Yellowstone Grizzly Bear Investigations 2011

Report of the Interagency Grizzly Bear Study Team

Photo courtesy of Gary Pollock

Cover photo: Bear 610 watches as one of her cubs climbs a tree. See "Cub Adoption Documented in Grand Teton National Park." Photo courtesy of Gary Pollock.

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Annual Report of the Interagency Grizzly Bear Study Team

2011

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

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U.S. Department of the Interior
U.S. Geological Survey
2012

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Introduction

(Mark A. Haroldson and Frank T. van Manen, Interagency Grizzly Bear Study Team)

This Report

This Annual Report summarizes results of grizzly bear (*Ursus arctos horribilis*) monitoring and research conducted in the Greater Yellowstone Ecosystem (GYE) by the Interagency Grizzly Bear Study Team (IGBST) during 2011. The report also contains a summary of nuisance grizzly bear management actions.

The IGBST continues to work on research questions associated with counts of unduplicated females with cubs-of-the-year (COY). These counts are used to estimate population size, which are then used to establish annual mortality limits. Previous research demonstrated these counts are biased low so the IGBST examined alternative techniques to estimate the number of unduplicated females with COY. Results of an investigation into an approach using sequential clustering of female with COY sightings combined with Bayesian methods and ancillary data resampling was presented at a workshop of study team members and quantitative ecologists in July 2011.

Although the method had promise, it was complex and depended on the assumption that the true density of female grizzly bears with COY within the ecosystem is known, information which we currently lack. Population estimates varied considerably based on a range of inputs for the underlying density and workshop participants concluded they could not support this approach at this time. The group considered an alternative approach based on a mark-recapture population estimate using sightings of radio-collared females with COY. The group endorsed this approach in large part because it has the potential to produce an unbiased estimate for the annual number of females with COY in the GYE. Work on this method continued through 2011 and final results are expected at the end of 2012.

The grizzly bear was removed from protection under the Endangered Species Act on 30 April 2007 (U.S. Fish and Wildlife Service [USFWS] 2007*a*) but relisted by a District Court order in 2009. During November 2011, the U.S Court of Appeals for the 9th Circuit upheld the lower court decision with regard to potential impacts of whitebark pine (*Pinus albicaulis*) decline on grizzly bears and vacated the delisting rule (Greater Yellowstone Coalition v. State of Wyoming, No. 09-36100 [9th Cir. 2011]). Although the change in status was upheld, we continue to follow monitoring protocols established under the Revised Demographic Recovery Criteria (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*). The IGBST will continue reporting on an array of required monitoring programs. These include both population and habitat components. Annual population monitoring includes:

- Monitoring unduplicated females with COY and estimating total population size for the entire GYE based on the model-averaged Chao2 estimate of females with COY (see "Assessing Trend and Estimating Population Size Using Counts of Unduplicated Females").
- Monitoring the distribution of females with young of all ages and having a target of at least 16 of 18 Bear Management Units (BMUs) within the Recovery Zone (i.e., Primary Conservation Area (PCA)) occupied at least 1 year in every 6, and no 2 adjacent BMUs can be unoccupied over any 6-year period (see "Occupancy of Bear Management Units by Females with Young").
- Monitoring all sources of mortality for independent (≥2 years old) females and males within the entire GYE. Mortality limits are set at ≤9% for independent females and ≤15% for independent males from all causes. Mortality limits for dependent young are ≤9% for known and probable human-caused mortalities (see "Estimating Sustainability of Annual Grizzly Bear Mortalities").

During 2011, demographic monitoring results triggered a Demographic Review, which entailed a reanalysis of survival and fecundity for grizzly bear in the GYE using data obtained during 2002–2011. The finding triggering the review provided evidence of a change in trajectory of annual estimates of females with COY (USFWS 2007*b*:page 8, number 19; also see "Assessing Trend and Estimating Population Size Using Counts of Unduplicated Females" in this report). The Demographic Review was held in February 2012 in conjunction with a workshop on population estimation and mortality limits. Results of the review are expected to be available during summer 2012. Briefly, results indicated that annual population growth rate for the period 2002–2011 was stable (0%/year) to slightly increasing (2%/year), compared with annual growth rates for the period 1983–2001 of 4 to 7% (Schwartz et al. 2006*c*). Our hypotheses for potential causes of this change in population trajectory include 1) density-dependent effects, 2) decline in available resources (i.e., whitebark pine decline), or 3) a combination of density dependence and changes in available resources. Additional work to evaluate intrinsic and extrinsic factors influencing population trend is planned for 2012.

Habitat monitoring includes documenting the abundance of the 4 major foods throughout the GYE including winter ungulate carcasses, cutthroat trout (*Oncorhynchus clarkii*) spawning numbers, bear use of army cutworm moth (*Euxoa auxiliaris*) sites, and whitebark pine cone production. These protocols have been monitored and reported by the IGBST for several years and are reported here. Additionally, we continue to monitor the health of whitebark pine in the ecosystem in cooperation with the Greater Yellowstone Whitebark Pine Monitoring Working Group. A summary of 2011 monitoring is also presented (Appendix A). The protocol has been modified to document mortality rate in whitebark pine from all causes, including mountain pine beetle (*Dendroctonus ponderosae*).

Although monitoring requirements under the Conservation Strategy (USFWS 2007*c*) do not apply since the GYE grizzly bear population was relisted, the U.S. Forest Service will continue 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 BMU subunit. This year, the 4th report detailing this monitoring program is provided (Appendix B). This report documents 1) changes in secure habitat, open motorized access route density, and total motorized route density inside the PCA; 2) changes in number and capacity of developed sites inside the PCA; 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.

Results of DNA hair snaring work conducted on Yellowstone Lake (Haroldson et al. 2005) during 1997–2000 showed a decline in cutthroat trout use by grizzly bears when compared to earlier work conducted by Reinhart (1990) in 1985–1987. Consequently, the IGBST started a 3-year study to determine if spawning cutthroat trout continue to be an important food for bears, or if the trout population has declined to the level that bears no longer use this resource. If trout are no longer a useful food resource, we want to determine what geographical areas and alternative foods bears are using and if those foods are an adequate replacement to maintain a healthy population. This project began in 2007 and field work was completed in 2009. Two graduate students and several field technicians worked on this research program. One of these students finished her dissertation (Fortin 2011, available at https://research.wsulibs.wsu.edu:8443/xmlui/bitstream/handle/2376/3011/Fortin_wsu_0251E_10250.pdf?sequence=1) and has submitted 1 manuscript for publication. Her results indicate that cutthroat trout are no longer an important food for grizzly bears living in the vicinity of Yellowstone Lake, and much of that loss has been made up by feeding on neonate elk (*Cervus elaphus*). The second student is expected to finish his dissertation in early 2012.

The annual reports of the IGBST summarize annual data collection. Because additional information can be obtained after publication, <u>data summaries are subject to change.</u> 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*), and Haroldson et al. (1998).

History and Purpose of the IGBST

It was recognized as early as 1973 that in order to understand the dynamics of grizzly bears in the GYE, there was a need for 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 Tribal Fish and Game Department formally joined the study team in 2009. The 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 overlap 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. The 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 summarizing monitoring and research efforts within the GYE (for a complete list visit our web page http://www.nrmsc.usgs.gov/research/igbst-home.htm). As a result, we now know much about 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*), habitat use (Knight et al. 1984), and population dynamics (Knight and Eberhardt 1985, Eberhardt et al. 1994, Eberhardt 1995, Schwartz et al. 2006*c*). Nevertheless, monitoring and updating continues so that status can be reevaluated annually.

This report truly represents a "study team" approach. 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; U.S. Geological Survey: J. Ball, C. Hockenbary, S. Thompson, C. Whitman; National Park Service: E. Albers, T. Bernacchi, D. Blanton, A. Bramblett, J. Carnes, L. Clarke, T. Coleman, S. Consolo Murphy, M. Cromp, C. Daigle-Berg, N. Derene, S. Dewey, S. Gunther, B. Helms, N. Herring, F. Madsen, P. Navaille, L. Quall, M. Renteria, J. Sacklin, D. Smith, B. Speeg, D. Stahler, A. Tallian, N. Welch, P.J. White, S. Wolff, B. Whitman; Montana Fish, Wildlife and Parks: N. Anderson, S. Brozovich, D. Fagone, R. Gosse, C. Kline, J. Paugh, J. Ramsey, M. Ross, S. Sheppard, J. Smith, J. Smolczynski, S. Stewart; Montana State University: S. Cherry, M. Higgs; Wyoming Game and Fish: G. Anderson, K. Bales, M. Boyce, D. Brimeyer, B. Brown, R. Clapp, C. Clark, D. Clause, C. Daubin, J. Davis, B. DeBolt, D. Ditolla, L. Ellsbury, T. Fagan, T. Fergus, G. Fralick, M. Garcia, A. Johnson, T. Kreeger, B. Kroger, D. Lasseter, S. Lockwood, B. Long, J. Longobardi, J. Lund, D. McWhirter, K. Mills, D. Moody, J. Olsen, C. Queen, S. Werbelow, D. Wilckens, M. Withroder; Idaho Fish and Game: T. Fletcher, T. Imthurn, J. Koontz, G. Losinski, L. Meates, H. Miyasaki, A. Sorenson, T. Wendt; U.S. Forest Service: J. Chutz, B. Davis, J. Harper, T. Matza, A. Pils, D. Probasco, D. Tyers; Pilots and Observers: B. Ard, S. Ard, H. Leach, J. Martin, J. Ortman, K. Overfield, T. Schell, D. Stinson, R. Stradley; Wildlife Services: M. Foster, J. Rost; Shoshone and Arapaho Tribes: K. Smith, B. Snyder Jr., W. Thayer, B. Warren; USFWS: P. Hnilicka, M. Mazur. Without the collection efforts, contributions, and dedication of all these people, the information contained within this report would not be available.

Finally, we acknowledge the important contributions of Dr. Charles Schwartz, who retired in the fall of 2011 after 14 years as Study Team leader. A lot of good science in support of grizzly bear conservation in the GYE was accomplished under his leadership.

Results and Discussion

Bear Monitoring and Population Trend

Marked Animals *(Mark A. Haroldson and Chad Dickinson, Interagency Grizzly Bear Study Team; and Dan Bjornlie, Wyoming Game and Fish Department)*

During the 2011 field season, 86 individual grizzly bears were captured on 107 occasions (Table 1), including 27 females (18 adult), 59 males (44 adult). Forty individuals were new bears not previously marked.

We conducted research trapping efforts for 591 trap days (1 trap day = 1 trap set for 1 day) in the GYE. During research trapping operations we had 61 captures of 41 (9 female, 32 male) individual grizzly bears for a trapping success rate of 1 grizzly capture every 9.7 trap days.

There were 46 management captures of 46 individual bears in the GYE during 2011 (Tables 1 and 2), including 18 females (10 adult) and 28 males (19 adult). Twenty-four individual bears (10 female, 14 male), were relocated due to conflict situations (Table 1). There were 21 (7 female, 14 male) management removals. One bear (subadult female) captured in a management situation was released on site when the mother and sibling could not be captured. One adult male initially captured at a management trap site was relocated and subsequently captured at a research trap site.

We radio-monitored 92 individual grizzly bears during the 2011 field season, including 29 adult females (Tables 2 and 3). Forty-eight grizzly bears entered their winter dens wearing active transmitters. Five additional bears not found during the fall (Sep-Nov) are considered missing (Table 3). Since 1975, 689 individual grizzly bears have been radiomarked in the GYE.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem during 2011.

Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
668	Male	Adult	05/03/11	Greybull River, Pr-WY	Management	Bear Cr, State-WY	WYGF
669	Male	Subadult	05/07/11	Bufalo Fork, Pr-WY	Management	Mormon Cr, SNF	WYGF
624	Male	Adult	05/07/11	Grass Cr, State-WY	Management	Removed	WYGF
670	Male	Adult	05/11/11	Clark's Fork River, Pr-WY	Management	Bear Cr, State-WY	WYGF
671	Male	Adult	05/12/11	Clark's Fork River, Pr-WY	Management	Bear Cr, State-WY	WYGF
			07/09/11	Dry Lake Cr, BTNF	Research	On site	WYGF
672	Female	Subadult	05/14/11	Little Rock Cr, Pr-WY	Management	Mormon Cr, SNF	WYGF
673	Male	Adult	06/10/11	Papoose Cr, Pr-MT	Research	On site	IGBST
674	Male	Adult	06/18/11	Pacific Cr, GTNP	Research	On site	IGBST
G168	Male	Adult	06/20/11	South Fork Dick Cr, SNF	Research	On site	WYGF
G169	Male	Adult	06/21/11	Francs Fork, SNF	Research	On site	WYGF
659	Male	Adult	06/24/11	Pacific Cr, GTNP	Research	On site	IGBST
G170	Male	Subadult	06/26/11	Dick Cr, SNF	Research	On site	WYGF
675	Male	Adult	06/27/11	Francs Fork, SNF	Research	On site	WYGF
676	Female	Subadult	07/03/11	Marsh Cr, BTNF	Management	On site	WYGF
677	Male	Adult	07/07/11	Papoose Cr, Pr-MT	Research	On site	IGBST
678	Female	Adult	07/09/11	Grizzly Cr, BTNF	Research	On site	WYGF
679	Male	Adult	07/13/11	Lizard Cr, GTNP	Research	On site	IGBST
360	Female	Adult	07/15/11	Papoose Cr, Pr-MT	Research	On site	IGBST

Table 1. Continued.							
Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
G146	Male	Adult	07/16/11	Fish Cr, BTNF	Management	Removed	WYGF
G171	Male	Subadult	07/18/11	Dry Lake Cr, BTNF	Research	On site	WYGF
Unm	Female	Adult	07/18/11	Buttermilk Cr, Pr-MT	Management	Removed	MTFWP
680	Female	Subadult	07/20/11	Wyoming Cr, CTNF	Research	On site	IDFG
			08/10/11	Wyoming Cr, CTNF	Research	On site	IDFG
			08/20/11	Porcupine Cr, CTNF	Research	On site	IDFG
681	Male	Adult	07/26/11	Buck Cr, GNF	Research	On site	IGBST
			08/09/11	Buck Cr, GNF	Research	On site	IGBST
			08/18/11	Buck Cr, GNF	Research	On site	IGBST
623	Male	Adult	07/26/11	Owl Cr, Pr-WY	Management	Reef Cr, SNF	WYGF
G152	Female	Adult	07/27/11	Wagon Cr, BTNF	Management	Removed	WYGF
682	Male	Adult	07/29/11	Dutch Joe Cr, BTNF	Management	Mormon Cr, SNF	WYGF
Unm	Male	Subadult	08/01/11	Bridge Cr, YNP	Management	Removed	YNP
683	Male	Subadult	08/04/11	Eldridge Cr, GNF	Research	On site	IGBST
			08/08/11	Eldridge Cr, GNF	Research	On site	IGBST
			08/10/11	Eldridge Cr, GNF	Research	On site	IGBST
593	Male	Adult	08/06/11	Wyoming Cr, CTNF	Research	On site	IDFG
416	Female	Adult	08/07/11	Deadhorse Cr, GNF	Research	On site	IGBST
G111	Female	Adult	08/07/11	South Fork Shoshone, Pr-WY	Management	Removed	WYGF
Unm	Male	Subadult	08/08/11	South Fork Shoshone, Pr-WY	Management	Removed	WYGF
Unm	Female	Subadult	08/08/11	South Fork Shoshone, Pr-WY	Management	Removed	WYGF
684	Male	Adult	8/11/11	Wyoming Cr, CTNF	Research	On site	IDFG
			8/18/11	Wyoming Cr, CTNF	Research	On site	IDFG
685	Male	Adult	08/15/11	Crow Cr, WRR	Research	On site	WYGF/WRR
586	Male	Adult	08/15/11	Crow Cr, WRR	Research	On site	WYGF/WRR
686	Female	Adult	08/18/11	Eldridge Cr, GNF	Research	On site	IGBST
687	Male	Adult	08/18/11	Hominy Cr, CTNF	Research	On site	IGBST
G172	Male	Adult	08/18/11	Crow Cr, WRR	Research	On site	WYGF
611	Male	Adult	08/20/11	Hominy Cr, CTNF	Research	On site	IGBST
377	Male	Adult	08/24/11	Strawberry Cr, BTNF	Management	Removed	WYGF
636	Male	Adult	08/28/11	Green River, BTNF	Management	Removed	WYGF
G173	Male	Adult	08/26/11	Middle Crow Cr, WRR	Research	On site	WYGF
524	Male	Adult	08/29/11	Wiggins Fork, SNF	Management	Mormon Cr, SNF	WYGF
G174	Male	Subadult	09/01/11	Warm Springs Cr, Pr-WY	Management	Clarks Fork River, SNF	WYGF
423	Female	Adult	09/01/11	Sunlight Cr, Pr-WY	Management	Calf Cr, CTNF	WYGF
155	Male	Adult	09/02/11	Otter Cr, YNP	Research	On site	IGBST
281	Male	Adult	09/04/11	Cascade Cr, YNP	Research	On site	IGBST
			09/06/11	Cascade Cr, YNP	Research	On site	IGBST
			09/07/11	Cascade Cr, YNP	Research	On site	IGBST
			09/08/11	Cascade Cr, YNP	Research	On site	IGBST
			09/14/11	Alum Cr, YNP	Research	On site	IGBST
			09/17/11	Sour Cr, YNP	Research	On site	IGBST

Table 1. Continued.

Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
394	Male	Adult	09/04/11	Cascade Cr, YNP	Research	On site	IGBST
			09/06/11	Cascade Cr, YNP	Research	On site	IGBST
			09/15/11	Cascade Cr, YNP	Research	On site	IGBST
			09/16/11	Otter Cr, YNP	Research	On site	IGBST
546	Male	Adult	09/09/11	Bear Cr, Pr-MT	Management	Removed	WS/MTFWP
550	Male	Adult	09/11/11	Sunlight Cr, Pr-WY	Management	Removed	WYGF
211	Male	Adult	09/15/11	Cascade Cr, YNP	Research	On site	IGBST
			09/16/11	Otter Cr, YNP	Research	On site	IGBST
			09/19/11	Alum Cr, YNP	Research	On site	IGBST
G120	Male	Adult	09/20/11	Wind River, SNF	Management	Removed	WYGF
448	Female	Adult	09/21/11	Arnica Cr, YNP	Research	On site	IGBST
			10/02/11	Arnica Cr, YNP	Research	On site	IGBST
			10/04/11	Arnica Cr, YNP	Research	On site	IGBST
688	Male	Subadult	09/21/11	Arnica Cr, YNP	Research	On site	IGBST
321	Female	Adult	09/22/11	Sour Cr, YNP	Research	On site	IGBST
			09/29/11	Sour Cr, YNP	Research	On site	IGBST
689	Male	Subadult	09/22/11	Sour Cr, YNP	Research	On site	IGBST
690	Female	Subadult	09/23/11	North Fork Shoshone, Pr-WY	Management	Squirrel Cr, CTNF	WYGF
Unm	Female	Adult	09/28/11	Sour Cr, YNP	Management	Removed	YNP/IGBST
Unm	Male	Subadult	09/29/11	Sour Cr, YNP	Management	Removed	YNP/IGBST
Unm	Male	Subadult	09/29/11	Sour Cr, YNP	Management	Removed	YNP/IGBST
691	Male	Subadult	09/30/11	Wolf Cr, Pr-MT	Management	Bear Cr, GNF	WS/MTFWP
692	Female	Subadult	10/04/11	South Fork Shoshone, Pr-WY	Management	Blackrock Cr, BTNF	WYGF
693	Female	Adult	10/04/11	Alum Cr, YNP	Research	On site	IGBST
589	Male	Adult	10/04/11	Bridge Cr, YNP	Research	On site	IGBST
694	Female	Adult	10/07/11	Clarks Fork Yellowstone, Pr-WY	Management	Boone Cr, CTNF	WYGF
337	Female	Adult	10/09/11	Clarks Fork Yellowstone, Pr-WY	Management	Squirrel Cr, CTNF	WYGF
G175	Female	Subadult	10/09/11	Clarks Fork Yellowstone, Pr-WY	Management	Squirrel Cr, CTNF	WYGF
G176	Female	Subadult	10/09/11	Clarks Fork Yellowstone, Pr-WY	Management	Squirrel Cr, CTNF	WYGF
G177	Female	Subadult	10/09/11	Clarks Fork Yellowstone, Pr-WY	Management	Squirrel Cr, CTNF	WYGF
517	Female	Adult	10/14/11	South Fork Shoshone, Pr-WY	Management	Bailey Cr, BTNF	WYGF
G178	Male	Subadult	10/13/11	South Fork Shoshone, Pr-WY	Management	Bailey Cr, BTNF	WYGF
G179	Male	Subadult	10/13/11	South Fork Shoshone, Pr-WY	Management	Bailey Cr, BTNF	WYGF
204	Male	Adult	10/15/11	Flat Mountain Cr, YNP	Research	On site	IGBST
G141	Male	Adult	10/17/11	Pine Cr, Pr-MT	Management	Removed	WS/MTFWP
541	Female	Adult	10/17/11	Flat Mountain Cr, YNP	Research	On site	IGBST
465	Male	Adult	10/19/11	South Fork Shoshone, Pr-WY	Management	Reef Cr, SNF	WYGF
Unm	Male	Adult	10/21/11	Box Cr, BTNF	Management	Removed	WYGF
695	Male	Subadult	10/28/11	Gibbon River, YNP	Research	On site	IGBST
628	Female	Adult	10/30/11	South Fork Shoshone, Pr-WY	Management	Removed	WYGF
566	Male	Adult	10/30/11	Gibbon River, YNP	Research	On site	IGBST
515	Male	Adult	10/30/11	Gibbon River, YNP	Research	On site	IGBST

Table 1. Continued.

Bear[a]	Sex	Age	Date	General location[b]	Capture type	Release site[b]	Agency[c]
696	Male	Adult	11/04/11	Pat O'Hara Cr, Pr-WY	Management	Gulf Cr, CTNF	WYGF
666	Female	Adult	11/06/11	Wind River, Pr-WY	Management	Removed	WYGF
552	Male	Adult	11/11/11	Pat O'Hara Cr, Pr-WY	Management	Sheffield Cr, BTNF	WYGF
Unm	Male	Adult	11/11/11	South Fork Shoshone, State-WY	Management	Removed	WYGF

[a] Unm = unmarked.
[b] 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, Pr = private.
[c] IDFG = Idaho Fish and Game; IGBST = Interagency Grizzly Bear Study Team, USGS; MTFWP = Montana Fish, Wildlife and Parks; WRR = Wind River Reservation; WS = Wildlife Services; WYGF = Wyoming Game and Fish; YNP = Yellowstone National Park.

Bear 673 at capture site, 2011. IGBST photo.

Table 2. Annual record of grizzly bears monitored, captured, and transported in the Greater Yellowstone Ecosystem since 1980.

Year	Number monitored	Individuals trapped	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

Table 3. Grizzly bears radio monitored in the Greater Yellowstone Ecosystem during 2011.

Bear	Sex	Age	Offspring[a]	Monitored		Current Status
				Out of den	Into den	
155	M	Adult		No	Yes	Active
204	M	Adult		No	Yes	Active
211	M	Adult		No	Yes	Active
227	M	Adult		Yes	No	Cast
281	M	Adult		No	Yes	Active
315	F	Adult	Not seen	Yes	No	Cast
321	F	Adult	1 yearling	No	Yes	Active
323	M	Adult		Yes	No	Cast
332	F	Adult	None	Yes	Yes	Active
337	F	Adult	3 COY	Yes	Yes	Active
360	F	Adult	None	No	No	Cast
394	M	Adult		No	Yes	Active
400	M	Adult		Yes	Yes	Active
416	F	Adult	None	No	Yes	Active
423	F	Adult	None	No	Yes	Active
448	F	Adult	None	Yes	Yes	Active
465	M	Adult		No	Yes	Active
481	F	Adult	None	Yes	Yes	Active
493	M	Adult		No	No	Cast
515	M	Adult		No	Yes	Active
517	F	Adult	None	Yes	Yes	Active
524	M	Adult		No	Yes	Active
526	M	Adult		Yes	No	Cast
533	F	Adult	Not seen	Yes	No	Cast
541	F	Adult	None	No	Yes	Active
552	M	Adult		No	Yes	Active
556	M	Adult		Yes	No	Cast
566	M	Adult		Yes	Yes	Active
586	M	Adult		No	No	Cast
587	M	Adult		Yes	No	Cast
589	M	Adult		Yes	No	Cast
593	M	Adult		No	Yes	Active
594	M	Adult		Yes	No	Cast
611	M	Adult		No	Yes	Active
613	F	Adult	Not seen	No	No	Cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
618	M	Adult		Yes	No	Cast
620	F	Adult	2 yearlings	Yes	No	Cast
622	M	Adult		Yes	No	Cast
623	M	Adult		No	Yes	Active
627	F	Adult	2 2-year-olds	Yes	Yes	Active
628	F	Adult	None	Yes	No	Removed
630	M	Adult		Yes	No	Cast
631	F	Adult	Not seen	Yes	No	Missing
636	M	Adult		Yes	No	Cast
643	M	Adult		Yes	No	Cast
644	M	Adult		Yes	No	Cast
645	F	Adult	None	Yes	Yes	Active
647	M	Subadult		Yes	No	Cast
648	M	Adult		Yes	No	Cast
650	F	Adult	Not seen	Yes	No	Cast
653	M	Subadult		Yes	No	Cast
655	M	Subadult		Yes	No	Cast
656	M	Subadult		Yes	No	Cast
657	M	Subadult		Yes	No	Cast
658	F	Adult	2 COY	Yes	Yes	Active
659	M	Adult		Yes	Yes	Active
661	F	Adult	1 COY	Yes	Yes	Active
662	F	Adult	None	Yes	Yes	Active
663	F	Adult	None	Yes	Yes	Active
664	M	Adult		Yes	No	Cast
665	F	Adult	None	Yes	No	Cast
666	F	Adult	None	Yes	No	Removed
667	F	Adult	Not seen	Yes	No	Cast
668	M	Adult		No	No	Cast
669	M	Subadult		No	No	Cast
670	M	Adult		No	No	Cast
671	M	Adult		No	No	Missing
672	F	Subadult		No	Yes	Active
673	M	Adult		No	Yes	Active
674	M	Adult		No	No	Cast
675	M	Adult		No	No	Cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
676	F	Subadult		No	Yes	Active
677	M	Adult		No	Yes	Active
678	F	Adult	None	No	Yes	Active
679	M	Adult		No	No	Missing
680	F	Subadult		No	Yes	Active
681	M	Adult		No	Yes	Active
682	M	Subadult		No	Yes	Active
683	M	Adult		No	Yes	Active
684	M	Adult		No	Yes	Active
685	M	Adult		No	Yes	Active
686	F	Adult	None	No	Yes	Active
687	M	Adult		No	Yes	Active
688	M	Subadult		No	Yes	Active
689	M	Subadult		No	Yes	Active
690	F	Subadult		No	Yes	Active
691	M	Subadult		No	No	Missing
692	F	Subadult		No	Yes	Active
693	F	Adult		No	Yes	Active
694	F	Subadult		No	Yes	Active
695	M	Subadult		No	Yes	Active
696	M	Adult		No	No	Missing

Assessing Trend and Estimating Population Size from Counts of Unduplicated Females *(Mark A. Haroldson, Interagency Grizzly Bear Study Team)*

Methods

Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) of the Grizzly Bear Recovery Plan (USFWS 1993), IGBST is tasked with estimating the number of females with COY, determining trend in this segment of the population, and estimating size of specific population segments to assess sustainability of annual mortalities. The area within which the revised criteria apply for counting females with COY and mortalities is referenced in Figure 1 of the Revised Demographic Criteria (USFWS 2007*b*). However, the area referenced in this figure is incorrect on its western and northern boundaries in Montana and will be corrected with an erratum (C. Servheen, U.S. Fish and Wildlife Service, personal communication). Specific procedures used to accomplish the above mentioned tasks are presented in IGBST (2005, 2006) and Harris et al. (2007). Briefly, the Knight et al. (1995) rule set is used to differentiate an estimate for the number of unique females with COY ($\hat{N}_{Obs}$) 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)

$$\hat{N}_{Chao2} = m + \frac{f_1^2 - f_1}{2(f_2 + 1)},$$

where *m* is the number of unique females sighted randomly (i.e., without the aid of telemetry), f_1 is the number of families sighted once, and f_2 is the number families sighted twice. This estimator accounts for individual sighting heterogeneity and produces an estimate for the total number of females with COY present in the population annually.

Next, we estimate trend and rate of change (λ) for the number of unique females with COY 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 linear model for $Ln(\hat{N}_{Chao2})$ with year (y_i) is:

$$Ln(\hat{N}_{Chao2}) = \beta_0 + \beta_1 y_i + \varepsilon_i .$$

Thus the population size at time zero is estimated as $\hat{N}_0 = \exp(\hat{\beta}_0)$ and the rate of population change is estimated as $\hat{\lambda} = \exp(\hat{\beta}\ )$, giving $\hat{N}_i = \hat{N}_0 \hat{\lambda}^{y_i}$. The quadratic model:

$$Ln(\hat{N}_{Chao2}) = \beta_0 + \beta_1 y_i + \beta_2 y_i^2 + \varepsilon_i ,$$

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 unduplicated females with COY ($\hat{N}_{MAFC}$) 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., AICc weight > 0.50, USFWS 2007*a*).

Given the assumption of a reasonably stable sex and age structure, trend for the females with COY 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 the $\hat{N}_{MAFC}$ and the estimated stable age structure for the population. Estimates for specific population segments and associated confidence intervals follow IGBST (2005, 2006). Thus, the total number of females ≥2 years old in the population is estimated by

$$\hat{N}_{females\ 2+} = \frac{\hat{N}_{MAFC}}{(0.289 * 0.77699)},$$

where 0.289 is the proportion of females ≥4 years old accompanied by COY from transition probabilities (IGBST 2005), and 0.77699 is the ratio of 4+ female to 2+ females in the population (IGBST 2006). Using the model averaged results in these calculations has the effect of putting the numerator ($\hat{N}_{MAFC}$) on the same temporal scale as the denominator (i.e., mean transition probability and ratio) which smoothes estimates and alleviates extreme variation which are likely uncharacteristic of the true population (IGBST 2006, Harris et al. 2007). The number of independent aged males is given by

$$\hat{N}_{males\ 2+} = \hat{N}_{females\ 2+} * 0.63513,$$

where 0.63513 is the ratio of independent males:independent females (IGBST 2006). The number of dependent young is estimated by

$$\hat{N}_{dependent\ \ young} = \{\hat{N}_{MAFC,t} + [(\hat{N}_{MAFC,t-1})(0.638)]\}2.04$$

where 2.04 is the mean number of COY/litter (Schwartz et al. 2006*a*) and 0.638 is the mean survival rate for COY (Schwartz et al. 2006*b*). Estimates of uncertainty associated with parameters of interest were derived from the delta method (Seber 1982:7) as described in IGBST (2006).

2011 Results

We documented 134 verified sightings of females with COY during 2011 within the area where the revised demographic criteria apply (Fig. 1). Most observations were obtained opportunistically via ground observers (62.7%), with aerial observation providing 36.5% of sightings (Table 4). Only 37% of

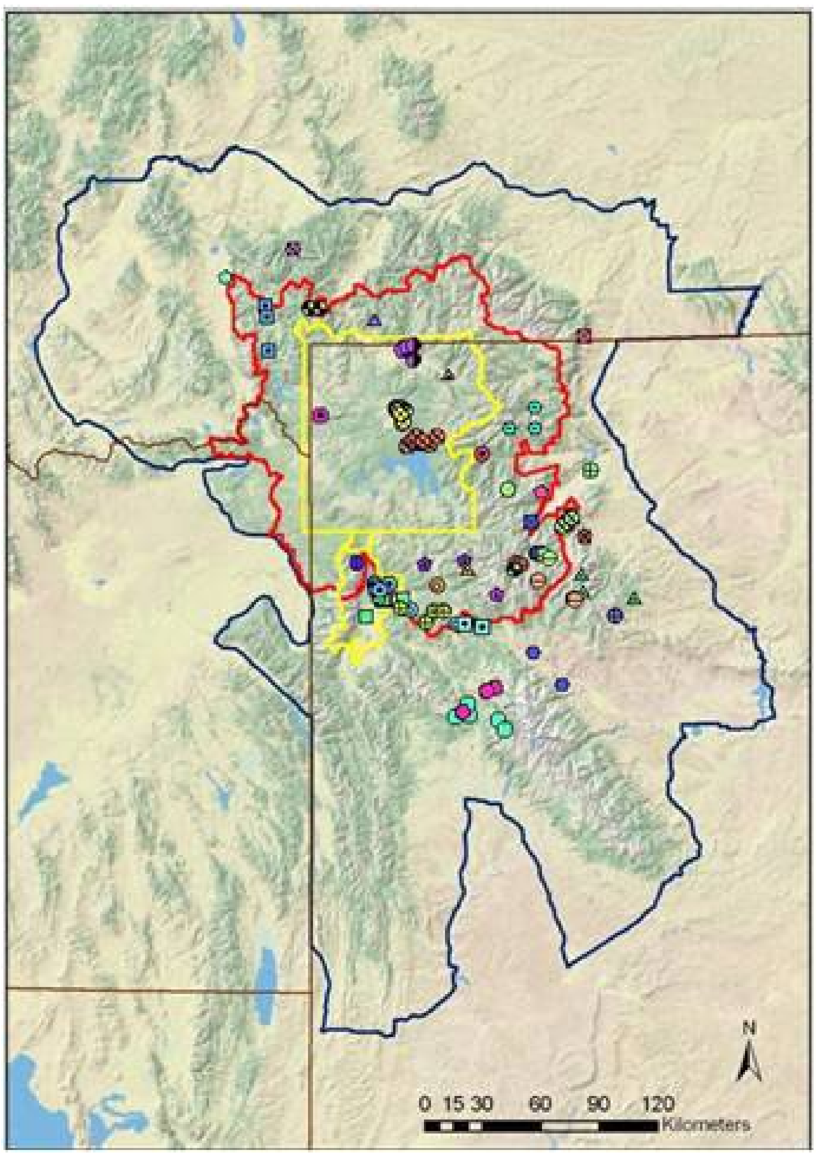

Fig. 1. Distribution of 134 observations of 39 (indicated by unique symbols) unduplicated female grizzly bears with cubs-of-the-year (COY) in the Greater Yellowstone Ecosystem during 2011. The outer dark blue line represents the boundary for conservation management within which females with COY are counted for estimation of trend and population size. Known and probable mortalities are also counted within this line for evaluation of sustainable mortality. The inner red and yellow boundaries indicate the Yellowstone grizzly bear Recovery Zone and National Park Services lands, respectively.

Table 4. Method of observation for female grizzly bears with cubs-of-the-year sighted in the Greater Yellowstone Ecosystem during 2011.

Method of observation	Frequency	Percent	Cumulative percent
Fixed wing – other researcher	7	5.2	5.2
Fixed wing – observation	31	23.1	28.4
Fixed wing - telemetry	11	8.2	36.6
Ground sighting	84	62.7	99.3
Trap	1	0.7	100.0
Total	134	100.0	

the observations of 5 unique females occurred within the boundaries of Yellowstone National Park. This result is much lower than the 74% of the observations and 20 unique females that were sighted in the Park during 2010. We were able to differentiate 39 unduplicated females from the 134 sightings using the rule set described by Knight et al. (1995). Total number of COY observed during initial sightings was 74 and mean litter size was 1.90 (Table 5). There were 13 single cub litters, 17 litters of twins, and 9 litters of triplets seen during initial observations (Table 5).

One-hundred twenty-three observations of 39 families were obtained without telemetry (Table 6). Using the sighting frequencies associated with these families our 2011 $\hat{N}_{Chao2}$ = 47 (Table 6). The model-averaged point estimate ($\hat{N}_{MAFC}$) was 56 (95% CI 45–68) and exceeded the demographic objective of 48 specified in the demographic criteria for the GYE (USFWS 2007*a*). Our 2011 estimated population size derived from $\hat{N}_{MAFC}$ was 593 (Table 7).

We use the annual $\hat{N}_{Chao2}$ for the period 1983–2011 (Table 6) to estimate the rate of population change (Fig. 2) for female with COY segment of the population. For the first time since we began using an information-theoretical approach and competing linear and quadratic models, AICc weights (Table 8) exhibited more support for the quadratic (51%) than the linear (49%) model. However, the estimated quadratic effect (-0.00110, SE = 0.00067) was not significant (*P* = 0. 11554). As required in the Revised Demographic Criteria (USFWS 2007*b*), this result triggered a demographic review. This review took place in February 2012 and results will be reported in an IGBST Workshop Summary that we expect will be available during Summer 2012. However, stated briefly, we use vital rates derived from grizzly bears radio monitored during the period 2002–2011 and repeated analyses used previously (Schwartz et al. 2006*c*) to estimate the population trajectory (λ). Results indicate that trajectory has changed and the population growth rate for the recent period is now stable to slightly increasing. This corroborates the results indicated by our $\hat{N}_{Chao2}$ regression analysis, and is in contrast to estimated growth rates of 4–7% per years during the decades of the 1980s and 1990s (Schwartz et al. 2006*c*). We hypothesized these changes in population growth may be attributed to 1) density-dependent effects, 2) declines in key food resource such as whitebark pine seeds, or 3) a combination of density-dependent effects and resource decline.

Female grizzly with 2 COY on buried bison carcass in Cottongrass Creek, YNP, 30 Aug 2011. Photo courtesy of Steve Ard.

Table 5. Number of unduplicated females with cubs-of-the-year ($\hat{N}_{Obs}$), litter frequencies, total number of cubs, and average litter size at initial observation for the years 1983–2011 in the Greater Yellowstone Ecosystem.

Year	$\hat{N}_{Obs}$	Total sightings	Litter sizes: 1 cub	2 cubs	3 cubs	4 cubs	Total # cubs	Mean litter size
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

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

Table 6. Annual estimates for the numbers of females with cubs-of-the-year in the Greater Yellowstone Ecosystem grizzly bear population, 1983–2011. The number of unique females observed ($\hat{N}_{Obs}$) includes those located using radio-telemetry; *m* gives 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 f_1, the number of families sighted once, f_2, the number of families sighted twice, and an 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

Table 7. Estimates and 95% confidence intervals (CI) for population segments and total grizzly bear population size for 2011 in the Greater Yellowstone Ecosystem.

	Estimate	Variance	95% CI	
			Lower	Upper
Independent females	248	472.1	205	290
Independent males	157	340.9	121	194
Dependent young	188	117.3	166	209
Total	593	930.3	533	652

Table 8. Parameter estimates and model selection results from fitting the linear and quadratic models for $Ln(\hat{N}_{Chao2})$ with years for the period 1983–2011.

Model	Parameter	Estimate	Standard Error	*t* value	Pr(>*t*)
Linear					
	β_0	2.94920	0.08889	33.17797	<0.0001
	β_1	0.03932	0.00517	7.59828	<0.0001
	SSE	1.46807			
	AICc	-79.55705			
	AICc weight	0.48637			
Quadratic					
	β_0	2.77946	0.13533	19.91916	<0.0001
	β_1	0.07218	0.02079	3.47116	0.00183
	β_2	-0.00110	0.00067	-1.6282	0.11554
	SSE	1.33223			
	AICc	-79.66609			
	AICc weight	0.51363			

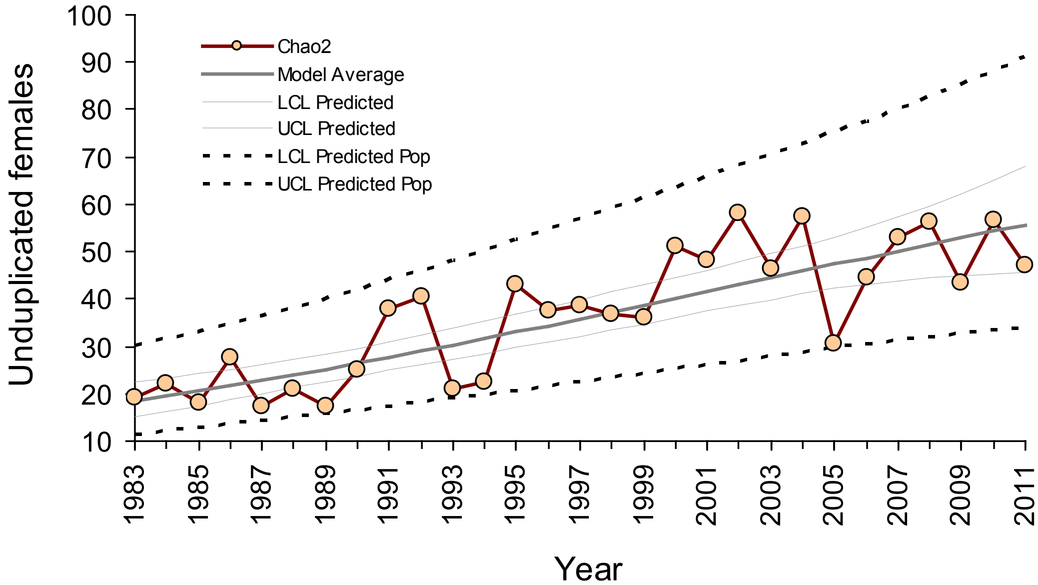

Fig. 2. Model-averaged estimates for the number of unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem for the period 1983–2011, where the linear and quadratic models of $Ln(\hat{N}_{Chao2})$ were fitted. The inner set of light solid lines represents a 95% confidence interval on the predicted population size for unduplicated females, whereas the outer set of dashed lines represents a 95% confidence interval for the individual population estimates for unduplicated females.

Cub Adoption Documented in Grand Teton National Park *(Steve Cain and Kate Wilmot, Grand Teton National Park; and Mark A. Haroldson, Interagency Grizzly Bear Study Team)*

During summer 2011, grizzly bear #610 adopted one of her mother's COY in Grand Teton National Park (GTNP). Grizzly #610's mother is bear #399, well known because she often forages and rests within 100 m of park roads in full view of park visitors. Grizzly #610 is from #399's 2006 litter and is also a well known habituated bear. As an adult she established a home range largely overlapping her mother's (Fig. 3). In spring of 2011, both bears emerged with COY, #399 with 3 and #610 with 2. The adult females were identifiable by ear tags (399 = red, 610 = yellow), their home ranges, habituated behavior, and individual markings (399 has an identifying scar on her nose). In late July #610 was observed with 3 COY and a few days later #399 with only 2. The extra cub stayed with #610 all summer, and DNA analyses later confirmed that one of #610's 3 cubs was #399's by birth.

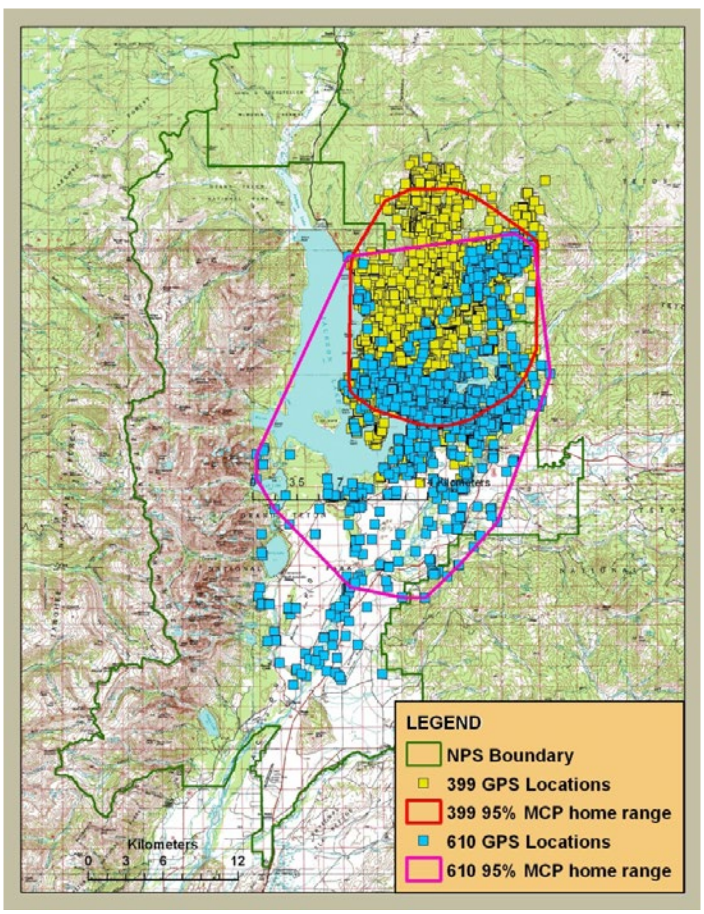

Fig. 3. Grizzly bear s #399 and #610 GPS locations and home ranges in Grand Teton National Park, Wyoming.

Grizzly #399 was first encountered during a 2001 research capture as a 5-year-old. She was captured 7 more times through 2005 and wore radio collars for a total of 55 months (VHF 13 mos, GPS 42 mos) during that time. Her home range, estimated using a 95% minimum convex polygon (MCP) and GPS locations (n = 7,690) collected from 5 May 2003 to 25 August 2006, was centered approximately on Pilgrim Mountain, about 8 km north of Jackson Lake Lodge (Fig. 3). Since 2008, direct observations indicate her range has expanded to include southern reaches of the park to the Gros Ventre River. She was observed with 1 COY in May 2004 that apparently did not survive the summer and 3 COY in 2006 which all survived to weaning in 2008. She was not observed with cubs again until 2011.

Grizzly #610 was first captured as a 3-year-old during 2009 black bear research trapping in the southern end of GTNP. At that time she was presumed and later confirmed through genetic analyses to be #399's daughter. She was recaptured but not handled later that year and cast her first and only radio collar to date in August 2010. Her 95% MCP home range estimated using GPS locations collected from 27 June 2009 to 2 August 2010 (n = 2,192) overlapped 399's home range and was centered on the Willow Flats area, immediately west of Jackson Lake Lodge (Fig. 3). During fall 2011 she expanded this area by making additional movements to the south including the Moose-Wilson road corridor, Blacktail Butte, and Antelope Flats areas, all within GTNP.

In an attempt to obtain DNA samples and confirm origin of the suspected adopted COY, we set up hair snares in 2 areas frequented by #610, one with a wire at cub height (~25 cm) and a second wire at adult height (~60 cm), another with just 1 wire at cub height. We baited the sites with small amounts of pronghorn (*Antilopcapra americana*) or elk blood, rumen contents, organs, or skeletal muscle rubbed on trees and downed logs within each hair corral and deployed remote cameras focused on these areas. Photographs of an adult grizzly bear with yellow ear tags accompanied by 3 COY verified that on 20 October 2011 grizzly #610 and 3 cubs visited our 1-wire site (Fig. 4). Subsequent DNA analyses of hair samples we collected from this time period to 20 microsatellite sites was conducted by Wildlife Genetics International (WGI, Nelson, British Columbia, Canada). Including previous DNA results from bears #399 and #610 among these samples and using simple Mendelian inheritance (i.e., shared alleles at every marker between parent and offspring) the relationship among the 3 COY was perfectly resolved and confirmed the identity of all 4 bears, including one of bear #399's cubs travelling with bear #610.

In bears, adoption is generally believed to result from traumatic events that separate family groups. Researchers John and Frank Craighead observed cub adoption during the 1960s in Yellowstone National Park (YNP), where threatening encounters with other bears at garbage dumps were common (Craighead et al. 1995). In the YNP 2007 cub adoption reported by Haroldson et al. (2008), the adoption of 2 cubs was reported to have possibly been preceded by an antagonistic encounter with wolves. In the present case, though simply anecdotal, just prior to the cub switch, park residents reported the sounds of "bears intensely fighting" in an area frequented by both bear families.

Various forms of altruistic parenting (behavior that benefits the recipient at the expense of the benefactor) occur in at least 120 mammal and 150 bird species (Riedman 1982). One adoption hypothesis suggests an individual's behavior toward relatives influences its overall genetic fitness (Riedman 1982). This line of reasoning would predict that bears would be more likely to adopt related young. But while documenting adoptions is difficult enough, discerning relationships among the players in the wild is usually not possible. In both this case and the YNP 2007 event, the adopting parent was the daughter of the adopted cub's mother, and thus also the adopted cub's sister, which is consistent with this "inclusive fitness" (Hamilton 1964) hypothesis.

Fig. 4. Remote camera photo of grizzly bear #610 (ear tag visible) and 3 COY at a hair snare (horizontal wire visible in upper middle of frame) site taken on 20 Oct 2011 in Grand Teton National Park, WY. GTNP photo.

Occupancy of Bear Management Units (BMU) by Females with Young *(Shannon Podruzny, Interagency Grizzly Bear Study Team)*

Dispersion of reproductive females throughout the ecosystem is assessed by verified observations of female grizzly bears with young (COY, yearlings, 2-year-olds, and/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 young on a running 6-year sum with no 2 adjacent BMUs unoccupied. Sixteen of 18 BMUs had verified observations of female grizzly bears with young during 2011 (Table 9). Eighteen of 18 BMUs contained verified observations of females with young in at least 4 years of the last 6-year (2006–2011) period.

Table 9. 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, 2006–2011.

Bear Management Unit	2006	2007	2008	2009	2010	2011	Number of years occupied 2006–2011
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	5
4) Boulder/Slough		X	X	X	X	X	5
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	X	6
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	X	6
Annual count of occupied BMUs	16	17	18	18	18	16	

Observation Flights *(Karrie West, Interagency Grizzly Bear Study Team)*

Two rounds of observation flights were conducted during 2011. Forty-seven Bear Observation Areas (BOAs; Fig. 5) were surveyed during Round 1 (15 Jun–17 Aug) and 35 BOAs during Round 2 (21 Jul–29 Aug). Observation time was 89 hours for Round 1 and 71 hours for Round 2; average duration of flights for both rounds combined was 1.95 hours (Table 10). Three hundred twenty-three bear sightings, excluding dependent young, were recorded during observation flights. This included 7 radio-marked bears, 262 solitary unmarked bears, and 54 unmarked females with young (Table 10). Observation rate was 2.02 bears/hour for all bears. One hundred eight young (59 COY, 27 yearlings, and 22 2- or 3-year-olds) were observed (Table 11). Observation rates were 0.34 females with young/hour and 0.18 females with COY/hour (Table 10).

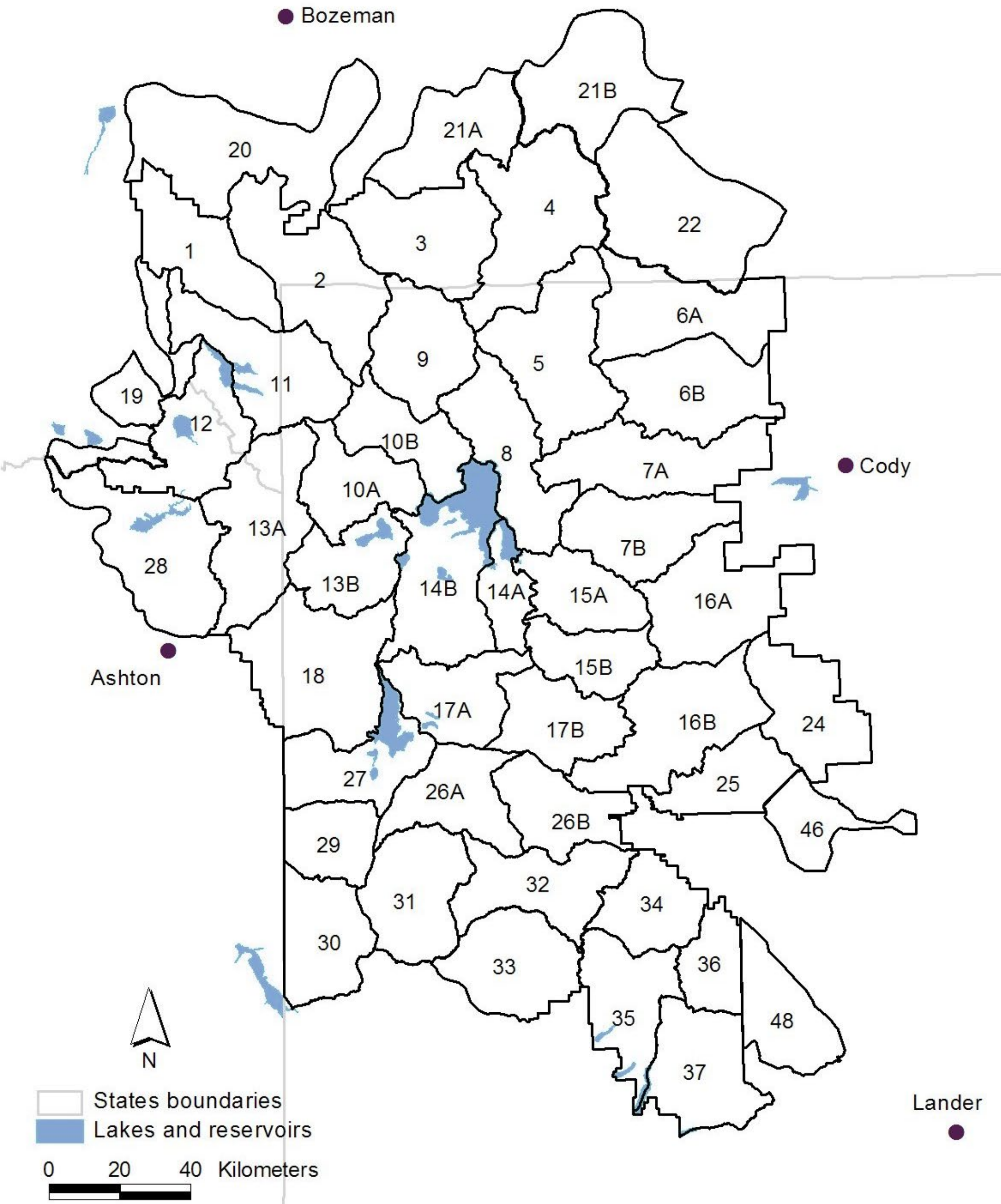

Fig. 5. Observation flight areas within the Greater Yellowstone Ecosystem, 2011. The numbers represent the 38 Bear Observation Areas. Those units too large to search during a single flight were further subdivided into 2 units. Consequently, there were 48 search areas.

Table 10. Annual summary statistics for observation flights conducted in the Greater Yellowstone Ecosystem, 1998–2011.

Date	Observation period	Total hours	Number of flights	Average hours/ flight	Bears seen: Marked: Lone	Bears seen: Marked: With young	Bears seen: Unmarked: Lone	Bears seen: Unmarked: With young	Total number of groups	Observation rate (bears/hour): All groups	Observation rate (bears/hour): With young	Observation rate (bears/hour): With COY[a]
1998[b]	Round 1	73.6	37	2.0	1	2	54	26	83	1.13		
	Round 2	75.4	37	2.0	2	0	68	18	88	1.17		
	Total	149.0	74	2.0	3	2	122	44	171	1.15	0.31	0.19
1999[b]	Round 1	79.7	37	2.2	0	0	13	8	21	0.26		
	Round 2	74.1	37	2.0	0	1	21	8	30	0.39		
	Total	153.8	74	2.1	0	1	34	16	51	0.33	0.11	0.05
2000[b]	Round 1	48.7	23	2.1	0	0	8	2	10	0.21		
	Round 2	83.6	36	2.3	3	0	51	20	74	0.89		
	Total	132.3	59	2.2	3	0	59	22	84	0.63	0.17	0.12
2001[b]	Round 1	72.3	32	2.3	0	0	37	12	49	0.68		
	Round 2	72.4	32	2.3	2	4	85	29	120	1.66		
	Total	144.7	64	2.3	2	4	122	41	169	1.17	0.31	0.25
2002[b]	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[b]	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[b]	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[b]	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[b]	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[b]	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[b]	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[b]	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[b]	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[b]	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

[a] COY = cub-of-the-year.

[b] Dates of flights (Round 1, Round 2): 1998 (15 Jul–6 Aug, 3–27 Aug); 1999 (7–28 Jun, 8 Jul–4 Aug); 2000 (5–26 Jun, 17 Jul–4 Aug); 2001 (19 Jun–11 Jul, 16 Jul–5 Aug); 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).

Table 11. Size and age composition of family groups seen during observation flights in the Greater Yellowstone Ecosystem, 1998–2011.

Year	Round	Females with cubs-of-the-year (number of cubs)			Females with yearlings (number of yearlings)			Females with 2-year-olds or young of unknown age (number of young)		
		1	2	3	1	2	3	1	2	3
1998[a]	Round 1	4	10	4	0	4	2	1	2	1
	Round 2	0	7	3	2	4	1	0	1	0
	Total	4	17	7	2	8	3	1	3	1
1999[a]	Round 1	2	1	1	0	1	2	1	0	0
	Round 2	2	2	0	0	3	1	0	1	0
	Total	4	3	1	0	4	3	1	1	0
2000[a]	Round 1	1	0	0	0	0	0	0	1	0
	Round 2	3	11	1	1	2	0	0	2	0
	Total	4	11	1	1	2	0	0	3	0
2001[a]	Round 1	1	8	1	1	0	0	0	0	1
	Round 2	14	10	2	4	2	1	0	0	0
	Total	15	18	3	5	2	1	0	0	1
2002[a]	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[a]	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[a]	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[a]	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[a]	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[a]	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[a]	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[a]	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[a]	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[a]	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

[a] Dates of flights (Round 1, Round 2): 1998 (15 Jul–6 Aug, 3–27 Aug); 1999 (7–28 Jun, 8 Jul–4 Aug); 2000 (5–26 Jun, 17 Jul–4 Aug); 2001 (19 Jun–11 Jul, 16 Jul–5 Aug); 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).

[b] Includes 1 female with 4 yearlings.

Telemetry Relocation Flights *(Karrie West, Interagency Grizzly Bear Study Team)*

One hundred nine telemetry relocation flights were conducted during 2011, resulting in 381.5 hours of search time (ferry time to and from airports excluded) (Table 12). Flights were conducted at least once during all months except February, with 81% occurring May-November. During telemetry flights, 858 locations of bears equipped with radio transmitters were collected, 114 (13%) of which included a visual sighting. Forty-five sightings of unmarked bears were also obtained during telemetry flights, including 39 solitary bears, 3 females with COY, and 3 females with yearlings. Rate of observation for all unmarked bears during telemetry flights was 0.13 bears/hour. Rate of observing females with COY was 0.016/hour, which was conisderably less than during observation flights (0.18/hour) in 2011.

In addition to the regular telemetry relocation flights, IGBST conducted bimonthly flights from 12 September through 9 November 2011 to locate grizzly bears fitted with GPS collars equipped with spread-spectrum technology (SST) (see "Use of Diminished Whitebark Pine Resources by Adult Female Grizzly Bears in the Taylor Fork Area of the Gallatin National Forest, Montana, 2011"). These flights are not included as routine telemetry because of the additional time required to interrogate collars and download data. From these 5 flights, we collected 4 locations (no visuals) from 4 grizzly bears that were part of our regular monitoring sample and 11 locations (no visuals) from 2 grizzly bears that were part of the SST project.

Table 12. Summary statistics for radio-telemetry relocation flights in the Greater Yellowstone Ecosystem, 2011.

				Radioed bears			Unmarked bears observed					
								Females			Observation rate (groups/hour)	
Month	Hours	Number of flights	Mean hours per flight	Number of locations	Number seen	Observation rate (groups/hr)	Lone bears	With COY[a]	With yearlings	With young	All groups	Females with COY
January	15.42	4	3.86	36	0	0.00	0	0	0	0	---	---
February	---	---	---	---	---	---	---	---	---	---	---	---
March	12.42	3	4.14	43	1	0.08	2	0	0	0	0.16	0.000
April	14.09	5	2.82	52	6	0.43	3	0	0	0	0.21	0.000
May	40.94	11	3.72	91	21	0.51	12	0	0	0	0.29	0.000
June	31.56	10	3.16	64	26	0.82	3	1	0	1	0.16	0.037
July	38.03	14	2.72	70	9	0.24	13	4	0	0	0.45	0.105
August	49.08	14	3.51	96	19	0.39	2	0	1	0	0.06	0.000
September	52.64	14	3.76	103	8	0.15	1	1	0	0	0.04	0.019
October	46.73	13	3.59	117	22	0.47	3	0	0	0	0.06	0.000
November	43.83	12	3.65	93	3	0.07	0	0	0	0	---	---
December	36.78	9	4.09	93	0	0.00	1	0	0	0	0.03	0.000
Total	381.52	109	3.50	858	114	0.30	40	6	1	1	0.13	0.016

[a] COY = cub-of-the-year.

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), IGBST is tasked with evaluating the sustainability of annual grizzly bear mortalities that occur within the boundary shown in Fig. 1. Specific procedures used to accomplish these tasked are presented in IGBST (2005, 2006). Briefly, estimates for specific population segments are derived from the modeled-averaged annual Chao2 estimate for females with COY (see section "Assessing Trend and Estimating Population Size from Counts of Unduplicated Females").

Sustainable mortality for independent aged (≥2 years) females is considered 9% of the estimated size for this segment of the population (IGBST 2005, 2006; USFWS 2007*b*). Thus, female mortalities are within sustainable limits if,

$$\hat{D}_F \leq \hat{N}_F * 0.09 ,$$

where, $\hat{N}_F$ is the estimated population size for independent aged females and $\hat{D}_F$ is the estimated total mortality for independent aged females. All sources of mortality are used to evaluate sustainability for independent aged bears, which included an estimate of the unreported loss (Cherry et al. 2002, IGBST 2005). Thus,

$$\hat{D}_F = A_F + R_F + \hat{B}_F , \quad (1)$$

where A_F is the number of sanctioned agency removals of independent females (including radio-marked individuals), R_F is the number of radio-marked bears lost (excluding sanctioned removals), and B_F is the median of the creditable interval for the estimated reported and unreported loss (Cherry et al. 2002). Exceeding independent female mortality limits for 2 consecutive years will trigger a biology and management review (USFWS 2007*b*).

Sustainability for independent aged males is 15% of the estimated male population (IGBST 2005, 2006; USFWS 2007*b*). Male mortality is considered sustainable if,

$$\hat{D}_M \leq \hat{N}_M * 0.15 ,$$

where $\hat{N}_M$ is the estimated population size for independent aged males and $\hat{D}_M$ is the estimated total mortality for independent males obtained by,

$$\hat{D}_M = A_M + R_M + \hat{B}_M , \quad (2)$$

where A_M is the number of sanctioned agency removals of independent males (including radio-marked individuals), R_M is the number of radio-marked bears lost (excluding sanctioned removals), and B_M is the median of the creditable interval for the estimated reported and unreported loss (Cherry et al. 2002). Exceeding independent male mortality limits for 3 consecutive years will trigger a biology and management review (USFWS 2007*b*).

Sustainability for dependent young (i.e., COY and yearlings) is set at 9% of the estimate for this population segment. Only human-caused deaths are assessed against this threshold (USFWS 2007*b*). Exceeding the dependent young mortality limit for 3 consecutive years will trigger a biology and management review (USFWS 2007*b*).

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. Those cases in which a carcass is physically inspected or when a management removal occurs are classified as "known" mortalities. Those instances where evidence strongly suggests a mortality has occurred but no carcass is recovered are classified as "probable." 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 at the least they provide an additional source of location information for grizzly bears in the GYE.

<u>2011 Mortality Results</u>

We documented 44 known and probable mortalities in the GYE during 2011; 37 were attributable to human causes (Table 13). Two of the documented mortalities occurred during 2010 (Table 13). One of these instances involved a radio-instrument female whose collar went on mortality during the fall of 2010, and whose fate was resolved in 2011. The second involved grizzly bear remains

Table 13. Grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2011.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
201101	624	M	Adult	05/07/2011	Grass Creek, State-WY	Known	Human-caused, management removal of bear #624 for allegedly breaking into 2 cabins and a trailer. DNA results confirmed this was not the bear that broke into the structures, but it was in at least 1 of the cabins.
201102		M	Subadult	2011	WY	Known	Human-caused. UNDER INVESTIGATION.
201103		M	Adult	2011	WY	Known	Human-caused. UNDER INVESTIGATION.
201104	Unm	M	Adult	06/02/2011	Tangle Creek, YNP	Known	Human-caused, road kill.
201105		F	Adult	2011	WY	Known	Human-caused. UNDER INVESTIGATION.
201106	Unm	F	Adult	07/11/2011	Skull Creek, Pr-WY	Known	Human-caused, road kill.
201107	G146	M	Adult	07/16/2011	Fish Creek, BTNF	Known	Human-caused, management removal of bear #G146 for repeated sheep and cattle depredation.
201108	Unm	F	Adult	07/18/2011	Buttermilk Creek, Pr-MT	Known	Human-caused, management removal for repeated food rewards in a campground and at residences.
201109	G152	F	Adult	07/27/2011	Wagon Creek, BTNF	Known	Human-caused, management removal for cattle depredation and prior management involving anthropogenic food rewards.
201110	Unm	M	Subadult	08/01/2011	Incinerator Creek, YNP	Known	Human-caused, management removal for numerous nuisance activities and food rewards in campground escalating to aggressive behavior towards humans.
201111		F	Adult	2010	WY	Known	Undetermined cause. UNDER INVESTIGATION.
201112	G111	F	Adult	08/07/2011	South Fork Shoshone, Pr-WY	Known	Human-caused, management removal of bear #G111 for numerous nuisance activities and obtaining food rewards at private residences, was accompanied by 2 COY.
201113	Unm	M	COY	08/08/2011	South Fork Shoshone, Pr-WY	Known	Human-caused, management live removal, was accompanying mother and female sibling obtaining food rewards at private residences.
201114	Unm	F	COY	08/08/2011	South Fork Shoshone, Pr-WY	Known	Human-caused, management live removal, was accompanying mother and male sibling obtaining food rewards at private residences.
201115	377	M	Adult	08/24/2011	Strawberry Creek, BTNF	Known	Human-caused, management removal of bear #377 for repeated cattle depredation.
201116	Unm	Unk	COY	06/25/2011	Pickett Creek, BLM-WY	Known	Undetermined cause, remains found by horn hunter, mortality date is approximate as COY had been dead for 2-3 months, sex is unknown.
201117	636	M	Adult	08/28/2011	Green River, BTNF	Known	Human-caused, management removal of bear #636 for repeated cattle depredation.

Table 13. Continued.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
201118		F	Adult	2011	WY	Known	Human-caused. UNDER INVESTIGATION.
201119	546	M	Adult	09/09/2011	Bear Creek, Pr-MT	Known	Human-caused, management removal of bear #546 for repeated cattle depredation.
201120	Unm	F	Adult	09/07/2011	Fales Fork, SNF	Known	Human-caused, hunting related defense of life by archery hunter. Female was accompanied by 3 yearlings.
201121	267	F	Adult	09/10/2011	Burnt Timber Creek, SNF	Known	Human-caused, hunting related defense of life kill of bear #267 by archery hunters. Female was accompanied by 3 COY at time of death.
201122	Unm	Unk	COY	09/10/2011	Burnt Timber Creek, SNF	Probable	Human-caused, COY of female #267 killed in self-defense by archery hunter.
201123	Unm	Unk	COY	09/10/2011	Burnt Timber Creek, SNF	Probable	Human-caused, COY of female #267 killed in self-defense by archery hunter.
201124	Unm	Unk	COY	09/10/2011	Burnt Timber Creek, SNF	Probable	Human-caused, COY of female #267 killed in self-defense by archery hunter.
201125	550	M	Adult	09/11/2011	Sunlight Creek ,Pr-WY	Known	Human-caused, management removal of bear #550 for livestock depredation and property damage.
201126	497	F	Adult	09/13/2011	South Fork Fish Creek, BTNF	Known	Human-caused, hunting related defense of life kill of bear #497 by archery hunters. Female was accompanied by 1 large young.
201127	Unm	F	Adult	Spr/Sum 2010	Cabin Creek, YNP	Known	Undetermined cause, likely died spring or summer of 2010. DNA results confirmed this was a female. Mortality date is approximate.
201128	G120	M	Adult	09/20/2011	Wind River, SNF	Known	Human-caused, management removal of bear #G120 for repeated cattle depredation.
201129	565	M	Adult	2011	Rock Creek, CTNF	Known	Human-caused, bear was shot and had been dead for approximately 1 week when reported by a hunter on 9/25/2011. Mortality date is approximated.
201130	Unm	F	Adult	09/29/2011	Sour Creek, YNP	Known	Human-caused, management removal of female with 2 COY for 1 human fatality, and was known to be at the site of a second human fatality.
201131	Unm	M	COY	09/29/2011	Sour Creek, YNP	Known	Human-caused, live management removal of 1st COY whose mother caused 1 human fatality, and was known to be at the site of a second human fatality.
201132	Unm	M	COY	09/29/2011	Sour Creek, YNP	Known	Human-caused, live management removal of 2nd COY whose mother caused 1 human fatality, and was known to be at the site of a second human fatality.
201133	618	M	Adult	2011	Davis Creek, Pr-MT	Known	Human-caused, mistaken identity kill of bear #618 by black bear hunter.
201134	Unm	F	Adult	10/02/2011	North Fork Buffalo, BTNF	Known	Human-caused, hunting related self-defense. Female was accompanied by 2 yearlings.

Table 13. Continued.

Unique	Bear[a]	Sex[b]	Age[c]	Date	Location[d]	Certainty	Cause
201135	Unm	F	Adult	10/11/2011	Lamar River, YNP	Known	Natural, was killed and partially consumed by another bear.
201136	G141	M	Adult	10/17/2011	Pine Creek, Pr-MT	Known	Human-caused, management removal of bear #G141 for sheep depredation.
201137	Unm	M	Adult	10/21/2011	Box Creek, BTNF	Known	Human-caused, management removal for repeated property damage and food rewards.
201138	Unm	F	Adult	08/01/2011	Lynx Creek, YNP	Known	Undetermined cause, skull was present when initially found, but gone when park staff returned to the site. Mortality date is approximate; DNA results indicated this was a female.
201139		F	Subadult	2011	WY	Known	Human-caused. UNDER INVESTIGATION.
201140	628	F	Adult	10/30/2011	South Fork Shoshone, Pr-WY	Known	Human-caused, management removal of bear #628 for repeated nuisance activity and food rewards in a residential area.
201141	666	F	Adult	11/06/2011	Wind River, Pr-WY	Known	Human-caused, management removal of bear #666 for obtaining multiple food rewards in the town of Dubios, WY.
201142	Unm	M	Adult	11/11/2011	South Fork Shoshone, State-WY	Known	Human-caused, management removal after hunter was injured in Buffalo Bill State Park, WY.
201143	Unm	Unk	COY	08/04/2011	Blackrock Creek, BTNF	Probable	Natural, radio collared female #658 lost 1st of 2 COY between 7/29 and 8/10. Location and mortality date are approximate.
201144	Unm	Unk	COY	08/04/2011	Blackrock Creek, BTNF	Probable	Natural, radio collared female #658 lost 2nd of 2 COY between 7/29 and 8/10. Location and mortality date are approximate.

[a] Unm = unmarked bear; number indicates bear number, Mkd = previously marked bear but identity unknown.
[b] Unk = unknown sex
[c] COY = cub-of-the-year, Unk = unknown age
[d] BTNF = 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.

found by YNP staff during August 2011. Condition of the remains indicated the bear likely died during the summer of 2010. Specific cause of death could not be determined for either of these mortalities and both were added to 2010 mortality totals. With the additions of these deaths the estimated total mortalities for independent female exceeded sustainable limits during 2010, although the estimated total mortality was only fractionally (i.e., <1 bear) over the limit.

Six of the known and probable losses documented during 2011 remain under investigation by USFWS and state law enforcement agencies. Specific information related to these mortalities is not provided because of on-going investigations. However, these events are included in the following summary. Eleven (29.7%) of the human-caused losses were hunting related; including 1 mistaken identity kill by a black bear hunter, and 9 losses from self-defense kills. These losses included 3 probable COY from a female that was killed in self-defense. One of the hunting related losses was a management capture and removal of an adult male that was defending a carcass in Buffalo Bill State Park, Wyoming, and had injured a hunter. Twenty (54.1%) of the human-caused losses involved management removals due to livestock depredation (*n* = 8), site conflicts (*n* = 9, including 1 female with 2 COY), and in response to human fatalities (*n* = 3). The 3 management removals in response to human fatalities involved a female with 2 COY that was known to have been responsible for 1 human fatality, and was known to have been at the location of a second human fatality, both occurring Hayden Valley, YNP (see investigative reports available at http://www.fws.gov/mountain-prairie/species/mammals/grizzly/MatayoshiInvestigationReport.pdf, and WallaceBoardOfReviewReport03022012.pdf). The COY involved in these incidents were captured and removed live to the Grizzly Discover Center, West Yellowstone, Montana. The remaining human-caused losses were from road kills (5.4%, *n* = 2), and malicious killing (10.8%, *n* = 4).

We also documented 3 natural mortalities and 2 grizzly bear deaths from undetermined causes occurring in 2011 (Table 13). One natural mortality was an adult female that was killed and partially consumed by another bear near the Lamar River, YNP. Two similar events were documented in the same area during 2007 (Haroldson and Frey 2008). The other natural mortalities were probable COY losses from a radio collared female that occurred in early August. The mortalities from undetermined causes were an adult female bear found near Lynx Creek, YNP, in September by park staff, and a COY found during August in Pickett Creek, Wyoming. Both of these bears had been dead for several months when found and cause of death could not be ascertained.

All the known and probable 2011 mortalities occurred within the boundary specified in the Revised Demographic Recovery Criteria and shown in Fig. 1. Among the 16 known and probable losses for independent-aged female bears there were 6 management removals and 10 other reported losses (Table 14). We documented 11 management removals and 5 reported losses of independent-aged male grizzly bears (Table 14). Human-caused losses of dependent young totaled 7 (Table 14). Using the criteria specified under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and methodology presented by IGBST (2005, 2006), estimates of total mortality for independent females and independent males exceeded mortality limits for 2011. The estimated total mortality for independent males was only fractionally (i.e., <1 bear) over the limit. Human-caused mortality limits for dependent young were not exceeded during 2011 (Table 14).

One documented mortality from 2009 remains under investigation. None of the mortalities documented during 2010 remain under investigation. Specific information pertaining to closed mortality investigations will be updated in the 2009, 2010, and 2011 Mortality List (http://www.nrmsc.usgs.gov/science/igbst/2011mort) as they become available. We remind readers that some cases can remain open and under investigation for an extended period. The study team cooperates with federal and state law enforcement agencies and will not release information that could compromise ongoing investigations.

Table 14. Annual size estimates ($\hat{N}$) for population segments and evaluation of sustainability for known and probable mortalities documented during 2011 within the boundaries specified in an erratum for the Revised Demographic Criteria (see "Assessing Trend and Estimating Population Size from Counts of Unduplicated Females"). Established mortality thresholds (USFWS 2007*b*) are 9%, 9%, and 15% for dependent young and independent (≥2 years) females and males, respectively. Only human-caused losses are counted against the mortality threshold for dependent young.

Population segment	$\hat{N}$	Human-caused loss	Sanctioned removals (A[a])	Radio-marked loss (R[b])	Reported loss	Estimated reported and unreported loss (B[c])	Estimated total mortality (D[d])	Annual mortality limit	Mortality threshold year result
Dependent young	188	7						17	Under
Independent females[e]	248	14	6	0	10	26	32	22	Exceeded
Independent males[f]	157	16	11	0	5	13	24	24	Exceeded[g]

[a] Term A in equation 1 and 2 is the annual count of agency sanctioned management removals of independent aged bears including those involving radio-marked individual.
[b] Term R in equation 1and 2 is the annual count of loss for independent aged bears wearing active telemetry except those removed through management actions.
[c] Term B in equation 1 and 2 is the median of the credible interval for estimated reported and unreported loss calculated using methods described in Cherry et al. (2002) from the annual reported loss.
[d] Term D in equation 1 and 2 is the estimated total mortality is the sum of the sanctioned removals, the radioed-marked loss, and the estimated reported and unreported loss.
[e] Mortality counts and estimates for independent aged females bears are indicated by subscript F in equation 1.
[f] Mortality counts and estimates for independent aged males bears are indicated by subscript M in equation 2.
[g] Mortality limit for independent males was exceeded by a fraction of a bear.

Skull of adult female grizzly bear 201135, killed by another bear, Lamar River, Yellowstone National Park, 11 Oct 2011. Photo courtesy of Craig Whitman/IGBST.

Key Foods Monitoring

Spring Ungulate Availability and Use by Grizzly Bears in Yellowstone National Park *(Shannon Podruzny, Interagency Grizzly Bear Study Team; and Kerry Gunther and Travis Wyman, Yellowstone National Park)*

It is well documented that grizzly bears use ungulates as carrion (Mealey 1980, Henry and Mattson 1988, Green 1994, Blanchard and Knight 1996, Mattson 1997) in Yellowstone National Park. Competition with recently reintroduced wolves (*Canis lupus*) for carrion and changes in bison (*Bison bison*) and elk management policies in the GYE have the potential to affect carcass availability and use by grizzly bears. For these and other reasons, we continue to survey historic carcass transects in Yellowstone National Park. In 2011, we surveyed routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses (Fig. 6).

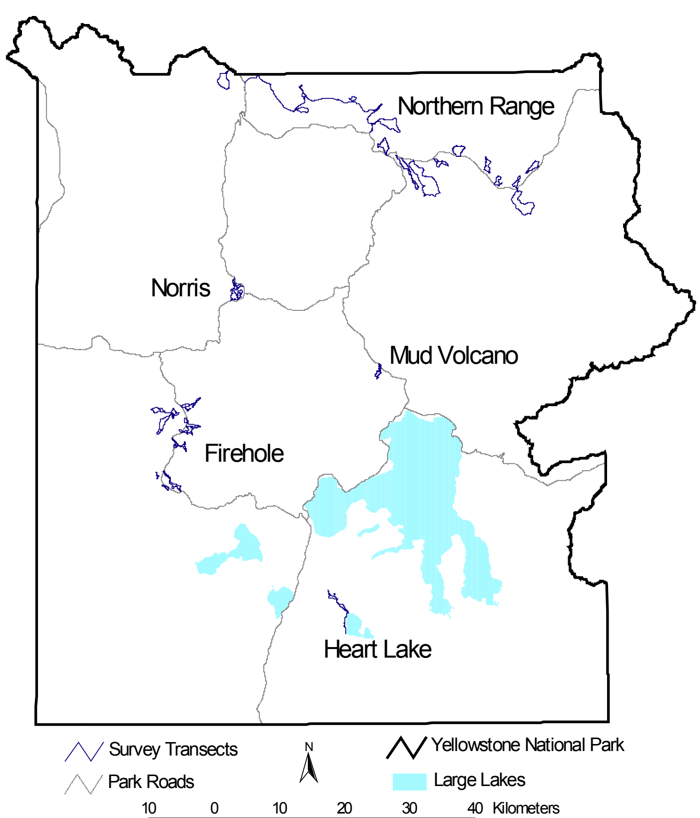

Fig. 6. Spring ungulate carcass survey transects in 5 areas of Yellowstone National Park.

We surveyed each route once for carcasses between April and mid-May. At each carcass, we collected a site description (i.e., location, aspect, slope, elevation, distance to road, distance to forest edge), carcass data (i.e., species, age, sex, cause of death), and information about animals using the carcasses (i.e., species, percent of carcass consumed, scats present). We were unable to calculate the biomass consumed by bears, wolves, or other unknown large scavengers with our survey methodology.

In 2011, we recorded 86 ungulate carcasses for a total of 0.338 carcasses/km surveyed (Fig. 7).

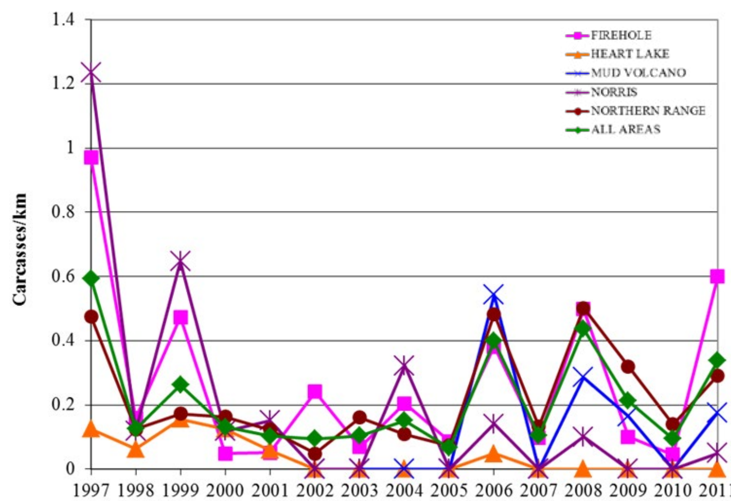

Fig. 7. Annual ungulate carcasses/km found on spring survey routes in winter ranges of Yellowstone National Park, 1997–2011.

Northern Range

We surveyed 11 routes on Yellowstone's Northern Range totaling 140.9 km traveled. We used a GPS to more accurately measure the actual distance traveled on most of the routes. We counted 32 elk, 52 bison, and 2 mule deer carcasses, which equated to 0.291 carcasses/km (Table 15). Sex and age of carcasses found are shown in Table 16. All carcasses were almost completely consumed by scavengers. Evidence of use by an unidentified specie of bears was found at 13 elk carcasses; evidence of use by wolves was found at 6 elk carcasses. Grizzly bear sign (e.g., tracks, scats, daybeds, or feeding activity) was found along 9 of the routes.

Table 15. Ungulate carcasses found and visitation of carcasses by bears, wolves, and unknown large scavengers along surveyed routes in Yellowstone National Park during spring 2011.									
	Elk				Bison				
Survey area (# routes)	Number of carcasses	# Visited by species Bear	Wolf	Unknown	Number of carcasses	# Visited by species Bear	Wolf	Unknown	Total carcasses/km
Northern Range (11)	32	13	6	13	7	2	0	4	0.29[a]
Firehole (8)	0	0	0	0	43	29	2	5	0.60
Norris (4)	0	0	0	0	1	1	1	1	0.05
Heart Lake (3)	0	0	0	0	0	0	0	0	0.00
Mud Volcano (1)	0	0	0	0	1	1	0	0	0.18

[a] Carcasses/km includes 2 mule deer carcasses found on the Northern Range.

Table 16. Age classes and sex of elk and bison carcasses found, by area, along surveyed routes in Yellowstone National Park during spring 2011.

	Elk (n = 32)						Bison (n = 52)					
	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total
Age												
Adult	22	0	0	0	0	22	7	29	1	0	0	37
Yearling	5	0	0	0	0	5	0	12	0	0	1	12
Calf	1	0	0	0	0	1	0	0	0	0	0	0
Unknown	4	0	0	0	0	4	0	2	0	0	0	2
Sex												
Male	10	0	0	0	0	10	5	12	1	0	1	19
Female	13	0	0	0	0	13	2	20	0	0	0	22
Unknown	9	0	0	0	0	9	0	11	0	0	0	11

Firehole River Area

We surveyed 8 routes in the Firehole drainage totaling 71.7 km. We counted 43 bison carcasses (0.60 carcasses/km). Evidence of use by grizzly bears was found at 14 of the carcasses, used by an unidentified specie of bear at 15 carcasses, and wolves at 2. Grizzly bear sign was found along 7 of the routes

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin totaling 20 km travelled. One bison carcass was observed, and grizzly bear sign was noted along all of the routes. A grizzly bear was encountered by surveyors near the bison carcass.

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin covering 16.2 km. We observed no carcasses. Grizzly bear sign (including tracks, feeding, and geophagy of thermal soil) was observed along all routes.

Mud Volcano

We surveyed a single route in the Mud Volcano area covering 6.1 km. One yearling bison carcass was found, and grizzly bear use was observed at the carcass, and grizzly sign was abundant in the area.

Carcass Numbers in Relation to Early Spring Snowpack Condition

We are interested in relating the changes in ungulate carcass numbers to potential independent measures of winter die-off. Such measures include weather, winter severity, and forage availability. All are considered limiting factors to ungulate survival during winter (Cole 1971, Houston 1982). Long-term changes in weather and winter severity monitoring may be useful in predicting potential carcass availability. We used a standardized measure of snow-water equivalent available in the snowpack on 1 April at 60 Natural Resources Conservation Service snowcourse and snotel sites across the GYE as a surrogate for winter severity monitoring.

We regressed ungulate carcasses per km with our measure of snow-water equivalent (Fig. 8) observed 1991–2010. Snowcourse data for 2011 was not publicly available at this writing. The linear relationship was significant ($R^2 = 0.78$, $F = 42.814$, df = 13, $P < 0.001$).

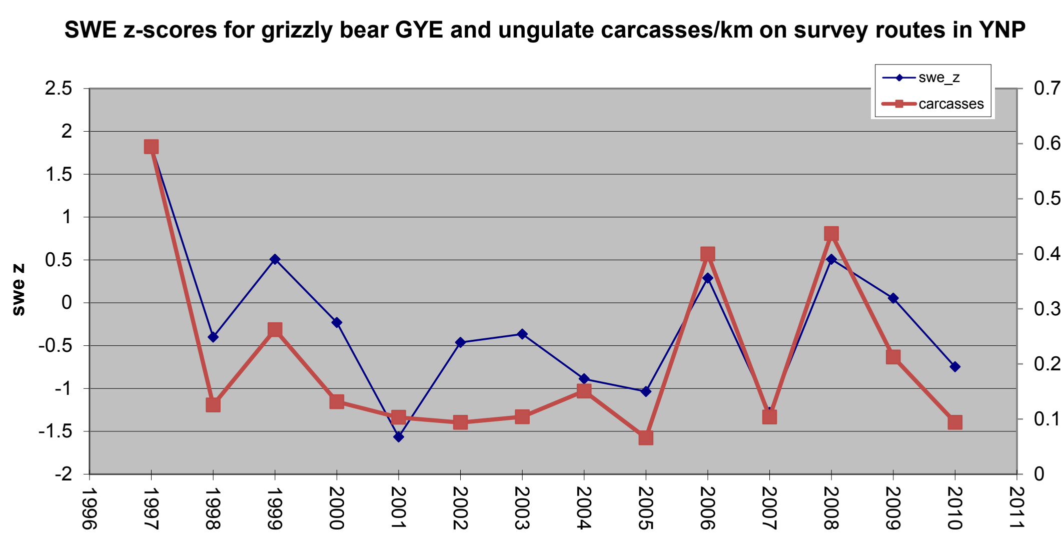

Fig. 8. Greater Yellowstone Ecosystem snow-water equivalent (1 Apr) and annual ungulate carcasses/km found on spring survey routes in winter ranges of Yellowstone National Park, 1997–2011.

Spawning Cutthroat Trout (*Kerry A. Gunther, Todd M. Koel, Patrick Perrotti, and Eric Reinertson, Yellowstone National Park*)

Spawning cutthroat trout were once commonly consumed by grizzly bears that had home ranges adjacent to Yellowstone Lake and its tributaries (Mealey 1975, Reinhart and Mattson 1990, Haroldson et al. 2005). In the 1970s and 1980s, grizzly bears were known to prey on cutthroat trout in at least 36 different tributary streams of the lake (Hoskins 1975, Reinhart and Mattson 1990). Haroldson et al. (2005) estimated that approximately 68 grizzly bears likely fished Yellowstone Lake tributary streams annually during the late 1990s. Bears also occasionally prey on cutthroat trout in other areas of the park, including the cutthroat trout (and/or cutthroat x rainbow trout, *Oncorhynchus mykiss* hybrids) in the inlet creek to Trout Lake located in the northeast section of the park.

Nonnative lake trout (*Salvelinus namaycush*), whirling disease caused by an exotic parasite (*Myxobolus cerebralis*), and drought have significantly reduced the native Yellowstone Lake cutthroat trout population and associated bear fishing activity (Haroldson et al. 2005; Koel et al. 2005, 2006). In 1994, lake trout were discovered in Yellowstone Lake (Keading et al. 1996). Lake trout are capable of rapid population increase (Curtis 1990) and thrived in the Yellowstone Lake environment (Koel et al. 2005). It is believed that lake trout have been reproducing in Yellowstone Lake since the late 1980s (Munro et al. 2005). Younger age classes of lake trout compete with cutthroat trout for macroinvertebrates (Elrod 1983, Elrod and O'Gorman 1991) and adult lake trout are efficient predators that consume an average of 59 cutthroat trout annually (Stapp and Hayward 2002), making them a significant threat to the cutthroat trout population. Lake trout introductions have been implicated in significant declines of native adfluvial cutthroat trout in several western North American Lakes (Cordone and Frantz 1966, Dean and Varley 1974, Behnke 1992). Lake trout are not a suitable ecological substitute for cutthroat trout because they remain within the lake for all life stages and do not enter tributary streams to spawn, making them unavailable to terrestrial predators such as grizzly bears. Nonnative whirling disease, discovered in cutthroat trout in Yellowstone Lake tributaries in 1998 (Koel et al. 2006), destroys head cartilage of young trout, resulting in loss of equilibrium, skeletal deformities, and inability to feed or avoid predators. Drought in the form of lower mountain snowfall has reduced stream flows, especially the amount of peak spring runoff (P. Bigelow, Yellowstone National Park, personal communication). Without spring floods, wave and ice formed gravel bars at the mouths of smaller streams are not blown out, blocking spring access by spawning cutthroat trout and/or preventing cutthroat trout fry from returning to the lake in the fall when stream flows diminish. 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 cutthroat trout as a food source by grizzly bears, and the population 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 (USFWS 2003, Koel et al. 2005). Visual stream surveys are also conducted along the inlet creek at Trout Lake in the northeast section of the park.

<u>Yellowstone Lake</u>

Fish Trap Surveys—The number of spawning cutthroat trout 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 (Fig. 9; 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 and/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. The weir is currently scheduled to be reconstructed during the late summer of 2012. Operation of the weir and fish trap is anticipated in 2013.

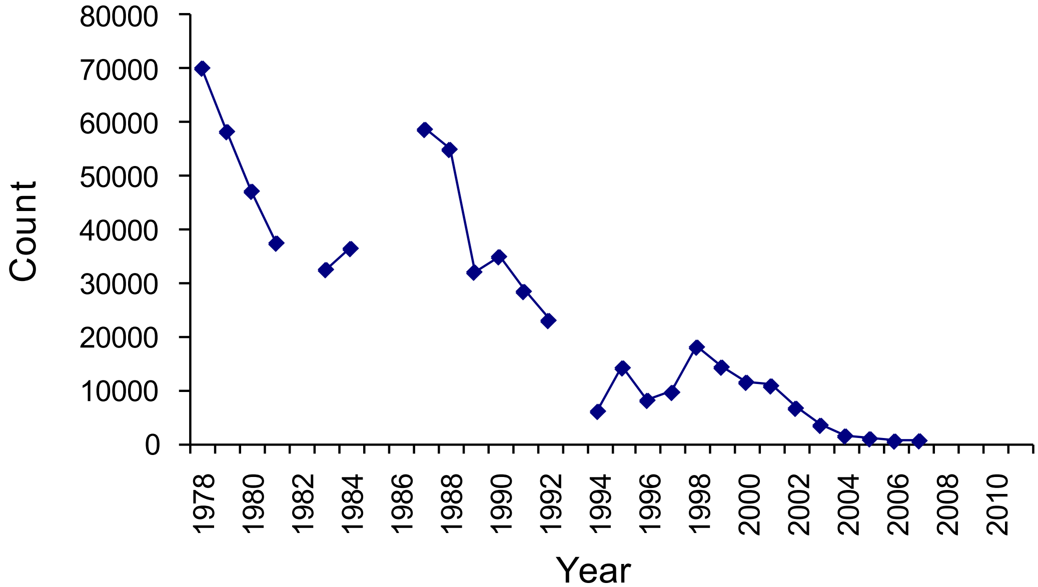

Fig. 9. Number of spawning cutthroat trout counted at the Clear Creek fish trap on the east shore of Yellowstone Lake, Yellowstone National Park, 1978–2011.

Visual Stream Surveys--Beginning 1 May most years, several streams including Lodge Creek, Hotel Creek, Hatchery Creek, Incinerator Creek, Wells Creek, Bridge Creek, Weasel Creek, and Sand Point Creek on the North Shore of Yellowstone Lake; and Sandy Creek, Sewer Creek, Little Thumb Creek, and un-named creek #1167 in the West Thumb area are checked daily to detect the presence of adult cutthroat trout (Andrascik 1992, Olliff 1992). Once adult trout 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 Olliff (1992). In each stream on each sample day, 2 people walk upstream from the stream mouth and record the number of adult trout observed. Sampling continues 1 day/week until most adult trout return to the lake (i.e., end of spawning). The length of the spawning season is calculated by counting the number of days from the first day spawners are observed through the last day spawners 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 2011 continued to show low numbers of spawning cutthroat trout in North Shore and West Thumb tributary streams (Table 17). In North Shore streams, only 9 spawning cutthroat trout were counted. Seven spawning trout were counted in Bridge Creek, 1 in Hatchery Creek, and 1 in Lodge Creek. No spawning cutthroat trout were observed in Incinerator Creek or Wells Creek. Hotel Creek, Weasel Creek, and Sand Point Creek were not surveyed in 2011. No evidence (fish parts, bear scats containing fish parts) of grizzly bear fishing activity was observed along any of the surveyed North Shore streams in 2011. On West Thumb streams, only 100 spawning cutthroat trout were counted including 89 in Little Thumb Creek, 4 in Sandy Creek, 4 in Sewer Creek, and 3 in creek #1167. No evidence (fish parts, bear scats containing fish parts) of grizzly bear fishing activity was observed along any of the surveyed West Thumb streams in 2011. The number of spawning cutthroat trout counted in the North Shore and West Thumb streams has decreased significantly since 1989 (Fig. 10).

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 (and/or cutthroat x rainbow trout hybrids). Once spawning trout are detected (i.e. onset of spawning), weekly surveys of adult trout in the inlet creek are

Table 17. 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, 2011.

Stream	Start of spawn	End of spawn	Duration of spawn (days)	Number of surveys during spawning period	Number of fish counted	Average fish/survey
North Shore Streams						
Lodge Creek	06/15/11	06/15/11	1	1	1	1.0
Hotel Creek			Not surveyed			
Hatchery Creek	06/21/11	06/21/11	1	1	1	1.0
Incinerator Creek			No spawn			
Wells Creek			No spawn			
Bridge Creek	06/15/11	06/21/11	7	2	7	3.5
Weasel Creek			Not surveyed			
Sand Point Creek			Not surveyed			
West Thumb Streams						
1167 Creek	06/13/11	06/13/11	1	1	3	3.0
Sandy Creek	06/20/11	06/20/11	1	1	4	4.0
Sewer Creek	06/13/11	06/20/11	8	2	4	2.0
Little Thumb Creek	06/13/11	07/05/11	23	4	89	22.3
Total (Yellowstone Lake)				12	109	9.1
Northern Range Stream						
Trout Lake Inlet	06/30/11	08/19/11	51	8	1,086	135.8

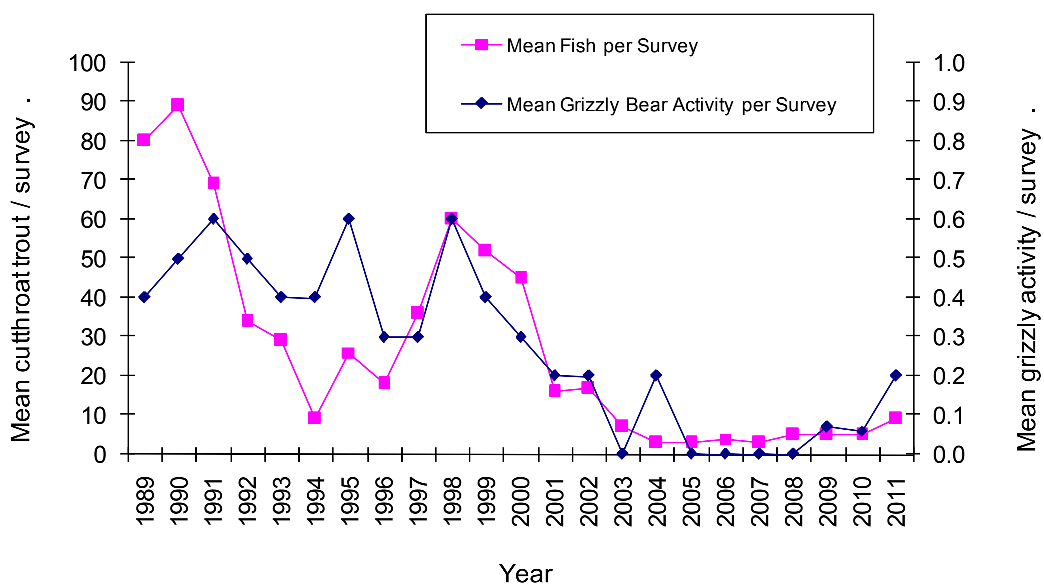

Fig. 10. Mean number of spawning cutthroat trout and mean activity by grizzly bears observed during weekly visual surveys of 8 North Shore and 4 West Thumb spawning streams tributary to Yellowstone Lake, Yellowstone National Park, 1989–2011.

conducted. On each sample day, 2 people walk upstream from the stream mouth and record the number of adult trout observed. Sampling continues 1 day/week until 2 consecutive weeks when no trout are observed in the creek and all trout have returned to Trout Lake (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 mean number of spawning trout observed per visit is calculated by dividing the total number of adult trout counted by the number of surveys conducted during the spawning season.

In 2011, the first movement of spawning trout from Trout Lake into the inlet creek was observed on 30 June. The spawn lasted approximately 51 days with the last spawning trout being observed in the inlet creek on 19 August. During the once per week visual surveys, 1,086 spawning cutthroat (and/or cutthroat trout x rainbow trout hybrids) were counted, an average of 136 per visit (Table 17). The number of fish observed per survey has ranged from a low of 31 in 2004, to a high of 306 in 2010 (Fig. 11). No grizzly bears or black bears, bear sign, or evidence of bear fishing activity was confirmed along the inlet creek during the surveys in 2011.

Cutthroat Trout Outlook--As part of management efforts to protect the native cutthroat trout population, park fisheries biologists and private-sector (contracted) netters caught and removed 221,495 lake trout from Yellowstone Lake in 2011 (Koel et al. In press). Population modeling suggests that recent increased effort may have halted population growth and continued catch at these rates may begin reducing the lake trout population. Completion of a Native Fish Conservation Plan/ Environmental Assessment (Koel et al. 2010*b*; FONSI May 2011) plans for a significant increase in lake trout suppression including incorporation of private sector, contract netters using large deep water trap-nets. Population models suggest that the heightened removal over a period of at least 10 years will drive the lake trout population into decline, providing much needed relief for the native cutthroat trout.

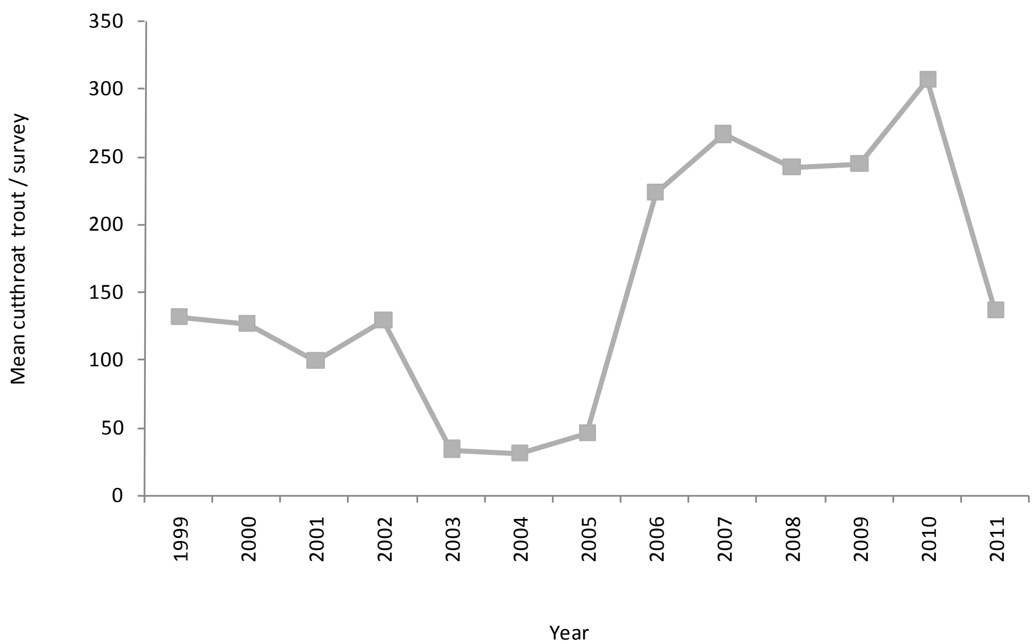

Fig. 11. Mean number of spawning cutthroat (and/or cutthroat x rainbow trout hybrids) observed during weekly visual spawning surveys of the Trout Lake inlet, Yellowstone National Park, 1999–2011.

Grizzly Bear Use of Insect Aggregation Sites Documented from Aerial Telemetry and Observations
(Dan Bjornlie, Wyoming Game and Fish Department; and Mark A. Haroldson, Interagency Grizzly Bear Study Team)

Army cutworm moths were first recognized as an important food source for grizzly bears in the GYE during the mid 1980s (Mattson et al. 1991*b*, French et al. 1994). Early observations indicated that moths, and consequently bears, showed specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. Such areas are referred to as "insect aggregation 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.

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 insect 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. The problem with this technique was that small sites were overlooked due to the inability to create polygons around sites with fewer than 3 locations. From 1997–99, 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).

A new technique was developed in 2000 (D. Bjornlie, Wyoming Game and Fish Department, personal communication). Using this technique, sites were delineated by buffering only the locations of bears observed actively feeding at insect aggregation sites by 500 m to account for error in aerial telemetry locations. The borders of the overlapping buffers at individual insect sites were 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 1 July through 30 September of each year were then overlaid on these polygons and enumerated. The technique to delineate confirmed sites developed in 2000 substantially decreased the number of sites described compared to past years in which locations from both feeding and non-feeding bears were used. Therefore, annual analysis for this report is completed for all years using this technique. Areas suspected as insect aggregation sites but dropped from the confirmed sites list using this technique, as well as 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 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 to 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.

In 2011, actively feeding grizzly bears were observed on 1 site classified as possible in past years. Therefore, this site was reclassified to confirmed and merged with an adjacent site due to its proximity. Analysis was done back to 1986 for this newly combined site. There were 4 observations of grizzly bears actively feeding in previously unknown areas in 2011. These sites were classified as possible. In addition, one long-term possible site was removed from the list of moth sites due to lack of evidence of grizzly bears using moths on that site. Adding the new possible sites and the reclassified site to the 2010 sites and removing the old possible site produced 37 confirmed sites and 16 possible sites for 2011.

The percentage of confirmed sites with documented use by bears varies from year to year, suggesting that some years have higher moth activity than others (Fig. 12). For example, 1993–1995 were probably poor moth years because the percentage of confirmed sites used by bears (Fig. 12) and the number of observations recorded at insect sites (Table 18) were low. Overall, insect aggregation site use by grizzly bears increased by 9% in 2011 (Fig. 12). The number of observations or telemetry relocations at sites increased from 2010, as well (Table 18). The number of insect aggregation sites used by bears in 2011 increased by 3 sites to 25 (Table 18) and was higher than the 5-year average of 22.6 sites/year from 2006–2010.

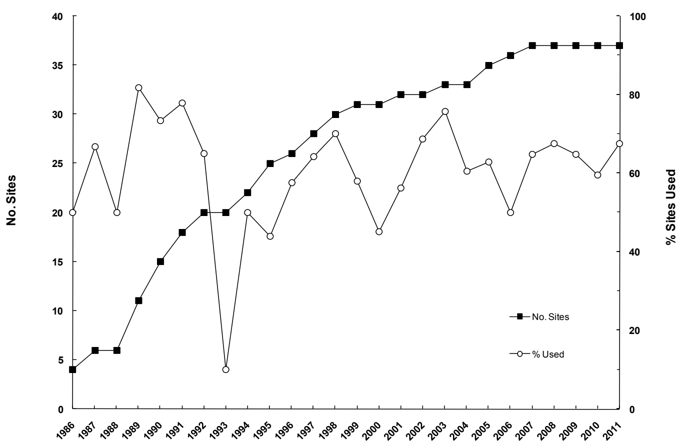

Fig. 12. Annual number of confirmed insect aggregation sites and percent of those sites at which either telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2011.

The IGBST maintains an annual list of unduplicated females observed with COY (see Table 5). Since 1986, 858 initial sightings of unduplicated females with COY have been recorded, of which 229 (27%) have occurred at (within 500 m, $n = 213$) or near (within 1,500 m, $n = 16$) insect aggregation sites (Table 19). In 2011, 7 of the 39 (17.9%) initial sightings of unduplicated females with COY were observed at insect aggregation sites, similar to 17.6% from 2010 (Table 19) but lower than the 5-year average of 24.1% from 2006–2010.

Table 18. The number of confirmed insect aggregation sites in the Greater Yellowstone Ecosystem annually, the number used by bears, and the total number of aerial telemetry relocations and ground or aerial observations of bears recorded at sites during 1986–2011.

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	5	5
1987	6	4	7	8
1988	6	3	12	29
1989	11	9	11	42
1990	15	11	8	76
1991	18	14	12	166
1992	20	13	5	99
1993	20	2	1	1
1994	22	11	1	28
1995	25	11	7	37
1996	26	15	21	66
1997	28	18	18	79
1998	30	21	11	173
1999	31	18	25	156
2000	31	14	39	89
2001	32	18	24	119
2002	32	22	36	239
2003	33	25	10	161
2004	33	20	2	131
2005	35	22	15	181
2006	36	18	19	180
2007	37	24	15	173
2008	37	25	21	215
2009	37	24	8	180
2010	37	22	4	158
2011	37	25	9	196
Total			334	2,775

[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 19. Number of initial sightings of unduplicated females with cubs-of-the-year (COY) 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, 1986–2011.

Year	Unduplicated females with COY[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	3	3	12.0	4	16.0
1991	24	8	12	50.0	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	7	21.2
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	8	21.6	10	27.0
2001	42	6	12	28.6	13	31.0
2002	52	11	17	32.7	17	32.7
2003	38	11	19	50.0	20	52.6
2004	49	11	16	32.7	16	32.7
2005	31	5	7	22.6	9	29.0
2006	47	11	14	29.8	15	31.9
2007	50	10	17	34.0	17	34.0
2008	44	7	11	25.0	14	31.8
2009	42	4	6	14.3	6	14.3
2010	51	7	9	17.6	9	17.6
2011	39	7	7	17.9	7	17.9
Total	858		213		229	
Mean	33.0	5.7	8.2	22.6	8.8	24.5

[a] Initial sightings of unduplicated females with COY; 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.

Survey flights at insect aggregation sites contribute to the count of unduplicated females with COY; however, it is typically low, ranging from 0 to 20 initial sightings/year since 1986 (Table 19). If these sightings are excluded, a similar trend in the annual number of unduplicated sightings of females with COY is still evident (Fig. 13), suggesting that some other factor besides observation effort at insect aggregation sites is responsible for the increase in sightings of females with cubs.

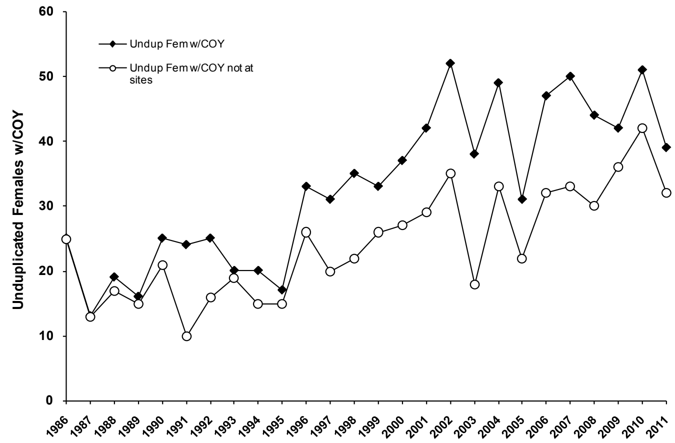

Fig. 13. The total number of unduplicated females with COY observed annually in the Greater Yellowstone Ecosystem and the number of unduplicated females with COY not found within 1,500 m of known insect aggregation sites, 1986–2011.

Whitebark Pine Cone Production *(Mark A. Haroldson and Shannon Podruzny, Interagency Grizzly Bear Study Team)*

Whitebark pine surveys on established transects indicated generally good cone production during 2011 (Fig. 14). Twenty-two transects were read. Overall, mean cones/tree was 19.8 (Table 20). All trees on transect S were dead and suitable replacement trees could not be found within the stand. This transect will be retired along with 4 that were retired in 2008 and 2009 (F1, H, R, and T; Table 21). While cone production on most transects was good, once again we observed better cone production (25.1 versus 17.4 mean cones/tree, Student's $t = -1.997$, $P = 0.049$) occurred on transects established during 2007 (CSA–CAG, Fig. 14 and Table 21) that tend to be located on the periphery of the GYE outside the Recovery Zone (Fig. 14). Difference in mean cones/tree between the 7 transects established in 2007 and older transects was also evident in 2010 and 2009; while no differences were observed in 2007 and 2008. The long-term pattern of a good cone crop in alternating or every third year has been evident since the mid 1990s (Fig. 15).

We observed no additional mountain pine beetle-caused tree mortality among trees originally surveyed since 2002, although we continue to observe beetle activity on recently marked trees. Thus total mortality on transect trees read since 2002 remains 72.6% (138/190) and 94.7% (18/19) of transects contain beetle-killed trees. Five (71.4%) of the 7 new transects exhibited beetle activity.

Near exclusive use of whitebark pine seeds by grizzly bears has been associated with falls in which mean cone production on transects exceeds 20 cones/tree (Blanchard 1990, Mattson et al. 1992). Typically, numbers of grizzly bear-human conflicts and management actions tend to increase during years with poor cone availability. The extensive areas of beetle-killed whitebark pine likely exacerbate this effect. Preliminary results of efforts to document the health of whitebark pine forests across the GYE are presented in Appendix A of this report. In 2011, we initiated a pilot project to examine use of mountain pine beetle-impacted whitebark pine habitats by adult female grizzly bears. Preliminary results indicate that the 2 bears monitored were obtaining whitebark pine cones even in heavily impacted areas (see section "Use of Diminished Whitebark Pine Resources by Adult Female Grizzly Bears in the Taylor Fork Area of the Gallatin National Forest, 2011").

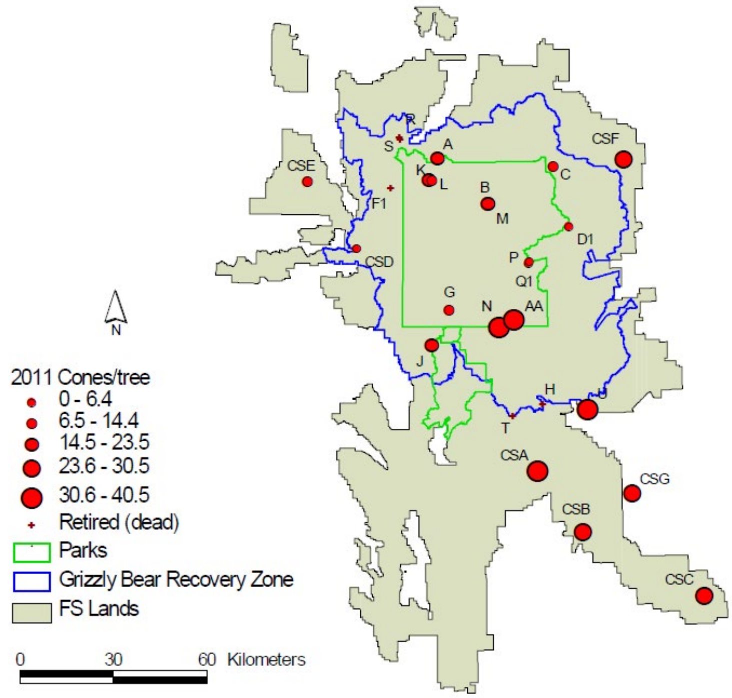

Fig. 14. Locations and mean cones/tree for 26 whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 2011.

Table 20. Summary statistics for whitebark pine (*Pinus albicaulis*) cone production transects surveyed during 2011 in the Greater Yellowstone Ecosystem.

Total			Trees				Transect			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
3,562	180	21	19.83	22.14	0	124	169.95	117.48	11	405

Table 21. Whitebark pine (*Pinus albicaulis*) cone production transect results for 2011.				
Transect	Cones	Trees	Mean	SD
A	141	6	23.50	49.4
B	182	10	18.20	11.0
C	94	9	10.44	7.0
D1	32	5	6.40	3.6
F1		Retired in 2008		
G	101	9	11.22	14.3
H		Retired in 2008		
J	187	10	18.70	19.6
K	191	10	19.10	7.6
L	144	10	14.40	11.5
M	195	10	19.50	13.4
N	351	10	35.10	15.0
P	18	10	1.80	2.4
Q1	11	10	1.10	2.0
R		Retired in 2009		
S		Retired in 2010		
T		Retired in 2008		
U	39	1	39.00	
AA	405	10	40.50	26.2
CSA	276	7	39.43	30.6
CSB	249	10	24.90	22.3
CSC	305	10	30.50	18.4
CSD	39	10	3.90	5.1
CSE	25	3	8.33	9.1
CSF	287	10	28.70	17.7
CSG	297	10	29.70	41.8

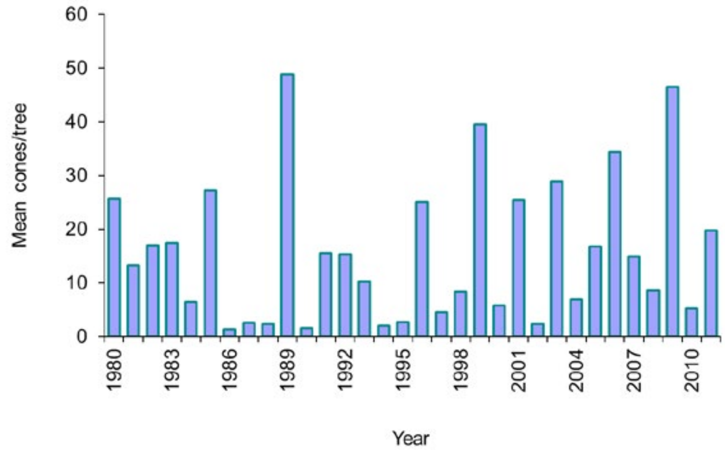

Fig. 15. Annual mean cones/tree on whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 1980–2011.

Whitebark pine pitched out beetle. Photo courtesy of J. Ball/ IGBST

Use of Diminished Whitebark Pine Resources by Adult Female Grizzly Bears in the Taylor Fork Area of the Gallatin National Forest, Montana, 2011
(Shannon Podruzny, Interagency Grizzly Bear Study Team)

The importance of whitebark pine as a food source for Yellowstone grizzly bears is well documented (Kendall 1983, Mattson et al. 1991*a*, Mattson et al. 1992, Felicetti et al. 2003, Schwartz et al. 2006*c*). The Yellowstone grizzly bear population was delisted from the federal Threatened Species List in 2007, but that decision was overturned by a district court judge in 2009 partially on the grounds that the USFWS had not adequately addressed potential future impacts to bears by changes in whitebark pine availability resulting from rapid, widespread whitebark pine mortality that began in the early 2000s.

Several recent evaluations document the decline of whitebark in the GYE. Interpretation of 2007 satellite imagery by the U.S. Department of Agriculture, Forest Service, Remote Sensing Applications Center indicated over 40% of whitebark stands in the GYE contained some level of canopy mortality (Goetz et al. 2009). Aerial surveys by the USDA Forest Health Protection program found beetle activity in more than 50% of whitebark stands in the GYE in 2008. Aerial photo evaluation at a sub-watershed level documented the spatial extent and severity of whitebark pine damage from mountain pine beetle outbreaks across the entire GYE (Macfarlane et al. 2010). Data from this project indicates that over 50% of whitebark stands in the GYE have already suffered high to complete mortality of overstory trees and 95% of forest stands containing whitebark pine have measurable mountain pine beetle activity (Macfarlane et al. 2010). White pine blister rust, a fungus introduced from Eurasia, is wide-spread and continuing to increase in incidence and severity; GYE-wide infection rates range from 20 to 81% (Jean et al. 2011, Bockino 2008, Bockino and McCloskey 2010, GYWPMWG 2010). In the northern Rocky Mountains, mortality is as high as 90% (Gibson et al. 2008) and the Interior Columbia Basin whitebark populations have declined by at least 45% (Kendall and Keane 2001).

Some previous studies provide some perspective on the degree to which grizzly bears in the GYE use whitebark pine seeds. During 1977–1987, scats from bears in the population centered on Yellowstone National Park consisted of 39% whitebark pine seeds on average for the month of September (typically the peak of whitebark pine feeding activity, Mattson et al. 1991*a*). This period represented the typical range of cone production, and did not segregate scats from male and female bears. Female grizzly bears captured in Grand Teton National Park in 2004–2006 had less than 10% digestibility-corrected volume of whitebark pine in their scats (IGBST, unpublished data). Male bears from that study had >40% scat volume in whitebark pine. Mountain pine beetle impacts in that area were light to moderate.

In 2011, we conducted a pilot study to examine how grizzly bears are currently using whitebark pine in an area of the GYE that had been heavily impacted by mountain pine beetles (Fig. 16). We deployed and followed 2 downloadable GPS collars on adult females. We documented habitat use by on-site examinations of those bear locations, and food habits through analysis of fecal samples collected at visited sites during the autumn (when bears typically use whitebark pine).

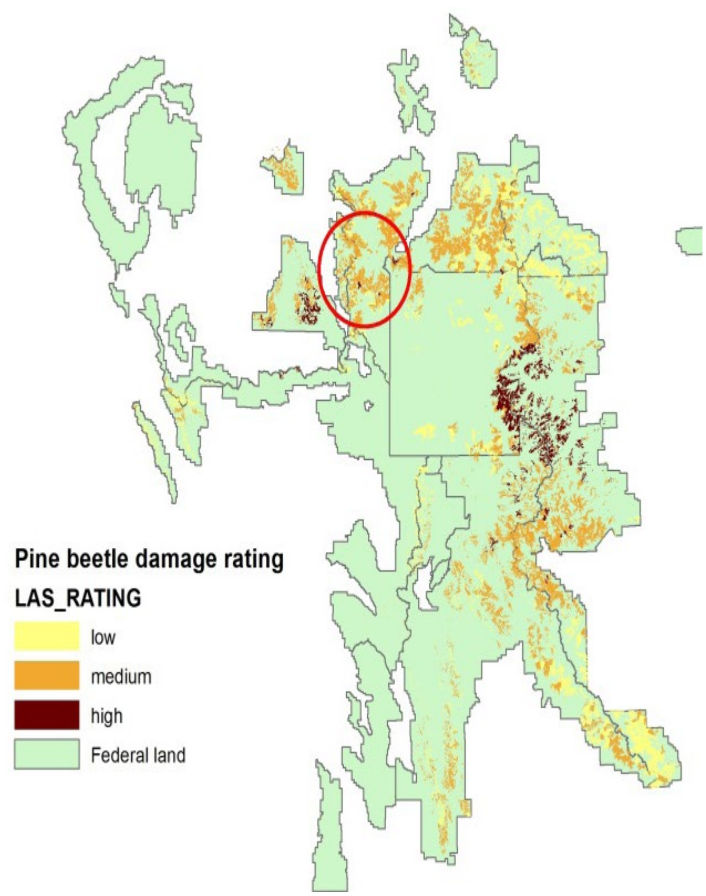

Fig. 16. Map showing mountain pine beetle damage categories in whitebark pine forests (following Macfarlane et al. 2010 and GYCCWPS 2011) with the Taylor Fork study area circled.

Methods

We conducted site visits of GPS telemetry locations to determine habitat selection and foraging patterns. Each week, we randomly selected a day from the week's download of each bear. For each bear-day, we visited most GPS locations collected for that 24-hour period. Our goal was to discern the foraging patterns of each sampled bear over a 24-hour time period.

At each visited location, we performed a detailed search for evidence of bear feeding activity and feces within 20 m of the location. Depending upon the evidence of bear use found, we collected 2 different levels of detailed information to describe bear activity and relevant information about the vegetation on site. For all plots, we collected basic site description information (level 1) and recorded types of feeding activities found. If evidence of feeding was found, we collected more detailed information on species used (level 2). Scats found at each site were collected and frozen.

Laboratory analysis of scat contents followed the procedures of Mealey (1980). Fecal samples were first air-dried then rehydrated and rinsed through coarse (0.125 in^2) and fine (0.0328 in^2) soil sieves. Any loss of small seeds was noted during the rinsing process. Rinsed samples were placed in a white enamel pan with water to disperse items. Individual items were identified to the finest possible taxonomic level, and the estimated percent composition of each item recorded. Diet items were grouped into categories following Mattson et al. (1991*a*). Because consumed items vary in digestibility and may be over- or under-represent in scat volumes, we used the correction factors recommended by Hewitt and Robbins (1996) to estimate the percent digestible dry matter for each group of items in the scats.

Results

We deployed 2 collars on adult female grizzly bears in the Taylor Fork drainage of the Gallatin National Forest (Fig. 16) in July 2011. A field crew visited 180 locations of the collars between 23 August and 21 October, and collected 63 scats. The sample represented 17 bear days. Evidence of any kind of activity (feeding, resting, tracks, scats, etc.) was found at 103 sites. Beds or resting sites were observed at 15 (8.33%) of visited locations. Of the locations visited, 63 sites had evidence of feeding activity (Table 22). Seven major feeding activities were identified at these locations:

1) Carcasses – large ungulate carcasses (elk) from predation or scavenging.

2) Roots – primarily sweet cicely (*Osmorrhiza* sp.), yampa (*Perideridia gairdneri*), or oniongrass (*Melica* spp.) dug directly by bears.

3) Rodent caches – nests and root caches (primarily of pocket gophers) excavated by bears. Roots from these caches included yampa, onion grass, American bistort (*Polygonum bistortoides*), and spring beauty (*Claytonia lanceolota*). Root digging and excavating rodent caches often occurred during the same feeding bout.

Table 22. Feeding activities found at 180 GPS locations of 2 female grizzly bears, Gallatin National Forest, Sep–Oct 2011.

	As a % of:		
Feeding activity	all 180 sites visited	63 sites with feeding activity	83 feeding activities observed
Ungulates (*n* = 16)	8.89%	25.40%	19.28%
Roots (*n* = 17)	9.44%	26.98%	20.48%
Rodent caches (*n* = 18)	10.00%	28.57%	21.69%
Whitebark pine (*n* = 13)	7.22%	20.63%	15.66%
Grazing (*n* = 3)	1.67%	4.76%	3.61%
Insects (*n* = 14)	7.78%	22.22%	16.87%
Berries (*n* = 2)	1.11%	3.17%	2.41%

4) Whitebark pine – squirrel middens excavated or branches of trees broken to obtain *Pinus albicaulis* cones.

5) Grazing – any type of grazing of plant material. This was often observed on cow parsnip (*Heracleum maximum*), but could include grasses, sedges, horsetails, and other forbs.

6) Insects – excavations of deadfall logs or anthills for insects.

7) Berries- including huckleberry (*Vaccinium mebranaceum*), grouse whortleberry *(Vaccinium scoparium*), gooseberries or currants (*Ribes* spp.), buffaloberry (*Shepherdia canadensis*), and strawberries (*Frageria* spp.).

We observed feeding on whitebark pine seeds at 13 sites. All of these observations were from the month of September. Each of the bears had 1 location/day during which they were using elk carcasses, during late September. Other activities were more even distributed throughout the season. In particularly, digging pocket gopher caches was observed through the end of the season.

Whitebark pine seeds constituted 27.3% of the dry digestible matter in collected scats (Fig. 17), but were present in 41.3% of all scats (Table 23). Forbs were the most common item found (71.4%) and constituted the highest volume (29.1%) in scats. Ungulates occurred in 20.6% of scats, and comprised 14.0% of the volume of dry digestible material. Other items found in scats but not documented at field sites included mushrooms, rodents, and other animal parts.

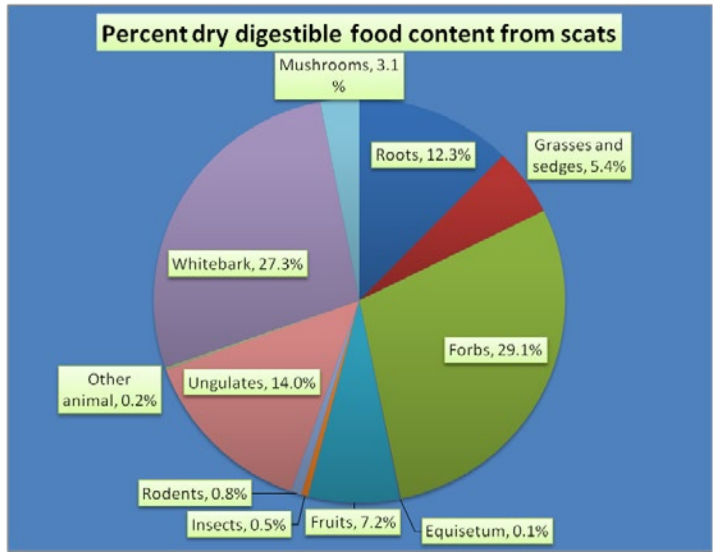

Fig. 17. Percentage composition of dietary items in 63 scats of 2 female grizzly bears, Sep–Oct 2011, Gallatin National Forest, MT. We used the procedures of Hewitt and Robbins (1996) to correct estimated volumes for digestibility.

Table 23. Food items found in 63 scats of 2 female grizzly bears, Gallatin National Forest, Sep–Oct 2011. Percent volume of dry digestible material was calculated using the procedures and correction factors of Hewitt and Robbins (1996).

Food item	% volume	SE	% occurrence
Roots	12.30%	3.56%	26.98%
Grasses and sedges	5.39%	1.98%	42.86%
Forbs	29.08%	4.68%	71.43%
Equisetum	0.06%	0.05%	3.17%
Fruits	7.20%	2.43%	20.63%
Insects	0.54%	0.26%	11.11%
Rodents	0.84%	0.71%	3.17%
Ungulates	14.03%	4.16%	20.63%
Other animal	0.20%	0.20%	1.59%
Whitebark pine seeds	27.31%	4.77%	41.27%
Mushrooms	3.06%	2.15%	3.17%

Discussion

Whitebark pine cone production in 2011 was moderately good, measured at 19.8 cones/live tree on established transects throughout the GYE (Haroldson and Podruzny 2011). We do not have an exact estimate of mature whitebark pine mortality within the Taylor Fork area as of 2011. The mapping effort in 2009 (Macfarlane et al. 2010) showed that most stands in the area had experienced 50% or more overstory mortality, but the mountain pine beetle outbreak was not finished at that time. Despite heavy overstory mortality, the study bears still obtained a significant amount of whitebark pine seeds. Often only 1 or 2 live whitebark trees were visible from excavated middens. The area was open for archery hunting in September, and it is a popular location for elk hunters. While the levels of whitebark pine use observed following these 2 bears was less than that observed prior to the mountain pine beetle outbreak (Mattson et al. 1991*a*), that study did not separate male and female feeding habits. Also, a large proportion of that sample was collected in Yellowstone National Park where bears do not have access to hunting-related elk carcasses. Although whitebark pine mortality during the Teton study was far less extensive, female grizzlies made less use of whitebark pine seeds than we observed in the Taylor Fork area.

Sage Peak, GNF, with beetle-killed and healthy whitebark pine, 2008. Photo courtesy of Shannon Podruzny/IGBST.

Habitat Monitoring

Grand Teton National Park Recreational Use *(Steve Cain, Grand Teton National Park)*

In 2011, total visitation in Grand Teton National Park was 3,866,579 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 2,587,437. Backcountry user nights totaled 28,216. Long and short-term trends of recreational visitation and backcountry user nights are shown in Table 24 and Fig. 18.

Table 24. 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
2002–2011	2,510,955	29,427

[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.

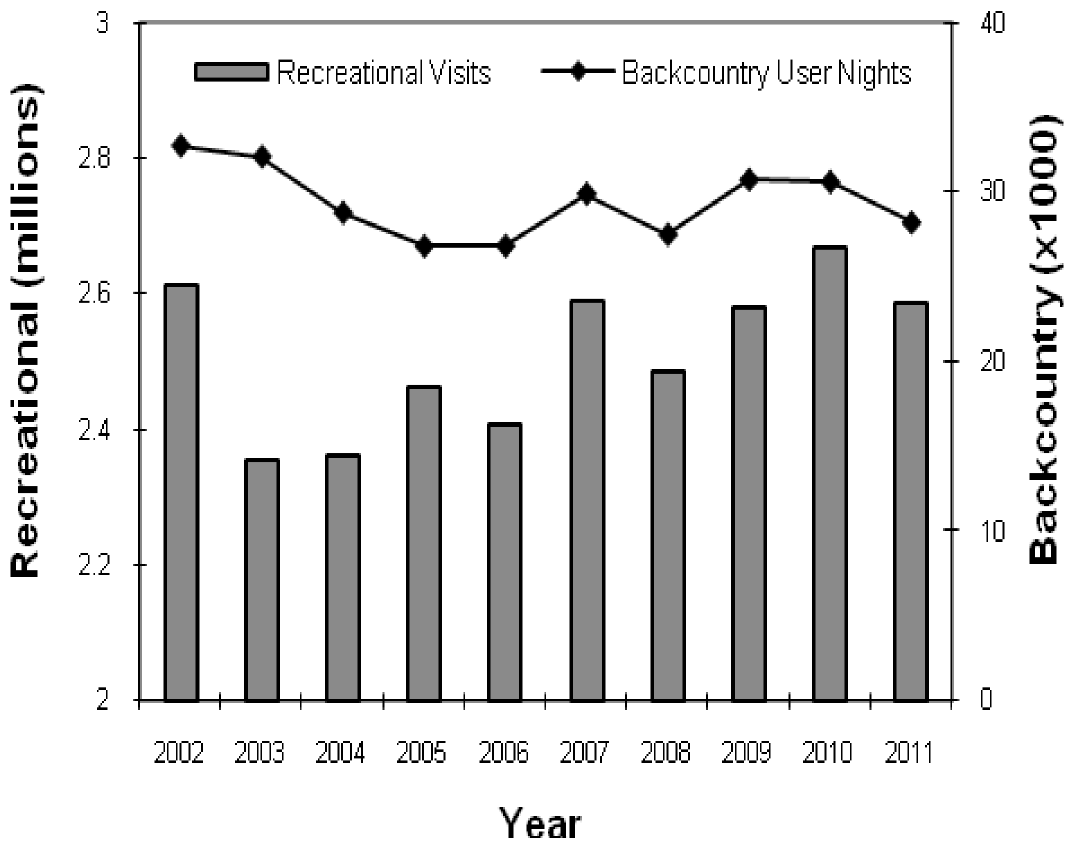

Fig. 18. Trends in recreational visitation and backcountry user nights in Grand Teton National Park during 2002–2011.

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

Total visitation to Yellowstone National Park was 4,369,842 people in 2011 including recreational and non-recreational (e.g., traveling through the Park on U.S. Highway 191 but not recreating) use. Recreational visits in 2011 totaled 3,394,321 the fifth straight year that recreational visitation has topped the 3 million mark. The last 3 years (2009–2011) have been the highest 3 years of recreational visitation ever recorded. Most of YNP's visitation occurs during the 6 month period from May through October. In 2011, there were 3,131,680 recreational visitors (92%) during those peak months, an average of 17,020 recreational visitors per day. In 2011, visitors spent 652,585 user nights camping in developed area roadside campgrounds, and 37,206 user nights camping in backcountry campsites in Yellowstone Park.

Average annual recreational visitation had 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 25). Average annual recreational visitation decreased slightly during 2000–2009, to an average of 2,967,718 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. Average annual backcountry user nights have been less variable between decades than total park visitation, ranging from 39,280 to 45,615 user nights/year (Table 25). The number of backcountry user nights is limited by both the number and capacity of designated backcountry campsites in the park.

Table 25. Average annual visitation, auto campground user nights, and backcountry user nights in Yellowstone National Park by decade from 1895 through 2011.

Decade	Average annual parkwide total recreational visitation	Average annual auto campground user nights	Average annual backcountry user nights
1890s	7,378[a]	Not available	Not available
1900s	17,110	Not available	Not available
1910s	31,746	Not available	Not available
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	300564	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	2,967,718	624,450	40,362
2010s	3,517,253[g]	669,273[g]	41,084[g]

[a] Data from 1895–1899. From 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 the years 1972–1979.
[g] Data for the year 2010 and 2011 only.

Trends in Elk Hunter Numbers within the Grizzly Bear Recovery Zone Plus the 10-Mile Perimeter Area *(Justin G. 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 annually estimate the number of hunters for each big game species. We used state estimates 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 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. Elk hunters were used because they represent the largest cohort of hunters for an individual species. While 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 hunter numbers within areas occupied by grizzly bears in the GYE.

We generated data from all states from 2001 to 2011 (Table 26). Complete data do not exist for all years. While Montana does calculate these numbers, the data are usually not available until the following year. As these data become available they will be added to the revised table in the future.

There has been a significant downward trend in hunter numbers in Idaho, Montana, and Wyoming since 2002 when hunter numbers peaked at 34,879 (Fig. 19). Hunter numbers in Idaho appear to have stabilized around 1,900 since they peaked at 3,619 in 2005. Hunter numbers in Montana peaked at 17,908 in 2002 and since that time have decreased to approximately 12,500. Wyoming has experienced the largest decrease in hunter numbers over the last 10 years. Hunter numbers have decreased from 13,709 in 2002 to fewer than 6,500 in 2011. Both Montana and Wyoming began to decrease the harvest of female elk in the mid 2000s as some elk herds approached their population objectives. Idaho reduced harvest objectives for females in 2008, which accounts for the decrease in hunter numbers in 2008 through 2011.

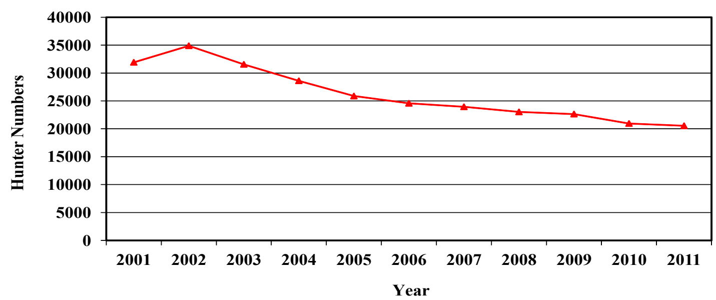

Fig. 19. Trend in elk hunter numbers within the Grizzly Bear Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming, 2001–2011.

Table 26. Estimated numbers of elk hunters within the Grizzly Bear Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming, for the years 2001–2011.

	Year										
State	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Idaho	2,914	3,262	3,285	3,454	3,619	3,016	2,592	1,763	1,819	1,904	1,860
Montana	15,407	17,908	16,489	14,320	12,365	12,211	12,635	12,470	12,382	12,334	12,269
Wyoming	13,591	13,709	11,771	10,828	9,888	9,346	8,716	8,792	8,440	6,712	6,413
Total	31,912	34,879	31,545	28,602	25,872	24,573	23,943	23,025	22,641	20,950	20,542

Grizzly Bear-Human Conflicts in the Greater Yellowstone Ecosystem *(Kerry A. Gunther, Yellowstone National Park; Bryan Aber, Idaho Department of Fish and Game; Mark T. Bruscino, Wyoming Game and Fish Department; Steven L. Cain, Grand Teton National Park; Kevin Frey, Montana Fish, Wildlife and Parks; Mark A. Haroldson and Charles C. Schwartz, Interagency Grizzly Bear Study Team)*

Conservation of grizzly bears in the GYE requires providing secure habitat (Schwartz et al. 2003) and keeping human-caused bear mortality at sustainable levels (IGBST 2005). Most human-caused grizzly bear mortalities are directly related to grizzly bear-human conflicts (Gunther et al. 2004). Grizzly bear-human conflicts may also erode public support for grizzly bear conservation. To effectively allocate resources for implementing management actions designed to prevent grizzly bear-human conflicts, land and wildlife managers need baseline information for the types, causes, locations, and recent trends of conflict incidents. To address this need, we record all grizzly bear-human conflicts reported in the GYE annually. We group conflicts into 6 broad categories using standard definitions (Table 27). To identify trends in areas with concentrations of conflicts, we calculated the 20–80% isopleths for the distribution of conflicts from the most recent 3-year period (2009–2011), using the fixed kernel estimator in the Animal

Table 27. Definitions of terminology.

Term	Definition
Anthropogenic foods	Incidents where grizzly bears obtained human foods including garbage, groceries, grease, pet foods, bird seed, livestock feed, or other edible human-related attractants (Gunther et al. 2004).
Beehives	Incidents where grizzly bears damaged or obtained honey from domestic beehives, colonies, or apiaries (Gunther et al. 2004).
Conflict	Incidents where bears injured 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). Multiple conflicts on the same day by the same bear are recorded as one conflict incident.
Early hyperphagia	The period from 16 Jul through 31 Aug (Mattson et al. 1999). This season is characterized by the onset of hyperphagia (Nelson et al. 1983) and consumption of army cutworm moths (Mattson et al. 1991*b*) and roots (Mattson et al. 1991*a*).
Estrus	The period from 16 May through 15 Jul (Mattson et al. 1999). Activities associated with reproduction (travel, leisure, play) dominate most behavior during this period (Mattson et al. 1991*a*). The primary high quality bear foods consumed during estrus are elk calves (Gunther and Renkin 1990) and over-wintered whitebark pine seeds when present.
Gardens/orchards	Incidents where grizzly bears damaged or consumed fruits or vegetables from gardens and orchards (Gunther et al. 2004).
Human injury	Incidents where grizzly bears killed or injured one or more people, including minor scratches, bites, and contusions (Gunther et al. 2004).
Late hyperphagia	The period from 1 Sep through den entrance (Mattson et al. 1999). The primary high quality bear foods during this season are army cutworm moths (Mattson et al. 1991*b*) and the current year's crop of whitebark pine seeds (Mattson et al. 1992). When the availability of whitebark pine seeds is below average during late hyperphagia, ungulate meat (Mattson 1997), roots, and false truffles become more prominent in the diet of GYE grizzly bears.
Livestock depredation	Incidents where grizzly bears killed or injured domestic cattle, sheep, horses, mules, burros, donkeys, lamas, goats, swine, ducks, geese, turkeys, chickens, rabbits, or other domestic livestock excluding pets (Gunther et al. 2004).
Property damage	Incidents where grizzly bears damaged personal property including camping equipment, vehicles, homes, cabins, sheds, barns, out-buildings, pets, or other personal property, but did not obtain anthropogenic foods (Gunther et al. 2004). If a bear damages property and obtains anthropogenic foods during the same incident, it is recorded in the anthropogenic foods category.
Spring	The period from den emergence through 15 May (Mattson et al. 1999). Winter-killed ungulate carcasses are the primary high quality bear food consumed during spring (Green et al. 1997).

Movements (Hooge and Eichenlaub 1997) extension for ArcView GIS (Environmental Systems Research Institute 2002). Using simple ocular analysis, the 60% isopleth best identified concentrations of conflicts at a scale useful for managers to focus efforts at conflict reduction.

Generally, the frequency of grizzly bear-human conflicts is inversely associated with the 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). However, livestock depredations tend to occur independent of the availability of natural bear foods (Gunther et al. 2004). Where cattle and sheep are available, some grizzly bears will prey on them regardless of the abundance of natural foods.

In 2011, the availability of high quality, concentrated bear foods in the ecosystem was above average during the spring, poor during estrus, average during early hyperphagia, and good during late hyperphagia. During spring, winter-killed ungulate carcasses were abundant on the Northern Ungulate Winter Range and in thermally influenced central interior ungulate winter ranges (see "Spring Ungulate Availability and Use by Grizzly Bears in Yellowstone National Park"). The spring season was exceptionally cold delaying snow melt and the phenological development of bear plant foods. During estrus, vegetal bear foods were scarce and very few spawning cutthroat trout were observed in monitored tributary streams of Yellowstone Lake (see "Spawning Cutthroat Trout"). However, predation on newborn elk calves was frequently observed during the estrus season. During early-hyperphagia many grizzly bears were observed at high elevation army cutworm moth aggregation sites on the eastern side of the ecosystem (see "Grizzly Bear Use of Insect Aggregation Sites Documented from Aerial Telemetry and Observations"). During late hyperphagia, whitebark pine seed production was good throughout most of the ecosystem (see "Whitebark Pine Cone Production").

Table 28. Number of grizzly bear-human conflicts reported by land ownership in the Greater Yellowstone Ecosystem, 2011.

Land owner[a]	Property damages	Anthropogenic foods	Human injury	Gardens/ orchards	Beehives	Livestock depredations	Total conflicts
ID-private	1	12	1	0	0	0	14
ID-state	0	0	0	0	0	0	0
MT-private	3	4	0	2	0	7	16
MT-state	0	0	0	0	0	0	0
WY-private	6	52	1	14	0	21	94
WY-state	1	0	1	0	0	0	2
BLM	0	0	1	0	0	0	1
BDNF	0	0	2	0	0	1	3
BTNF	3	3	1	0	0	41	48
CNF	0	0	0	0	0	0	0
CTNF	0	1	0	0	0	0	1
GNF	7	1	2	0	0	0	10
SNF	3	7	2	4	0	16	32
GTNP/JDR	0	1	1	0	0	0	2
YNP	0	4	2[b]	0	0	0	6
Total	24	85	14	20	0	86	229

[a] BLM = Bureau of Land Management, BDNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger-Teton National Forest, CNF = Custer National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP/JDR = Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway, ID = Idaho, MT = Montana, SNF = Shoshone National Forest, WY = Wyoming, YNP = Yellowstone National Park.

[b] Both resulted in fatalities.

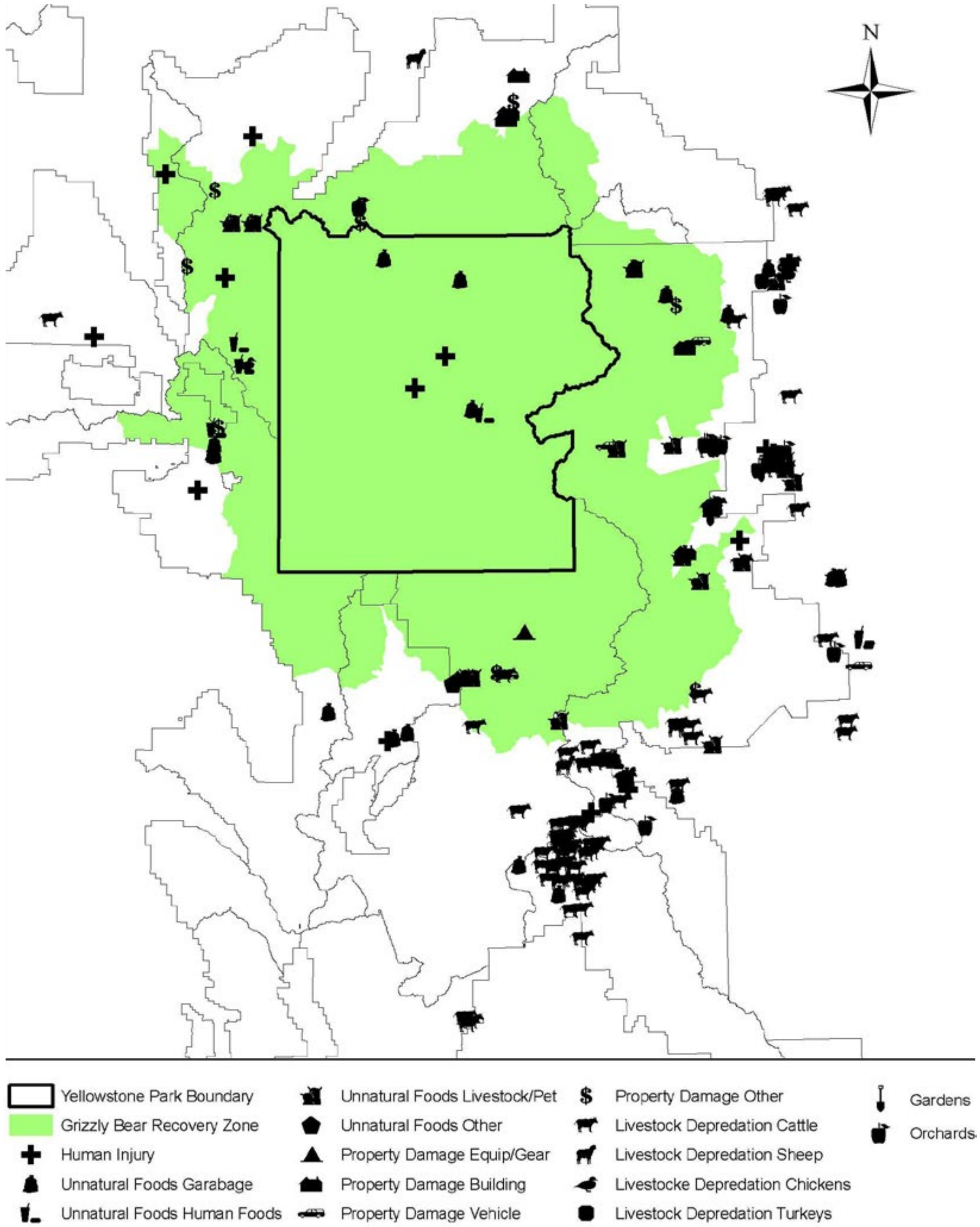

Fig. 20. Locations of grizzly bear-human conflicts reported in the Greater Yellowstone Ecosystem in 2011 (shaded area represents the Yellowstone Grizzly Bear Recovery Zone).

There were 229 grizzly bear-human conflicts reported in the GYE in 2011 (Table 28, Fig. 20), one of the highest conflict years reported since record keeping began in 1992 (Fig. 21). These incidents included bears killing livestock (38%, *n* = 86), damaging property while obtaining anthropogenic foods (37%, *n* = 85), damaging property without obtaining anthropogenic foods (10%, *n* = 24), obtaining vegetables and fruit from gardens and orchards (9%, *n* =20), and injuring people (6%, *n* = 14). The number of incidents where grizzly bears killed livestock, damaged gardens and orchards, and injured people in 2011, were higher than the long-term averages recorded from 1992–2010 (Table 29). Grizzly bears did not damage any beehives in 2011. Use of electric fence to protect apiaries has been very successful at preventing grizzly bears from accessing beehives.

Most (74%, *n* = 170) bear-human conflicts in 2011 occurred outside the Yellowstone ecosystem grizzly bear recovery zone (USFWS 1993). Twenty-six percent (*n* = 59) of the bear-human conflicts occurred inside the Recovery Zone, 37% (*n* = 84) were within 10 miles of the recovery zone boundary,

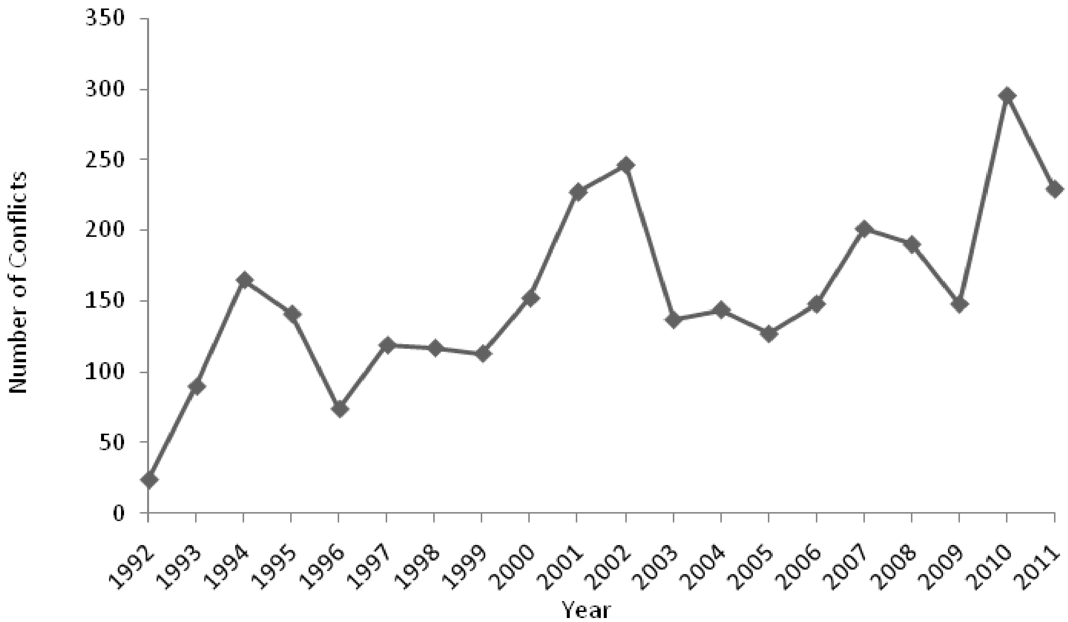

Fig. 21. Number of grizzly bear-human conflict incidents in the Greater Yellowstone Ecosystem, 1992–2011.

Table 29. Comparison between the average annual number of grizzly bear-human conflicts recorded from 1992–2010 and the number reported in 2011, in the Greater Yellowstone Ecosystem.

Type of conflict	1992–2010 Average ± SD	2011
Human injury	5 ± 3	14
Property damage	22 ± 12	24
Anthropogenic foods	59 ± 38	85
Gardens/orchards	7 ± 6	20
Beehives	3 ± 4	0
Livestock depredations	56 ± 22	86
Total conflicts	150 ± 62	229

and 38% (n = 86) were greater than 10 miles outside the recovery zone. Over half (54%, n = 124) of the conflicts occurred on private land in the states of Wyoming (44%, n = 94), Montana (7%, n = 16), and Idaho (6%, n = 14). Forty-six percent (n = 105) of the conflicts occurred on public land administered by the U.S. Forest Service (41%, n = 94), National Park Service (3%, n = 8), state of Wyoming (<1%, n = 2), and Bureau of Land Management (<1%, n = 1).

We identified 4 geographic areas where concentrations of grizzly bear-human conflicts occurred in the GYE over the last 3 years (Fig. 22). These 4 areas contained over half (57%, 385 of 672) of the total conflicts that occurred from 2009–2011, and included: 1) the Green River area (154 conflicts); 2) the North and South Forks of the Shoshone River (125 conflicts); 3) the Clarks Fork area (56 conflicts); and 4) the Gardiner Basin (50 conflicts). These 4 areas should receive priority when allocating state, federal, and private resources available for reducing grizzly bear-human conflicts in the GYE.

Land ownership and management mandates affected patterns of bear-human conflicts observed in the GYE in 2011. On private land, bears damaging property and obtaining anthropogenic foods (garbage, grain, bird seed, dog food, garden vegetables, apples) were the most common conflicts reported (76%, 94 of 124). On U.S. Forest Service lands, livestock depredations were the most common (62%, 58 of 94) type of conflict. On National Park Service lands, we documented only 8 total conflicts, 5 involved bears obtaining anthropogenic foods and 3 involved surprise encounters that resulted in human injuries. Although there were few conflicts on National Park Service lands, management of non-food conditioned, human-habituated bears required considerable management effort. In Grand Teton National Park, 204 roadside traffic-jams caused by visitors viewing habituated grizzly bears along roadsides and the outskirts developments were reported. In Yellowstone National Park, 414 roadside grizzly bear-jams were reported. In both parks, a significant amount of staff time was spent managing habituated bears, the traffic associated with bear-jams, and the visitors that stopped to view and photograph bears.

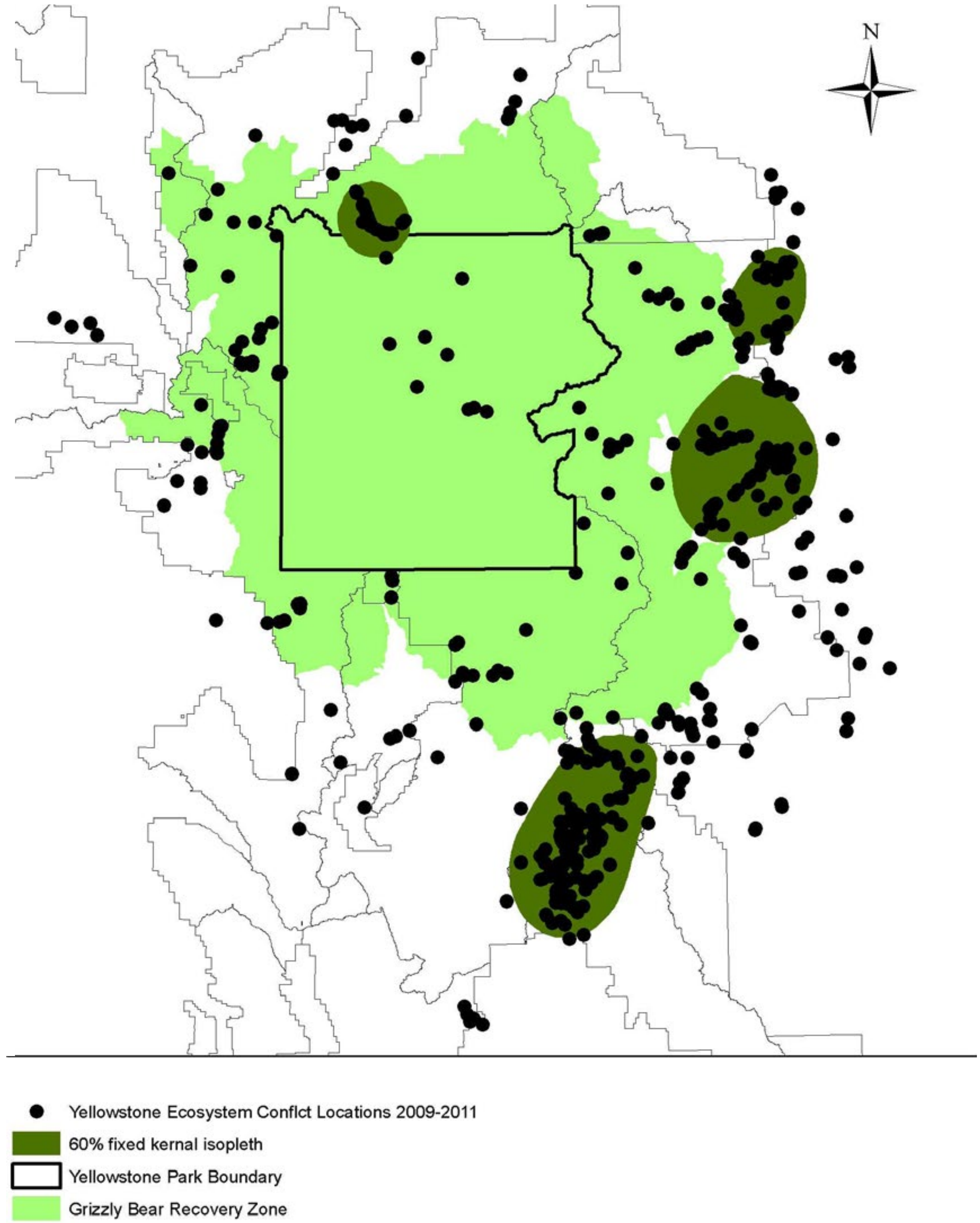

Fig. 22. Concentrations (dark shaded polygons) of grizzly bear-human conflicts that occurred in the Greater Yellowstone Ecosystem from 2009–2011, identified using the 30% fixed kernel isopleths (lightly shaded area represents the Yellowstone Grizzly Bear Recovery Zone).

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Grizzly bear on elk carcass, Pelican Creek, YNP, 17 Jul 2011. Photo courtesy of Steve Ard.

Greater Yellowstone Whitebark Pine Monitoring Working Group

2011 ANNUAL REPORT SUMMARY

Monitoring Whitebark Pine in the Greater Yellowstone Ecoregion

Introduction

Whitebark pine (*Pinus albicaulis*) occurs at high-elevations and in subalpine communities in the Pacific Northwest and Northern Rocky Mountains. It is a key component in the upper ranges of these ecosystems where it provides a multitude of ecological functions, including regulating runoff by slowing the progress of snowmelt and providing high energy food sources to birds and mammals. Whitebark pine often grows in locations that are inhospitable to other tree and vegetative species, though once it has populated an area, it creates favorable habitat that enables other species to colonize. By generating these beneficial microenvironments, whitebark pine plays a significant role in forest successional processes and promotes diversity (Tomback and Kendall 2001). As a stone pine species, it produces indehiscent cones and relies primarily on birds for seed dispersal (McCaughey and Schmidt 2001). High in calories and rich in fat, these seeds provide seasonal forage for a variety of wildlife. In addition to its ecological importance in high elevation ecosystems, whitebark pine is a revered icon for backcountry explorers and mountain recreationists.

Whitebark pine, in mixed and dominant stands, occurs in over two million acres within the six national forests and two national parks that comprise the Greater Yellowstone Ecosystem (GYE) (Greater Yellowstone Coordinating Committee Whitebark Pine Subcommittee [GYCCWPS] 2010).

Currently, whitebark pine is being impacted by multiple ecological disturbances. Substantial declines in whitebark pine populations have been documented throughout its range. White pine blister rust (*Cronartium ribicola*), mountain pine beetle (*Dendroctonus ponderosae*), and wildfires all pose significant threats to the persistence of healthy whitebark pine populations on the landscape.

Interagency Whitebark Pine Monitoring Program

Under the auspices of the Greater Yellowstone Coordinating Committee (GYCC), the National Park Service Inventory and Monitoring Program and several other agencies began a collaborative, long-term monitoring program to track and document the health and status of whitebark pine across the GYE. This alliance resulted in the formation of the Greater Yellowstone Whitebark Pine Monitoring Working Group (GYWPMWG), which consists of representatives from the U.S. Forest Service (USFS), U.S. Fish and Wildlife Service (USFWS), National Park Service (NPS), U.S. Geological Survey (USGS), and Montana State University (MSU). A protocol for monitoring the health and status of whitebark pine populations in the GYE was developed between 2004 and 2007 by the GYWPMWG. After rigorous peer review, the Interagency Whitebark Pine Monitoring Protocol for the Greater Yellowstone Ecosystem (GYWPMWG 2011) received final approval in 2007 and was recently updated in 2011. This report presents a summary of the data collected by the monitoring program between 2004 and 2011.

Monitoring Objectives

Generally, the objectives of the whitebark pine monitoring program are to detect and monitor changes in the health and status of whitebark pine populations across the GYE due to infection by white pine blister rust, attack by mountain pine beetle, and damage by other environmental and anthropogenic agents. Specifically, the Interagency Whitebark Pine Monitoring Protocol addresses the following four objectives:

Objective 1 - To estimate the proportion of live whitebark pine trees (>1.4 m tall) infected with white pine blister rust, and to estimate the rate at which infection of trees is changing over time.
Objective 2 - Within transects having infected trees, to determine the relative severity of infection of white pine blister rust in whitebark pine trees >1.4 m tall.
Objective 3 - To estimate survival of individual whitebark pine trees >1.4 m tall explicitly taking into account the effects of white pine blister rust infection rates and severity, mountain pine beetle activity, fire, and other damaging agents.
Objective 4 - To assess and monitor recruitment of whitebark pine understory individuals (<1.4 m tall) into the cone producing population (a pilot effort was initiated in 2010 and will be implemented in 2012).

Study Area

The study area is within the GYE and includes six national forests and two national parks (the John D. Rockefeller Memorial Parkway is included with Grand Teton National Park) (Figure 1). The target population is all whitebark pine trees in the GYE. The sample frame includes stands of whitebark pine approximately 2.5 ha or greater within and outside of the grizzly bear Recovery Zone (RZ). A total of 10,770 mapped whitebark polygons or stands were identified in the mapping process with 2,362 located within the RZ and 8,408 located outside of the RZ. Stands within the RZ were derived from the cumulative effects model for grizzly bears while outside the RZ, the sample frame includes whitebark stands mapped by each of the six separate USFS units and compiled by the NPS for the cumulative effects model effort (Dixon 1997). Areas that burned since the 1988 fires were excluded from the sample frame.

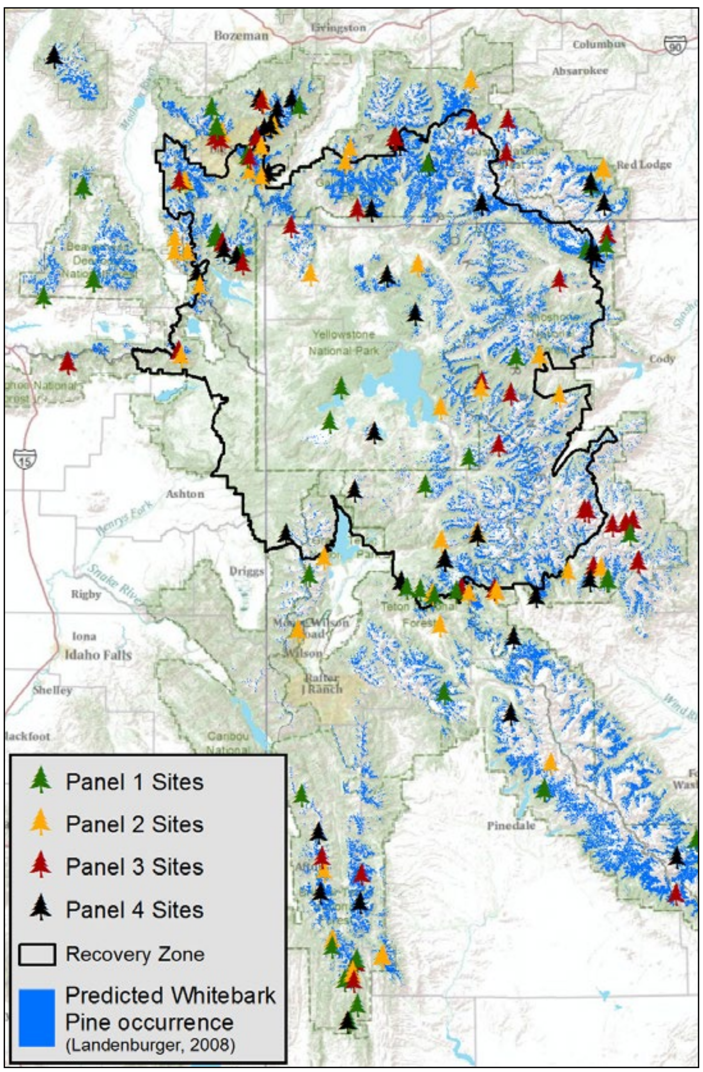

Figure 1. Location of whitebark pine survey transects in the Greater Yellowstone Ecosystem. Panel 1, 2, 3, and 4 had a full resurvey for white pine blister rust infection in 2008, 2009, 2010, and 2011 respectively.

NPS/JOHN FOTHERGILL

Methods

Details of the sampling design and field methodology can be found in the Interagency Whitebark Pine Monitoring Protocol for the GYE (GYWPMWG 2011). The basic approach is a two-stage cluster design with stands (polygons) of whitebark pine being the primary units and 10x50 m transects being the secondary units. Initial establishment of permanent transects took place between 2004 and 2007; during this period, 176 permanent transects in 151 whitebark pine stands were established and 4,774 individual trees >1.4 m tall were permanently marked in order to estimate changes in white pine blister rust infection and survival rates over an extended period. The sample of 176 transects is a probabilistic sample that provides statistical inference to the GYE.

In 2008, individual transects were randomly assigned to one of four panels; each panel consists of approximately 44 stands. This is the number of transects that can be realistically visited in a given field season by one, two-person field crew. Sampling every four years is sufficient to detect change in blister rust infection, however, with the recent increase in whitebark pine mortality due to mountain pine beetle, the monitoring group became concerned that a four year revisit interval might not be sufficient to document overall mortality of whitebark pine trees >1.4 m tall. In response, we temporarily modified the revisit design to incorporate the dynamic nature of the current mountain pine beetle epidemic to a two-year revisit schedule. With this design, two of the four panels are surveyed annually; one panel is subject to the full survey documenting white pine blister rust infection and mountain pine beetle indicators while the second panel is subject to a partial survey focused solely on mountain pine beetle indicators. Both surveys record tree status as live, dead, or recently dead.

Eighty-five transects were resurveyed in 2008, 90 in 2009, 88 in 2010, and 87 in 2011 by two, two-person crews, one led by the NPS Greater Yellowstone Inventory & Monitoring Network (GRYN) and the other led by the USGS Interagency Grizzly Bear Study Team (IGBST).

Results

Status of White Pine Blister Rust

The 2007 baseline estimate of the proportion of live whitebark pine trees infected with white pine blister rust in the GYE is 0.20 (± 0.037 se) (GYWPMWG 2008). This estimate is based on data from 4,774 individual live trees in 176 transects collected over a four-year period between 2004 and 2007 after all transects and tree records were established. In Table 1, we report the estimates of the proportion of whitebark pine trees infected with white pine blister rust based on the resurveys of panels 1, 2, 3, and 4 conducted in 2008, 2009, 2010, and 2011 respectively. The estimates for proportion of live trees infected only infer to each panel for the year they are resurveyed. It should be recognized that these estimates do not denote a cumulative proportion of live trees infected from 2008 to 2011.

Table 1. Design based ratio estimates for the proportion of infected whitebark pine trees >1.4 m tall in panel 1, 2, and 3 and 4 other summary information (Irvine 2010).

2008 [Panel 1] Location	**Within Recovery Zone**	**Outside Recovery Zone**	**Total for Panel 1**
Number of stands	15	22	37
Number of transects	15	27	42
Number of unique trees sampled	323	661	984
Number of transects infected	13 of 15	19 of 27	32 of 42
Proportion of live trees infected	0.137	0.281	0.249
Proportion of live trees infected Standard Error (SE)	0.055	0.037	0.031
Confidence Interval (CI) for proportion of live trees infected	[0.018, 0.255]	[0.205, 0.357]	[0.186, 0.312]
2009 [Panel 2] Location	**Within Recovery Zone**	**Outside Recovery Zone**	**Total for Panel 2**
Number of stands	17	21	38
Number of transects	17	28	45
Number of unique trees sampled	295	684	979
Number of transects infected	13 of 16	26 of 28	39 of 44
Proportion of live trees infected	0.16	0.465	0.398
Proportion of live trees infected Standard Error (SE)	0.066	0.062	0.051
Confidence Interval (CI) for proportion of live trees infected	[0.019, 0.300]	[0.336, 0.595]	[0.296, 0.501]
2010 [Panel 3] Location	**Within Recovery Zone**	**Outside Recovery Zone**	**Total for Panel 3**
Number of stands	16	22	38
Number of transects	16	29	45
Number of unique trees sampled	370	675	1,045
Number of transects infected	11 of 16	24 of 29	35 of 45
Proportion of live trees infected	0.128	0.102	0.108
Proportion of live trees infected Standard Error (SE)	0.042	0.07	0.055
Confidence Interval (CI) for proportion of live trees infected	[0.037, 0.218]	[-0.043, 0.248]	[-0.005, 0.220]
2011 [Panel 4] Location	**Within Recovery Zone**	**Outside Recovery Zone**	**Total for Panel 4**
Number of stands	16	21	37
Number of transects	18	26	44
Number of unique trees sampled	168	1022	1190
Number of transects infected	16 of 18	25 of 26	41 of 44
Proportion of live trees infected	0.23	0.25	0.25
Proportion of live trees infected Standard Error (SE)	0.118	0.073	0.062
Confidence Interval (CI) for proportion of live trees infected	[-0.017, 0.485]	[0.097, 0.400]	[0.119, 0.372]


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Upon completion of the 2011 field season, all panels were resurveyed once for white pine blister rust infection. From these combined data between 2004-2007 and 2008-2011, we will present a step-trend analysis on white pine blister rust change, severity of infection, and survival of whitebark pine in the GYE.

White pine blister rust infection remains widespread throughout the ecosystem. Decreases in white pine blister rust infection observed on some transects are most likely an artifact of increased mortality on the transect due to mountain pine beetle infestation or wildfire. Increases in white pine blister rust infection are explained by the actual increase in observable infection on trees within a transect.

Status of Tree Survival

To determine whitebark pine mortality, we resurvey all transects to reassess the status of permanently tagged trees >1.4 m tall. We subtract the total number of resurveyed dead tagged trees from the total number of live tagged trees recorded during initial establishment period from 2004 to 2007. By the end of 2011, we observed a total of 977 dead tagged whitebark pine trees within the boundaries of the permanent monitoring transects; this equates to a loss of approximately 20% of the original live tagged tree sample (Figure 2). While transects are experiencing varying degrees of mortality, they are also experiencing varying degrees of recruitment. Once a whitebark pine tree within the transect boundary reaches a height greater than 1.4 m tall, it is permanently tagged and included in the live, tree sample. As of 2011, 3,767 (79%) of the originally marked trees remained alive, 30 trees were not relocated (1%), and an additional 301 new trees were added (Table 2).

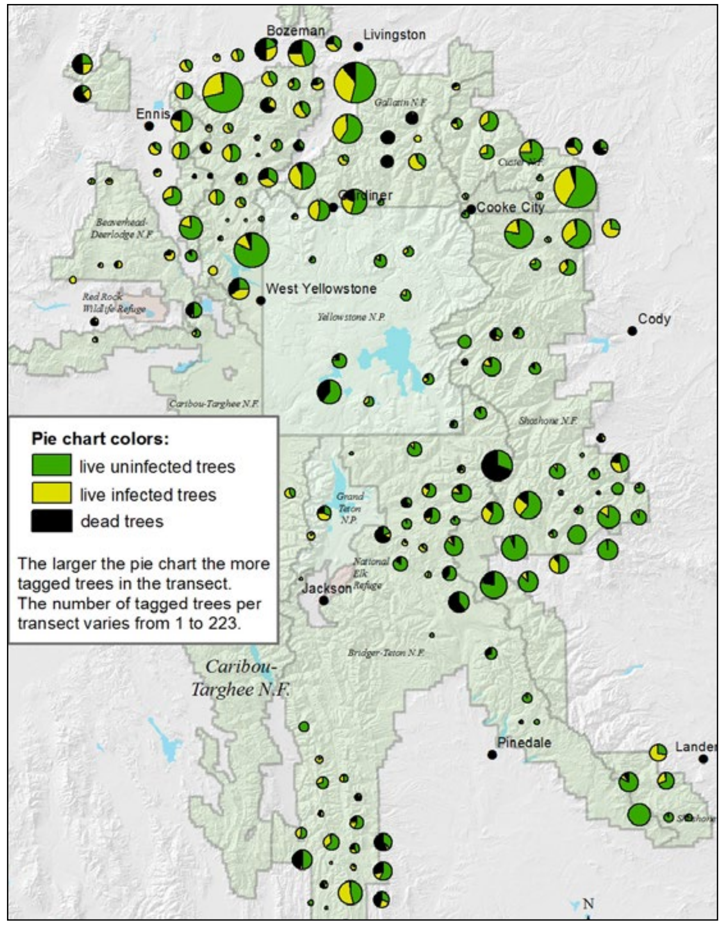

Figure 2. Preliminary map of the ratio of whitebark pine trees within each transect as alive, dead or with the presence of blister rust infection from surveys 2004-2011. The infection status ranges from a tree with a single canker on a branch to a tree that may have a bole canker.

Table 2. Mortality and recruitment status of whitebark pine trees from 2008-2011 that were marked in 2004-2007. The new recruits were not included in the calculations of the proportion of dead and live trees.

2004-2007 transect establishment	2008-2011 resurvey results				
Live trees tagged	Total dead trees (from original 4,774 tagged)	% dead tagged trees	% live, tagged trees	% tagged trees not relocated	New recruits added (not included in percentages)
4,774	977	20%	80%	1%	301

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Presence of Mountain Pine Beetle

High elevation forests across the GYE are experiencing elevated mortality as a result of the current mountain pine beetle epidemic. Mountain pine beetle exhibit a propensity for attacking whitebark pine trees that are 10 cm DBH and greater. Trees that are less than 10 cm DBH are not large enough to successfully support mountain pine beetle brood (Amman et al. 1977); consistent with this observation, tree mortality observed in transects was much greater in trees >10 cm DBH. By the end of 2011, we found that 33% (n=775) of the trees >10 cm DBH had died, whereas only 8% (n=202) of the trees ≤10 cm had died (Figure 3).

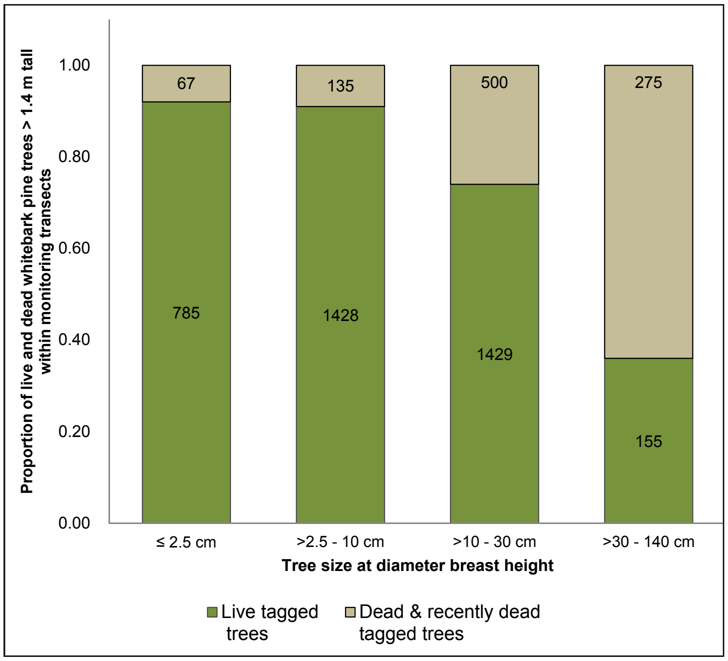

Figure 3. Proportion of live, dead, and recently dead tagged whitebark pine > 1.4 m tall within the monitoring transects by size class. A recently dead tree has persistent non-green needles, whereas a dead tree has shed all of its needles. These values are based on the original sample (4,774) and do not include the 301 trees that have been added since initial establishment. Dead and recently dead could be from any number of causes such as mountain pine beetle, fire, windthrow, or unknown.

Of the resurveyed trees that were recorded as dead since initial transect establishment, approximately 71% had J-shaped galleries present underneath the bark. Similar to white pine blister rust infection, mountain pine beetle infestation is widespread and varies in severity throughout the GYE. Of the 176 established transects, 111 have recorded evidence of mountain pine beetle infestation while 65 have no observed evidence of mountain pine beetle infestation (Figure 4).

NPS/JOHN FOTHERGILL

Whitebark pine tree showing blister rust infection.

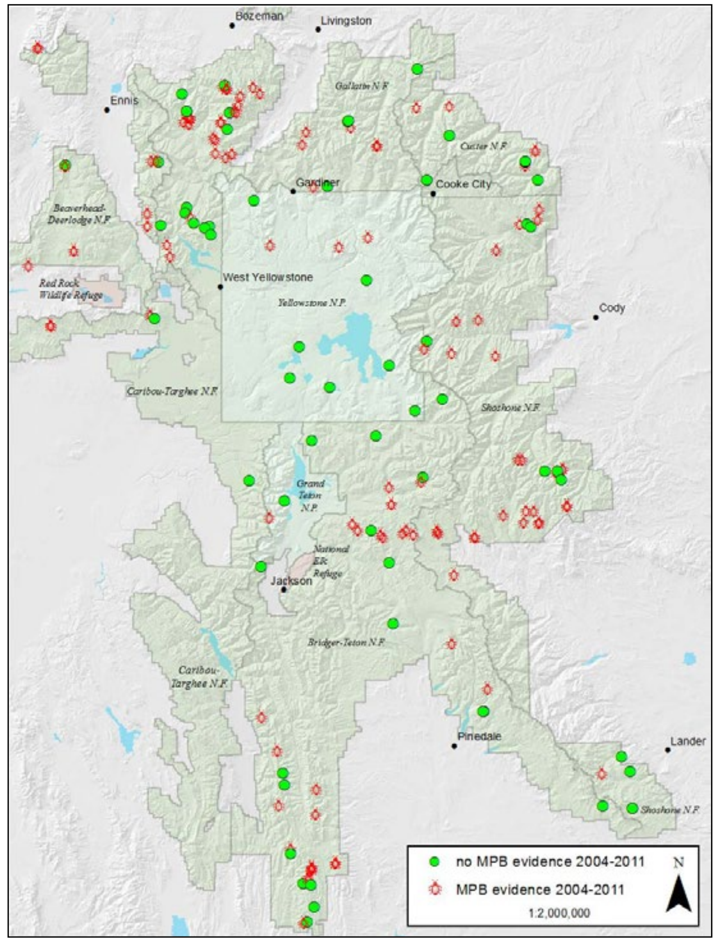

Figure 4. Location of transects throughout the GYE with and without evidence of mountain pine beetle infestation.

Future Direction

This year, 2012, will mark the beginning of the second complete revisit of panels 1 through 4 following the panel revisit schedule in Figure 2. In addition, we will commence implementation of Objective 4 of the protocol to assess and monitor the recruitment of whitebark pine understory individuals into the cone producing population as well as collect baseline data on whitebark pine demographics.

This long-term monitoring program provides critical information that will help determine the likelihood of whitebark pine persisting as a functional and vital part of the ecosystem. In addition, data from this program are currently being used to inform managers, guide management strategies and restoration planning, and substantiate conservation efforts throughout the GYE. The interagency protocol has also been a valuable resource for a variety of agencies embarking on five-needle pine monitoring including the Greater Yellowstone Coordinating Committee's Whitebark Pine Strategy for the Greater Yellowstone Area (GYCCWPS 2011).

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Greater Yellowstone Whitebark Pine Monitoring

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2011 Grizzly Bear Habitat Monitoring Report
compiled by the
Greater Yellowstone Area Grizzly Bear Habitat Modeling Team

Recent Actions

On 22 November 2011, the Ninth Circuit Court of Appeals upheld a Montana federal district court's decision to maintain federal protective status to the Greater Yellowstone Area grizzly population. The court order (9th Cir. 2011) effectively nullified the 2007 delisting of the Yellowstone grizzly and reinstated threatened designation to the population under the Endangered Species Act of 1973 . The court's opinion affirmed the district court's ruling that the U.S. Fish and Wildlife Service (USFWS) failed to articulate a rational connection between the data in the record and its determination that whitebark pine declines were not a threat to the Yellowstone grizzly population. In this same court ruling, the U.S. Court of Appeals partially reversed the district court's decision by upholding the USFWS plaintiff's argument that existing regulatory mechanisms are adequate to maintain a recovered Yellowstone grizzly population.

This decision, according to USFWS's grizzly bear coordinator Chris Servheen, fundamentally endorses the *Final Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area* (U.S. Fish and Wildlife Service 2007*a*) as a "gold plated" management plan for the Yellowstone grizzlies (Los Angeles Times 2011). The USFWS meanwhile plans to pursue a new proposal to delist the Yellowstone grizzly bear. The argument for delisting will be built upon the assemblage and analysis of a strong body of scientific information which clarifies the relationship between whitebark pine and grizzly recovery. With the recent reinstatement of federal protection over the Yellowstone grizzly bear, the Conservation Strategy is no longer a legally binding document. However, regardless of the bear's legal status, state and federal managers throughout the ecosystem are committed to continue working together under the framework of the Conservation Strategy to ensure that healthy and viable habitat endures for the long-term growth and sustainability of the Yellowstone grizzly population.

Background

The Conservation Strategy for grizzly bear management in the Yellowstone Ecosystem was developed as a coordinated inter-agency and multi-state management plan to guide the long-term management of a recovered and delisted grizzly bear population. The Strategy effectively serves as a Memorandum of Understanding between state and federal agencies that formalizes a series of standards and monitoring requirements for assessing the health and status of Yellowstone grizzly bears, their food sources, and their habitat. The Strategy's habitat monitoring standards were incorporated into the National Forest Plans and the National Park Superintendent's Compendia of the 6 national forests and the 2 national parks comprising the Greater Yellowstone Ecosystem (GYE).

***Habitat Standards and Monitoring Protocol inside the Grizzly Bear Recovery Zone*:**
Habitat standards formalized by the Conservation Strategy apply only inside the Grizzly Bear Recovery Zone (GBRZ), a 9,210 mi^2 secure haven at the core of the GYE that harbors 84 to 90 percent of the population's female grizzlies with cubs. The recovery zone is divided into 18 bear management units (BMU) which are collectively divided further into a total of 40 bear management subunits (BMS) (Figure 1). Unit delineations were crafted into smaller areas so that impacts from human activity could be evaluated at a scale relevant to bear movement. BMUs were designed to correspond roughly to the lifetime range of an adult female grizzly bear while subunits approximate the annual range of an adult female grizzly bear. The Strategy's habitat standards are reported per BMS and were implemented to maintain habitat conditions throughout the recovery zone as they existed in 1998. This 1998 "baseline" was predicated on evidence that habitat conditions at that

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[1] The terminology *Grizzly Bear Recovery Zone* (GBRZ) is also referred to as the *Primary Conservation Area* (PCA). The 2 different terms reflect the current legal status of the bear, and are employed when the bear is listed versus delisted, respectively.

time, and indeed throughout the 1990s, supported a growing bear population (Eberhardt et al. 1994, Boyce et al. 2001, USFWS 2007*b*). Because 1998 signifies a benchmark in grizzly bear recovery, it was chosen as the standard against which all future habitat comparisons are to be made. Three habitat standards formulated in the Conservation Strategy require that the following attributes be maintained at, or improved upon, that which existed in 1998:

1. percentage of secure habitat
2. number and capacity of developed sites
3. number of commercial grazing allotments and permitted sheep animal months

These 3 attributes are linked to human activities that potentially contribute to the mortality and displacement of grizzly bears. By targeting attributes associated with human activities, the habitat standards provide land managers some discretionary control to limit the negative impacts of human disturbance. All 3 of these factors are to be maintained, monitored and reported annually against the 1998 baseline.

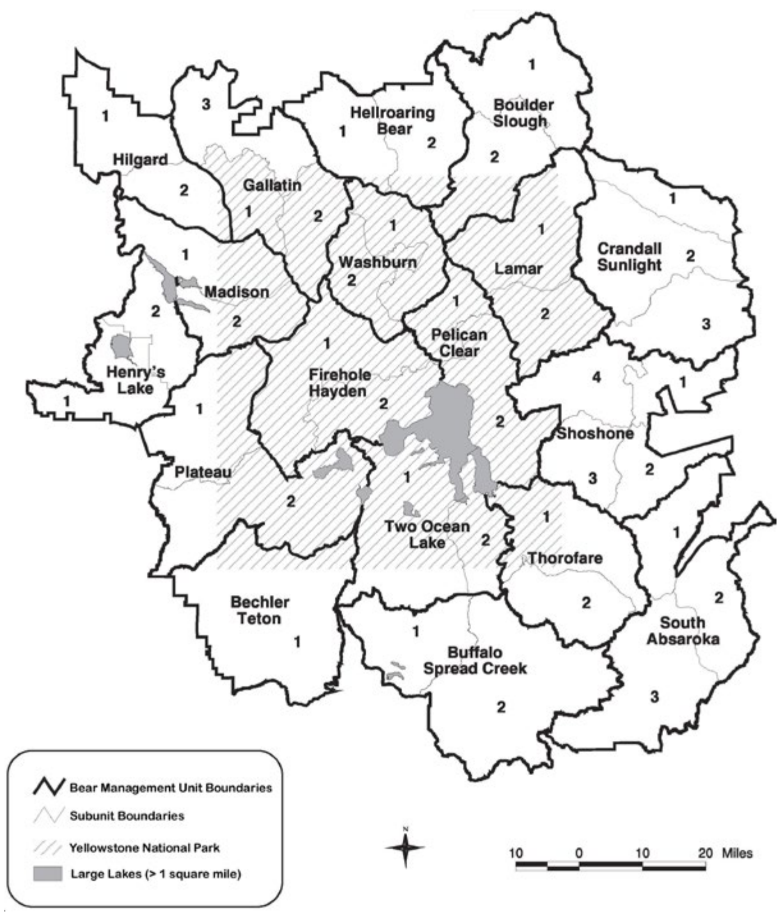

Figure 1. Bear management units and subunits inside the Grizzly Bear Recovery Zone.

In conjunction with the habitat standards, several other pertinent habitat factors require monitoring to track the overall condition of habitat for bears in the GBRZ. Monitoring protocol requires that seasonally open motorized access route density (OMARD), total motorized access route density (TMARD), and grizzly bear conflicts pertaining to livestock grazing allotments must be reported annually inside the GBRZ. OMARD is the percentage of each bear management subunit where open motorized route density is *greater than 1 mile per square mile*. TMARD, which accounts for all motorized routes (including those with seasonal closures), refers to percent area with total motorized route density *greater than 2 miles per square mile*.

***Monitoring Protocol outside the Grizzly Bear Recovery Zone*:**
Additional monitoring protocol for areas outside the GBRZ was established in the Conservation Strategy to support and encourage the recovery of the Yellowstone grizzly bear population and their expansion outside the recovery zone boundary into areas designated "biologically suitable and socially acceptable" for grizzly bear occupancy. Lands inside the GBRZ are managed primarily to maintain grizzly bear habitat, whereas lands outside the GBRZ are managed with more consideration for human use (U.S. Fish and Wildlife Service 1993:17–18). Forty-three bear analysis units (BAUs) established outside the GBRZ correspond to areas where state and federal agencies currently manage for grizzly bear populations (Figure 2). BAUs were designed in a manner consistent with bear management subunits inside the GBRZ. Monitoring protocol requires that changes in secure habitat on forest lands outside the recovery zone be reported biennially (every 2 years) per BAU. Secure analysis was last reported for areas outside the GBRZ in 2010 and consequently will be summarized again in the 2012 report.

Figure 2. Bear Analysis Units outside the Grizzly Bear Recovery Zone (GBRZ) on the national forests in the Greater Yellowstone Ecosystem. Simple hatched area is the GBRZ and Grand Teton National Park. Crosshatched bear analysis units are not currently evaluated, as they are considered socially unacceptable for grizzly bear occupancy in Wyoming.

Introduction

This report is the collective annual response by the national forests and national parks within the GYE to the commitments outlined in the Conservation Strategy and Forest Plan Amendment to monitor and report habitat standards for the Yellowstone grizzly bear population. Information cited in this report was compiled to evaluate the current status of grizzly bear habitat inside the recovery zone as measured against the 1998 baseline standards. In compliance with the monitoring protocol specified in the Conservation Strategy, this report documents all permanent and temporary changes that occurred in 2011 inside the GBRZ pertaining to the following factors affecting grizzly bear habitat: (1) seasonal and total road densities, (2) percent secure habitat, (3) number and capacity of human developed sites, (4) number of commercial livestock grazing allotments and permitted sheep animal months (AMs), and (5) number of grizzly bear/livestock conflicts occurring on commercial grazing allotments both inside and outside the GBRZ. The first 3 items are reported per BMS while the last 2 are reported per administrative unit. All categories, except livestock conflict information, are measured and compared against the 1998 baseline.

Monitoring for Livestock Grazing

Number of Allotments and Sheep Animal Months inside the GBRZ

The livestock allotment standard established in the Conservation Strategy ensures that there will be *no increase in commercial livestock grazing allotments or any increase in permitted sheep AMs* inside the GBRZ from that which existed in 1998. Animal months are calculated by multiplying the permitted number of sheep times the months of permitted use 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 and Park lands within the GBRZ. They do not include horse grazing areas associated with outfitters in backcountry situations or livestock grazing on private in-holdings. Allotments are categorized as "active", "vacant", or "closed". An active allotment is one with an active permit to be grazed; however, a "no-use" permit can be granted if a permittee chooses not to graze that year. 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 to resolve resource conflict issues or other concerns. A closed allotment is one that has been permanently de-activated such that commercial grazing will not be permitted to occur anytime in the future.

Changes in Allotments since 1998

Commercial livestock grazing on public lands inside the GBRZ has decreased measurably since 1998. In 1998 there were 71 active cattle allotments being grazed inside the GBRZ and another 12 vacant allotments. Since then, 4 of the active allotments have been permanently closed to commercial grazing and 12 have been vacated and are no longer being actively grazed. Of the 12 vacant cattle allotments present in 1998, 1 was reactivated in 2007 (Meadow View allotment on the Caribou-Targhee National Forest), 4 have since been permanently closed, and 7 have remained vacant up until the present.

Domestic sheep allotments inside the recovery zone have mostly been phased out since 1998. Of the 11 sheep allotments that were active in 1998, only the Meyers Creek allotment on the Caribou-Targhee remains active today. Nine of these 11 sheep allotments have been permanently closed to all commercial grazing, while 1 was vacated. Of the 7 sheep allotments that were vacant in 1998, 6 have been permanently closed, while 1 remains vacant today and has not been grazed since 1998. Sheep AMs have diminished from a total of 23,090 permitted in 1998 to 870 in 2011.

Allotment Changes in 2011

There were very few changes in the status and number of cattle and sheep allotments inside the GBRZ during 2011 (Table 1). Two cattle allotments on the Gallatin National Forest (Mill Creek and Section 22) changed from an active status to vacant. As of 2011, 59 active cattle allotments and 17 vacant allotments remain inside the PCA. The only remaining active domestic sheep allotment inside the recovery zone (Meyers Creek, Caribou-Targhee NF) took a "no-use" permit again in 2011. Consequently, no commercial grazing of domestic sheep has occurred inside the recovery zone for at least the past 3 years. As a side note, a recent correction to the number of current livestock allotments inside the recovery zone belatedly accounts for the permanent closure in 2006 of the only cattle grazing allotment remaining inside Grand-Teton National Park. The Pacific Creek allotment had been vacant for many years and was permanently closed in 2006 when the permittee was provided an alternative grazing location outside of the recovery zone.

Table 1. Number of commercial livestock grazing allotments and sheep animal months inside the Grizzly Bear Recovery Zone (GBRZ) in 1998 and 2011.

	Cattle/Horse Allotments				Sheep Allotments				Sheep Animal Months	
	Active		Vacant		Active		Vacant			
Administrative Unit	1998 Base	Current 2011	1998 Base	Current 2011	1998 Base	Current 2011	1998 Base	Current 2011	1998 Base	Current 2011
Beaverhead-Deerlodge NF	3	3	2	0	0	0	0	0	0	0
Bridger-Teton NF	9	6	0	2	0	0	0	0	0	0
Caribou-Targhee NF (1)	11	9	1	3	7	1	4	0	14,163	870
Custer NF	0	0	0	0	0	0	0	0	0	0
Gallatin NF (2)	23	15	9	13	2	0	3	2	3,540	0
Shoshone NF	24	24	0	0	2	0	0	0	5,387	0
Grand Teton NP (3)	1	0	0	0	0	0	0	0	0	0
Total in GBRZ	71	57	12	18	11	1	7	2	23,090	870

(1) *The Meyers Creek allotment, the only domestic sheep allotment remaining inside the GBRZ, took a "no lease" permit this past year. No sheep were grazed on this allotment in 2011.*

(2) *The Mill Creek and Section 22 cattle allotments in the Gallatin NF went from "active" to "vacant" in 2011.*

(3) *The Pacific Creek cattle allotment was permanently closed in 2006 but not reported until 2011.*

Livestock Conflicts Inside and Outside the GBRZ

Grizzly bear conflicts associated with livestock depredation are reported on an annual basis for all commercial grazing allotments and forage reserves on federal lands located within the GYE. Persistent conflicts between livestock and grizzly bears have historically led to the relocation or removal of grizzly bears. This section summarizes the reported annual incidences of grizzly bear depredation on livestock occurring on commercial grazing allotments maintained on Forest and Park lands throughout the ecosystem. Livestock related conflicts are considered recurring if 3 or more years of recorded conflict have occurred on a given allotment during the most recent 5-year period. Allotments with recurring conflicts are to be monitored, evaluated, and phased out as the opportunity arises with willing permittees. Several cattle and sheep allotments that have experienced persistent conflicts in the past have since been closed or are now vacant.

<u>Livestock Conflicts in 2011</u>

A total of 58 grizzly bear/livestock conflicts, occurring on 16 commercial grazing allotments throughout the GYE, were reported in 2011. The number of conflicts per allotment is reported in column 8 of Table 2. All of these conflicts involved livestock depredation, and collectively resulted in the death of 40 calves, 1 cow, and 5 sheep by grizzly bears. Another 13 calves, 1 heifer, and 6 sheep were injured by grizzlies. Two calves had to be euthanized due to their injuries. Ninety-seven percent of the reported conflicts occurred outside the Grizzly Bear Recovery Zone, with the majority (53%) occurring on the Green River grazing allotment in the north zone of the Bridger-Teton National Forest. Management actions in response to the 2011 depredation conflicts led to the removal of 3 male and 1 female grizzly bears from the Yellowstone population. Figure 3 illustrates the spatial distribution of sheep and cattle conflict occurrences on federal lands in 2011.

Recurring Conflicts in 2011

Nine commercial grazing allotments within the GYE were sources of recurring conflicts over the past 5 years (Table 2). During this 5-year time span, 68% of all 272 reported livestock conflicts occurred on allotments characterized by recurring depredation. The vast majority of recurring conflicts (90%) occurred outside the GBRZ. Recurring conflicts on the Bridger-Teton and Shoshone National Forests collectively accounted for 93% of such conflicts (62% and 31%, respectively), whereas the remaining 7% occurred on the Caribou-Targhee National Forest. The Upper Green River cattle allotment located on the Pinedale Ranger District of the Bridger-Teton National Forest has persistently been a chronic hotspot of livestock/grizzly bear conflicts. Over the past 5 years, 106 recurring conflicts were reported on the Upper Green, accounting for 39% of all depredation conflicts on Forest lands throughout the GYE. During this same 5 year period, 11 male and 1 female grizzly bear were euthanized in response to depredatory conflicts occurring on grazing allotments located on National Forest land within the GYE. All 12 bear removals occurred on allotments experiencing recurring conflicts. Ten of the 12 management removals were directly related to depredatory conflicts on the Upper Green River allotment.

Table 2. Commercial livestock allotments with documented grizzly bear conflicts during the past 5 years. Allotments with conflicts occurring in 3 of the last 5 years are considered to be recurring conflicts.

			Conflicts					
Allotment Name	**Total Acres**	**Percent inside GBRZ**	**2007 (Y/N)**	**2008 (Y/N)**	**2009 (Y/N)**	**2010 (Y/N)**	**2011 (number of conflicts)**	**Recurring conflicts (Y or N)**
Beaverhead-Deerlodge National Forest								
Bufiox	13,077	0%	N	N	N	N	1	N
West Fork	53,093	0%	Y	N	N	N	0	N
Bridger-Teton National Forest								
Badger Creek	7,254	0%	N	N	Y	Y	0	N
Beaver-Horse	25,358	0%	Y	N	N	N	0	N
Crow's Nest	3,640	0%	N	N	N	N	1	N
Elk Ridge Complex	30,577	0%	N	Y	Y	Y	2	**Y**
Fish Creek	111,835	35%	N	N	N	N	2	N
Green River Drift	1,002	0%	N	N	N	N	1	N
Noble Pasture	762	0%	N	N	N	Y	1	N
Sherman C&H	8,287	0%	N	N	N	Y	3	N
Turpin Meadow	1,493	100%	N	N	N	N	1	N
Upper Green River	131,944	0%	Y	Y	Y	Y	31	**Y**
Caribou-Targhee National Forest								
Antelope Park	14,492	0%	N	N	N	Y	0	N
Bootjack	8,468	100%	N	N	N	Y	0	N
Gerritt Meadows	1,096	0%	N	Y	N	N	0	N
Palisades	16,812	0%	N	N	Y	N	0	N
Squirrel Meadows	28,797	100%	Y	Y	Y	Y	0	**Y**

Table 2. Continued.

Allotment Name	Total Acres	Percent inside GBRZ	Conflicts 2007 (Y/N)	2008 (Y/N)	2009 (Y/N)	2010 (Y/N)	2011 (number of conflicts)	Recurring conflicts (Y or N)
Shoshone National Forest								
Bald Ridge	24,853	23%	N	N	N	Y	0	N
Basin	73,115	99%	Y	Y	N	N	0	N
Bear Creek	33,672	0%	N	Y	N	N	0	N
Belknap	13,049	100%	N	N	Y	Y	0	N
Bench (Clarks Fork)	28,751	16%	Y	Y	Y	Y	1	**Y**
Crandall	30,089	100%	N	Y	N	Y	0	N
Dick Creek	9,569	0%	N	N	N	Y	0	N
Face of the Mtn.	8,553	0%	N	Y	N	Y	0	N
Fish Lake	12,742	0%	Y	Y	N	N	0	N
Hardpan Table Mtn.	13,474	63%	N	Y	N	N	0	N
Horse Creek	29,980	62%	N	Y	N	N	2	N
Little Rock	4,901	0%	N	N	N	Y	0	N
Parque Creek	13,528	34%	Y	N	Y	Y	0	**Y**
Piney	14,287	0%	N	N	Y	Y	1	**Y**
Salt Creek	8,263	0%	N	Y	N	N	0	N
Table Mtn.	13,895	100%	Y	N	N	N	0	N
Union Pass	39,497	0%	N	Y	Y	Y	1	**Y**
Warm Springs.	16,875	0%	Y	N	N	N	3	N
Wiggins Fork	37,653	0%	N	Y	Y	Y	3	**Y**
Wind River	44,158	34%	Y	N	Y	Y	4	**Y**

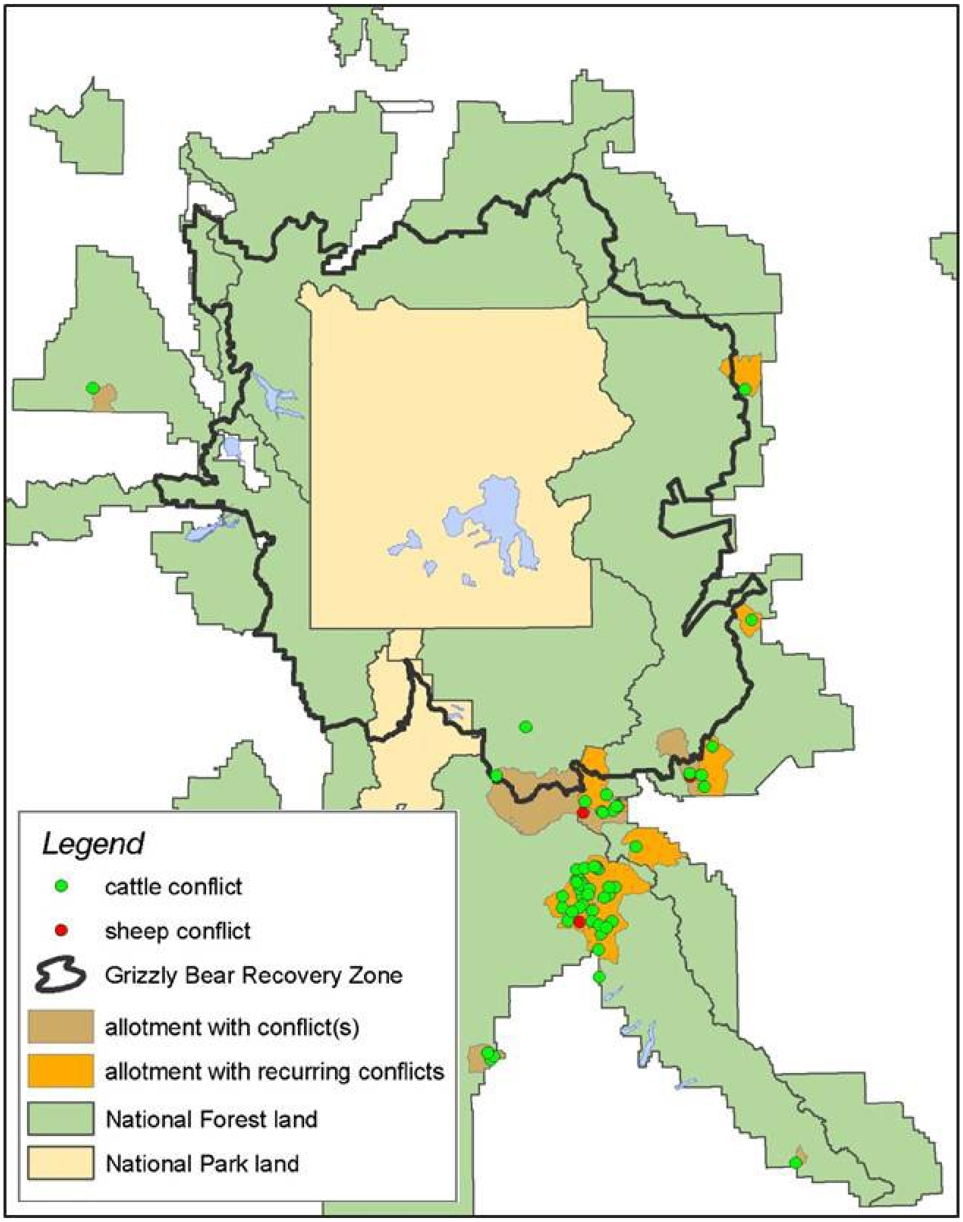

Figure 3. Distribution of grizzly bear/livestock conflicts reported in 2011.

Monitoring for Developed Sites

The Conservation Strategy standard for developed sites within the GBRZ requires that the number and capacity of developed sites be maintained at or below the 1998 level. A developed site includes, but is not limited to sites on public land that are developed or improved for human use. Such sites include, but are not limited to campgrounds, developed trailheads, lodges, administrative sites, service stations, summer homes, restaurants, visitor centers, and permitted natural resource extraction/exploration sites such as oil and gas exploratory wells, production wells, mining activities, and related work camps. Any proposed increase, expansion, or change of use of developed sites from the 1998 baseline inside the GBRZ will be thoroughly analyzed, and potential impacts (detrimental and positive) documented through biological evaluation or assessment by the action agency. Mitigation of detrimental impacts must occur within the affected subunit to offset the nature and extent of potential deleterious effects. Improvements or reductions in developed sites that result in beneficial habitat conditions for grizzly bears may be implemented. These improvements may be banked to mitigate equivalent impacts of future proposed site development, expansion, or change of use within the same subunit. 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. Developments on private land are not counted against this standard.

Changes in Developed Sites since 1998

Developed sites inside the GBRZ have decreased in number from 592 sites in 1998 to 584 sites in 2011 (Table 3). Although there has been a net decline in the total number of developed sites overall within the GBRZ, the Hilgard #2 bear management subunit has had an increase of 1 developed site since 1998. This increase occurred when a trailhead in subunit #1 was moved from one side of the road to the other (in subunit #2). Although this transfer technically accounted for an increase in developed sites on Hilgard #2, it was determined to have no measurable impact to the grizzly bear and did not violate the intent of the developed site standard. Since 1998, 6 subunits inside the GBRZ have had a reduction of 1 developed site each, and another subunit (Hilgard #1) decreased by 3. For a complete summary of all documented changes in developed sites, and associated mitigation action since 1998, please refer to Attachment C of this Report.

Changes in Number of Developed sites in 2011

Crandall/Sunlight Subunit #1: Enhancements of the Island Lake Campground on the Shoshone National Forest, completed in 2011, led to the addition of 6 new campsites within the existing campground footprint. No new road construction occurred, nor was there an infringement upon existing secure habitat as a result of the campground improvement. The increase in overnight capacity was compensated for by the closure of 6 dispersed campsites in the Long Lake area (a few miles east of the Island Lake campground) as well as the permanent closure in 2010 of approximately 1.1 km (0.7 mi) of road accessing the dispersed sites. The number and location of dispersed sites within the Crandall/Sunlight #1 BMS will be monitored annually for at least 5 years to determine: a) whether or not the closure of the Long Lake sites is effective, and b) whether new dispersed sites are appearing as a result of the closure. This monitoring will have the added benefit of indicating whether additional future closures of dispersed campsites within this BMS would be warranted.

Gallatin Subunit #2: Several administrative out-buildings at the Stephens Creek Government Horse Corral in Yellowstone National Park were permanently removed and replaced with a new barn in the same location. This action was determined to have no detrimental effect on grizzly bears, and no further mitigation was required.

Henrys Lake Subunit #2: The removal of the DeFosses Cabin in 2011 led to a reduction of developed sites on the Caribou-Targhee portion of the Henrys Lake subunit #2. The number of developed sites on the Henrys Lake subunit exceeded the 1998 baseline level in 2006 when the Reas Pass day-use site was added on the Gallatin portion of the subunit. The rationale for the Reas Pass site was to provide a small concentrated day-use site with bear-resistant garbage containers and an outhouse, to eliminate the recurring problem of dispersed trash and garbage from heavy day-use occurring along a major motorized route. Partial mitigation for this site came from the closure of the Tepee Creek snowmobile parking area in the adjacent Madison #1 subunit. The recent removal of the DeFosses cabin brings the number of developed sites on the Henrys Lake #2 subunit back to the level existing in 1998. This reduction in the number of developed sites is reflected in Table 3.

Lamar Subunit #1: The Lamar River picnic area near the Buffalo Ranch was removed and the area reclaimed in 2000. However, due to an oversight, this removal did not get recorded in the 1998 baseline database. The closure of the picnic area is presented in this report as a correction to the 1998 baseline database and accounts for the reduction of 1 developed site in the Yellowstone portion of the Lamar subunit #1 as represented in Table 3.

Table 3. The 1998 baseline and the 2011 numbers of developed sites on public lands within each of the Bear Management Subunits in the Greater Yellowstone Ecosystem.

Bear Management Subunit	Admin units (1)	Total number of developed sites in subunit 1998 Base	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)		Change in number of sites from 1998 Base (+ or -)
			1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2021	
Bechler-Teton #1	CTNF	60	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	4	4	10	10	0	0	
Boulder-Slough #1	CNF	20	0	0	0	0	1	1	0	0	0	0	0	0	6	6	0
	GNF		0	0	1	1	6	6	0	0	1	1	3	3	2	2	
Boulder-Slough #2	GNF	9	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	BTNF	18	0	0	1	1	1	1	0	0	0	0	2	2	0	0	0
	GTNP		0	0	0	0	7	7	2	2	2	2	3	3	0	0	
Buffalo-Spread Creek #2	BTNF	22	1	1	4	4	3	3	3	3	5	5	5	4	1	1	-1
Crandall-Sunlight #1	SNF	23	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	SNF	18	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	SNF	11	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	YNP	26	0	0	1	1	5	5	1	1	6	6	13	13	0	0	0
Firehole-Hayden #2	YNP	15	0	0	1	1	3	3	1	1	2	2	8	8	0	0	0
Gallatin #1	YNP	4	0	0	0	0	3	3	0	0	1	1	0	0	0	0	0
Gallatin #2	YNP	21	0	0	2	2	5	5	1	1	12	12	1	1	0	0	0
Gallatin #3	GNF	17	0	0	2	2	9	9	0	0	0	0	6	6	0	0	0
	YNP		0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Hellroaring-Bear #1	GNF	35	0	0	5	5	11	11	0	0	3	3	6	6	8	8	0
	YNP		0	0	0	0	1	1	0	0	0	0	1	1	0	0	
Hellroaring-Bear #2	GNF	4	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	CTNF	20	2	2	3	3	1	1	0	0	3	3	10	10	1	0	-1
Henrys Lake #2	CTNF	18	0	0	0	0	1	1	0	0	1	0(4)	1	1	1	1	-1
	GNF		5	5	3	3	4	4	0	0	0	0	2	3	0	0	
Hilgard # 1	BDNF	14	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	

Table 3. Continued.

Bear Management Subunit	Admin units [1]	Total number of developed sites in subunit 1998 Base	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]		Change in number of sites from 1998 Base (+ or -)
			1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2021	
Hilgard # 2	GNF	9	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	YNP	37	0	0	1	1	5	5	0	0	3	3	2	1 [5]	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	YNP	4	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0
Madison #1	GNF	21	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	GNF	25	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	YNP	2	0	0	0	0	2	2	0	0	0	0	0	0	0	0	0
Pelican-Clear #2	YNP	13	0	0	1	1	4	4	1	1	4	4	3	3	0	0	0
Plateau #1	CTNF	3	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	CTNF	7	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	SNF	9	1	1	2	2	0	0	0	0	0	0	6	6	0	0	0
Shoshone #2	SNF	2	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
Shoshone #3	SNF	4	2	2	0	0	1	0	1	1	0	0	0	0	0	0	-1
Shoshone #4	SNF	23	3	3	3	2	3	3	6	6	0	0	8	9	0	0	0
South Absaroka #1	SNF	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
South Absaroka #2	SNF	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
South Absaroka #3	SNF	15	1	1	3	3	4	4	1	1	1	1	5	4	0	0	-1
Thorofare #1	BTNF	4	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	BTNF	2	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
	NP		0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Table 3. Continued.

Bear Management Subunit	Admin units [1]	Total number of developed sites in subunit 1998 Base	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]		Change in number of sites from 1998 Base (+ or -)
			1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2011	1998 Base	2021	
Two Ocean Lake #1	YNP	14	0	0	2	2	3	3	1	1	3	3	2	2	0	0	0
	BTNF		0	0	1	1	0	0	0	0	0	0	0	0	0	0	
	YNP		0	0	0	0	1	1	0	0	0	0	1	1	0	0	
Two Ocean Lake #2	BTNF	4	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0
	GTNP		0	0	0	0	0	0	0	0	1	1	1	1	0	0	
Washburn #1	YNP	25	0	0	2	2	8	8	2	2	7	7	6	6	0	0	0
Washburn #2	YNP	12	0	0	1	1	6	6	0	0	1	1	4	4	0	0	0
Total GBRZ	**ALL**	**592**	**24**	**24**	**67**	**66**	**161**	**160**	**28**	**28**	**117**	**114**	**167**	**164**	**28**	**27**	**-8**

[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 coded as Major Developed Areas. However, these sites are a combination of recreation facilities and administrative facilities. Changes in use or capacity will be evaluated based on whether the use is recreational or administrative. Individual buildings or other facilities within these areas are not tracked individually.

[3] Mining claims with Plans of Operations are considered developed sites for this baseline. Not all sites currently have active projects.

[4] The DeFosses cabin on the Caribou-Targhee portion of Henrys Lake subunit #2 was permanently removed.

[5] The Buffalo Ranch picnic area in the Yellowstone National Park portion of the Lamar subunit #1 was closed and reclaimed in 2000, but mistakenly did not get recorded in the 1998 baseline database until 2011.

Monitoring for Secure Habitat and Motorized Route Density Inside the GBRZ

Maintaining or improving grizzly bear secure habitat at or above 1998 levels in each bear management subunit inside the GBRZ is required under the Conservation Strategy and Forest Plan Amendment. Although the Conservation Strategy does not have legal imperative when the listing of the grizzly bear is re-instated, commitment to maintaining secure habitat at or above 1998 levels will continue to remain a desired objective. Secure habitat is defined as any contiguous area ≥10 acres and more than 500 meters away from an open or gated motorized route. Gated routes that are permanently closed to the public, yet remain potentially accessible by administrative personnel are still considered open-motorized and hence, detract from secure grizzly bear habitat. Lakes larger than 1 square mile in spatial extent are excluded from secure analysis. Annual reporting of changes in secure habitat is required for areas inside the GBRZ and in alternating years for areas outside the recovery zone.

It should be noted that most gains in secure grizzly bear habitat are achieved through the decommissioning of motorized roads and trails. A route is considered decommissioned when it has been effectively treated on the ground so that motorized access by the public and by administrative personnel is permanently restricted, and the route no longer functions as a motorized pathway. Road decommissioning can range from the complete obliteration of the road prism on one end of the spectrum, to physical barriers permanently blocking the entrance points of the road to all motorized traffic. The former method results in restoration of land to a pre-existing natural state while the latter leaves the road surface intact, allowing the area to naturally revegetate with time. For the purpose of monitoring grizzly bear habitat, the prime objective of decommissioning is to limit the negative impacts associated with motorized access.

Unlike secure habitat, there are no mandatory standards for maintenance of motorized route density. However, changes in this parameter will be monitored and reported annually. According to the monitoring protocol of the Conservation Strategy, 2 route density values are to be reported on an annual basis: 1) seasonal open motorized access route density (OMARD) greater than 1 mile per square mile, and 2) total motorized access route density (TMARD) greater than 2 miles per square mile. In almost all cases TMARD is less than OMARD because it includes only those areas with a higher concentration of roads (2 miles per square mile as opposed to 1 mile per square mile for OMARD). Seasonal OMARD is calculated for Season 1 (1 Mar through 15 Jul) and Season 2 (16 Jul through 30 Nov). Motorized access is not monitored from 1 December through the end of February when grizzly bears are assumed to be denning. All open motorized routes (including seasonal and yearlong restricted routes) are accounted for in TMARD regardless of public accessibility. Decommissioned roads do not contribute to seasonal or total road density. Increases in road density do not necessarily lead to a diminishment of secure habitat. If new roads are built in areas with relatively high road density, that area may already be non-secure and therefore would not impinge upon existing secure habitat. Refer to Attachment A and Attachment B for a comprehensive summary of the habitat standards and monitoring rules.

Permanent Changes in Secure Habitat, OMARD, and TMARD since 1998

Since 1998 there has been no net decline in the amount of secure habitat measured in any of the 40 bear management subunits within the recovery zone (Table 4). Conversely, over the past 13 years, secure habitat has incrementally increased in 15 subunits. Two subunits in particular, Gallatin #3 and Hilgard #1, show significant increases in secure habitat of 13.7% and 4.4%, respectively. The substantial improvements seen in these 2 subunits are partly attributable to efforts associated with the *Gallatin Range Consolidation Act* which resulted in the trade of timber (mostly from outside the GBRZ) for land inside the recovery zone. Lands acquired via these exchanges were previously private corporate timber lands which subsequently underwent considerable road decommissioning upon completion of the sales. Incremental gains in secure habitat throughout the ecosystem are primarily achieved by decommissioning of motorized routes. Since 1998, approximately 606 km (377 miles) of open motorized routes (trails and roads) on federal lands throughout the ecosystem have been permanently closed to motorized use. Roughly 78% of the decommissioning efforts occurred inside the GBRZ. These closures have accounted for a net gain of 148 km^2 (57 mi^2) in secure habitat since 1998.

The decommissioning of motorized routes inside the GBRZ accounts for the net decrease in TMARD exhibited in 14 bear management subunits (Table 4). Changes seen in seasonal OMARD are the result of either decommissioning or seasonal access restrictions. The most significant change in motorized route density has occurred on the Gallatin subunit #3, with a decrease of 15.1% in seasonal OMARD and 10% in TMARD. Motorized routes constitute the fundamental metric of secure habitat. Table 4 summarizes the permanent change in secure habitat, seasonal OMARD, and TMARD for each subunit within the grizzly bear recovery zone.

Table 4. 1998 Baseline and 2011 for open motorized access route density (OMARD), total motorized access route density (TMARD), and secure habitat for 40 Bear Management Unit (BMU) subunits in the Greater Yellowstone Area.

	OMARD % > 1 mi/mi²						TMARD % > 2 mi/mi²			% Secure Habitat			Square Miles (excluding lakes)		
	Season 1 (1 Mar–15 Jul)			Season 2 (16 Jul–30 Nov)											
BMU subunit Name	1998	2011	% chg	1998	2001	% chg	1998	2011	% chg	1998	2011	% chg	Subunit	1998 Secure Habitat	2011 Secure Habitat
Bechler/Teton	17.0	16.9	-0.1	17.0	16.9	-0.1	5.8	5.8	0.0	78.1	78.1	0.0	534.3	417.0	417.0
Boulder/Slough #1	3.2	3.2	0.0	3.2	3.2	0.0	0.3	0.3	0.0	96.6	96.6	0.0	281.9	272.2	272.2
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	11.5	0.0	5.3	5.3	0.0	88.3	88.3	0.0	219.9	194.1	194.1
Buffalo/Spread Creek #2	14.5	15.3	0.8	15.6	14.8	-0.8	12.7	12.5	-0.2	74.3	74.3	0.0	507.6	377.2	377.3
Crandall/Sunlight #1	13.3	12.9	-0.4	19.3	18.9	-0.4	7.2	6.7	-0.5	81.1	81.4	0.3	129.8	105.2	105.6
Crandall/Sunlight #2	15.6	15.2	-0.4	16.6	16.4	-0.2	11.7	11.6	-0.1	82.3	82.3	0.0	316.2	260.3	260.3
Crandall/Sunlight #3	14.4	14.3	-0.1	19.2	19.1	-0.1	10.6	10.6	0.0	80.4	80.7	0.3	221.8	178.3	178.9
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	3.0	-0.6	3.6	3.0	-0.6	0.5	0.5	0.0	96.3	96.9	0.6	127.7	122.9	123.7
Gallatin #2	9.5	9.5	0.0	9.5	9.5	0.0	4.5	4.5	0.0	90.2	90.2	0.0	155.2	139.9	139.9
Gallatin #3	46.0	30.8	-15.1	46.0	30.8	-15.1	22.9	12.9	-10.0	55.3	68.9	13.7	217.6	120.2	150.0
Hellroaring/Bear #1	22.4	21.3	-1.1	23.1	22.0	-1.1	15.8	14.6	-1.2	77.0	77.6	0.6	184.7	142.2	143.4
Hellroaring/Bear #2	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	99.5	99.5	0.0	228.9	227.8	227.8
Henry's Lake #1	49.0	49.0	0.0	49.0	49.0	0.0	31.2	31.2	0.0	45.4	46.1	0.7	191.2	86.8	88.1
Henry's Lake #2	49.9	48.8	-1.1	49.9	48.8	-1.1	35.2	31.3	-3.9	45.7	47.5	1.8	140.2	64.1	66.6
Hilgard #1	29.0	23.5	-5.6	29.0	23.5	-5.6	15.3	8.5	-6.8	69.8	74.1	4.4	201.2	140.3	149.2
Hilgard #2	21.0	20.5	-0.5	21.0	20.5	-0.5	13.6	11.8	-1.7	71.4	73.1	1.7	140.5	100.4	102.8
Lamar #1	9.9	9.8	0.0	9.9	9.8	0.0	3.8	3.7	-0.1	89.4	89.4	0.0	299.9	268.1	268.1
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 4. Continued.

	OMARD % > 1 mi/mi^2						TMARD % > 2 mi/mi^2			% Secure Habitat			Square Miles (excluding lakes)		
	Season 1 (1 Mar–15 Jul)			Season 2 (16 Jul–30 Nov)											
BMU subunit Name	1998	2011	% chg	1998	2001	% chg	1998	2011	% chg	1998	2011	% chg	Subunit	1998 Secure Habitat	2011 Secure Habitat
Madison #1	29.2	28.9	-0.3	29.5	29.2	-0.3	12.5	11.5	-1.1	71.5	71.8	0.3	227.9	162.9	163.7
Madison #2	33.7	32.9	-0.8	33.7	32.9	-0.8	24.0	21.4	-2.6	66.5	67.3	0.8	149.4	99.4	100.6
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	20.6	-1.5	22.2	20.8	-1.4	12.9	10.3	-2.6	68.8	70.9	2.1	286.3	197.0	203.0
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	1.1	0.0	98.5	98.5	0.1	122.2	120.3	120.4
Shoshone #2	1.3	1.3	0.0	1.3	1.3	0.0	0.7	0.7	0.0	98.8	98.8	0.0	132.4	130.9	130.9
Shoshone #3	3.9	2.9	-0.9	3.8	2.9	-0.9	2.1	1.6	-0.5	97.0	97.7	0.8	140.7	136.5	137.6
Shoshone #4	4.5	4.5	0.0	5.3	5.3	0.0	2.9	2.9	0.0	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	3.5	0.0	3.5	3.5	0.0	0.3	0.3	0.0	96.3	96.3	0.0	371.9	358.3	358.3
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
PCA Mean / Total Area	**12.3**	**11.6**	**-0.7**	**12.7**	**12.0**	**-0.7**	**6.7**	**5.9**	**-0.8**	**85.6**	**86.2**	**0.6**	**9025.4**	**7724.5**	**7781.9**

Permanent Changes in OMARD, TMARD, and Secure Habitat in 2011

Very little change in motorized routes, and hence secure habitat, was reported inside the Grizzly Bear Recovery Zone during 2011. Most of the changes inside the recovery zone were due to decommissioning efforts incurred on the Gallatin National Forest in conjunction with implementation of the new Forest Travel Plan. The following is a summary per bear management subunit of changes in OMARD, TMARD, and secure habitat for 2011.

Hellroaring-Bear #1 subunit: Approximately 4.1 km (2.5 mi) of open motorized access routes in the southern portion of the Hellroaring-Bear #1 subunit on the Gallatin National Forest were decommissioned in 2011. Measures for closure consisted of a combination of recontouring and rip/slash on spur routes in the Bear Creek and Darroch Creek area just outside of the Absaroka-Beartooth Wilderness area. Due to the close proximity of existing motorized routes, these closures had negligible impact (less than 1 hundredth of a percent) on OMARD, TMARD, and secure habitat.

Henrys Lake #2 subunit: Decommissioning efforts accounted for an increase of 1.5% in secure habitat on the Gallatin National Forest portion of the Henrys Lake #2 subunit. Approximately 12.2 km (7.6 mi) of gated administrative routes on the Hebgen Lake District, south of Earthquake Lake, were officially decommissioned. An additional 1 km (0.6 mi) of motorized route crossing the Nez Perce National Historic Trail immediately west of the continental divide was also permanently closed to all motorized traffic. Collectively, these closures led to incremental reduction in OMARD and TMARD of 0.6% and 2.2%, respectively.

Hilgard #1 subunit: A total of 4.1 km (2.5 miles) of closures occurred in several disparate spots on this subunit which straddles the Gallatin and Beaverhead-Deerlodge National Forests. All closures took place on the Gallatin portion since no motorized routes reside on the Beaverhead-Deerlodge half, which is mostly designated wilderness. Closures consisted of 1.1 km (0.7 mi) of old logging road off of Buck Creek road, 2.2 km (1.4 mi) of spur routes off of Taylor Fork road, and 0.8 km (0.5 mi) of user-created route near Cameron draw. Collectively, these closures accounted for 0.1% and 0.3% decline in OMARD and TMARD respectively. There was no significant change (less than 1 tenth of a percent) in secure habitat.

Hilgard #2 subunit: This subunit which falls on the Hebgen Lake District of the Gallatin National Forest showed a decrease of 0.25% in TMARD due to peripheral closures implemented in the adjacent subunit to the north (Hilgard #1 subunit). The Taylor Fork and Cameron Draw decommissions reported for Hilgard #1 occurred along the shared border between the 2 Hilgard subunits, leading to the small reduction in TMARD reported for Hilgard #2. No measurable changes in OMARD or secure habitat occurred in this subunit.

Plateau #1 subunit: A minor increase of 0.1 percent in TMARD was reported for this subunit which lies partially on the Hebgen Lake District of the Gallatin National Forest. This increase in route density was due to the construction of a new connector route which closes the loop between ATV routes #1756 and #1757 south of the Rendezvous Ski area and north of Frog Pond. The connector route spans a distance of 1.2 km (0.7 mi) but is completely contained within the nonsecure buffers of the 2 pre-existing ATV routes. Because of this proximity to existing routes it had no impact on secure habitat.

Temporary Changes to Secure Habitat in 2011

Projects that temporarily affect secure habitat are allowed under the Conservation Strategy but must adhere to the application rules for temporary changes to secure habitat (Attachment B). A project is one that results in a temporary reduction in secure habitat inside the GBRZ due to changes in motorized access routes. Projects typically involve the building of new roads, reconstructing existing roads, and or opening permanently restricted roads. Application standards require that only 1 temporary project may be active at any given time in a particular subunit. Also, the total acreage of secure habitat affected by the project within a given BMU must not exceed 1% of the total acreage of the largest subunit within that BMU. To qualify as a temporary project, implementation will last no longer than 3 years and secure habitat must be restored within 1 year upon termination of the project.

Three temporary projects were operational inside the GBRZ during 2011. All 3 of these projects occurred on the Shoshone National Forest, with 2 on the Crandall/Sunlight #2 subunit, and a third on the South Absaroka #2 subunit (Table 5). The 2 concurrent Crandall/Sunlight subunit projects were consistent with Conservation Strategy standards since one of these projects (Hunter Peak) restricted all motorized use to existing Forest Service roads and consequently, had no measurable impact on secure habitat during 2011. An additional temporary project on the Buffalo/Spread Creek #2 subunit in the Bridger-Teton National Forest was closed in 2011. Below is a brief summary of the temporary projects of 2011.

Buffalo Valley Timber Sales – Bridge-Teton National Forest
Two timber sales initiated under the *Buffalo Valley Fuels Management Project* were successfully terminated in 2011. Harvest operations associated with the Turpin Meadows sale did not require construction of new temporary road access, however, activity associated with the Blackrock-Hatchet sale had required 2.1 km (1.3 mi) of new temporary road in the Buffalo/Spread Creek #2 subunit located on the north zone of the Bridger Teton National Forest. The intent of the harvest operations was to reduce existing hazardous fuel loadings, remove beetle-killed snags, and reduce ladder fuels within the Turpin Meadows, Hatchet Ranch, and Blackrock Ranger Station areas. Further mechanical treatment and 2 prescribed burns are still scheduled to occur in the next 1 to 3 years. However, future motorized activities will be limited to existing roads and will not require construction of new temporary motorized access routes. The last of the temporary roads associated with the Blackrock-Hatchet timber sale were effectively decommissioned and rehabbed during 2011, restoring secure habitat to pre-project conditions. Since no further road construction is slated for the Buffalo Valley Fuels Management project, this project is considered closed with respect to monitoring grizzly bear secure habitat.

Reef Creek Timber Sale - Shoshone National Forest
The *Reef Creek Timber Sale* in the North Zone of the Shoshone National Forest was initiated in 2010 as part of the larger *Upper Clarks Fork Vegetation Management Project*. Although harvest activities were completed by the end of 2010, one portion of a temporary road remained open at the close of 2011 and is slated for decommissioning this year. Timber harvest operations for the duration of the project were confined to the Reef Creek area in the Crandall/Sunlight #2 subunit and entailed the construction of approximately 1 km (0.7 mi) of new temporary road near Reef Creek and east of the Crandall Ranger Station. Less than 1 tenth of a square mile of secure habitat was temporarily affected by this project. All but 1 remaining road segment, approximately 0.6 km in length, were decommissioned in 2011. This remaining road access was kept open to allow the public an opportunity to retrieve wood from slash piles. This road will be decommissioned and hence, permanently closed to motorized traffic in 2012.

Hunter Peak Timber Sale - Shoshone National Forest
The *Hunter Peak Timber Sale*, like the *Reef Creek* sale, was approved for harvest operations in the Crandall/Sunlight subunit #2 as part of the *Upper Clarks Fork Vegetation Management Project*. Motorized activities linked to this timber sale have been limited to pre-existing motorized routes since project initiation, and thus has not yet required the construction of any new temporary roads. Consequentially, operations associated with the Hunter Peak timber sale did not negatively impact grizzly bear secure habitat during 2011. However, future construction of temporary motorized access is scheduled for implementation in 2012 upon closure of the one road segment remaining open from the Reef Creek project. The initial proposal calls for approximately 2.3 km of new temporary motorized access in proximity to the Crazy Creek campground along U.S. Highway 212. It now seems likely that fewer roads than originally proposed will be necessary. Although the Hunter Peak sale temporally overlaps the Reef Creek sale, temporary impacts to secure habitat was restricted to the Reef Creek target area.

Vista Timber Sale - Shoshone National Forest
The *Vista Timber Sale was* initially approved in 2007 for the South Absaroka #3 subunit as part of the extensive *Upper Wind River Vegetation Treatment Project*. The objective of the proposed vegetation treatment is 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. Access to timber units will primarily be provided by re-establishing motorized access to 2.7 km (1.7 mi) of existing Forest Service road that had been permanently closed to motorized traffic. In association with this project, an additional 1.1 km (0.7 mi) of new road was constructed in 2010 approximately 330 m outside of the subunit's southwest boundary and hence, outside of the grizzly bear

recovery zone. Upon termination of the project, this new road will remain closed to the public but accessible to Forest Service personnel for administrative purposes. It is calculated that collectively these changes in motorized routes will potentially incur negative temporary impacts on 0.17 mi^2 of secure habitat. This is well below the maximum 3.5 mi^2 of temporary change permitted to secure habitat, and is consistent with the 1 percent rule. All temporary changes to motorized routes inside the GBRZ will be completely restored to previous status upon termination of the project.

Table 5. Temporary projects inside the GBRZ during 2011.

Bear Management Subunit [1]	**Area of BMS excluding lakes (mi^2)**	**Maximum change allowed (mi^2)** [2]	**Project Name & Administrative Unit**	**Secure habitat 2011 (mi^2)**	**Secure habitat with project (mi^2)**	**Secure habitat affected by project (mi^2)**	**Project Status**
Buffalo/Spread Creek #1	219.9	**5.1**	**Buffalo Valley Timber Sales** (Bridger-Teton NF)	194.1	194.1	0.00	TERMINATED (All temporary roads closed in 2011)
Buffalo/Spread Creek #2	**507.6**			**377.3**	**377.3**	**0.00**	
Crandall/Sunlight #1	129.8	**3.2**	**Reef Creek** (Shoshone NF)	105.6	105.6	0.00	ACTIVE
Crandall/Sunlight #2	**316.2**			**260.3**	**260.3**	**0.0031**	
Crandall/Sunlight #3	221.8			178.9	178.9	0.0000	
Crandall/Sunlight #1	129.8	**3.2**	**Hunter Peak** (Shoshone NF)	105.6	105.6	0.00	ACTIVE (No secure habitat impacted in 2011)
Crandall/Sunlight #2	**316.2**			**260.3**	**260.3**	**0.00**	
Crandall/Sunlight #3	221.8			178.9	178.9	0.00	
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 #3	**348.3**			**337.2**	337.0	**0.17**	

(1) The subunit(s) affected by the temporary project is denoted in bold font
(2) The maximum allowable temporary change in secure habitat for a project cannot exceed 1% of the area of the largest subunit within the bear management unit

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