the fire ring (*n* = 1).

Reactions of Bears to the Presence of People in Backcountry Campsites.—In 8 of the 9 incidents where grizzly bears entered occupied backcountry campsites, the campers believed that the bear knew people were present in the campsite. The reaction of bears to the presence of people were reported for all 8 of these incidents and included fleeing (*n* = 6), a neutral response (*n* = 1), and a curious response in 1 instance (Table 37). There were no people attacked by grizzly bears in backcountry campsites in YNP in 2014.

Reactions of Bears to Encounters with People on Backcountry Trails.—In 2014, there were 27 grizzly bear-human encounters where people encountered grizzly bears on backcountry trails where the bear was aware of the human presence (Table 37). The reaction of bears to the encounters were reported for 25 of these incidents. Grizzly bears reacted to encounters with people along backcountry trails with flight behaviors in 44% (n = 11), neutral behaviors in 44% (n = 11), and curious behaviors in 8% (n = 2) of the incidents. Grizzly bears reacted aggressively (bluff charge) without making contact in 1 encounter. No people were attacked by grizzly bears on backcountry trails in the park in 2014.

Reactions of Bears to Encounters with People in Off-Trail Backcountry Areas.—In 2014, there were 20 incidents where people encountered grizzly bears and the bear was aware of human presence while traveling off-trail in backcountry areas (Table 37). The reaction of bears to the encounters were reported for all incidents and included neutral behaviors in (50%; n = 10), fleeing in (45%; n = 9), and in a curious response (5%; n = 1). Grizzly bears did not react aggressively in any of the encounters. No people were attacked by grizzly bears during encounters in off-trail backcountry areas of the park in 2014.

Summary

Grizzly bears instill fear in many YNP visitors and when they attack people in the park, it generates world-wide news further spreading their ferocious reputation. However, grizzly bears rarely reacted aggressively toward people during encounters in YNP in 2014. In the 294 encounters between grizzly bears and people where the bears reaction was reported, bears reacted with neutral behaviors in 65% (n = 190), by fleeing in 31% (n = 92), curious behaviors in 2% (n = 6), and with stress or warning behaviors in <1% (n = 1) of the incidents. Grizzly bears reacted with aggression without contact in 2% (n = 5) of the encounters (Table 40). None of the encounters between people and grizzly bears in YNP in 2014 resulted in an attack.

Table 40. Grizzly bears reactions to 294 interactions with people that occurred in developments, roadside corridors, backcountry campsites, backcountry trails, and off-trail backcountry areas in Yellowstone National Park, 2014.

	Reaction of bear											
	Flee		Neutral behavior		Curious		Stress/agitation		Aggression		Attack	
Location of encounter	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Park development	17	57%	11	37%	0	0%	1	3%	1	3%	0	0%
Roadside corridor	49	23%	157	74%	2	1%	0	0%	3	1%	0	0%
Backcountry campsite	6	75%	1	13%	1	13%	0	0%	0	0%	0	0%
Backcountry trail	11	44%	11	44%	2	8%	0	0%	1	4%	0	0%
Backcountry off-trail	9	45%	10	50%	1	5%	0	0%	0	0%	0	0%
Total	92	31%	190	65%	6	2%	1	<1%	5	2%	0	0%

Literature Cited

Andrascik, R. 1992. Lake area-Bridge Bay spawning survey. Pages 29–35 *in* R. Andrascik, D. G. Carty, R. D. Jones, L. R. Kaeding, B. M. Kelly, D. L. Mahony, and S. T. Olliff. Annual project report for 1991, Fishery and Aquatic Management Program, Yellowstone National Park. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Yellowstone National Park, Wyoming, USA.

Basile, J. 1982. Grizzly bear distribution in the Yellowstone area, 1973–79. Research Note INT-321. U.S. Forest Service, Intermountain Forest and Range Experiment Station, Ogden, Utah, USA.

Bjornlie, D., and M. A. Haroldson. 2011. Grizzly bear use of insect aggregation sites documented from aerial telemetry and observation. Pages 33–35 *in* C. C. Schwartz, M. A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2010. U.S. Geological Survey, Bozeman, Montana, USA.

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

Bjornlie, D. D., F. T. van Manen, M. R. Ebinger, M. A. Haroldson, D. J. Thompson, and C. M. Costello. 2014*b*. Whitebark pine, population density, and home-range size of grizzly bears in the Greater Yellowstone Ecosystem. PLoS ONE 9(2):e88160. doi: 10.1371/journal.pone.0088160.

Blanchard, B. 1985. Field techniques used in the study of grizzly bears. Interagency Grizzly Bear Study Team report. National Park Service, Bozeman, Montana, USA.

Blanchard, B. M. 1987. Size and growth patterns of the Yellowstone grizzly bear. International Conference on Bear Research and Management 7:99–107.

Blanchard, B. and R. Knight. 1991. Movements of Yellowstone grizzly bears, 1975–87. Biological Conservation 58:41–67.

Blanchard, B. M., R. R. Knight, and D. J. Mattson. 1992. Distribution of Yellowstone grizzly bears during the 1980s. American Midland Naturalist 128:332–338.

Burnham, K. P., and D. R. Anderson. 2002. Model selection and multimodel inference: a practical information-theoretic approach. Second edition. Springer-Verlag, New York, New York, USA.

Chao, A. 1989. Estimating population size for sparse data in capture-recapture experiments. Biometrics 45:427–438.

Cherry, S., M. A. Haroldson, J. Robison-Cox, and C. C. Schwartz. 2002. Estimating total human-caused mortality from reported mortality using data from radio-instrumented grizzly bears. Ursus 13:175–184.

Cherry, S., G. C. White, K. A. Keating, M. A. Haroldson, and C. C. Schwartz. 2007. Evaluating estimators for numbers of females with cubs-of-the-year in the Yellowstone grizzly bear population. Journal of Agricultural, Biological, and Environmental Statistics 12(2):195–215.

Costello, C. M., F. T. van Manen, M. A. Haroldson, M. R. Ebinger, S. L. Cain, K. A. Gunther, and D. D. Bjornlie. 2013. Influence of whitebark pine decline on fall habitat use and movements of grizzly bears in the Greater Yellowstone Ecosystem. Ecology and Evolution 4:2004–2018

Craighead, J. J., K. R. Greer, R. R. Knight, and H. I. Pac. 1988. Grizzly bear mortalities in the Yellowstone Ecosystem, 1959–1987. Report

of the Montana Department of Fish, Wildlife and Parks; Craighead Wildlife Institute; Interagency Grizzly Bear Study Team; and National Fish and Wildlife Foundation.

Craighead, J. J., J. Sumner, and J. A. Mitchell. 1995. The grizzly bears of Yellowstone: their ecology in the Yellowstone ecosystem, 1959–1992. Island Press, Washington, D.C., USA.

Eberhardt, L. L. 1995. Population trend estimates from reproductive and survival data. Pages 13–19 *in* R. R. Knight and B. M. Blanchard, authors. Yellowstone grizzly bear investigations: report of the Interagency Study Team, 1994. National Biological Service, Bozeman, Montana, USA.

Eberhardt, L. L., B. M. Blanchard, and R. R. Knight. 1994. Population trend of Yellowstone grizzly bear as estimated from reproductive and survival rates. Canadian Journal of Zoology 72:360–363.

French, S. P., M. G. French, and R. R. Knight. 1994. Grizzly bear use of army cutworm moths in the Yellowstone ecosystem. International Conference on Bear Research and Management 9:389–399.

Green, G. I. 1994. Use of spring carrion by bears in Yellowstone National Park. Thesis, University of Idaho, Moscow, Idaho, USA.

Gunther, K. A., B. Aber, M. T. Bruscino, S. L. Cain, M. A. Haroldson, and C. C. Schwartz. 2012. Grizzly bear-human conflicts in the Greater Yellowstone Ecosystem. Pages 48–52 *in* F. T. van Manen, M. A. Haroldson, and K. West, editors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 2011. U.S. Geological Survey, Bozeman, Montana, USA.

Gunther, K. A., M. A. Haroldson, K. L. Frey, S. L. Cain, J. Copeland, and C. C. Schwartz. 2004. Grizzly bear-human conflicts in the Greater Yellowstone Ecosystem, 1992–2000. Ursus 15(1):10–24.

Gunther, K. A., R. R. Shoemaker, K. L. Frey, M. A. Haroldson, S. L. Cain, F. T. van Manen, and J. K. Fortin. 2014. Dietary breadth of grizzly bears in the Greater Yellowstone Ecosystem. Ursus 25(1):61–73.

Haroldson, M. A. 2012. Assessing trend and estimating population size from counts of unduplicated females. Pages 10–15 *in* C. C. Schwartz, M. A. Haroldson, and K. West, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2011. U.S. Geological Survey, Bozeman, Montana, USA

Haroldson, M. A., K. A. Gunther, D. P. Reinhart, S. R. Podruzny, C. Cegelski, L.Waits, T. C. Wyman, and J. Smith. 2005. Changing numbers of spawning cutthroat trout in tributary streams of Yellowstone Lake and estimates of grizzly bears visiting streams from DNA. Ursus 16(2):167–180.

Haroldson, M. A., M. Ternent, G. Holm, R. A. Swalley, S. R. Podruzny, D. Moody, and C. C. Schwartz. 1998. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1997. U.S. Geological Survey, Biological Resources Division, Bozeman, Montana, USA.

Harris, R. B., G. C. White, C. C. Schwartz, and M. A. Haroldson. 2007. Population growth of Yellowstone grizzlies: uncertainty, correlation, and future monitoring. Ursus 18(2):167–177.

Herrero, S., T. Smith, T. D. DeBruyn, K. Gunther, and C. A. Matt. 2005. Brown bear habituation to people: safety risks and benefits. Wildlife Society Bulletin 33:362–373.

Higgs, M. D., W. A. Link, G. C. White, M. A. Haroldson, and D. D. Bjornlie. 2013. Insights into the latent multinomial model through mark-resight data on female grizzly bears with cubs-of-the-year. Journal of Agricultural, Biological, and Environmental Sciences 18:556–577.

Hopkins, J. B., S. Herrero, R. T. Shideler, K. A. Gunther, C. C. Schwartz, and S. T. Kalinowski. 2010. A proposed lexicon of terms and concepts for human-bear management in North America. Ursus 21(2):154–168.

Interagency Grizzly Bear Study Team. 2005. Reassessing methods to estimate population size and sustainable mortality limits for the Yellowstone grizzly bear. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Montana State University, Bozeman, Montana, USA.

Interagency Grizzly Bear Study Team. 2006. Reassessing methods to estimate population size and sustainable mortality limits for the Yellowstone grizzly bear: workshop document supplement. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Montana State University, Bozeman, Montana, USA.

Interagency Grizzly Bear Study Team. 2012. Updating and evaluating approaches to estimate population size and sustainable mortality limits for grizzly bears in the Greater Yellowstone Ecosystem. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, Montana, USA. Available at http://nrmsc.usgs.gov/files/norock/IGBST/GYEGBMonMortWksRpt2012(2).pdf.

Interagency Grizzly Bear Study Team. 2013. Response of Yellowstone grizzly bears to changes in food resources: a synthesis. Report to the Interagency Grizzly Bear Committee and Yellowstone Ecosystem Subcommittee. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, Montana, USA. http://nrmsc.usgs.gov/research/igbst/GBFSR_Refs

Jope, K. L. 1985. Implications of grizzly bear habituation to hikers. Wildlife Society Bulletin 13:32–37.

Keating, K. A., C. C. Schwartz, M. A. Haroldson, and D. Moody. 2002. Estimating numbers of females with cubs-of-the-year in the Yellowstone grizzly bear population. Ursus 13:161–174.

Knight, R. R., B. M. Blanchard, and L. L. Eberhardt. 1995. Appraising status of the Yellowstone grizzly bear population by counting females with cubs-of-the-year. Wildlife Society Bulletin 23:245–248.

Knight, R. R., and L. L. Eberhardt. 1985. Population dynamics of Yellowstone grizzly bears. Ecology 66:323–334.

Knight, R. R., D. J. Mattson, and B. M. Blanchard. 1984. Movements and habitat use of the Yellowstone grizzly bear. Interagency Grizzly Bear Study Team report. National Park Service, Bozeman, Montana, USA.

Koel, T. M., J. L. Arnold, P. E. Bigelow, and M. E. Ruhl. 2010*b*. Native fish conservation plan for Yellowstone National Park. Environmental Assessment. National Park Service, U.S. Department of the Interior, Yellowstone National Park. December 16, 2010. 232 pp. + Appendices.

Koel, T. M., J. L. Arnold, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and M. E. Ruhl. In press. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2014. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, USA.

Koel, T. M., J. L. Arnold, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and M. E. Ruhl. 2010*a*. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2008. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, USA. YCR-2010-03.

Koel, T. M., P. E. Bigelow, P. D. Doepke, B. D. Ertel, and D. L. Mahony. 2005. Nonnative lake trout result in Yellowstone cutthroat trout decline and impacts to bears and anglers. Fisheries 30(11):10–19.

Koel, T. M., D. L. Mahony, K. L. Kinnan, C. Rasmussen, C. J. Hudson, S. Murcia, and B. L. Kerans. 2006. *Myxobolus cerebralis* in native cutthroat trout of the Yellowstone Lake ecosystem. Journal of Aquatic Animal Health 18:157–175.

Mattson, D. J. 1997. Use of ungulates by Yellowstone grizzly bears *Ursus arctos*. Biological Conservation 81:161–177.

Mattson, D. J., B. M. Blanchard, and R. R. Knight. 1991*a*. Food habits of Yellowstone grizzly bears. Canadian Journal of Zoology 69:1619–1629.

Mattson, D. J., C. M. Gillin, S. A. Benson, and R. R. Knight. 1991*b*. Bear feeding activity at alpine insect aggregation sites in the Yellowstone ecosystem. Canadian Journal of Zoology 69:2430–2435.

Mattson, D. J., G. I. Green, and R. Swalley. 1999. Geophagy by Yellowstone grizzly bears. Ursus 11:109–116.

McCullough, D. R. 1982. Behavior, bears, and humans. Wildlife Society Bulletin 10:27–33.

Mealey, S. P. 1975. The natural food habits of free ranging grizzly bears in Yellowstone National Park, 1973–1974. Thesis, Montana State University, Bozeman, Montana, USA.

Olliff, S. T. 1992. Grant Village spawning stream survey. Pages 36–43 *in* R. Andrascik, D. G. Carty, R. D. Jones, L. R. Kaeding, B. M. Kelly, D. L. Mahony, and S. T. Olliff. Annual project report for 1991, Fishery and Aquatic Management Program, Yellowstone National Park. U.S. Fish and Wildlife Service, Fisheries Assistance Office, Yellowstone National Park, Wyoming, USA.

Pimm, S. L., and A. Redfearn. 1988. The variability of population densities. Nature 334:613–614.

Podruzny, S., K. Gunther, and T. Wyman. 2012. Spring ungulate availability and use by grizzly bears in Yellowstone National Park. Pages 29–31 *in* F. T. van Manen, M. A. Haroldson, and K. West, editors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 2011. U.S. Geological Survey, Bozeman, Montana, USA.

Reinhart, D. P. 1990. Grizzly bear habitat use on cutthroat trout spawning streams in tributaries of Yellowstone Lake. Thesis, Montana State University, Bozeman, Montana, USA.

Schullery, P. 1992. The bears of Yellowstone. High Plains Publishing Company, Inc., Worland, Wyoming, USA.

Schwartz, C. C., J. K. Fortin, J. E. Teisberg, M. A. Haroldson, C. Servheen, C. T. Robbins, and F. T. van Manen. 2014*a*. Body and diet composition of sympatric black and grizzly bears in the Greater Yellowstone Ecosystem. Journal of Wildlife Management 78:68–78.

Schwartz, C. C., M. A. Haroldson, G. C. White, R. B. Harris, S. Cherry, K. A. Keating, D. Moody, and C. Servheen. 2006. Temporal, spatial, and environmental influences on the demographics of the Yellowstone grizzly bear. Wildlife Monographs 161.

Schwartz, C. C., J. Teisberg, J. Fortin, M. A. Haroldson, C. Servheen, C. Robbins, and F. T. van Manen. 2014*b*. Use of isotopic sulfur to determine whitebark pine consumption by Yellowstone bears: a reassessment. Wildlife Society Bulletin 38:182–187.

Schwartz, C. C., M. A. Haroldson, M. A., Cherry, S., and K. A. Keating. 2008. Evaluation of rules to distinguish unique female grizzly bears with cubs in Yellowstone. Journal of Wildlife Management 72:543–554.

Smith, T. S., S. Herrero, and T. D. DeBruyn. 2005. Alaskan brown bears, humans, and habituation. Ursus 16:1–10.

Syslo, J. M., C. S. Guy, P. E. Bigelow, P. D. Doepke, B. D. Ertel, and T. M. Koel. 2011. Response of non-native lake trout (*Salvelinus*

namaycush) to 15 years of harvest in Yellowstone Lake, Yellowstone National Park. Canadian Journal of Fisheries and Aquatic Science 68:2132–2145

U.S. Fish and Wildlife Service. 1993. Grizzly bear recovery plan. Missoula, Montana, USA.

U.S. Fish and Wildlife Service. 2003. Final Conservation Strategy for the grizzly bear in the Yellowstone Ecosystem. U.S. Fish and Wildlife Service, Missoula, Montana, USA.

U.S. Fish and Wildlife Service. 2007*a*. Final Rule designating the Greater Yellowstone Area population of grizzly bears as a Distinct Population Segment and removing the Yellowstone Distinct Population Segment of grizzly bears from the Federal List of Endangered and Threatened Wildlife. 72 FR 14866. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/FR_Final_YGB_rule_03292007.pdf

U.S. Fish and Wildlife Service. 2007*b*. Grizzly Bear Recovery Plan Supplement: revised demographic recovery criteria for the Yellowstone Ecosystem. 72 FR 11377. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Grizzly_bear_Recovery_Plan_supplement_demographic.pdf

U.S. Fish and Wildlife Service. 2007c. Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Final_Conservation_Strategy.pdf

U.S. Fish and Wildlife Service. 2013. Grizzly Bear Recovery Plan Draft Revised Supplement: Proposed Revisions to the Demographic Recovery Criteria for the Grizzly Bear Population in the Greater Yellowstone Area. Available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Grizzly_Bear_Recovery_Plan_March2013.pdf

van Manen, F. T., M. R. Ebinger, M. A. Haroldson, R. B. Harris, M. D. Higgs, S. Cherry, G. C. White, and C. C. Schwartz. 2014. Re-evaluation of Yellowstone grizzly bear population dynamics not supported by empirical data: Response to Doak & Cutler. Conservation Letters 7:323–331.

Wilson, R. M., and M. F. Collins. 1992. Capture-recapture estimation with samples of size one using frequency data. Biometrika 79:543–553.

Appendix A

2014 Grizzly Bear Annual Habitat Monitoring Report

Greater Yellowstone Area Grizzly Bear Habitat Modeling Team

April 2015

BACKGROUND

This report is the collective response from the National Parks and National Forests within the Greater Yellowstone Ecosystem (GYE) to grizzly bear habitat monitoring and reporting obligations put forth in the *Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area* (U.S. Fish and Wildlife Service [USFWS] 2007). The Conservation Strategy requires annual reporting to evaluate federal adherence of habitat standards for the Yellowstone grizzly bear population. Habitat standards and monitoring requirements identified in the Conservation Strategy went into effect in 2007 when federal protections under the Endangered Species Act (ESA) were removed for the Yellowstone population. However, the legal status of the Yellowstone grizzly bear remains a contentious issue and the original delisting was challenged and overturned in a Montana District Court in 2009. With the 2009 ruling, which was upheld in a 2011 Court of Appeals, the grizzly bear population in the GYE is once again listed as a threatened species under the ESA. To address concerns raised by the courts, the Interagency Grizzly Bear Study Team (IGBST) conducted a comprehensive food synthesis to evaluate the ecological plasticity of Yellowstone grizzly bears in response to changing habitat resource conditions (IGBST 2013). The USFWS decision whether to move forward with a new delisting rule is pending. Regardless of the legal status of the Yellowstone grizzly bear, land managers associated with the 6 National Forests and two National Parks throughout the GYE are committed to abiding by habitat standards identified in the Conservation Strategy for the long-term protection and well-being of the grizzly bear population.

INTRODUCTION

The intent of habitat standards established in the Conservation Strategy is to preserve adequate secure habitat for grizzly bears and reduce negative impacts of human presence in occupied habitat throughout the core area of the GYE. Three distinct habitat standards were enumerated in the Conservation Strategy pertaining to motorized access, human development, and commercial livestock grazing; all three of which are known to contribute to mortality and displacement of grizzly bears in occupied areas across the landscape. The three habitat standards specifically call for no net decrease in secure habitat (a metric for the absence of motorized access), and no net increase in the number of human developed sites and grazing allotments from that which existed in 1998. This 1998 baseline is predicated on evidence that habitat conditions at that time, and for the preceding decade, contributed to the 4 to 7% population growth of the Yellowstone grizzly

bear population observed between 1983 and 2001. Habitat standards apply only within the Grizzly Bear Recovery Zone (GBRZ)[1], which is located at the core of the GYE (Figure A1).

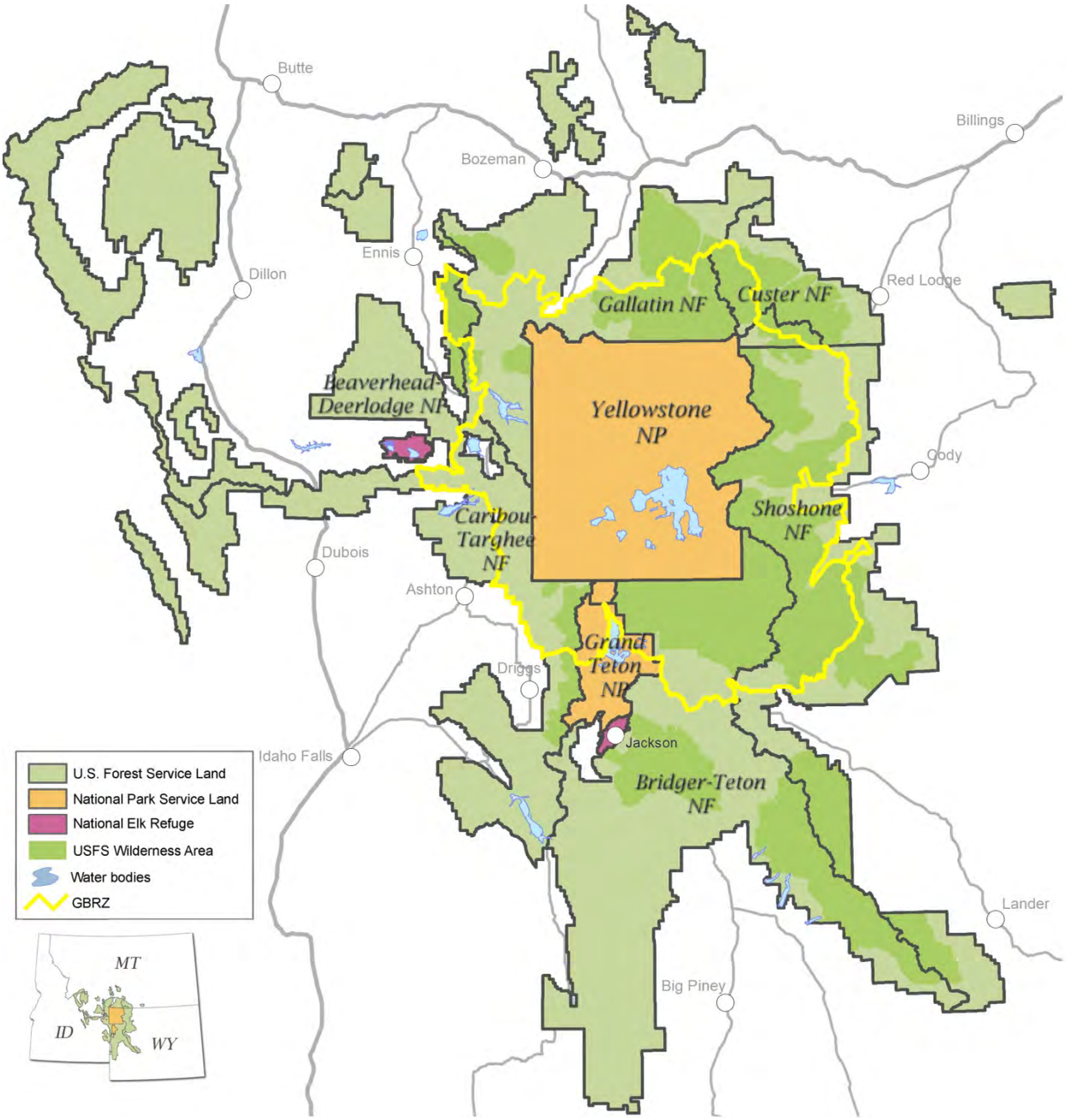


Figure A1. *Federal lands comprising the Greater Yellowstone Ecosystem (GYE) and the Grizzly Bear Recovery Zone (GBRZ).*

[1] The Grizzly Bear Recovery Zone (GBRZ) is a term used when the Yellowstone grizzly bear is under federal protection. The same area is referred to as the Primary Conservation Area when the bear is removed from federal protection. The GBRZ term is used in this 2014 report to reflect the current legal status of the Yellowstone grizzly bear as a threatened population.

HABITAT MONITORING REQUIREMENTS

Annual Monitoring Requirements (inside the GBRZ)

To comply with annual habitat monitoring requirements, the following pages summarize all changes incurred inside the GBRZ during the past year and compare current status with that of 1998 for the following habitat parameters: (1) number of commercial livestock grazing allotments and permitted domestic sheep animal months, (2) number of developed sites, (3) motorized access route densities, and (4) percentage of secure habitat. In addition, all incidental and recurring grizzly bear conflicts associated with livestock allotments are summarized annually for public land throughout the ecosystem, both inside and outside the GBRZ. Current status of these habitat monitoring parameters, except for livestock grazing, are evaluated, summarized, and reported annually for each of the 40 subunits within the 18 Bear Management Units (BMU; Figure A2) and are compared against 1998 levels. The 1998 habitat baseline measurements represent the most current and accurate information available documenting habitat conditions inside the GBRZ during 1998. Forest and Park personnel continue to improve the quality of their information to more accurately reflect what was on the landscape in 1998.

Additional habitat monitoring for spring ungulate availability, spawning cutthroat trout, insect aggregation sites, and whitebark pine cone production are reported in the section titled *Key Foods Monitoring* found in the main body of this current IGBST annual report.

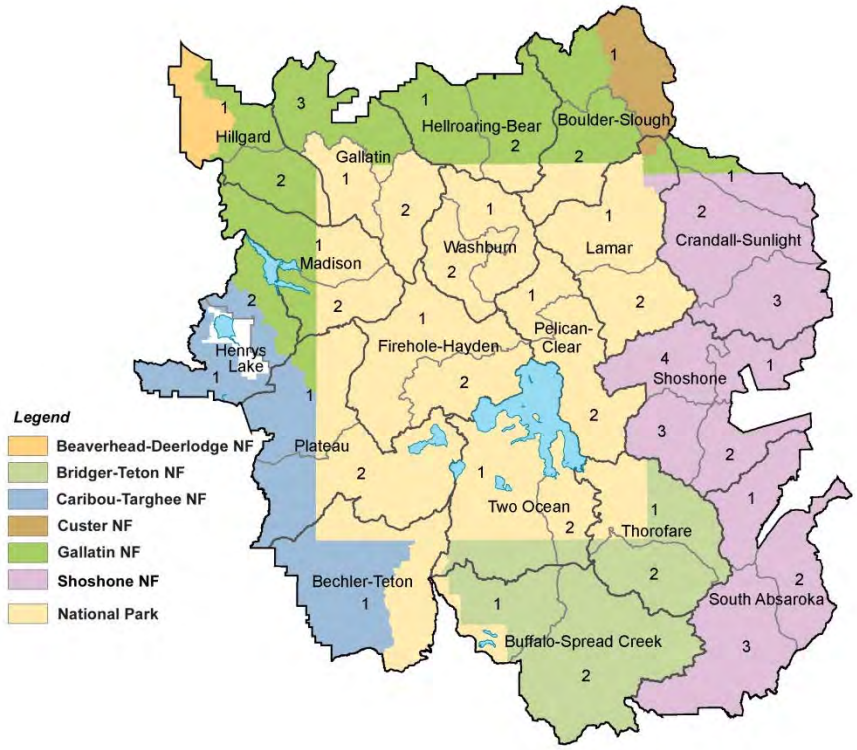


Figure A2. *Bear Management Units (BMUs) and subunits comprising the Grizzly Bear Recovery Zone in the Yellowstone ecosystem.*

Biennial Monitoring Requirements (outside the GBRZ)

In addition to annual monitoring requirements imposed by the Conservation Strategy, the Grizzly Bear Forest Plan Amendment (USDA, 2006*a*, 2006*b*) requires biennial monitoring and reporting of changes in secure habitat on National Forest lands outside the GBRZ. Although habitat standards apply only inside the GBRZ, percent secure habitat outside this boundary is monitored and reported on even years for each Bear Analysis Unit (BAU). The actual monitoring requirement specified by the Forest Plan Amendment is to report changes for each National Forest, however, it was determined that BAU divisions were necessary to be more consistent with analyses conducted inside the GBRZ. BAUs, delineated in Appendix A of the Forest Plan Amendment, are shown in Figure A3.

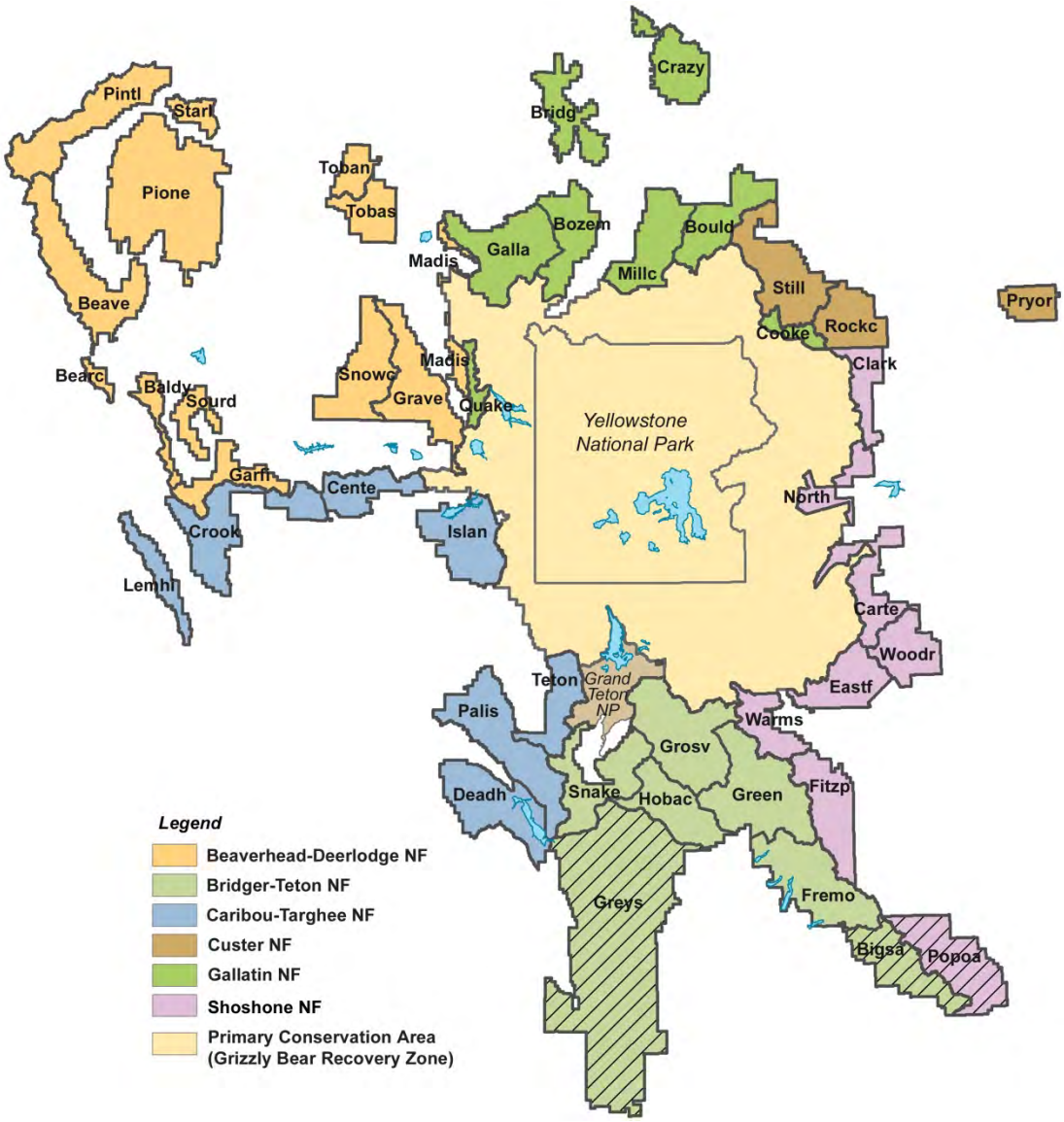


Figure A3. *Bear Analysis Units (BAUs) outside the Grizzly Bear Recovery Zone. Units with hatched lines are considered socially unacceptable for grizzly bear occupancy and are not currently reported.*

MONITORING FOR LIVESTOCK GRAZING

The habitat standard for livestock allotments established in the Conservation Strategy requires that there be *no net increase in the number of commercial livestock grazing allotments or any increase in permitted sheep animal months (AMs) inside the GBRZ from that which existed in 1998*. These AMs are calculated by multiplying the permitted number of sheep times the months of permitted grazing on a given allotment. Existing grazing allotments are to be phased out as opportunity arises with willing permittees. The change in number of active and vacant livestock allotments cited in this report account for all commercial grazing allotments occurring on National Forest land within the GBRZ. With closure of the last cattle allotment inside Grand Teton National Park in 2011 there are no grazing allotments today on National Park land inside the GYE. 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 included 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 a "no-use" permit 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 active permit, but which may be grazed periodically by other permittees at the discretion of the land management agency. Such reactivation of vacant allotments is typically on a temporary basis to resolve resource issues or other concerns. Vacant allotments can be assumed non-active unless otherwise specified. When chronic conflicts occur on cattle allotments inside the GBRZ and an opportunity exists with a willing permittee, cattle can be moved to a vacant allotment where there is less likelihood of conflict. A closed allotment is one that has been permanently deactivated such that commercial grazing will not be permitted to occur anytime in the future.

Corrections to the 1998 Baseline for livestock allotments

In 2014 a concerted effort was made by each of the National Forest units within the GYE to review and update, if necessary, the status and number of commercial livestock grazing allotments known to exist inside the GBRZ during 1998. A number of errors were identified on the Gallatin and Shoshone National Forests and subsequent corrections have been made to the 1998 baseline for grazing allotments. The corrected number and area of baseline allotments are based on the most current information available pertaining to 1998 conditions and are represented in Table A1. The review conducted in 2014 led to the following *net* increase in the number of livestock allotments known to exist on National Forest land inside the GBRZ during 1998: active cattle/horse ($n = +1$, Gallatin National Forest), vacant cattle/horse ($n = +1$, Gallatin National Forest), and vacant sheep ($n = +3$, 1 Gallatin National Forest, 2 Shoshone National Forest). Aside from identified errors of omission or commission, the known configuration of an allotment may also have been initially reported incorrectly. For example, on the Shoshone National Forest, the Crandall cattle/horse allotment had actually been split into two distinct allotments (Crandall II and Reef Creek) managed under a single permit in 1998. This particular example technically accounts for an increase in the total number of allotments; however, the actual footprint of grazing did not change and was properly accounted for in the 1998 baseline. The increase in number of known vacant sheep allotments in 1998 did not represent an increase of sheep grazing activity on the landscape because these vacant allotments had not been reactivated since 1998, and were subsequently closed post-1998.

The present-day status of all commercial livestock allotments comprising the 1998 baseline were also reviewed in 2014 for any errors. A number of corrections were made on the Bridger-Teton, Caribou-Targhee, Gallatin, and Shoshone National Forests. To the best of our knowledge, Table A1 represents an accurate comparison of current and 1998 levels of commercial livestock grazing allotments on National Forest land inside the GBRZ.

Change in Cattle allotments since 1998: The number of active commercial cattle grazing allotments on public lands inside the GBRZ has decreased since 1998 when there were 72 active and 13 vacant commercial cattle allotments (Table A1). Today there are 54 active and 13 vacant commercial cattle allotments operating inside the GBRZ. This accounts for a permanent closure of approximately 28% of the total area commercially grazed by cattle in 1998, and an additional 5% that has been vacated and is no longer being actively grazed. Of the total area of vacant cattle grazing land present in 1998, 57% (157 km^2) has been permanently closed, and 43% (118 km^2) remains vacant today.

Sheep allotments since 1998: Domestic sheep allotments inside the GBRZ have mostly been phased out since 1998. In 1998 there were 11 active and 10 vacant sheep allotments inside the GBRZ. Today there is one active and no vacant commercial sheep allotments remaining inside the GBRZ (Table A1). This accounts for a permanent closure of 92% of the total area actively grazed by domestic sheep inside the GBRZ since 1998. Of the 23,090 sheep AMs issued in 1998, only 1,970 (Meyers Creek) are permitted today. The Meyers Creek sheep allotment on the Caribou-Targhee National Forest is the only active sheep allotment remaining inside the GBRZ today. In recent years this lone sheep allotment has been issued a no-grazing permit, and consequently, there has been no domestic sheep grazing inside the GBRZ since 2008. Of the 312 km^2 of vacant sheep allotments present in 1998, 100% have been permanently closed.

Recent Action - Meyers Creek Sheep Allotment: The Meyers Creek sheep allotment, located on the Caribou-Targhee National Forest and administered by the U.S. Forest Service, is the only active sheep allotment currently remaining inside the GBRZ. Historically, the USDA Sheep Experiment Station (USSES), located in the Centennial Mountains of Idaho and Montana, has used the Meyers Creek sheep allotment as a supplemental grazing pasture. When legal protections for the Yellowstone grizzly bear were reinstated under the Endangered Species Act in 2009, it was determined that the USSES would prepare an Environmental Impact Statement (EIS) to assess effects of historic and ongoing grazing on grizzly bears, and would enter into formal consultation with the USFWS. In 2010, a directive by the Agricultural Research Service (ARS) halted all sheep grazing on the Meyers Creek allotment and adjacent USSES Summer Range lands while the USSES prepared the EIS. Meanwhile, ongoing grazing and research activities elsewhere on USSES lands (outside the GBRZ) would continue. In November, 2011 the USFWS issued a biological opinion on action proposed by the ARS to continue sheep grazing in the project area. Five environmental groups filed a lawsuit in 2013 arguing that the USFWS opinion violated the Endangered Species Act and Administrative Procedure Act and asked the federal judge to temporarily shut down the USSES. As part of a January 2014 settlement, USFWS issued a biological opinion on May 30, 2014, evaluating effects on grizzly bears from sheep grazing on the USSES. On June 20, 2014, the U.S. Secretary of Agriculture announced the decision to halt funding on the Sheep Station and redirect those funds to other

projects. In July, the U.S. House of Representatives Agriculture Appropriation Subcommittee notified the Department of Agriculture of their opposition to the reprogramming of funds. Cottonwood Law Center, Western Watersheds Project, WildEarth Guardians, and Gallatin Wildlife Association gave notice of intent to sue ARS and USFWS for violations of the Endangered Species Act on July 16, 2014, and an amended complaint against ARS and USFWS was filed on September 10, 2014. The USFWS issued an amended biological opinion in February 2015 addressing effects on grizzly bears due to sheep grazing on the USSES. Meanwhile, there has been no sheep grazing on the Meyers Creek allotment since 2008.

Changes in Allotments during 2014

Only one change in grazing allotments was reported for inside the GBRZ in 2014. The Basin cattle allotment on the Gallatin National Forest was changed from vacant to permanently closed. No other changes to the number or acreage of commercial livestock allotments were reported to occur on federal lands inside the GBRZ during 2014.

Table A1. *Number of commercial livestock grazing allotments and sheep animal months (AMs) inside the Grizzly Bear Recovery Zone in 1998 and 2014.*

Administrative Unit	Cattle/Horse Allotments				Sheep Allotments				Sheep Animal Months	
	Active		Vacant		Active		Vacant			
	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014
Beaverhead-Deerlodge NF	3	3	2	0	0	0	0	0	0	0
Bridger-Teton NF	9	5	0	1	0	0	0	0	0	0
Caribou-Targhee NF [(1)]	11	7	1	1	7	1	4	0	14,163	1,970
Custer NF	0	0	0	0	0	0	0	0	0	0
Gallatin NF	23	14	10	11	2	0	4	0	3,540	0
Shoshone NF	25	25	0	0	2	0	2	0	5,387	0
Grand Teton NP	1	0	0	0	0	0	0	0	0	0
Total number in GBRZ	**72**	**54**	**13**	**13**	**11**	**1**	**10**	**0**	**23,090**	**1.970**
Total area in GBRZ (km^2)	**2,674**	**1,845**	**275**	**247**	**600**	**14**	**312**	**0**		

[(1)] The Meyers Creek allotment, the only active sheep grazing unit remaining inside the GBRZ, took a "no use" permit in 2014.

Livestock Conflicts Inside and Outside the GBRZ

Conflicts between grizzly bears and livestock have historically led to the capture and relocation or removal of grizzly bears in the GYE. Grizzly bear conflicts associated with livestock depredation are reported on an annual basis for all sheep and cattle grazing allotments and forage reserves on National Forest land within the GYE. This section summarizes the reported annual

incidences of grizzly bear-livestock conflict occurring on commercial grazing allotments maintained on National Forest lands throughout the ecosystem, and does not include livestock conflicts on private or State land.

Livestock Conflicts in 2014

In 2014, 91 grizzly bear-livestock conflicts (cattle and sheep) were reported on 13 distinct commercial grazing allotments on Forest Service land within the GYE (Table A2, Figure A4). Only one of the 91 conflicts occurred inside the GBRZ. This lone incident involved a heifer calf mortality on the Parque cattle allotment on the Shoshone National Forest. Ninety-eight percent (n = 89) of livestock conflicts during 2014 involved grizzly bear depredation on cattle, and 2% (n = 2) involved sheep. Seventy-three percent (n = 66) of all livestock-related conflicts reported during 2014 occurred on the Upper Green River cattle allotment located outside the GBRZ on the north portion of the Bridger-Teton National Forest. Approximately 7,356 cows/calves were grazed on the Upper Green River unit during 2014. Livestock mortalities due to grizzly bears on this allotment accounted for less than one percent of the total number of cattle grazed (10 yearlings, 48 calves, and 2 steer). Management actions in response to livestock-related conflicts on public land led to the removal of two adult male grizzly bears from the Yellowstone population in 2014. Both of these grizzly bear removals were due to persistent depredation conflicts associated with the Upper Green River cattle allotment.

Recurring Livestock Conflicts 2014

Grazing allotment conflicts are considered to be "recurring" when an allotment exhibits livestock-related conflicts during three or more years from the most recent 5-year period. During the past five years (2010–2014) an estimated 365 livestock-related conflicts occurred on commercial grazing allotments on National Forest land within the GYE. During this same time period, 14 distinct allotments sustained recurring conflicts; 6 on the Bridger-Teton National Forest and 8 on the Shoshone National Forest (Table A2, Figure A4). Over the past 5 years, there have been 18 grizzly bear mortalities on Forest Service land due to livestock-related conflicts. Of the 18 mortalities, 17 (5 adult females, 12 adult males) were management-sanctioned removals, and one subadult male was fatally shot by a sheepherder in an act of self-defense. During the past 5 years, livestock-related conflicts on the Upper Green River cattle allotment in the Bridger-Teton National Forest accounted for approximately 54% (n = 196) of all such conflicts occurring on Forest Service land throughout the GYE. Of the 18 livestock-related grizzly bear mortalities, 14 (78%) were due to cattle depredation on the Upper Green River allotment.

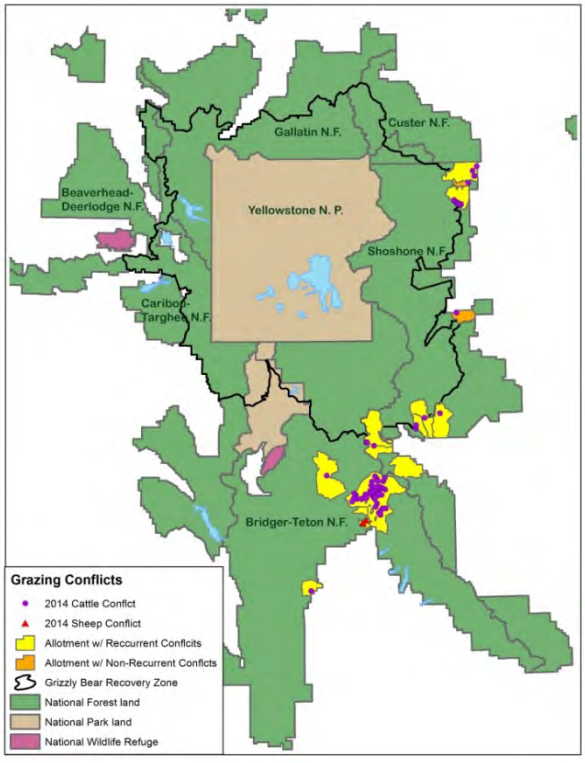


Figure A4. *Grizzly bear-livestock conflicts occurred on grazing allotments within National Forest land in 2014.*

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

Allotment Name	Total Acres	Conflicts					Total conflicts (2010-2014)	Recurring conflicts (Y/N)
		2010	2011	2012	2013	2014		
Beaverhead –Deerlodge National Forest								
Barnett	6,454	0	0	0	1	0	**1**	N
Bufiox	13,077	0	1	0	0	0	**1**	N
Red Tepee	8,256	0	0	0	1	0	**1**	N
Upper Ruby	44,395	0	0	0	1	0	**1**	N
Bridger-Teton National Forest								
Badger Creek	7,254	1	0	0	0	0	**1**	N
Beaver-Horse	25,359	0	0	2	0	0	**2**	N
Crows Nest	3,640	0	1	0	0	0	**1**	N
Elk Ridge	6,365	6	2	1	0	0	**9**	**Y**
Fish Creek *	76,217	0	2	0	0	0	**2**	N
Green River Drift	1,002	0	1	0	0	0	**1**	N
Jack Creek	32,387	0	0	1	0	0	**1**	N
Kinky Creek	22,834	0	0	1	0	0	**1**	N
Kohl Ranch	483	0	0	1	0	0	**1**	N
Lime Creek	4,973	1	0	0	0	0	**1**	N
New Fork - Boulder	10,976	0	0	0	2	0	**2**	N
Nobel Pasture	762	1	1	0	1	0	**3**	**Y**
North Cottonwood	28,177	0	0	0	1	0	**1**	N
Pot Creek	4,499	0	0	0	1	0	**1**	N
Prospect Peak	8,917	0	0	1	0	0	**1**	N
Redmond / Bierer Cr	7,109	0	0	0	1	0	**1**	N
Roaring Fork	8,416	0	0	1	0	0	**1**	N
Rock Creek	5,148	3	0	1	1	2	**7**	**Y**
Sherman C&H	8,287	2	3	1	1	1	**8**	**Y**
Tosi Creek	14,090	1	0	1	0	0	**2**	N
Turpin Meadow	1,493	0	1	0	0	0	**1**	N
Union Pass *	39,497	0	0	1	0	0	**1**	N
Upper Green River	131,944	20	31	41	40	66	**198**	**Y**
Upper Gros Ventre	67,497	0	0	5	1	1	**7**	**Y**
Wagon Creek	182	0	0	0	1	0	**1**	N
Caribou-Targhee National Forest								
Antelope Park	14,492	2	0	0	0	0	**2**	N
Bootjack	8,468	1	0	0	0	0	**1**	N
Squirrel Meadows	28,797	5	0	7	0	0	**12**	N
Shoshone National Forest								
Bald Ridge	24,853	1	0	0	0	0	**1**	N

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

Allotment Name	Total Acres	Conflicts					Total conflicts (2010-2014)	Recurring conflicts (Y/N)
		2010	2011	2012	2013	2014		
Bear Creek	33,672	0	0	1	1	0	**2**	N
Beartooth	30,317	1	0	0	2	3	**6**	**Y**
Beartooth Highway	9,350	0	0	0	1	0	**1**	N
Belknap	13,049	1	0	0	0	0	**1**	N
Bench (Clarks Fork)	28,751	4	1	0	0	8	**13**	**Y**
Crandall	30,089	2	0	0	1	0	**3**	N
Deep Lake	6,486	0	0	0	0	1	**1**	N
Dick Creek	9,569	1	0	0	0	0	**1**	N
Ghost Creek	11,579	0	0	6	0	0	**6**	N
Horse Creek	29,980	0	2	1	0	1	**4**	**Y**
Lake Creek	21,399	0	0	0	1	0	**1**	N
Little Rock	4,901	1	0	0	0	0	**1**	N
Parque Creek	13,528	1	0	2	0	2	**5**	**Y**
Piney	14,287	1	1	0	0	0	**2**	N
Rock Creek	16,833	0	0	1	0	1	**2**	N
South Absaroka Trans	152,256	0	0	0	1	0	**1**	N
Union Pass	39,497	1	1	6	2	0	**10**	**Y**
Warm Springs.	16,875	0	3	4	2	1	**10**	**Y**
Wiggins Fork	37,653	2	3	1	0	1	**7**	**Y**
Wind River	44,158	5	4	1	0	3	**13**	**Y**
Total Conflicts		**64**	**58**	**88**	**64**	**91**	**365**	

* Forage reserve

MONITORING FOR DEVELOPED SITES

Habitat standards identified in the Conservation Strategy require that the *number of developed sites and capacity of human-use of developed sites inside the GBRZ be maintained at or below the levels existing in 1998*. Administrative site expansions are exempt from mitigation if such developments are deemed necessary for enhancement of public lands and when other viable alternatives are not plausible. A developed site is one on public land that has been developed or improved for human use or resource development and includes, but is not limited to, campgrounds, trailheads, lodges, administrative sites, 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 land are not counted against this standard.

Corrections to 1998 Developed Sites Baseline

Two errors of omission were submitted in 2014 for correction to the 1998 Developed Sites Baseline: the Lizard Creek campground in Grand Teton National Park and the Buffalo Horn

administrative cabin on the Gallatin National Forest. The Lizard Creek campground located along the north eastern shore of Jackson Lake and just inside the western border of the Buffalo-Spread Creek #1 subunit, was erroneously excluded from the 1998 baseline. According to John Daugherty's 2002 book, *A Place called Jackson Hole*, this campground predates 1998 and existed as early as the 1960s. Also excluded from the baseline is the Buffalo Horn administrative cabin located within the Gallatin #3 subunit. Evidence of the 1998 status of this administrative site is based on a vintage 1999 Forest Service Visitors Map which locates the cabin feature approximately 2.6 km northeast of Grouse Mountain and south of Cow Flats. Both the Lizard Creek campground and the Buffalo Horn administrative cabin remain active sites today. For a complete list of developed sites comprising the 1998 baseline, please see Supplemental Table S1 in this report (available online only).

Changes in Developed Sites since 1998

The number of developed sites inside the GBRZ has decreased from 595 sites in 1998 to 578 in 2014. This net reduction of 17 developed sites affected 11 subunits throughout the GBRZ (Table A3). Only 1 subunit (Hilgard #2) has shown an increase in developed sites since 1998. This increase occurred in 2005 when the Taylor Falls/Lightning trailhead, originally located in subunit #1 of the Hilgard BMU, was moved from one side of a road to the other, placing it in subunit #2. In this case, the loss in one subunit resulted in 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. For a complete list of developed sites comprising the 1998 baseline, please see Supplemental Table S1 in this report (available online only).

Changes in Developed Sites in 2014

During 2014 three changes in developed sites occurred inside the GBRZ. These changes took place on the Bridger-Teton and Shoshone National Forests and coincided with two distinct subunits:

Buffalo-Spread Creek #2: The *Box Creek* and *Angles front country campgrounds*, located on the Bridger-Teton National Forest, were permanently closed in 2014. Both of these sites had corresponding trailheads which remain open, and consequently they have been reclassified as trailheads in the developed sites database. This accounts for a reduction of 2 campgrounds and a corresponding increase of 2 trailheads in the Buffalo-Spread Creek #2 subunit as recorded in Table A3. Closure of the over-night camp sites results in a reduction of human-use capacity of these developed sites and may be used as mitigation for future changes elsewhere within the subunit.

Shoshone #1: The *Blackwater Pond Picnic Area* located on the Shoshone National Forest was closed in 2014 as partial mitigation for construction of a new recreational zip-line to be installed at the Sleeping Giant ski area located 16 km to the west and inside the Shoshone #4 subunit. Infrastructure associated with the picnic area was removed, including 4 picnic tables, 1 outhouse, 2 benches, and a paved turnaround. Removal of this site will not be banked since it is considered mitigation for future development at the Sleeping Giant Ski area.

Table A3. The 1998 and 2014 numbers of developed sites on public lands within each of the Bear Management subunits in the Greater Yellowstone Ecosystem.

Bear Management Subunit	Total number of Developed Sites in subunit 1998 Base	Admin Unit [1]	Summer Home Complexes		Developed Campgrounds		Trailheads		Major Developed sites & Lodges [2]		Administrative or Maintenance sites		Other Developed sites		Plans of Operation for Minerals Activities [3]		Changes in number of sites from 1998 (+ or -)
			1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	
Bechler-Teton #1	59	CTNF	0	0	1	1	5	5	2	2	4	4	16	16	0	0	0
		YNP	0	0	0	0	2	2	0	0	2	2	2	2	0	0	
		GTNP	0	0	8	8	3	3	1	1	3[4]	3	10	10	0	0	
Boulder-Slough #1	20	CNF	0	0	0	0	1	1	0	0	0	0	0	0	6	0	-6
		GNF	0	0	1	1	6	6	0	0	1	1	3	3	2	2	
Boulder-Slough #2	9	GNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
		YNP	0	0	1	1	3	3	0	0	2	2	1	1	0	0	
Buffalo-Spread Creek #1	19	BTNF	0	0	1	1	1	1	0	0	0	0	2	2	0	0	0
		GTNP	0	0	1[5]	1	7	7	2	2	2	2	3	3	0	0	
Buffalo-Spread Creek #2	22	BTNF	1	1	4	2[6]	3	5	3	3	5	5	5	3[7]	1	1	-2
Crandall-Sunlight #1	23	SNF	0	0	2	2	5	5	1	1	1	1	5	5	0	0	0
		GNF	0	0	2	2	2	2	0	0	0	0	5	5	0	0	
Crandall-Sunlight #2	18	SNF	0	0	5	5	4	4	1	1	2	2	5	5	1	1	0
		GNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Crandall-Sunlight #3	11	SNF	0	0	2	2	3	3	0	0	1	1	2	2	0	0	0
		WG&F	0	0	2	2	0	0	0	0	1	1	0	0	0	0	
Firehole-Hayden #1	26	YNP	0	0	1	1	5	5	1	1	6	6	13	13	0	0	0
Firehole-Hayden #2	15	YNP	0	0	1	1	3	3	1	1	2	2	8	8	0	0	0
Gallatin #1	4	YNP	0	0	0	0	3	3	0	0	1	1	0	0	0	0	0
Gallatin #2	21	YNP	0	0	2	2	5	5	1	1	12	12	1	1	0	0	0
Gallatin #3	18	GNF	0	0	2	2	9	9	0	0	1[8]	1	6	6	0	0	0
		YNP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hellroaring-Bear #1	36	GNF	0	0	5	5	11	11	0	0	3	3	7	7	8	8	0
		YNP	0	0	0	0	1	1	0	0	0	0	1	1	0	0	
Hellroaring-Bear #2	4	GNF	0	0	0	0	1	1	0	0	1	1	0	0	0	0	0
		YNP	0	0	0	0	0	0	0	0	2	2	0	0	0	0	
Henrys Lake #1	20	CTNF	2	2	3	3	1	1	0	0	3	3	10	10	1	0	-1
Henrys Lake #2	18	CTNF	0	0	0	0	1	1	0	0	1	0	1	1	1	1	0

Table A3. The 1998 and 2014 numbers of developed sites on public lands within each of the Bear Management subunits in the Greater Yellowstone Ecosystem.

Bear Management Subunit	Total number of Developed Sites in subunit 1998 Base	Admin Unit [1]	Summer Home Complexes		Developed Campgrounds		Trailheads		Major Developed sites & Lodges [2]		Administrative or Maintenance sites		Other Developed sites		Plans of Operation for Minerals Activities [3]		Changes in number of sites from 1998 (+ or -)
			1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	
		GNF	5	5	3	3	4	4	0	0	0	0	2	3	0	0	
Hilgard #1	14	BDNF	0	0	0	0	0	0	0	0	3	1	0	0	0	0	-3
		GNF	0	0	0	0	6	5	1	1	2	2	2	2	0	0	
Hilgard #2	9	GNF	0	0	0	0	4	5	0	0	1	1	1	1	0	0	1
		YNP	0	0	0	0	3	3	0	0	0	0	0	0	0	0	
Lamar #1	37	YNP	0	0	1	1	5	5	0	0	3	3	2	1	0	0	-1
		GNF	0	0	2	2	6	6	0	0	6	6	3	3	6	6	
		SNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		CNF	0	0	0	0	1	1	0	0	0	0	0	0	2	2	
Lamar #2	4	YNP	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0
Madison #1	21	GNF	0	0	1	1	11	11	0	0	1	1	8	7	0	0	-1
		YNP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Madison #2	25	GNF	8	8	2	2	1	1	1	1	4	4	5	5	0	0	0
		YNP	0	0	0	0	1	1	0	0	2	2	1	1	0	0	
Pelican-Clear #1	2	YNP	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
Pelican-Clear #2	13	YNP	0	0	1	1	4	4	1	1	4	4	3	3	0	0	0
Plateau #1	3	CTNF	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0
		GNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
		YNP	0	0	0	0	0	0	0	0	1	1	0	0	0	0	
Plateau #2	7	CTNF	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0
		YNP	0	0	0	0	0	0	0	0	4	4	0	0	0	0	
Shoshone #1	9	SNF	1	1	2	2	0	0	0	0	0	0	6	5[9]	0	0	-1
Shoshone #2	2	SNF	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
Shoshone #3	4	SNF	2	2	0	0	1	0	1	1	0	0	0	0	0	0	-1
Shoshone #4	23	SNF	3	3	3	2	3	3	6	6	0	0	8	9	0	0	0
South Absaroka #1	0	SNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Absaroka #2	2	SNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
South Absaroka #3	15	SNF	1	1	3	3	4	4	1	1	1	1	5	4	0	0	-1

Table A3. The 1998 and 2014 numbers of developed sites on public lands within each of the Bear Management subunits in the Greater Yellowstone Ecosystem.

Bear Management Subunit	Total number of Developed Sites in subunit 1998 Base	Admin Unit (1)	Summer Home Complexes		Developed Campgrounds		Trailheads		Major Developed sites & Lodges (2)		Administrative or Maintenance sites		Other Developed sites		Plans of Operation for Minerals Activities (3)		Changes in number of sites from 1998 (+ or -)
			1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	1998	2014	
Thorofare #1	4	BTNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		YNP	0	0	0	0	0	0	0	0	4	4	0	0	0	0	
Thorofare #2	2	BTNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
		YNP	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Two Ocean Lake #1	15	YNP	0	0	2	2	3	3	1	1	3	3	2	2	0	0	-1
		BTNF	0	0	1	1	0	0	0	0	0	0	0	0	0	0	
		GTNP	0	0	0	0	1	1	0	0	1(4)	1	1	0	0	0	
Two Ocean Lake #2	4	BTNF	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
		YNP	0	0	0	0	0	0	0	0	1	1	1	1	0	0	
Washburn #1	25	YNP	0	0	2	2	8	8	2	2	7	7	6	6	0	0	0
Washburn #2	12	YNP	0	0	1	1	6	6	0	0	1	1	4	4	0	0	0
Total GBRZ	**595**	**ALL**	**24**	**24**	**68**	**65**	**161**	**162**	**28**	**28**	**118**	**115**	**168**	**163**	**28**	**21**	**-17**

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

(2) Grant, Lake, Fishing Bridge, Old Faithful, Canyon and Mammoth in YNP are classified as Major Developed Areas and are comprised of a combination of recreation and administrative facilities. Changes in capacity of use are evaluated based on whether the use is recreational or administrative. Individual buildings or facilities at these sites are not tracked individually.

(3) Mining claims with Plans of Operations are considered developed sites for the 1998 baseline. Not all Plan sites have active projects.

(4) The Snake River Construction Staging Maintenance site in GTNP was incorrectly associated with the Bechler-Teton subunit. This site is located in the Two Ocean #1 subunit. This accounts for a decrease of 1 site in the Bechler-Teton subunit and a corresponding increase of 1 in the Two Ocean #1 subunit. Baseline correction, 2015.

(5) The Lizard Creek campground in GTNP was erroneously excluded from the 1998 Baseline. This site existed prior to 1998. This correction accounts for an increase of 1 site for 1998 and 2014 in the Buffalo-Spread Creek #1 subunit. Baseline correction, 2015.

(6) The Box Creek and Angles campgrounds in the BTNF (Buffalo-Spread Creek #2) were closed in 2014 but the trailheads associated with these two sites remain open. Both sites were reclassified as trailheads, leading to a reduction of 2 campgrounds and an increase in 2 trailheads. Baseline correction, 2015.

(7) The Blackrock composting site in the BTNF (Buffalo-Spread Creek #2) was closed in 2009 but not accounted for in previous reports.

(8) The Buffalo-Horn administrative cabin in the GNF was erroneously excluded from the 1998 Baseline. This site existed prior to 1998. This correction accounts for an increase of 1 administrative site for 1998 and 2014 in the Gallatin #3 subunit. Baseline correction, 2015.

(9) The Blackrock picnic area in the SNF (Shoshone #1 subunit) was closed in 2014 as mitigation for a zip-line constructed at the Sleeping Giant Ski Area.

MONITORING SECURE HABITAT AND MOTORIZED ACCESS inside the GBRZ

Habitat standards identified in the Conservation Strategy require that grizzly bear *secure habitat be maintained at or improved upon levels existing in 1998* for each of the 40 subunits inside the GBRZ. Secure habitat serves as a metric of human presence/absence in grizzly bear habitat and is based entirely on proximity to motorized routes (both roads and trails). Secure habitat is defined as any contiguous area ≥10 acres in size and more than 500 m from an open or gated motorized route. Lakes larger than 2.59 km^2 (1 square mile) in size are excluded from habitat calculations.

Monitoring protocol established in the Conservation Strategy and Forest Plan Amendment requires that secure habitat, seasonal open motorized access route density (OMARD), and total motorized access route density (TMARD) be reported annually for each subunit within the 18 BMUs inside the GBRZ. Values for secure habitat are compared against 1998 levels inside the GBRZ to ensure adherence to the secure habitat standard. 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 effectively treated on the ground so that motorized access by the public and administrative personnel is restricted. Road decommissioning can range from complete obliteration of the road prism to physical barriers permanently and effectively blocking all access points to motorized traffic. Any route that is open to public or administrative motorized use during any portion of the non-denning season (March 1 through November 30) detracts from secure habitat. This includes routes that are gated to the public yearlong but which may be accessed by administrative personnel.

The Conservation Strategy and Forest Plan Amendment do not impose any mandatory standards pertaining to motorized route density; however, changes in this parameter are monitored and reported annually. This provision for monitoring route density was incorporated into these two seminal management documents based on evidence indicating that grizzly bears are sensitive to the effects of access management, especially as related to motorized use. Monitoring protocol requires that the following parameters be reported for each BMU subunit on an annual basis: (1) seasonal OMARD > 1 mile/mi^2 (0.62 km/km^2), and (2) TMARD > 2 miles/mi^2 (1.2 km/km^2). Seasonal OMARD is measured for two seasons: Season 1 (March 1–July 15), and Season 2 (July 16–November 30). Gated routes that prohibit public access for an entire season do not count toward seasonal route density (i.e., season of closure) but do contribute toward TMARD. All motorized routes open to the public and or administrative personnel during any portion of the non-denning season contribute to TMARD. Decommissioned routes that are managed for long-term closure to all motorized use do not contribute to OMARD or TMARD and do not detract from secure grizzly bear habitat.

Permanent Changes in Secure Habitat since 1998

The golden standard for secure grizzly bear habitat inside the recovery zone calls for “no net loss” in secure habitat with respect to levels that existed in 1998. Compliance with this habitat standard has been met in all 40 BMU subunits as documented in Table A4. Secure habitat is

measured for each subunit as a percentage of the subunit area, excluding major lakes. In each of the 40 subunits, secure habitat has either been maintained or increased with respect to 1998 levels. Improvements in secure habitat range anywhere from a minor increase of 0.1% demonstrated in a number of subunits, to a more significant gain of 16.7% for the Gallatin #3 subunit. Throughout the GBRZ, this translates to a net increase of approximately 324 km^2 (125 mi^2) of secure habitat since 1998; an increase comparable in size to that of Yellowstone Lake. The greatest improvement in secure habitat is the 16.7 % increase occurring on the Gallatin #3 Bear Management Subunit (BMS) on the Gallatin National Forest. The Gallatin #3 is one of three subunits targeted in the Conservation Strategy and Forest Plan Amendment as in need of improvement above 1998 levels (also targeted were Henrys Lake #2 and Madison #2). For these 3 subunits, the Gallatin National Forest is currently working on an amendment to their Forest Plan which will establish the enhanced secure levels resulting from their Travel Plan as the new baseline from which change will be measured. Other notable gains in secure habitat, ranging from 3.6% on the Hellroaring-Bear #1 subunit to 12% on the Hilgard #1 subunit, are also identified in Table A4. These gains in secure habitat were incurred on the Gallatin National Forest as a result of systematic decommissioning of unnecessary non-system roads due to Travel Plan implementation.

Permanent Changes in OMARD and TMARD since 1998

Current levels of motorized route density, as compared with 1998 levels, are presented in Table A4 per BMU subunit inside the GBRZ. Total motorized access route density (TMARD) corresponds to densities greater than 2 mi/mi^2 (1.2 km/km^2), while Season 1 and Season 2 open motorized access route density (OMARD) correspond to levels greater than 1 mi/mi^2 (0.62 km/km^2). As mentioned previously, there are no mandatory standards pertaining to motorized route densities; instead, levels of motorized access are limited indirectly by the standard for secure habitat. Consequently, OMARD and TMARD levels have been maintained close to or reduced with respect to 1998 levels for all 40 subunits within the GBRZ. A notable number of improvements in route density since 1998 have taken place on subunits that are partially or completely contained within the Gallatin National Forest. The documented decreases in motorized route density can be directly attributed to implementation of the 2006 Gallatin National Forest Travel Plan and reflects an overall goal to manage motorized access in a manner that allows for recovery of threatened species such as the grizzly bear.

Permanent Changes in Motorized Routes during 2014

Changes to motorized routes inside the GBRZ were minor in 2014, resulting in a net gain of approximately 7.8 km^2 (3 mi^2) of secure habitat. Field surveys were conducted in Grand Teton National Park and the Shoshone and Bridger-Teton National Forests to evaluate and update the motorized status of targeted non-system routes of uncertain status. On the Grand-Teton portion of the Buffalo-Spread Creek #1 subunit, field results identified 16.2 km of legacy maintenance routes that have naturally decommissioned with time. Approximately 13.3 km of non-system routes on the Shoshone National Forest were determined to be naturally decommissioned and no longer accessed by the public or administrative personnel. The 13.3 km of decommissions were distributed across the Crandall #2 and #3 subunits and the Shoshone #1, #2 and #4 subunits; resulting in a negligible change in motorized route density and secure habitat on these subunits.

On the Bridger-Teton National Forest, 16.2 km of decommissions in the Buffalo #2 subunit were reported; many being non-system, user-created routes.

As part of the Gallatin National Forest Travel Plan implementation, reconfiguration of the Henderson Mountain ATV route on the Lamar #1 subunit yielded 680 m of new motorized trail. On the Hellroaring #1 subunit, the Otto road extension led to 270 m of new motorized access and the decommissioning of 344 m of open motorized route.

Table A4. *1998 Baseline and 2014 percentages per subunit of open motorized access route density (OMARD), total motorized access route density (TMARD), and secure habitat for 40 Bear Management Unit subunits in the Grizzly Bear Recovery Zone, Greater Yellowstone Ecosystem.*

BMU subunit Name	OMARD % > 1 mile / mile²						TMARD % < 2 miles / mile²			% Secure Habitat			Area (miles²) (excluding lakes)		
	Season 1 (Mar 1 – Jul 15)			Season 2 (Jul 16 – Nov 30)									Subunit	Secure Habitat	
	1998	2014	% chg	1998	2014	% chg	1998	2014	% chg	1998	2014	% chg		1998	2014
Bechler/Teton	17.0	17.0	-0.1	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	2.8	-0.5	3.2	2.8	-0.5	0.3	0.2	-0.1	96.6	97.1	0.5	281.9	272.2	273.7
Boulder/Slough #2	2.1	2.1	0.0	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	11.4	11.4	0.0	11.5	11.4	-0.1	5.3	6.1	0.8	88.3	88.6	0.4	219.9	194.1	194.9
Buffalo/Spread Creek #2	14.5	15.0	0.6	15.6	14.5	-1.0	12.7	11.6	-1.1	74.3	74.4	0.1	507.6	377.2	377.5
Crandall/Sunlight #1	13.3	12.5	-0.9	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	15.6	14.8	-0.8	16.6	16.0	-0.6	11.7	11.2	-0.5	82.3	82.7	0.4	316.2	260.3	261.5
Crandall/Sunlight #3	14.4	14.3	-0.1	19.2	18.8	-0.4	10.6	10.4	-0.2	80.4	81.1	0.7	221.8	178.3	179.9
Firehole/Hayden #1	10.4	10.5	0.1	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	8.9	8.9	0.0	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	2.7	-0.9	3.6	2.7	-0.9	0.5	0.1	-0.4	96.3	96.9	0.6	127.7	122.9	123.7
Gallatin #2	9.5	9.1	-0.4	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	18.6	-27.4	46.0	27.4	-18.5	22.9	12.5	-10.5	55.3	72.0	16.7	217.6	120.2	156.7
Hellroaring/Bear #1	22.4	18.4	-4.0	23.1	18.4	-4.7	15.8	11.6	-4.2	77.0	80.6	3.6	184.7	142.2	148.8
Hellroaring/Bear #2	0.1	0.0	-0.1	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	49.0	49.2	0.2	31.2	31.1	-0.1	45.4	46.1	0.7	191.2	86.8	88.2
Henry's Lake #2	49.9	41.3	-8.6	49.9	41.3	-8.6	35.2	30.8	-4.5	45.7	51.5	5.8	140.2	64.1	72.5
Hilgard #1	29.0	8.2	-20.8	29.0	13.4	-15.7	15.3	4.4	-10.9	69.8	83.1	13.3	201.2	140.3	164.5
Hilgard #2	21.0	8.8	-12.2	21.0	16.1	-4.9	13.6	4.6	-9.0	71.4	80.2	8.8	140.5	100.4	112.7
Lamar #1	9.9	9.7	-0.1	9.9	9.7	-0.1	3.8	3.9	0.1	89.4	89.9	0.5	299.9	268.1	269.6
Lamar #2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0	180.8	180.8	180.8

Table A4. *1998 Baseline and 2014 percentages per subunit of open motorized access route density (OMARD), total motorized access route density (TMARD), and secure habitat for 40 Bear Management Unit subunits in the Grizzly Bear Recovery Zone, Greater Yellowstone Ecosystem.*

BMU subunit Name	OMARD % > 1 mile / mile²						TMARD % < 2 miles / mile²			% Secure Habitat			Area (miles²) (excluding lakes)		
	Season 1 (Mar 1 – Jul 15)			Season 2 (Jul 16 – Nov 30)									Subunit	Secure Habitat	
	1998	2014	% chg	1998	2014	% chg	1998	2014	% chg	1998	2014	% chg		1998	2014
Madison #1	29.2	13.2	-16.0	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	-1.8	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	2.0	2.0	0.0	0.5	0.5	0.0	97.8	97.8	0.0	108.4	106.0	106.0
Pelican/Clear #2	5.4	5.4	0.0	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	22.0	16.9	-5.2	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	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	1.5	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	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	3.8	2.8	-1.1	2.1	1.5	-0.6	97.0	97.8	0.8	140.7	136.5	137.6
Shoshone #4	4.5	4.4	0.0	5.3	5.2	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	0.6	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	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	2.4	2.4	0.0	2.7	2.7	0.0	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	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	0.0	0.0	0.0	100.0	100.0	0.0	180.1	180.1	180.1
Two Ocean/Lake #1	3.5	3.6	0.2	3.5	3.6	0.2	0.3	0.5	0.2	96.3	96.3	0.0	371.9	358.3	358.2
Two Ocean/Lake #2	0.0	0.0	0.0	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	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	7.4	7.4	0.0	1.1	1.1	0.0	92.0	92.0	0.0	144.1	132.6	132.6
Total for GBRZ	**12.3**	**9.8**	**-2.5**	**1**	**10.9**	**-1.8**	**6.7**	**5.4**	**-1.3**	**85.6**	**87.0**	**1.4**	**9025**	**7724**	**7852**

Temporary Changes to Secure Habitat in 2014 due to Federal Projects

Temporary reductions in secure habitat below the 1998 baseline are allowed inside the GBRZ when associated with authorized Federal projects. In these cases, adherence to the one percent application rule and other provisions to consolidate and reduce detrimental effects must be met. The one percent rule states that the total acreage of secure habitat affected by a project within a given BMU must not exceed 1% of the total acreage of the largest subunit within that BMU. Application rules permit only one temporary project to be active in a particular subunit at any given time. Three projects involving temporary reductions in secure habitat were operational inside the GBRZ during 2014 (Table A5). Below is a brief summary of these three projects.

Grouse Mountain (Bridger-Teton National Forest): The Grouse Mountain Experimental Whitebark Pine Enhancement project was initiated in 2012 on the Bridger-Teton National Forest directly southwest of Grouse Mountain in the Buffalo-Spread Creek subunit #2. Section 7 consultation with USFWS was completed on May 7, 2012 and field activities associated with this project were launched that summer; although initial incursions into secure grizzly bear habitat were not implemented until summer of 2013. Approximately 0.9 km of decommissioned route, previously rendered impassable due to downfall, was cleared of debris for the current project. Motorized incursions during 2014 led to a temporary loss of 0.26 km^2 (0.1 mi^2) of secure habitat; well below the 13.2 km^2 (5.1 mi^2) allowed by the one percent rule. No temporary roads associated with the Grouse Mountain project are open to the public. A closed gate across the main road used to access the project area limits public access during the spring-fall period. All temporary project roads will be decommissioned in 2015 at termination of the project.

Beem Gulch Timber Sale (Shoshone National Forest): The Beem Gulch timber sale, located in the Crandall/Sunlight #3 subunit on the Shoshone National Forest, was authorized under the Sunlight Vegetation Management Project decision. Ground work was initiated in December 2012. Although most timber harvest activities were completed by the end of 2013, approximately 1.5 km of temporary roads remained open in 2014 for public access to salvageable firewood piles. These roads will most likely be closed in 2015. The temporary loss of 1.8 km^2 (0.7 mi^2) in secure habitat during 2014 due to project activities did not cause a reduction in secure habitat below 1998 levels for the Crandall/Sunlight subunit.

Upper Wind River Vista Timber Sale (Shoshone National Forest): The *Upper Wind River Vegetation Treatment Project* was approved in 2007 and initially authorized one large timber sale (referred to as the Vista Sale) comprised of 5 distinct timber cutting units in the South Absaroka #3 subunit. Treatments were proposed to expedite hazardous fuel reduction in an at-risk timbered area south of Brooks Lake on the Wind River Ranger District of the Shoshone National Forest. In 2011 the Vista timber sale was broken up into three separate sales: *Vista*, *Brooks Lake Creek*, and *Pinnacles Heights*. Access to timber units inside the GBRZ called for the reactivation of approximately 2.2 km of decommissioned Forest Service routes and construction of 1.3 km of new motorized route in a small area concentrated immediately south of Brooks Lake and north of U.S. Highway 212. An additional 1.1 km of new permanent road was constructed in 2010 just outside of the subunit's southwest boundary and outside of the GBRZ. This new administrative road will be remain open to Forest Service personnel but closed to the public upon project termination. During 2014, project activities on 3.5 km of project roads led to

a temporary reduction of 0.5 km^2 (0.2 mi^2) of secure habitat; well less than the 9.1 km^2 (3.5 mi^2) permitted by the 1 percent rule. It is anticipated that all 1.3 km of new road construction will be closed by the end of 2015 and all temporary project roads inside the GBRZ will be decommissioned (closed to the public and administrative staff) upon closure of the project.

Table A5. *Temporary projects inside the Grizzly Bear Recovery Zone during 2014.*

Bear Management	Area ($miles^2$) (excluding major lakes)		Project Name & Admin Unit	Secure Habitat ($miles^2$)			Project Status
	Subunit [1]	Maximum change Allowed [2]		2014 w/o project	2014 with project	Area affected	
Buffalo-Spread Cr #1	219.9	**5.1**	**Grouse Mountain** (Bridger-Teton NF)	194.9	194.9	0.00	ACTIVE
Buffalo-Spread Cr #2	**507.6**			**377.5**	**377.4**	**0.10**	
Crandall-Sunlight #1	129.8	**3.2**	**Beem Gulch** (Shoshone NF)	106.2	106.2	0.00	ACTIVE
Crandall-Sunlight #2	316.2			260.5	260.5	0.00	
Crandall-Sunlight #3	**221.8**			**178.9**	**178.3**	**0.66**	
South Absaroka #1	163.2	**3.5**	**Upper Wind River Vista Timber Sale** (Shoshone NF)	161.9	161.9	0.00	ACTIVE
South Absaroka 2	190.6			190.3	190.3	0.00	
South Absaroka #2	**348.3**			**337.2**	**337.0**	**0.18**	

[1] Subunits affected by a temporary project are highlighted in gray.
[2] The maximum allowable temporary reduction in secure habitat is 1% of the area of the largest subunit within the BMU.

MONITORING SECURE HABITAT OUTSIDE THE GBRZ

Monitoring and reporting change in secure habitat on National Forest land outside the GBRZ is required biennially by the 2006 Forest Plan Amendment for grizzly bear conservation in the GYE. Monitoring protocol outside the GBRZ calls for quantifying secure habitat and tracking change against an established baseline. Prior to 2012 the baseline was predicated on a 2003 transportation data layer (USDA 2006*b*, p.45,56). However, this 2003 baseline layer was incomplete because several national forests had not yet completed a digital inventory of motorized trails or lacked a comprehensive inventory of motorized status for system and non-system routes. With passage of the 2005 Travel Management Rule (TMR, USDA 2005), motorized access was limited to a managed system of roads and trails, and each national forest was made responsible to generate maps for the public that clearly identify authorized corridors of motorized travel. In 2012, the 2003 transportation baseline was replaced with a more recent and accurate 2008 layer that more accurately captured some of the unauthorized non-system routes. However, the lack of a comprehensive national inventory of user-created routes, combined with their continuing proliferation, makes producing a definitive inventory a daunting challenge that most often goes unmet. A host of factors reinforce this difficulty, including the affordability and availability of off-highway-vehicles (OHVs), the intrinsic nature of the terrain that may limit the

effectiveness of barriers, and insufficient funds allowing comprehensive enforcement of travel rules and decommissioning of non-system routes. Some user-created routes are abandoned, and slowly over time become naturally decommissioned due to downfall and regrowth of vegetation; other routes persist on the landscape through continued unlawful use. TMR regulations have not proven sufficient to control the proliferation of un-authorized travel and consequential development of non-system routes. Because secure habitat is calculated exclusively by generating buffers around motorized route features, our best estimate for secure habitat is only as good as our motorized access database. Table A6 represents the best estimates available for percent secure habitat in each Bear Analysis Unit (BAU) outside the GBRZ based on our best available information of motorized route configurations for the six national forests within the GYE.

Changes in Secure Habitat outside the GBRZ during 2014

Listed below are changes to motorized routes and secure habitat that have occurred outside the GBRZ since last reported in 2012:

Gallatin BAU - As part of the Gallatin National Forest Travel Plan implementation in 2014, 32 km of new motorized trails were constructed in the north portion of the Gallatin BAU and comprised: Moose-Swan motorcycle connector trail (d = 0.4 km), Swan-Storm ATV connector trail (d = 3.3 km), and Little Bear-Wilson ATV trail (d = 28.3 km). Construction of new access routes was part of the final stage of Travel Plan implementation and led to a decrease of 0.4% in secure habitat in the Gallatin BAU since last reported in the 2012 annual report. When desired future conditions of Full Travel Plan are reached, secure habitat in the Gallatin BAU will be reduced by 0.6% below 2008 conditions.

Bozeman BAU - As part of the Gallatin National Forest Travel Plan implementation in 2014, 4 km of new motorized trail was constructed for the Moser-Lick Creek connector ATV trail in the north half of the Bozeman BAU. This resulted in a decrease of 0.4% in secure habitat since last reported for 2012. When desired future conditions of Full Travel Plan are reached, secure habitat in the Bozeman BAU will be reduced by 0.7% below 2008 conditions.

Boulder BAU - As part of the Gallatin National Forest Travel Plan implementation in 2014, the new West Deer Creek road (d = 4.4 km) was constructed to replace the old Cherry Creek access road in the north portion of the Boulder BAU. As part of the West Deer-Cherry Creek deal, an additional 3.6 km of road directly to the west was permanently decommissioned. Route changes in the Boulder BAU led to no measurable increase in secure habitat.

Gros Ventre BAU - Permanent barriers were constructed in 2014 to prohibit approximately 6.8 km of motorized access at the north and south access points of an illegal user-created OHV trail located in the Breakneck Flat area of the Gros Ventre BAU on the Bridger-Teton National Forest. Road closures in the Gros Ventre BAU resulted in an increase of 0.2% in secure habitat since last reported in 2012.

Teton BAU – In 2014, OHV areas previously open to cross-country travel in the Teton Basin Ranger District of the Caribou-Targhee National Forest were officially closed to off-highway

travel. Upon implementation of this designation, all motorized travel in 135.5 km^2 of OHV areas on the Teton Basin Ranger District was restricted to system routes delineated on the 2014 Caribou-Targhee Motor Vehicle Use Maps (MVUM). Prior to this restriction, entire OHV areas in this district were stamped "non-secure" in the Grizzly Bear Motorized Access Model and detracted from the total percentage of secure habitat calculated for the Teton BAU. However, with travel now clearly restricted to system routes, and with all system routes accounted for in the Grizzly Bear Motorized Access database, secure habitat in these areas is now based on 500-m buffers around open and gated motorized roads and trails. As part of the Teton Basin OHV closure, 2.7 km of the non-system Nelson Spring road remains open under a special use permit and has been incorporated into the system routes designated on the 2014 MVUM. Restricting motorized travel to system roads and trails accounts for an 11% increase in secure habitat since 2008 on the Teton BAU.

Table A6. *Percent secure habitat in Bear Analysis Units (BAUs) outside the Grizzly Bear Recovery Zone for each of the six national forests in the GYE. Current 2014 levels of secure habitat are compared against 2008 baseline and 2012 levels.*

Bear Analysis Unit (BAU)	Percent Secure Habitat				BAU Area [(1)] (miles^2)
	2008 (baseline)	2012	2014 (current)	Change (2008 – 2014)	
Beaverhead-Deerlodge National Forest					
Baldy Mountain	46.2	55.0	55.0	8.9	96.9
Bear Creek	60.7	62.6	62.6	1.9	36.4
Beaver Creek	48.5	57.3	57.3	8.8	478.9
Garfield	64.8	71.6	71.6	6.8	182.0
Gravelies	60.6	58.5	58.5	-2.1	384.4
Madison Range	99.2	99.4	99.4	0.2	89.2
Pintler Mountains	59.2	57.6	57.6	-1.6	410.3
Pioneer Mountains	52.9	55.1	55.1	2.2	912.2
Snowcrest Range	70.9	74.8	74.8	3.8	357.2
Sourdough	40.1	46.9	46.9	6.8	111.2
Starlight	40.0	34.8	34.8	-5.2	79.0
Tobacco Roots North	52.7	53.4	53.4	0.7	106.7
Tobacco Roots South	46.9	47.5	47.5	0.6	186.3
Mean Secure / Total Area	**57.1**	**59.6**	**59.6**	**2.5**	**3,431**
Bridger-Teton National Forest					
Fremont	88.0	88.2	88.2	0.2	440.0
Green River	65.7	65.7	65.7	0.0	527.9
Gros Ventre	63.7	63.7	63.9	0.2	507.7
Hoback Range	58.9	58.9	58.9	0.0	292.9
Snake River	64.0	64.2	64.2	0.3	348.9
Mean Secure / Total Area	**68.1**	**68.2**	**68.2**	**0.1**	**2,117**
Caribou-Targhee National Forest					
Centennials	50.9	50.9	50.9	0.0	199.1

Table A6. *Percent secure habitat in Bear Analysis Units (BAUs) outside the Grizzly Bear Recovery Zone for each of the six national forests in the GYE. Current 2014 levels of secure habitat are compared against 2008 baseline and 2012 levels.*

Bear Analysis Unit (BAU)	Percent Secure Habitat				BAU Area [(1)] (miles^2)
	2008 (baseline)	2012	2014 (current)	Change (2008 – 2014)	
Crooked Creek	59.4	59.3	59.5	0.1	403.0
Dead Horse Ridge	50.8	50.8	50.6	-0.2	364.8
Island Park	36.7	36.7	36.7	0.0	333.9
Lemhi Mountains	70.0	70.0	70.0	0.0	143.1
Palisades Reservoir	59.8	59.8	59.8	0.0	472.5
Teton	64.8	64.8	75.8	11.0	209.5
Mean Secure / Total Area	**56.1**	**56.0**	**57.6**	**1.6**	**2126.0**
Custer National Forest					
Pryor Mountains	38.8	38.8	38.8	0.0	121.8
Rock Creek	83.8	83.8	83.8	0.0	237.2
Stillwater	85.3	85.7	85.7	0.4	404.7
Mean Secure / Total Area	**69.3**	**69.4**	**69.4**	**0.1**	**763.7**
Gallatin National Forest					
Boulder	64.8	69.9	69.9	5.1	277.9
Bozeman	45.6	59.8	59.4	13.8	270.5
Bridger	28.3	38.4	38.4	10.1	236.3
Cooke City	99.6	99.6	99.6	0.0	68.7
Crazy	57.2	67.6	67.6	10.4	254.8
Gallatin	52.3	59.8	59.5	7.2	415.0
Mill Creek	82.3	83.8	83.8	1.6	312.2
Quake	85.0	92.1	92.1	7.2	66.2
Mean Secure / Total Area	**64.4**	**71.4**	**71.3**	**6.9**	**1,902**
Shoshone National Forest					
Carter	77.6	77.9	77.9	0.3	261.1
Clarks Fork	70.1	70.1	70.1	0.0	160.5
East Fork	73.2	73.2	73.2	0.0	251.0
Fitzpatrick	98.4	98.4	98.4	0.0	317.8
North Fork	78.0	78.0	78.0	0.0	143.2
Warm Springs	30.6	30.5	29.4	-1.2	183.0
Wood River	84.7	85.3	85.3	0.6	228.5
Mean Secure / Total Area	**73.2**	**73.3**	**73.2**	**0.0**	**1545.2**

Literature Cited

Interagency Grizzly Bear Study Team. 2013. Response of Yellowstone grizzly bears to changes in food resources: a synthesis. Report to the Interagency Grizzly Bear Committee and Yellowstone Ecosystem Subcommittee. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Bozeman, Montana, USA. <http://www.nrmsc.usgs.gov/files/norock/IGBST/IGBST_FoodSynReport120213.pdf>

U.S. Department of Agriculture, Forest Service. 2005. Travel Management; Designated Routes and Areas for Motor Vehicle Use. Final Rule. 36 CFR parts 212, 251, 261, and 295. <http://www.fs.fed.us/recreation/programs/ohv/final.pdf.>

U.S. Department of Agriculture, Forest Service. 2006*a*. Forest Plan Amendment for grizzly bear habitat conservation for the Greater Yellowstone Area National Forests. Record of Decision. <www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5187774.pdf.>

U.S. Department of Agriculture, Forest Service. 2006*b*. Forest Plan Amendment for grizzly bear habitat conservation for the Greater Yellowstone Area National Forests. Final environmental impact statement. <http://www.fws.gov/mountain-prairie/species/mammals/grizzly/USDA_Forest_Service_2006a.pdf.>

U.S. Fish and Wildlife Service. 2007. Final conservation strategy for the Grizzly bear in the Greater Yellowstone Area. <http://www.fws.gov/mountain-prairie/species/mammals/grizzly/Final_Conservation_Strategy.pdf>

Supplemental Tables S1 and S2 (available online only)

Appendix B

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

Monitoring Whitebark Pine in the Greater Yellowstone Ecosystem

2014 Annual Report

Natural Resource Data Series NPS/GRYN/NRDS—2015/796

The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado, publishes a range of reports that address natural resource topics. These reports are of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner.

Data in this report were collected and analyzed using methods based on established, peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols. This report received formal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data, and whose background and expertise put them on par technically and scientifically with the authors of the information.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

This report is available from http://science.nature.nps.gov/im/units/gryn/index.cfm and the Natural Resource Publications Management website (http://www.nature.nps.gov/publications/nrpm/).

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Appendix C

2014 WYOMING BEAR WISE COMMUNITY PROJECT UPDATE

Dusty Lasseter, Bear Wise Community Coordinator, Wyoming Game and Fish Department

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 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 to: 1) minimize accessibility of unnatural attractants to bears in developed areas, 2) use a public outreach and education campaign to reduce knowledge gaps about bears and the causes of conflicts, and 3) deploy a bear-resistant waste management system and promote bear-resistant waste management infrastructure.

This report provides a summary of program accomplishments in 2014. Past accomplishments are reported in the 2006–2013 annual reports of the Interagency Grizzly Bear Study Team (IGBST) and in the 2011–2013 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 Area (GYA) 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 vandal 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 GYA. The North Fork of the 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 8 years, the Bear Wise Community Programs in both Cody and Jackson have deployed a multi-faceted education and outreach campaign in an effort to reduce human-bear conflicts and promote proper attractant management. Although a wide array of challenges remain and vary among communities, many accomplishments have been made and progress is expected to continue as Bear Wise efforts gain momentum.

Wapiti Project Update

The Wapiti Bear Wise Community Program continues to use radio, television and print media, mass mailings, and 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 contacts 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 2014 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 Park County, federal funding for grizzly bear conservation, Bole and Klingstein Foundation, and the Memorial Bear Fund. 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, 671 domestic livestock carcasses have been removed from private lands. An article discussing the efficacy of the program was published in *International Bear News* (volume 23(3):30–31).

2. Recommendations concerning the proper storage of garbage and other attractants are provided to the Park County Planning and Zoning Commission for new developments within the greater Cody area. The Coordinator reviews proposed developments on a case-by-case basis, attends monthly meetings, and contacts applicants directly to discuss conflict prevention measures. To date, these comments have been adopted as either formal recommendations or as a condition of approval for 19 new developments within Park County.

3. A traveling interactive Bear Aware educational display was developed and produced for use in public libraries across northwest Wyoming. The display focuses on the prevention of human-bear conflicts and features graphics, an interactive touch screen monitor, short video segments, a grizzly bear hide and skull, and educational materials that are available for check out. The display was featured at the Hot Springs County and Washakie County Libraries.

4. The Wyoming Game and Fish partnership with the North Fork Bear Wise Group (NFBWG) continues to grow. The group is comprised of six local Wapiti citizens that meet monthly in order to articulate community needs and assist in the development of educational and outreach initiatives. The group purchased a new billboard sign to replace a fading sign and has secured magnets to be mailed in the spring of 2015 to 2,500 Park County residents.

5. Billboards, “Bear Use Area” highway signs, and educational kiosks remain posted throughout Wapiti and the Crandall/Sunlight area north of Cody. Kiosk message boards are updated three times during the non-denning season with seasonally appropriate conflict prevention information. Also, two “Bear Aware” signs were placed in high use areas of the Heart Mountain Ranch which is managed by the Nature Conservancy.

6. WGFD employees consulted with Department of Recreation to ensure attractants were properly stored at the Anchor Dam campground. The Department of Recreation went forward with building a 20 foot meat pole so that campers could store game or other attractants. They also built two permanent bear boxes that can be used to securely store attractants.

7. Educational black bear/grizzly bear identification materials were distributed to individuals and to local sporting goods stores in the Cody, Pinedale, and Lander areas and mailed to black bear hunters who registered bait sites with the Department in areas surrounding the GYA.

8. Numerous informational presentations were given that focused on human-bear conflict prevention to audiences including the Park and Big Horn County public school systems, homeowners associations, Boy Scouts, 4-H members, DANO, Paint Rock Hunter Management Program, guest ranches, and college students. Frequent 1-on-1 contacts were made during the 2014 conflict season in areas where the occurrence of human-bear conflicts has historically been high.

9. A "Working Safely in Bear Country" workshop was conducted for the Park County Weed and Pest District, Bureau of Land Management, Rocky Mountain Power, Bighorn Canyon National Recreation Area, and Marathon Oil and Gas employees.

10. A booth containing information on bear identification, attractant storage, hunting and recreating safely in bear country, and the proper use of bear spray was staffed at the Lander Winter Fair, Cody Arbor Day, Wyoming Outdoorsmen Banquet, and Spring into Yellowstone.

11. A public service announcement (PSA) was recorded by the by WGFD personnel on "Staying Safe in Bear Country" and broadcast over the radio in the spring and fall of 2014 on the Bighorn Basin Radio Network.

12. Training was provided to new and previous Hunter Education Instructors to ensure that they are properly teaching large carnivore material. The instructors were all provided with "Staying Safe in Bear Country" DVD's and two canisters of inert bear spray for Hunter Education courses. In addition 500 canisters of inert bear spray were purchased this year to be distributed at a later date for educational efforts.

13. Grant money was received from the IGBC to purchase supplies for the bear trailer that is used by the Forest Service, Grand Teton National Park, and the Wyoming Game and Fish Department. There were stickers, pencils, temporary tattoos, and book markers that were purchased with the funding and handed out at public events.

14. The Memorial Bear Fund also gave a grant for the purchase of five 150-foot temporary electric fences and five electric chargers to be used for securing attractants. Although there are many uses for this electric fence, this year WGFD personnel put 18 temporary electric fences up to secure bee apiaries.

15. A grant from the IGBC was utilized to film and photograph "Montana Grizzly Encounters" captive bear *Brutus*. In order to get the best possible footage, Wyoming, Idaho, and Montana wildlife agencies worked together to film the captive bear. The three-day filming of Brutus will be used to show how **NOT** to behave in bear country. This was a great opportunity to get footage of what could happen if attractants aren't properly stored.

16. WGFD personnel reviewed educational handouts for the Bighorn Forest Service and gave recommendations for a bear kiosk to the Louisiana Department of Wildlife and Fisheries. Personnel also created door hangers to be used in areas with recent bear activity.

17. Due to some recent black bear conflicts at Sinks Canyon State Park 8 bear resistant dumpsters were deployed to secure trash. These bear resistant dumpsters were obtained from Yellowstone National Park when they replaced their infrastructure.

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 2013 are as follows:

1. The Department hosted "Living in Lion, Bear, and Wolf Country" workshops in Pinedale and Green River. Approximately 75 people attended the workshops.

2. Hunting in Bear Country presentations were given to two hunter safety classes in the Region.

3. A bear safety presentation was given to cowboys and sheepherders of two different grazing associations in the Region.

4. A bear safety presentation was provided to approximately 50 employees of a local natural gas production company in the Region.

5. A bear safety presentation was given to staff members of the Sublette County Chamber of Commerce and Sublette County Visitor's Center.

6. A bear safety presentation was given to the Pinedale and Big Piney Ranger Districts of the United States Forest Service.

7. A bear safety and first responder presentation was given to Sublette County's Tip Top Search and Rescue group.

8. A bear safety presentation was given to Sublette County Weed and pest workers and volunteers.

9. A bear safety presentation was given to staff members of the Red Cliff Bible Camp.

10. A bear safety presentation was given to approximately 30 Pinedale District Bureau of Land Management employees.

11. The Department hosted a bear safety booth at Pinedale's Rendezvous Days Celebration, contacting hundreds of participants over a three-day period. Pinedale's Rendezvous Days attracts approximately 10,000 people over the 4-day event and Department employees contact an estimated 1,000 constituents.

12. The Department hosted a bear safety booth at the Cora Rural Fire Department's annual picnic and celebration, contacting dozens of homeowners that live and recreate in occupied grizzly bear habitat.

13. Department personnel and livestock operators removed over 90% of livestock carcasses and livestock remains discovered on public and private lands within the Region in 2014 (conflicts with livestock increased 47% within the Region from 2013 to 2014 primarily due to increased density and distribution of bears).

14. Worked extensively with owners of Fremont Lake summer homes. Department staff visited every house in the association, distributed bear information and left "door hangers" when residences were vacant. Additionally, Department personnel attended a homeowners meeting and presented information, answered questions, and dispelled several rumors about bear safety and bear management. Attractant storage and reporting seemed to improve in 2014

Objectives for 2015 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. The Department is also working to assist the U.S. Forest Service with providing bear proof storage and meatpoles at targeted areas in the Region.

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 high 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 Hole Project Update

The Bear Wise Jackson Hole program continues educational and outreach initiatives to reduce human-bear conflicts within the community of Jackson and surrounding areas. In 2014, 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, and using our bear education trailer.

1. A bear education trailer was purchased in August 2010 with funding contributions from the Department, Grand Teton National Park, Bridger Teton National Forest and Jackson Hole Wildlife Foundation. Two bear mounts (1 grizzly bear and 1 black bear) have been placed in the trailer along with other educational materials. The bear mounts were donated to the Department through a partnership with the United States Taxidermist

Association and the Center for Wildlife Information. The trailer was displayed and staffed at various events and locations including Teton National Park, Jackson Elk Fest, Fourth of July Parade and the National Elk Refuge Visitor Center.

2. Public service announcements were broadcast on 4 local radio stations in Jackson for a total of 6 weeks throughout the spring, summer, and fall of 2014. The announcements focused on storing attractants so they are unavailable to bears and hunting safely in bear country.

3. Numerous educational talks were presented to various groups including homeowner's associations, guest ranches, youth camps, Jackson residents, tourists, school groups and Teton County employees.

4. Door flyers with detailed information about attractant storage and bear conflict avoidance were distributed in two Teton County residential areas where high levels of bear/human conflicts were occurring.

5. Bear spray purchased by the Jackson Hole Wildlife Foundation was distributed by WGFD personnel free of charge to hunters at North Jackson trailheads.

6. Spanish language bear informational pamphlets were distributed to Spanish speaking residents in Teton County with the help of the Teton County Latino Resource Center, Teton Literacy Center, and the Jackson Visitor Center.

7. Restroom posters with information about attractant storage were placed in 16 different restaurants in Teton County for a 6-month period.

8. Refrigerator magnets featuring tips about proper attractant management were distributed to Teton Village homeowners and Jackson Hole Mountain Resort lodging.

9. Numerous personal contacts were made with private residents in Teton County. This has proven to be a useful way to establish working relationships with residents and maintain an exchange of information about bear activity in the area.

10. A booth containing information on bear identification, attractant storage, hunting and recreating safely in bear country, and the proper use of bear spray was staffed at the Jackson Hole Antler Auction.

11. Assisted 6 hunting outfitters with the installation and maintenance of electric fence systems around their field camps located in the Bridger-Teton National Forest.

12. 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.

13. Consultations were conducted at multiple businesses and residences where recommendations were made regarding sanitation infrastructure and compliance with the Bear Conflict Mitigation and Prevention Land Development Regulations (LDR).

14. Bear Aware educational materials were distributed to campground hosts in the Caribou-Targhee National Forest, hunters, and numerous residents in Teton County.

15. Several radio and newspaper interviews were conducted regarding conflict prevention in the Jackson area.

16. Educational black bear/grizzly bear identification materials were distributed to black bear hunters who registered bait sites with the Wyoming Game and Fish Department in the Jackson region.

Objectives for the Bear Wise Jackson Hole program in 2015 will be 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 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 are 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.

Information and Education

2014 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. Each announcement is posted in a timely fashion to the web page. In 2014, 14 notifications were distributed and posted on the website.

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 grizzly bear management web page continues to be maintained and updated on a regular basis in order to provide timely information to the public regarding grizzly bear management activities conducted by the department. The web page contents include various interagency annual reports and updates and links to other grizzly bear recovery web sites.
b) Beginning May 2014, weekly updates of ongoing management activities related to depredations, research, trapping and monitoring, and information and education were posted to the department's website. A total of 23 weekly updates were posted from May 17, 2014 through October 31, 2014.

3) Conservation Education

a) In 2014, nine "Staying Safe in Bear, Lion and Wolf Country" seminars were conducted to increase understanding and knowledge of bears, bear behavior and conflict avoidance, Statewide, 270 attendees participated in the seminars.

4) 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 titled "*Staying Safe in Bear Country, A Behavioral-Based Approach to Reducing Risk*". A section on bear safety is included in the student manual. Approximately 5,000 students are certified each year.
b) On an annual basis, newly certified hunter education instructors are trained by Department personal in techniques used to prevent encounters while hunting in bear country and the proper use of bear spray. Inert bear spray canisters are used to demonstrate the proper use of bear spray at our New Instructor Hunter Education Academy and are distributed directly to our volunteer instructors at annual Hunter Education Instructor Workshops held around the state.

Literature Cited

Servheen C., M. Haroldson, K. Gunther, K. Barber, M. Bruscino, M. Cherry, B. Debolt, K. Frey, L. Hanauksa-Brown, G. Losinski, C. Schwartz, and B. Summerfield. 2004. Yellowstone mortality and conflict reduction report: presented to the Yellowstone Ecosystem Subcommittee (YES) April 7, 2004.

Publications

For information regarding Wyoming Game and Fish Department's grizzly bear management program; including links to publications, reports, updates, and plan visit: https://wgfd.wyo.gov/web2011/wildlife-1000674.aspx

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Appendix D

PROJECT UPDATE: GRIZZLY BEAR RESPONSE TO ELK HUNTING IN GRAND TETON NATIONAL PARK

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Introduction

Although population growth of grizzly bears (*Ursus arctos*) in the Greater Yellowstone Ecosystem (GYE) has slowed from 4–7% during the 1980s and 1990s to 0–2% during the last decade, expansion of occupied range has continued throughout the last decade. Successful population recovery has coincided with increases in human populations on the periphery of the ecosystem and human visitation to national parks. One particular challenge is the availability of ungulate gut piles and carcasses during fall hunting seasons, a time when bears' caloric demand and intake is greatest due to hyperphagia. These areas may represent seasonal "ecocenters" for bears. Supporting this concept, Haroldson et al. (2004) found that grizzly bears were 2.4–2.7 and 2.3–4.4 times more likely to be outside Yellowstone National Park's northern and southern boundaries, respectively, following the opening of the September elk season, thus increasing the risk of human-bear conflicts and grizzly bear mortality. Gunther et al. (2004) found that grizzly bears killed in defense of human life (n = 32) represented the greatest source of human-caused mortality during 1992–2000, including 27 from ungulate hunters.

Under its 1950 establishing legislation, Grand Teton National Park (GTNP) is authorized to conduct a joint elk reduction program (ERP), when necessary, with the State of Wyoming for conservation of the Jackson elk herd, a significant portion of which travels though GTNP during annual fall migrations to wintering areas on the National Elk Refuge (NER) and 3 nearby state feed grounds. Because the GTNP hunting season is open later than those on adjacent lands, the 'ecocenter' effect of a highly attractive grizzly bear food source may exacerbate the potential for bear-hunter conflicts. Clearly, the fall elk hunting in conjunction with increasing grizzly bear numbers creates a unique challenge for wildlife managers at GTNP.

Several GTNP provisions for mitigating hunter-grizzly bear conflicts are already in place, including requiring hunters to carry bear spray, providing hunt camps with game storage facilities, prohibiting artificial elk calls, and providing hunters with a bear safety education packet. In response to recent human-bear conflicts, GTNP proposed additional measures and revisions to the ERP for 2013. These revisions are currently based on a limited set of regulatory tools, involving changes in hunter densities (e.g., hunters/day, access), closure of areas to hunting (e.g., Snake River bottoms), and changes in hunting regulations to reduce wounding loss (e.g., ammunition limits). However, even with these changes, GTNP managers expect conflicts between elk hunters and grizzly bears to increase. Therefore, park managers are seeking new, science-based information to help reduce conflict potential. With funding from the combined USGS-NPS Natural Resource Preservation Program, we designed a study to gain a better understanding of grizzly bear responses to the ERP in GTNP. Our specific objectives are to determine: 1) changes in grizzly bear density and distribution relative to the timing and location of the GTNP elk hunting season, 2) spatial and temporal distribution of elk remains, 3) grizzly

bear detection and use of elk remains, and 4) the relative risk of human-bear encounters. Here, we report on 2014 field sampling activities. A similar sampling scheme is planned for 2015 and a final project report is planned for June 2016.

Field Data Collection

During the 2014 field season we erected and monitored 60 hair-snare corrals distributed across 20 5- × 5- km grid cells during 3 separate primary sampling periods of 5 weeks each, with each week representing a secondary sampling period. We conducted 300 corral visits during the 2014 field season (3 primary periods × 5 secondary periods × 20 hair corrals). We also developed sampling protocols for non-invasive DNA sampling of grizzly bears using the network of utility poles and included these as opportunistic samples for a mark and recapture design similar to Kendall et al. (2008). Field personnel also collected hair samples snagged on vegetation by back-tracking grizzly bear tracks in the snow during the ERP hunting season. Samples were also collected from hunter gut piles and wounding-loss elk that were circumscribed with barbed wire as temporary hair corrals. We collected 425 hair samples. Seventy-six percent of samples originated from hair corrals, 13% from power pole rubs, 5% from carcasses, 3% from back-tracking, and 3% from grizzly bear research trap sites. All hair-sampling devices were removed at the end of the 2014 study period.

Based on remote camera monitoring, hair corrals were visited and the non-food reward scent lure was investigated by bison (*Bison bison*), elk (*Cervus elaphus*), mule deer (*Odocoileus hemionus*), gray wolves (*Canis lupus*), coyotes (*Canis latrans*), mountain lions (*Puma concolor*) black bears (*U. americanus*), grizzly bears, red fox (*Vulpes vulpes*), American pine martin (*Martes americana*), and red squirrels (*Tamiasciurus hudsonicus*). Black and grizzly bears were the only species observed rubbing on powerpoles. Grizzly bears, coyotes, and red fox were the only species observed at carcass corrals during the active ERP hunting season. Of the 425 hair samples collected, approximately 91% were identified as bear hair based on visual assessment in the field and remote camera data. Approximately 3% of the samples could not reliably be assigned to the genus level based on field personnel classification and camera data. The remaining 6% of samples included bison, elk, moose, and wolf hair. Of the bear samples collected, approximately 57% were visually identifiable as grizzly bear, 29% black bear. The remaining 14% were clearly Ursid hairs, but will require additional analysis (cuticular scale patterns or DNA analysis) for species identification.

Two females and 5 males were captured and fitted with GPS radio collars. During the 2014 study period we recorded 16,149 telemetry locations, including locations outside GTNP, for a total of 800 bear-monitoring days. To investigate patterns of spatial proximity among grizzly bears and humans, we used GPS receivers to record movement paths of field personnel, hunters, and outfitters on 267 occasions during the 2014 ERP hunting season in hunt areas 75 and 79. The overall return rate of these GPS units was 97%. Finally, we assigned gridded spatial locations to elk kill sites for 185 of the 209 (89%) elk harvested during the 2014 ERP hunting season based on hunter-reported grid cells of landscape descriptions on harvest records returned to the NPS.

Literature Cited

Gunther K.A., S.L Cain, J. Copeland, K. Frey, M.A. Haroldson, and C.C. Schwartz. 2004. Grizzly bear-human conflicts in the Greater Yellowstone Ecosystem, 1992–2000. Ursus 15:10–22.

Haroldson, M.A., C.C. Schwartz, S. Cherry, and D.S. Moody. 2004. Possible effects of elk harvest on fall distribution of grizzly bears in the Greater Yellowstone Ecosystem. Journal of Wildlife Management 68(1):129–137.

Kendall, K.C. and K.S. McKelvey. 2008. Hair Collection. *In* Noninvasive Survey Methods for Carnivores. Long, R.A., P. MacKay, W.J. Zielinski, and J.C. Ray. eds. Island Press, Washington, D.C., USA.