Yellowstone Grizzly Bear Investigations 2008

Report of the Interagency Grizzly Bear Study Team

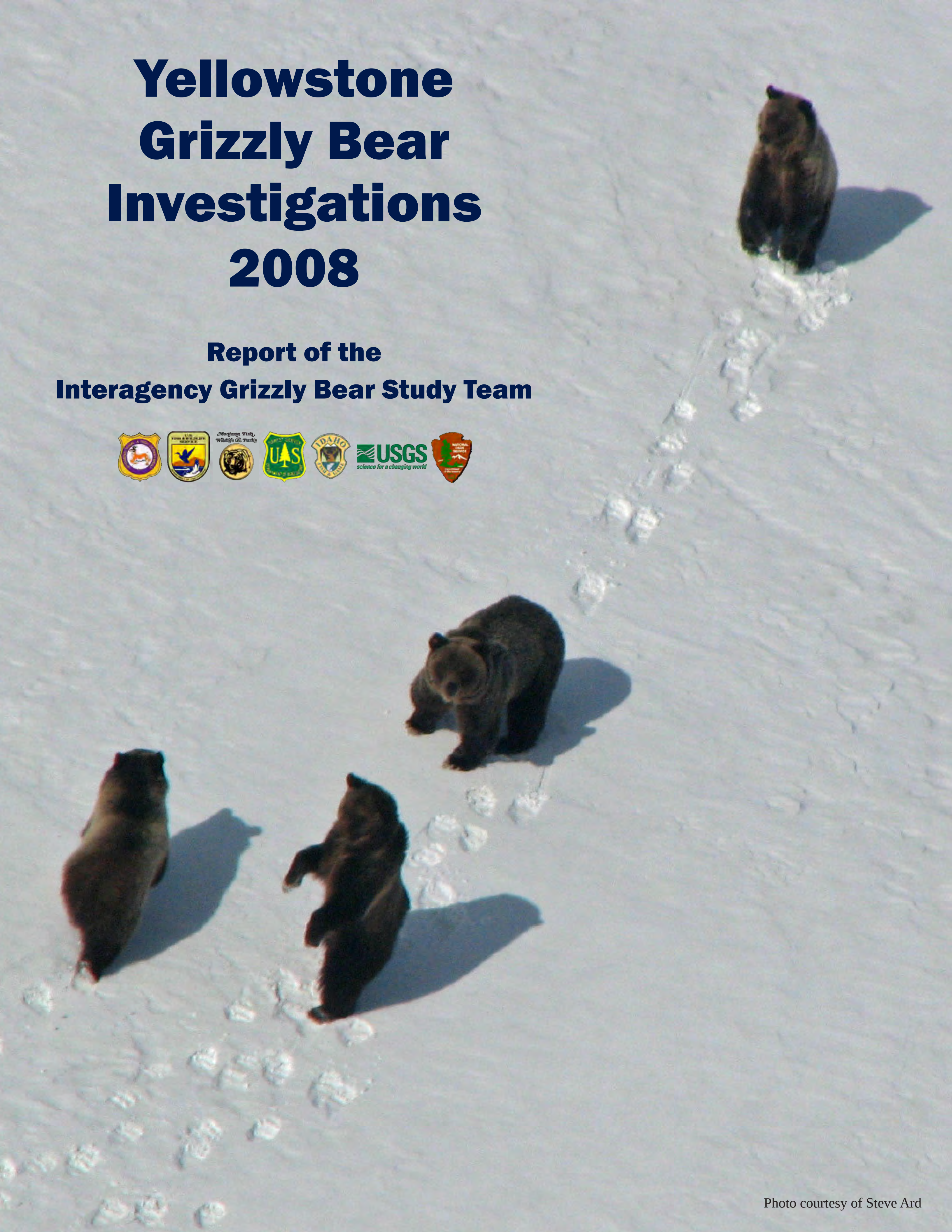

Photo courtesy of Steve Ard

Cover: Female #533 with her 3 3-year-old offspring after den emergence, taken 1 May 2008 by Steve Ard.

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Annual Report of the Interagency Grizzly Bear Study Team

2008

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

Edited by Charles C. Schwartz, Mark A. Haroldson, and Karrie West

U.S. Department of the Interior
U.S. Geological Survey
2009

Table of Contents

This report will be updated as Appendixes D and E become available

Introduction

(Charles C. Schwartz, Interagency Grizzly Bear Study Team; and David S. Moody, Wyoming Game and Fish Department)

This Report

The contents of this Annual Report summarize results of monitoring and research from the 2008 field season. The report also contains a summary of nuisance grizzly bear (*Ursus arctos horribilis*) management actions.

The Interagency Grizzly Bear Study Team (IGBST) continues to work on issues associated with counts of unduplicated females with cubs-of-the-year (COY). These counts are used to estimate population size, which is then used to establish mortality thresholds. A recent review published in the Journal of Wildlife Management (Schwartz et al. 2008) suggest that the rule set of Knight et al. (1995) returns conservative estimates, but with minor improvements, counts of unduplicated females with COY can serve as a reasonable index of population size useful for establishing annual mortality limits. As a follow up to the findings of Schwartz et al. (2008), the IGBST held a workshop in October 2007 (IGBST 2008). The purpose of the workshop was to discuss the feasibility of developing new models that improve our ability to distinguish unique females with COY. The outcome of that workshop was a research proposal detailing methods to develop a hierarchical model that should improve the methods used to distinguish unique females with COY. Multiple agencies who are members of the Yellowstone Grizzly Bear Coordinating Committee are providing funding for this project and funds are currently being transferred. We anticipate starting this project in summer 2009, and we expect results to be available by winter 2009.

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*). 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 is now tasked with reporting on an array of required monitoring programs. These include both population and habitat components. Annual population monitoring includes:

- Monitoring unduplicated females with COY for the entire Greater Yellowstone Area (GYA). The IGBST developed improved methods to estimate the annual number of females with COY and we detail them in this years report (see *Assessing trend and estimating population size from counts of unduplicated females*).
- Calculating a total population estimate for the entire GYA based on the model averaged Choa2 estimate of females with COY. Methods used to estimate the number of independent females and independent males (age ≥2 year) are also provided (see *Assessing trend and estimating population size from 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 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 GYA. 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*).

Habitat monitoring includes documenting the abundance of the 4 major foods throughout the GYA including winter ungulate carcasses, cutthroat trout (*Oncorhynchus clarkii*) spawning numbers, bear use of army cutworm moth (*Euxoa auxiliaris*) sites, and whitebark pine (*Pinus albicaulis*) cone production. These protocols have been monitored and reported by the IGBST for several years and are reported here. Additionally, we continued to monitor the health of whitebark pine in the ecosystem in cooperation with the Greater Yellowstone Whitebark Pine Monitoring Working Group. A summary of the 2008 monitoring is also presented (see Appendix _). The protocol has been modified to document mortality rate in whitebark pine from all causes, including mountain pine beetle (*Dendroctonus ponderosae*).

Also the Conservation Strategy (USFWS 2007*c*) requires maintenance of secure habitat, livestock allotments, and developed sites at 1998 levels in each BMU subunit. This year, the second report detailing this monitoring program is provided. This report documents 1) changes in secure habitat, open motorized access route density, 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 and 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 (see Appendix _).

Results of DNA hair snaring work conducted on Yellowstone Lake (Haroldson et al. 2005) from 1997–2000 showed a decline in cutthroat trout use by grizzly bears when compared to earlier work conducted by Reinhardt (1990) in 1985–1987. As a consequence, 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 foods the bears are using and if those foods are an adequate replacement to maintain a healthy population of grizzly bears. This project began in 2007. There are 2 graduate students and several field technicians working on the program. A summary of the 2008 field work can be found in Appendix A.

The state of Wyoming, following recommendations from the Yellowstone Ecosystem Subcommittee and the IGBST, launched the Bear Wise Community Effort in 2005. The focus is to minimize human/bear conflicts, minimize human-caused bear mortalities associated with conflicts, and safeguard the human community. Results of these efforts are detailed in Appendix B. Also, the state of Wyoming conducted a field study testing remote sensing cameras to count females with COY. Results of that study are reported in Appendix C.

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

It was recognized as early as 1973, that in order to understand the dynamics of grizzly bears throughout the Greater Yellowstone Ecosystem (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 National Park Service, U.S. Forest Service, USFWS, and the States of Idaho, Montana, and Wyoming. The U.S. Geological Survey (USGS) became part of IGBST in 1997. The responsibilities of the IGBST are to: (1) conduct both 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 (YNP) 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 YNP in 1967, bear demographics (Knight and Eberhardt 1985), food habits (Mattson et al. 1991*a*), and growth patterns (Blanchard 1987) for grizzly bears changed. Since 1975, the IGBST has produced annual reports and numerous scientific publications (for a complete list visit our web page http://www.nrmsc.

usgs.gov/research/igbst-home.htm) summarizing monitoring and research efforts within the GYE. As a result, we 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). 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 the study. Without the collection efforts of many, the information contained within this report would not be available. USGS: J. Akins, J. Ball, J. Brown, H. Cardani, A. Ganick, J. Irving, P. Lendrum, J. Lewis, K. Quinton, G. Rasmussen, T. Rosen, C. Rumble, S. Schmitz, J. Teisberg, S. Thompson, B. Visaggi, C. Whitman; NPS: H. Bosserman, A. Bramblett, T. Coleman, C. Daigle-Berg, S. Dewey, L. Felicetti, L. Frattaroli, B. Gafney, S. Gunther, B. Hamblin, L. Haynes, D. Smith, D. Stahler, A. Tallian, P.J. White, S. Wolff, B. Wyman; MTFWP: N. Anderson, J. Smith, J. Smolczynski, S. Stewart; MSU; S. Cherry; WYGF: G. Anderson, T. Achterhof, D. Brimeyer, G. Brown, J. Clapp, D. Clause, B. DeBolt, D. Ditolla, L. Ellsbury, T. Fagan, G. Fralick, H. Haley, A. Johnson, N. Johnson, B. Kroger, M. Ladd, J. Longobardi, P. Luepke, D. McWhirter, B. Nesvik, C. Queen, R. Roemmich, C. Sax, Z. Turnbull; IDFG; C. Anderson, L. Hanauska-Brown, S. Grigg, T. Imthum, R. Knight, J. Koontz, G. Losinski, H. Miyasaki, S. Roberts, J. Rydalch; USFS: B. Davis, T. Hershey, M. Hinschberger, L. Otto, A. Pils, C. Pinegar; Pilots and Observers: C. Anderson, B. Ard, S. Ard, N. Cadwell, R. Danielson, D. Ford, K. Hamlin, H. Leech, T. Schell, D. Stinson, D. Stradley, R. Stradley; WS: G. McDougal, J. Rost; Shoshone and Arapaho Tribes: B. St. Clair, B. Makeshine; USFWS: P. Hnilicka, D. Skates.

Photo courtesy of Steve Ard, 31 Jul 2005

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 2008 field season, 66 individual grizzly bears were captured on 79 occasions (Table 1), including 19 females (11 adult) and 47 males (27 adult). Thirty-two individuals were new bears not previously marked.

We conducted research trapping efforts for 551 trap days (1 trap day = 1 trap set for 1 day) in the GYE. During research trapping operations we had 39 captures of 30 individual grizzly bears for a trapping success rate of 1 grizzly capture every 14 trap days.

There were 40 management captures of 36 individual bears in the GYE during 2008 (Tables 1 and 2), including 12 females (7 adult) and 24 males (12 adult). None of the bears captured at management settings were subsequently caught at research trap sites. Twenty-eight individual bears (10 females, 18 males), were relocated due to conflict situations (Table 1). Two subadult siblings (G133 and G134) were relocated twice. One bear (#582) was transported and subsequently removed. Eight other individuals (2 females, 6 males) were captured and removed due to conflicts (see *Estimating sustainability of annual grizzly bear mortalities*). Two of these bears (1 female, 1 male) were live removals to Washington State University.

We radio-monitored 87 individual grizzly bears during the 2008 field season, including 30 adult females (Tables 2 and 3). Fifty-one grizzly bears entered their winter dens wearing active transmitters. Two additional bear not located since September are considered missing (Table 3). Since 1975, 595 individual grizzly bears have been radiomarked in the GYE.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem during 2008.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site	Agency[b]
291	Male	Adult	04/19/08	E Fork Wind River, Pr-WY	Management	Removed	WYGF
579	Male	Subadult	04/21/08	Boulder River, Pr-MT	Management	Removed	MTFWP
G126	Female	Subadult	05/08/08	Wind River, Pr-WY	Management	Sunlight Creek, SNF	WYGF
G127	Male	Subadult	05/08/08	Wind River, Pr-WY	Management	Sunlight Creek, SNF	WYGF
525	Female	Adult	05/09/08	Wind River, Pr-WY	Management	Sunlight Creek, SNF	WYGF
580	Male	Adult	05/09/08	Long Creek, Pr-WY	Management	Mormon Creek, SNF	WYGF
581	Male	Adult	05/17/08	Crandall Creek, Pr-WY	Management	Mormon Creek, SNF	WYGF
582	Male	Subadult	06/08/08	Rattlesnake Creek, Pr-WY	Management	Pilot Creek, SNF	WYGF
			08/09/08	Beartooth Creek, SNF	Management	Removed	WYGF
583	Male	Subadult	06/12/08	Grass Creek, BLM-WY	Research	On site	WYGF
584	Male	Subadult	06/13/08	Rasberry Creek, State-WY	Research	On site	WYGF
448	Female	Adult	06/14/08	Bridge Creek, YNP	Research	On site	IGBST
			07/26/08	Bridge Creek, YNP	Research	On site	IGBST
			10/23/08	Arnica Creek, YNP	Research	On site	IGBST
585	Male	Adult	06/14/08	Yellowstone River, YNP	Research	On site	IGBST
149	Female	Adult	06/17/08	Yellowstone River, YNP	Research	On site	IGBST
586	Male	Subadult	06/19/08	Grass Creek, BLM-WY	Research	On site	WYGF
587	Male	Subadult	06/28/08	Pacific Creek, Pr-WY	Management	Glade Creek, CTNF	WYGF

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site	Agency[b]
492	Female	Subadult	06/30/08	Flat Mountain Creek, YNP	Research	On site	IGBST
			07/18/08	Flat Mountain Creek, YNP	Research	On site	IGBST
434	Male	Adult	07/08/08	Horse Creek, SNF	Management	Sunlight Creek, SNF	WYGF
588	Male	Subadult	07/10/08	Standard Creek, BDNF	Research	On site	IGBST
360	Female	Adult	07/17/08	Papoose Creek, Pr-MT	Research	On site	IGBST
G128	Female	Subadult	07/18/08	S Fork Shoshone R., Pr-WY	Management	Lost Lake, BTNF	WYGF
541	Female	Adult	07/22/08	Flat Mountain Creek, YNP	Research	On site	IGBST
495	Female	Adult	07/22/08	Soda Butte Creek, GNF	Management	Removed	MTFWP
433	Male	Adult	07/24/08	Crow Creek, BTNF	Management	Removed	WYGF
504	Male	Adult	07/28/08	Gypsum Creek, BTNF	Management	Removed	WYGF
487	Male	Adult	07/27/08	Wood River, Pr-WY	Management	Boone Creek, CTNF	WYGF
589	Male	Adult	07/28/08	Bridge Creek, YNP	Research	On site	IGBST
464	Male	Adult	07/31/08	Trail Creek, BTNF	Management	Removed	WYGF
497	Female	Adult	08/04/08	Cow Creek, BTNF	Management	Sunlight Creek, BTNF	WYGF
565	Male	Subadult	08/09/08	Warm River, CTNF	Research	On site	IGBST
			08/26/08	Warm River, CTNF	Research	On site	IGBST
G129	Male	Subadult	08/09/08	Tepee Creek, BTNF	Management	Clark Fork, SNF	WYGF
373	Male	Adult	08/12/08	Warm River, CTNF	Research	On site	IGBST
590	Female	Subadult	08/13/08	Marston Creek, SNF	Research	On site	WYGF
545	Male	Adult	08/13/08	Sheridan Creek, SNF	Management	Removed	WYGF
556	Male	Adult	08/21/08	Warm River, CTNF	Research	On site	IGBST
			08/24/08	Warm River, CTNF	Research	On site	IGBST
591	Female	Subadult	08/21/08	Warm River, CTNF	Research	On site	IGBST
592	Male	Adult	08/21/08	Marston Creek, SNF	Research	On site	WYGF
593	Male	Subadult	08/22/08	Porcupine Creek, CTNF	Research	On site	IGBST
302	Male	Adult	08/23/08	Marston Creek, SNF	Research	On site	WYGF
594	Male	Subadult	08/23/08	Warm River, CTNF	Research	On site	IGBST
400	Male	Adult	08/23/08	Porcupine Creek, CTNF	Research	On site	IGBST
563	Male	Adult	08/24/08	Warm River, CTNF	Research	On site	IGBST
595	Male	Subadult	08/24/08	Bootjack Creek, CTNF	Research	On site	IGBST
279	Female	Adult	08/28/08	Sheridan Creek, SNF	Management	N Fork Shoshone R., SNF	WYGF
G130	Male	Subadult	09/12/08	Bennett Creek, Pr-WY	Management	Fox Creek, SNF	WYGF
G131	Male	Subadult	09/12/08	Bennett Creek, Pr-WY	Management	Fox Creek, SNF	WYGF
G132	Male	Subadult	09/12/08	Bennett Creek, Pr-WY	Management	Fox Creek, SNF	WYGF
596	Female	Adult	09/14/08	Bennett Creek, Pr-WY	Management	Mormon Creek, SNF	WYGF
363	Male	Adult	09/25/08	Monument Bay, YNP	Research	On site	IGBST
			10/19/08	Monument Bay, YNP	Research	On site	IGBST
597	Female	Subadult	09/26/08	Yellowstone River, Pr-MT	Management	Charcoal Bay, YNP	MTFWP
598	Male	Subadult	09/26/08	Yellowstone River, Pr-MT	Management	Charcoal Bay, YNP	MTFWP
458	Female	Adult	10/01/08	Buffalo Fork, Pr-WY	Management	Mormon Creek, SNF	WYGF
G133	Male	Subadult	10/01/08	Buffalo Fork, Pr-WY	Management	Mormon Creek, SNF	WYGF
			10/21/08	Clark Fork River, Pr-WY	Management	Mormon Creek, SNF	WYGF

Table 1. Continued.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site	Agency[b]
G134	Male	Subadult	10/01/08	Buffalo Fork, Pr-WY	Management	Mormon Creek, SNF	WYGF
			10/06/08	Sunlight Creek, Pr-WY	Management	On site	WYGF
			10/22/08	Clark Fork River, Pr-WY	Management	Mormon Creek, SNF	WYGF
443	Male	Adult	10/03/08	Coyote Creek, YNP	Research	On site	IGBST
567	Male	Adult	10/04/08	Monument Bay, YNP	Research	On site	IGBST
204	Male	Adult	10/07/08	Monument Bay, YNP	Research	On site	IGBST
			10/16/08	Alluvium Creek, YNP	Research	On site	IGBST
			10/19/08	Cub Creek, YNP	Research	On site	IGBST
450	Male	Adult	10/16/08	Crevice Creek, Pr-MT	Management	Arnica Creek, YNP	MTFWP
574	Male	Adult	10/16/08	Monument Bay, YNP	Research	On site	IGBST
599	Male	Adult	10/17/08	Pacific Creek, BTNF	Management	Mormon Creek, SNF	WYGF
520	Male	Adult	10/19/08	Antelope Creek, YNP	Research	On site	IGBST
			10/20/08	Antelope Creek, YNP	Research	On site	IGBST
211	Male	Adult	10/21/08	Antelope Creek, YNP	Research	On site	IGBST
600	Male	Subadult	10/22/08	Stephens Creek, YNP	Management	Arnica Creek, YNP	MTFWP/YNP
601	Female	Subadult	10/22/08	Stephens Creek, YNP	Management	Arnica Creek, YNP	MTFWP/YNP
602	Female	Subadult	10/22/08	Stephens Creek, YNP	Management	Arnica Creek, YNP	MTFWP/YNP
265[c]	Female	Adult	10/22/08	Stephens Creek, YNP	Management	Removed	MTFWP/YNP
514	Male	Adult	10/27/08	Pacific Creek, BTNF	Management	Mormon Creek, SNF	WYGF

[a] BDNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, SNF = Shoshone National Forest, YNP = Yellowstone National Park, Pr = private.
[b] IGBST = Interagency Grizzly Bear Study Team, USGS; MTFWP = Montana Fish, Wildlife and Parks; WYGF = Wyoming Game and Fish; YNP = Yelowstone National Park.
[c] Conflict occurred along Yellowstone River at private residence. Capture operation by MTFWP was conducted at remote location in YNP due to human safety concerns.

Remote camera photo of Bear #588 at trap site in Standard Creek, Beaverhead-Deerlodge National Forest, 29 Jun 2008. Bear #588 was the first research capture of a grizzly bear in the Gravellys.

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

Table 3. Grizzly bears radio monitored in the Greater Yellowstone Ecosystem during 2008.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current Status
149	F	Adult	None	No	No	Dead
179	F	Adult	2 COY	Yes	Yes	Active
204	M	Adult		Yes	Yes	Active
205	F	Adult	1 2-year-old	Yes	Yes	Active
211	M	Adult		No	Yes	Active
246	F	Adult	3 yearlings	Yes	Yes	Active
279	F	Adult	None	No	Yes	Active
289	F	Adult	2 COY, lost 1	Yes	Yes	Active
295	F	Adult	3 COY	Yes	Yes	Active
302	M	Adult		No	Yes	Active
360	F	Adult	None	No	Yes	Active
363	M	Adult		No	Yes	Active
373	M	Adult		Yes	Yes	Active
379	M	Adult		Yes	Yes	Active
400	M	Adult		No	Yes	Active
407	M	Adult		Yes	No	Cast
428	F	Adult	Not seen	Yes	No	Failed battery
434	M	Adult		No	No	Cast
439	F	Adult	2 COY	Yes	No	Cast
443	M	Adult		No	Yes	Active
448	F	Adult	None	No	Yes	Active
450	M	Adult		No	Yes	Active
458	F	Adult	2 yearlings	No	No	Removed
459	M	Adult		Yes	No	Cast
472	F	Adult	1 2-year-old	Yes	No	Cast
487	M	Adult		No	No	Cast
489	F	Adult	3 yearlings	Yes	No	Cast
492	F	Subadult		Yes	Yes	Active
497	F	Adult	None	No	No	Cast
499	F	Adult	None	Yes	Yes	Active
500	F	Adult	2 COY	Yes	Yes	Active
503	F	Adult	Not seen	Yes	No	Cast
514	M	Adult		No	Yes	Active
520	M	Adult		No	Yes	Active
525	F	Adult	2 yearlings, both killed	No	Yes	Active
526	M	Subadult		Yes	No	Cast
529	M	Subadult		Yes	No	Cast
530	F	Adult	Not seen	Yes	No	Cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored Out of den	Monitored Into den	Current Status
531	F	Adult	None	Yes	Yes	Active
532	M	Adult		Yes	Yes	Active
533	F	Adult	3 3-year-olds	Yes	Yes	Active
537	F	Adult	None	Yes	Yes	Active
541	F	Adult	None	Yes	Yes	Active
547	M	Adult		Yes	No	Cast
550	M	Adult		Yes	No	Cast
551	F	Adult	Not seen	Yes	Yes	Active
554	F	Subadult		Yes	Yes	Active
556	M	Adult		Yes	Yes	Active
559	F	Adult	1 2-year-old	Yes	No	Cast
560	F	Subadult		Yes	No	Unresolved
561	F	Subadult		Yes	No	Dead
562	M	Adult		Yes	No	Dead
563	M	Adult		Yes	No	Dead
565	M	Subadult		Yes	Yes	Active
566	M	Subadult		Yes	No	Cast
567	M	Adult		Yes	Yes	Active
569	F	Adult	Not seen	Yes	Yes	Active
570	M	Adult		Yes	No	Cast
573	M	Adult		Yes	No	Cast
574	M	Adult		Yes	Yes	Active
576	F	Adult	None	Yes	Yes	Active
577	F	Adult	None	Yes	Yes	Active
578	M	Subadult		Yes	No	Cast

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored Out of den	Monitored Into den	Current Status
579	M	Subadult		No	No	Cast
580	M	Adult		No	No	Missing
581	M	Adult		No	Yes	Active
582	M	Subadult		No	No	Removed
583	M	Subadult		No	No	Dead
584	M	Subadult		No	Yes	Active
585	M	Adult		No	No	Dead
586	M	Subadult		No	No	Cast
587	M	Subadult		No	No	Cast
588	M	Subadult		No	Yes	Active
589	M	Adult		No	Yes	Active
590	F	Subadult		No	Yes	Active
591	F	Subadult		No	Yes	Active
592	M	Adult		No	Yes	Active
593	M	Subadult		No	Yes	Active
594	M	Subadult		No	Yes	Active
595	M	Subadult		No	No	Dead
596	F	Adult	3 yearlings	No	Yes	Active
597	F	Yearling		No	No	Missing
598	M	Yearling		No	No	Dead
599	M	Adult		No	Yes	Active
600	M	Yearling		No	Yes	Active
601	F	Yearling		No	Yes	Active
602	F	Yearling		No	Yes	Active

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

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

Methods

Grizzly bears in the GYE were removed from protection under the Endangered Species Act (ESA 1975) as of 30 April 2007 (USFWS 2007*a*). Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and the demographic monitoring section of the Final Conservation Strategy for Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*), IGBST is tasked with estimating the number of female with COY, determining trend in this segment of the population, and estimating size of specific population segments to assess sustainability of annual mortalities. Specific procedures used to accomplish these tasks are presented in IGBST (2005, 2006) and Harris et al. (2007). Briefly, the Knight et al. (1995) rule set is used to estimate 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 female 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 $\hat{\lambda} = \exp(\hat{\beta}_1)$, 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 tend. 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 COY 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

$$\hat{N}_{males\ 2+} = \frac{\hat{N}_{females\ 2+}}{(0.63513)},$$

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).

Results

We documented 118 verified sightings of females with COY during 2008 (Fig. 1). This was a 65% decrease from the number of sightings obtained in 2007 (n = 335). Most (43%) sightings were obtained during observation flights (Table 4). Thirty-one percent of the observations occurred within the boundary of Yellowstone National Park. From the 118 sightings we were able to differentiate 44 unduplicated females using the rule set described by Knight et al. (1995). Total number of COY observed during initial sightings was 84 and mean litter size was 1.91 (Table 5). There were 10 single cub litters, 28 litters of twins, and 6 litters of triplets seen during initial observations (Table 5).

Forty-three families and 102 observations were obtained without telemetry (Table 6). Using these data and associated sighting frequencies $\hat{N}_{Chao2}$ = 53 (Table 6). Annual $\hat{N}_{Chao2}$ estimates for the period 1983–2008 (Table 6) were used to estimate the rate of population change (Fig. 2). Parameter estimates and AICc weights for the linear and quadratic models (Table 7) suggest that only the linear model is needed to model changes in the unduplicated female population for the period. The estimate of $\hat{\lambda}$ = 1.04513 with 95% confidence interval 1.03201 to 1.05841. The estimated quadratic effect (-0.00074, SE = 0.00092) was not significant (P = 0.427), with 74% of the AICc weight associated with the linear model. Therefore, the linear model is the best approximating model for the data.

The $\hat{N}_{MAFC}$ = 56 (95% CI 46–68) for 2008. The model averaged point estimate exceeds the demographic objective of 48 specified in the demographic criteria for the GYE (USFWS 2007*a*, 2007*b*). Additionally, AICc weight continues to support the linear model (USFWS 2007*b*), indicating an increasing trend.

Using $\hat{N}_{MAFC}$ = 56, the estimated population size for 2008 is 596 (Table 8).

Table 4. Method of observation for female grizzly bears with cubs-of-the-year sighted in the Greater Yellowstone Ecosystem during 2008.

Method of observation	Frequency	Percent	Cumulative percent
Fixed wing – other researcher	6	5.1	5.1
Fixed wing – observation	51	43.2	48.3
Fixed wing - telemetry	19	16.1	64.4
Ground sighting	42	35.6	35.6
Helicopter – other research	0	0	100.0
Trap	0	0	100.0
Total	118	100	

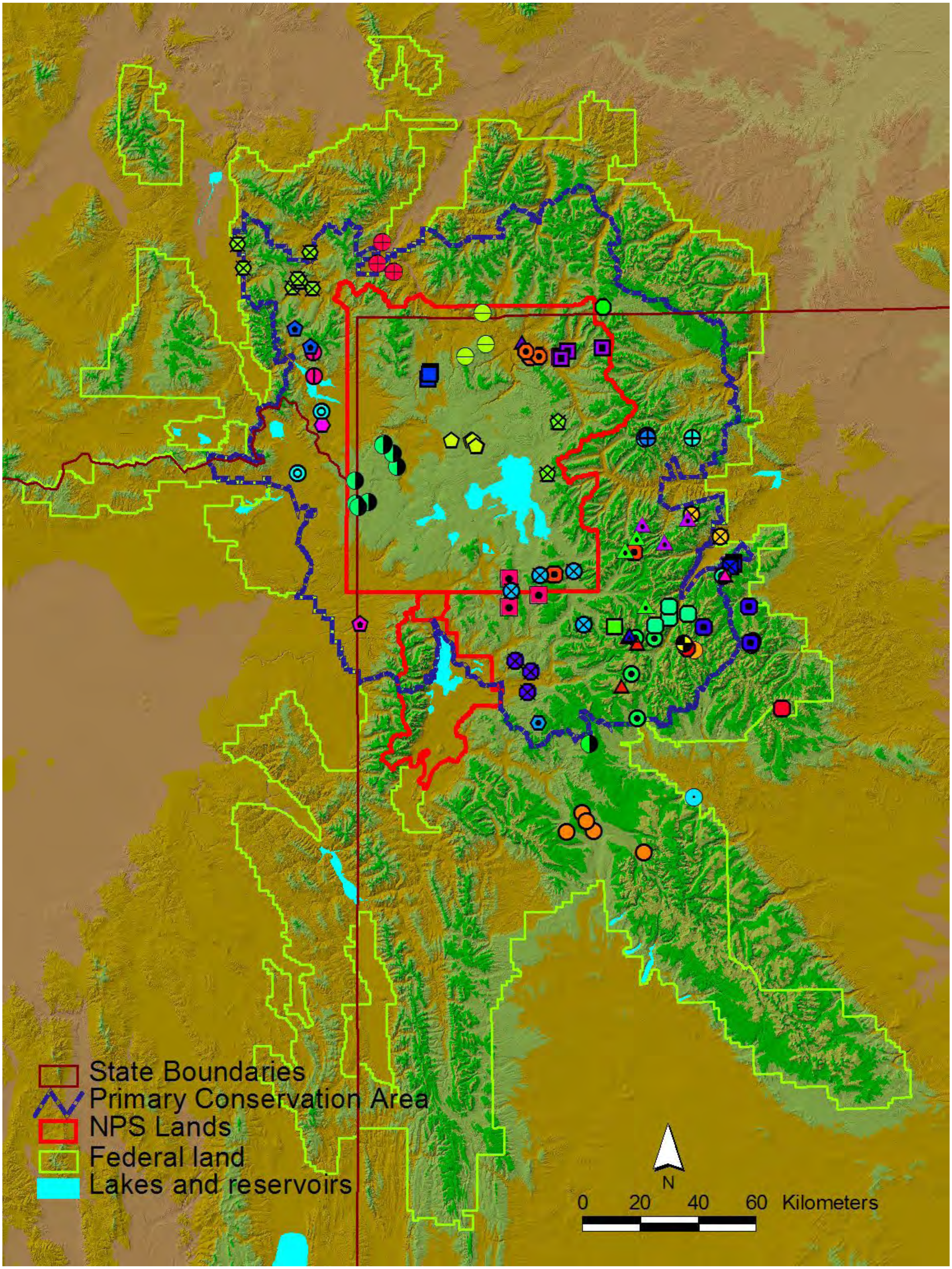

Fig. 1. Distribution of 118 observations of 44 (indicated by unique symbols) unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem during 2008.

Table 5. Number of unduplicated females with cubs-of-the-year ($\hat{N}_{Obs}$), litter frequencies, total number of cub, and average litter size at initial observation for the years 1973–2008 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
1973	14	14	4	8	2	0	26	1.86
1974	15	15	6	7	2	0	26	1.73
1975	4	9	2	2	0	0	6	1.50
1976	17	26	3	13	1	0	32	1.88
1977	13	19	3	8	2	0	25	1.92
1978	9	11	2	4	3	0	19	2.11
1979	13	14	2	6	5	0	29	2.23
1980	12	17	2	9	1	0	23	1.92
1981	13	22	4	7	2	0	24	1.85
1982	11	18	3	7	1	0	20	1.82
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

[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, 1983–2008. 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 biased 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

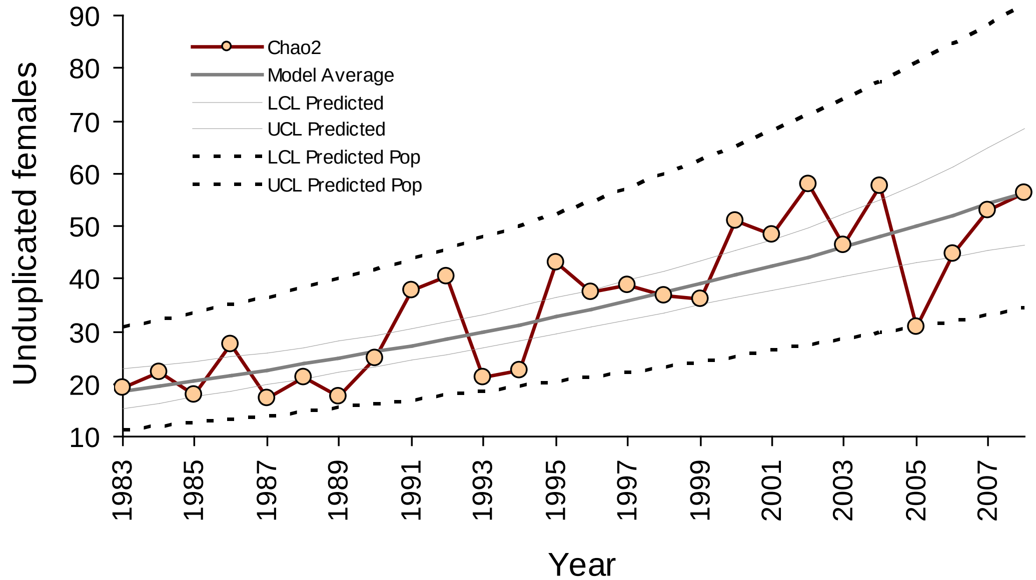

Fig. 2. Model-averaged estimates for the number of unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem for the period 1983–2008, where the linear and quadratic models of $Ln(\hat{N}_{Chao2})$ were fitted. The inner set of light solid lines represents a 95% confidence interval on the predicted population size for unduplicated female, whereas the outer set of dashed lines represents a 95% confidence interval for the individual population estimates for unduplicated females.

Table 7. Parameter estimates and model selection results from fitting the linear and quadratic models for $Ln(\hat{N}_{Chao2})$ with years for the period 1983–2008.

Model	Parameter	Estimate	Standard error	*t* value	Pr(>*t*)
Linear					
	β_0	2.90286	0.09450	30.71899	<0.0001
	β_1	0.04414	0.00611	7.21379	<0.0001
	SSE	1.31419			
	AICc	-70.51588			
	AICc weight	0.73933			
Quadratic					
	β_0	2.80904	0.15008	18.71745	<0.0001
	β_1	0.06425	0.02562	2.50805	0.01964
	β_2	-0.00074	0.00092	-0.80861	0.42702
	SSE	1.27786			
	AICc	-68.43085			
	AICc weight	0.26067			

Table 8. Estimates and 95% confidence intervals (CI) for population segments and total grizzly bear population size for 2008 in the Greater Yellowstone Ecosystem.

			95% CI	
	Estimate	Variance	Lower	Upper
Independent females	251	483.9	208	294
Independent males	159	349.5	123	196
Dependent young	185	107.5	165	206
Total	596	940.9	535	656

Bear #295 and her 3 cubs-of-the-year, 25 Jun 2008. Photo courtesy of Steve Ard.

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

Dispersion of reproductive females throughout the ecosystem is assessed by verified observation of female grizzly bears with young (COY, yearlings, 2-year-olds, and/or young of unknown age) by BMU. The requirements specified in the Conservation Strategy (USFWS 2007*c*) and the Revised 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. Eighteen of 18 BMUs had verified observations of female grizzly bears with young during 2008 (Table 9). Eighteen of 18 BMUs contained verified observations of females with young in at least 4 years of the last 6-year (2003–2008) 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, 2003–2008.

Bear Management Unit	2003	2004	2005	2006	2007	2008	Years occupied
1) Hilgard	X	X	X	X	X	X	6
2) Gallatin	X	X	X	X	X	X	6
3) Hellroaring/Bear	X		X	X		X	4
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	X	6
10) Firehole/Hayden	X	X	X	X	X	X	6
11) Madison			X	X	X	X	4
12) Henry's Lake		X	X	X	X	X	5
13) Plateau	X	X	X		X	X	5
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
Totals	16	16	18	16	17	18	

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

Two rounds of observation flights were conducted during 2008. Forty-six Bear Observation Areas (BOAs; Fig. 3) were surveyed during Round 1 (12 Jun–26 Jul); 45 BOAs were flown during Round 2 (1 Jul–23 Aug). Observation time was 98 hours for Round 1 and 102 hours for Round 2; average duration of flights for both rounds combined was 2.2 hours (Table 10). Three hundred sixty-nine bear sightings, excluding dependent young, were recorded during observation flights. This included 8 radio-marked bears (4 solitary bears, a female with 1 COY seen during both rounds, a female with 3 COY, and a female with 1 2-year-old), 272 solitary unmarked bears, and 89 unmarked females with young (Table 10). Observation rate was 1.85 bears/hour for all bears. One hundred fifty-eight young (83 COY, 58 yearlings, and 17 2-year-olds) were observed (Table 11). Observation rates were 0.47 females with young/hour and 0.23 females with COY/hour (Table 11).

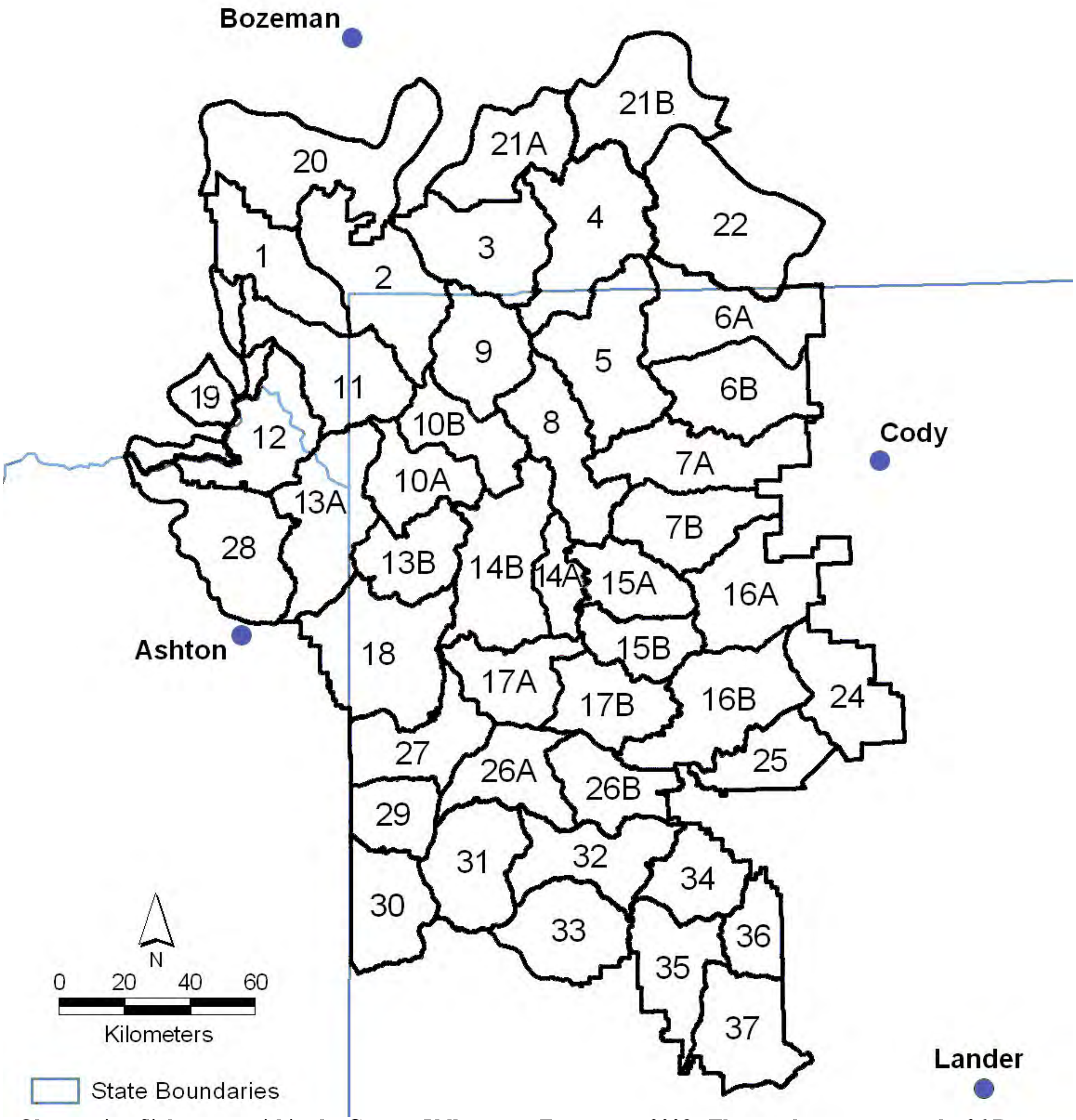

Fig. 3. Observation flight areas within the Greater Yellowstone Ecosystem, 2008. The numbers represent the 36 Bear Observation Areas. Those units too large to search during a single flight were further subdivided into 2 units. Consequently, there were 46 search areas.

Table 10. Annual summary statistics for observation flights conducted in the Greater Yellowstone Ecosystem, 1997–2008.

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]
1997[b]	Round 1	55.5	26	2.1	1	1	38	19	59	1.08		
	Round 2	59.3	24	2.5	1	1	30	17	49	0.83		
	Total	114.8	50	2.3	2	2	68	36	108	0.94	0.33	0.16
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

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

[b] Dates of flights (Round 1, Round 2): 1997 (24 Jul–17 Aug, 25 Aug–13 Sep); 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–28 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–26Jul, 1 Jul–23 Aug).

Table 11. Size and age composition of family groups seen during observation flights in the Greater Yellowstone Ecosystem, 1998–2008.

	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)		
Date	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

[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–28 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–26Jul, 1 Jul–23 Aug).
[b] Includes 1 female with 4 yearlings.

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

One hundred thirteen telemetry relocation flights were conducted during 2008, resulting in 370.7 hours of search time (ferry time to and from airports excluded) (Table 12). Flights were conducted at least once during all months, with 84% occurring May–November. During telemetry flights, 942 locations of bears equipped with radio transmitters were collected, 120 (13%) of which included a visual sighting. Thirty-one sightings of unmarked bears were also obtained during telemetry flights, including 26 solitary bears, 2 females with COY, 1 female with yearlings, and 2 females with 2-year-olds. Rate of observation for all unmarked bears during telemetry flights was 0.08 bears/hour. Rate of observing females with COY was 0.005/hour, which was considerably less than during observation flights (0.23/hour) in 2008.

Bear #575 on an elk carcass, 11 Aug 2008. Photo courtesy of Steve Ard.

Table 12. Summary statistics for radio-telemetry relocation flights in the Greater Yellowstone Ecosystem, 2008.

				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	6.04	2	3.02	28	0	0.00	0	0	0	0	---	---
February	13.42	4	3.36	35	0	0.00	0	0	0	0	---	---
March	24.94	6	4.16	81	1	0.04	3	0	0	0	0.12	0.000
April	10.95	4	2.74	36	2	0.18	0	0	0	0	---	---
May	66.87	16	4.18	151	42	0.63	8	0	0	0	0.12	0.000
June	39.57	14	2.83	78	14	0.35	3	0	0	0	0.08	0.000
July	35.71	13	2.75	92	22	0.62	4	2	0	1	0.20	0.056
August	40.80	14	2.91	95	16	0.39	5	0	1	1	0.17	0.000
September	38.15	12	3.18	97	9	0.24	1	0	0	0	0.03	0.000
October	48.32	14	3.45	132	10	0.21	1	0	0	0	0.02	0.000
November	39.98	12	3.33	95	4	0.10	1	0	0	0	0.02	0.000
December	5.90	2	2.95	22	0	0.00	0	0	0	0	---	---
Total	370.65	113	3.28	942	120	0.32	26	2	1	2	0.08	0.005

[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)*

Grizzly bears in the GYE were removed from protection under the Endangered Species Act (ESA 1975) as of 30 April 2007 (USFWS 2007*a*). Under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and the demographic monitoring section of the Final Conservation Strategy for Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*), IGBST is tasked with evaluating the sustainability of annual mortalities. 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 Choa2 estimate for females with COY (see *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 triggers a biology and management review (USFWS 2007*a*).

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 triggers a biology and management review (USFWS 2007*a*).

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*a*). Exceeding the dependent young mortality limit for 3 consecutive years triggers a biology and management review (USFWS 2007*a*).

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.

2008 Mortality Results

We documented 48 known and probable, and 4 possible mortalities in the GYE during 2008 (Table 13). We also documented 2 mortalities that evidence indicated occurred prior to 2008. The remains on an old adult male bear believed to have died from natural causes during the fall of 2007 were found during July in Trout Creek, YNP. The skull of a yearling bear found during the fall of 2006 by a park visitor was turned in to YNP officials. There was no indication as to the cause of death for this bear. The 4 possible mortalities were hunting related incidents. In 3 of these events bears were known to have been wounded but no substantive evidence developed that mortalities had occurred.

Of the 48 known and probable mortalities occurring during 2008, 37 were attributable to human causes (Table 13). Twenty (54%) of the human-caused losses were hunting related; including 5 mistaken identity kills by spring black bear (*Ursus americanus*) hunters and 8 self-defense kills, 4 of which were adult females. Three of the adult females were accompanied by 5 COY, which are considered probable losses. Other hunter related losses included 1 COY shot when its mother charged hunters (evidence indicated the female was not wounded), and 1 adult female killed when an outfitter attempted to haze the bear away from a backcountry camp (Table 1). The remaining human-caused losses were management removals (n = 10), malicious killings (n = 2), self-defense at residences (n = 2), handling related (n = 2), and a road kill (n = 1). We also documented 7 natural mortalities and 4 from undetermined causes (Table 13).

The 2 handling related deaths both occurred after research captures by IGBST personnel in Idaho. Both bears (males #563 and #595) were captured in culvert traps and handled on 24 August. In both instances standard protocols were followed and characteristics of the anesthesia, handling events, and recoveries were unremarkable. Bear #595 was found dead by a hunter on 31 August. Necropsy and subsequent laboratory analysis. completed by the Wildlife Health Laboratory, Idaho Department of Fish and Game. attributed cause of death to a clostridial (*Clostridium* spp.) infection at the anesthesia injection site. A similar pathology was suspected but specific cause of death could not be confirmed for bear #563 because the carcass was not discovered until 4 September and the state of decomposition was advanced. Clostridial infections are known to cycle with weather and moisture conditions and incidents of complication from the bacteria were high in ruminates in the general vicinity of these captures during 2008 (P. Mamer, Idaho Department of Fish and Game, personal communication). As a result of these mortalities, handling protocols were reviewed and amended to included application of a prophylactic antibiotic that is affective for Clostridium.

Among known and probable losses for independent aged female bears there were 3 management removals, 1 death of radio-marked bear, and 10 other reported losses for a total of 14 (Table 14). We documented 7 management removals, 5 radio-marked losses, and 11 reported losses for independent aged males (Table 14). Human-caused losses of dependent young totaled 8 (Table 14). Using the criteria specified under the Revised Demographic Recovery Criteria (USFWS 2007*b*) and methodology presented by IGBST (2005, 2006), mortality thresholds for independent females and males were exceeded during 2008 (Table 14). This is the first year these thresholds have been exceeded. The mortality threshold for dependent young was not exceeded (Table 14).

An additional mortality occurred during 2008 that was not included in the list for 2008. Sometime during the fall (Oct–Nov) an instrumented yearling male was maliciously killed and dumped in Ashton Reservoir, Idaho. This individual was a COY during fall of 2007 when its mother was killed by a hunter north of Gardiner, Montana. This bear was considered a probable mortality during 2007 and as such was not included in 2008.

Table 13. Grizzly bear mortalities documented in the Greater Yellowstone Ecosystem during 2008.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
Unm	U	Yearling	Fall/2006	Bear Creek, YNP	Known	Undetermined cause. Remains (skull) of a yearling (by tooth eruption) found November 2006, and report to YNP on 9/30/2008.
Unm	M	Adult	Fall/2007	Trout Creek, YNP	Known	Natural, specific cause undetermined. Likely due to maladies associated with old age.
291	M	Adult	4/19/2008	E Fork Wind River, Pr-WY	Known	Human-caused, management removal of bear #291 for repeated property damage. Bear was not collared.
579	M	Subadult	4/21/2008	Boulder River, Pr-MT	Known	Human-caused, management removal (live to WSU) of bear #579 for repeated nuiscane activity, unnatural foods and property damage. Bear was not collared.
Unm	M	Adult	5/7/2008	North Fork Shoshone, SNF	Known	Human-caused, mistaken identity kill by black bear hunter.
Unm	M	Subadult	5/10/2008	Meadow Creek, GNF	Known	Human-caused, mistaken identity kill by black bear hunter.
G109	M	Adult	5/25/2008	Cliff Creek, BTNF	Known	Human-caused, bear #G109 mistaken identity kill by black bear hunter.
Unm	M	Adult	5/27/2008	Clark Fork River, SNF	Known	Human-caused, mistaken identity kill by black bear hunter.
Unm	M	Subadult	6/1/2008	Crooked Creek, Pr-WY	Known	Natural, parts of hide and skull found, hole in skull from bite indicates bear killed by wolf or bear. Mortality date is approximate. Samples collected, DNA determined male.
Unm	F	Subadult	6/1/2008	Yellowstone River, YNP	Known	Undetermined, remains of a carcass found in the Yellowstone River near confluence with Gardner River on 9/14. Sex determination from DNA was female. Date is approximate.
Unm	F	Yearling	6/9/2008	Middle Creek, YNP	Known	Natural, apparent malnutrition.
561	F	Subadult	6/10/2008	Soda Fork, BTNF	Known	Undetermined cause, 2-year-old female #561 found dead by outfitter on 7/8/2008. Failed (battery life) ear transmitter recovered at site.
Unm	M	Adult	6/14/2008	Reef Creek, SNF	Known	Human-caused, bear was wounded due to mistaken identity by a black bear hunter, wounded bear charged the hunter and was killed.
Unm	U	COY	6/14/2008	Bear Creek, State-MT	Probable	Natural, female grizzly bear #289 lost 1 COY between 6/3 and 6/25. Approximate mortality date.
Unm	M	COY	6/15/2008	Greybull River, State-WY	Known	Undetermined cause, male COY found dead on Phelps Mountain Road, did not appear to be human-caused.
583	M	Subadult	7/19/2008	Slaughter Creek, SNF	Known	Natural, bear #583 possibly killed by wolves. Bear was collared.
495	F	Adult	7/22/2008	Soda Butte Creek, GNF	Known	Human-caused, management removal of bear #495 (live to WSU) for human-injury and property damage at campground. Failed collar (battery life) on bear.
433	M	Adult	7/24/2008	Crow Creek, BTNF	Known	Human-caused, management removal of bear #433 for repeated livestock depredations. Bear was not collared when captured.
504	M	Adult	7/28/2008	Gypsum Creek, BTNF	Known	Human-caused, management removal of bear #504 for repeated livestock depredations. Bear was not collared when captured.

Table 13. Continued.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
464	M	Adult	7/31/2008	Trail Creek, BTNF	Known	Human-caused, management removal of bear #464 for repeated cattle depredation. Bear was not collared at time of removal.
582	M	Subadult	8/11/2008	Beartooth Creek, SNF	Known	Human-caused, management removal of bear #582 for numerous food rewards and habituated behaviors in campgrounds. Was wearing active collar when removed.
585	M	Adult	8/12/2008	Pelican Creek, YNP	Known	Natural, bear #585 died of maladies associated with old age. Bear was collared.
412	F	Adult	8/13/2008	Glade Creek, GTNP	Known	Undetermined, bear #412 was found dead by agency personnel, had been cached and fed on by bear(s) and wolves. Bear was not collared.
545	M	Adult	8/13/2008	Sheridan Creek, SNF	Known	Human-caused, management removal of bear #545 for repeated cattle depredation. Bear was not collared at time of removal.
453	M	Adult	8/24/2008	Soda Butte Creek, Pr-MT	Known	Human-caused, DLP kill of bear #453 as it broke into home. Bear was not collared when killed.
595	M	Subadult	8/31/2008	Rock Creek, CTNF	Known	Human-caused, bear #595 was found dead by hunter. Bear had been handled on 8/24/2008. Capture related, significant infection at the injection site. Bear was collared.
563	M	Adult	9/2/2008	Thirsty Creek, CTNF	Known	Human-caused, bear #563 was found dead via telemetry. Bear had been handled on 8/24/2008. Likely capture related, similar to #595. Bear was collared.
432	M	Adult	9/12/2008	Castle Creek, SNF	Known	Human-caused, hunting related, bear #432 charged archery hunter calling elk. Shot with bow, human injuries. Not collared at time of death.
Unm	F	Adult	9/19/2008	Castle Creek, SNF	Possible	Human-caused, hunting related, female with 2-3 yearlings charged archery hunters calling elk, 1 pistol shot at female at close range, small blood trail for short distance, no carcass found.
Unm	U	Yearling	9/19/2008	Castle Creek, SNF	Possible	Human-caused, hunting related, yearling with mother and 1–2 siblings charged archery hunters calling elk, 2 shots at yearling at close range, small blood trail for short distance, no carcass found.
562	M	Adult	9/28/2008	N Fork Fish Creek,	Known	Human-caused, hunting related, self defense kill of bear #562. Bear was collared.
303	F	Adult	10/1/2008	Long Creek, SNF	Known	Human-caused, hunting related, self defense kill of bear #303. Female was accompanied by 2 COY. Bear was not collared when killed.
Unm	U	COY	10/1/2008	Long Creek, SNF	Probable	Human-caused, hunting related, COY of female #303 killed by hunters.
Unm	U	COY	10/1/2008	Long Creek, SNF	Probable	Human-caused, hunting related, COY of female #303 killed by hunters.
Unm	F	Adult	10/2/2008	Yellowstone River, BTNF	Known	Human-caused, hunting related, female with 2 COY was killed when she was charged hunter at elk carcass.
Unm	U	COY	10/2/2008	Yellowstone River, BTNF	Probable	Human-caused, hunting related, COY of female killed by hunter.
Unm	U	COY	10/2/2008	Yellowstone River, BTNF	Probable	Human-caused, hunting related, COY of female killed by hunter.
Unm	F	Adult	10/7/2008	Cartridge Creek, SNF	Known	Human-caused, hunting related, female with 2 yearlings was killed when she charged elk hunter.

Table 13. Continued.						
Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
Unm	F	Adult	10/7/2008	Hoodoo Creek, SNF	Known	Human-caused, hunting related, female with 1 COY killed when she charged guide near meat pole.
Unm	U	COY	10/7/2008	Hoodoo Creek, SNF	Probable	Human-caused, hunting related, COY of female killed by hunter.
Unm	F	Adult	10/13/2008	Crystal Creek, YNP	Known	Natural, specific cause undetermined. Likely due to predation attempt on bison or conflict with wolves.
G129	M	Adult	10/15/2008	Little Rock Creek, SNF	Known	Human-caused, human injuries, bear #G129 was killed when he charged. Bear was not collared.
149	F	Adult	10/18/2008	Cottongrass Creek, YNP	Known	Natural, bear #149 died of maladies associated with old age. Bear was collared.
G126	F	Yearling	10/19/2008	Warm Springs Creek, SNF	Known	Human-caused, malicous killing of yearling #G126.
G127	M	Yearling	10/19/2008	Warm Springs Creek, SNF	Known	Human-caused, malicous killing of yearling #G127.
458	F	Adult	10/22/2008	Clark Fork River, PR-WY	Known	Human-caused, management removal (shot) of bear #458 for repeated property damage and food rewards. Two yearlings (G133 and G134) were relocated. Bear was collared when removed.
265	F	Adult	10/22/2008	Stephens Creek, YNP	Known	Human-caused, management removal of adult female #265 (possible ID). Three yearlings relocated to Arnica Creek, YNP. Bear was not collared when removed. MTFWP removed #265 for conflicts at private residence in MT. The capture operation was conducted at a remote location in YNP for reasons of human safety.
318	M	Adult	10/25/2008	Crevice Creek, PR-MT	Known	Human-caused, DLP kill of bear #318, aggressive behavior at residence. Bear was not collared when killed.
Unm	M	Adult	10/28/2008	Ishawooa Creek, SNF	Known	Human-caused, DL kill while hunting.
Unm	F	COY	10/30/2008	Cinnabar Creek, GNF	Known	Human-caused, DL kill while hunting. Female with COY charged hunter, COY was killed, no evidence that female was wounded.
Unm	F	Adult	10/30/2008	Cinnabar Creek, GNF	Possible	Human-caused, DL kill while hunting. Female with COY charged hunter, COY was killed, no evidence that female was wounded.
Unm	F	Subadult	11/1/2008	South Fork Madison, GNF	Known	Human-caused. Female was apparently hit by vehicle and was paralyzed in rear legs. Bear was dispatched by warden.
447	F	Adult	11/4/2008	Wolverine Creek, BTNF	Known	Human-caused, hunting related. Bear #447 shot in camp. Bear was not collared.
Unm	U	Adult	11/18/2008	Middle Creek, GNF	Possible	Human-caused, hunting related. Elk hunter shot bear at site of 2 hunter killed elk carcasses. Bear was hit but ran away from site. No evidence of mortality found at site.

[a] Unm = unmarked bear, number indicates bear number.
[b] COY = cub-of-the-year.
[c] BTNF = Bridger-Teton National Forest, CTNF = Caribou-Targhee National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, MTFWP = Montana Fish, Wildlife and Parks, SNF = Shoshone National Forest, WWR = Wind River Reservation, YNP = Yellowstone National Park, Pr = private.

Table 14. Annual size estimates ($\hat{N}$) for population segments and evaluation of sustainability for known and probable mortalities documented during 2008 in the Greater Yellowstone Ecosystem. Established mortality thresholds (USFWS 2007*b*) are 9%, 9%, and 15% for dependent young and independent (≥2) 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	185	8						17	Under
Independent females[e]	251	9	3	1	10	26	30	23	Exceeded
Independent males[f]	159	20	7	5	11	29	41	24	Exceeded

[a] Term A in equations 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 equations 1 and 2 is the annual count of loss for independent aged bears wearing active telemetry except those removed through management actions.
[c] Term B in equations 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 equations 1 and 2 is estimated total mortality which 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 female bears are indicated by subscript F in equation 1.
[f] Mortality counts and estimates for independent aged male bears are indicated by subscript M in equation 2.

The carcass of an adult female grizzly bear was found during a telemetry flight 13 Oct 2008 (Table 13) in Crystal Creek, YNP. It was unknown if the bison was involved in the bear's death or merely at the scene. Photo courtesy of Steve Ard.

Key Foods Monitoring

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

It is well documented that grizzly bear use ungulates as carrion (Mealey 1980, Henry and Mattson 1988, Green 1994, Blanchard and Knight 1996, Mattson 1997) in YNP. Competition with recently reintroduced wolves (*Canis lupus*) for carrion and changes in bison (*Bison bison*) and elk (*Cervus elaphus*) management policies in the GYE have the potential to affect carcass availability and use by grizzly bears. For these and other reasons, we continue to survey historic carcass transects in YNP. In 2008, we surveyed routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses (Fig. 4).

We surveyed each route once for carcasses between April and early-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.

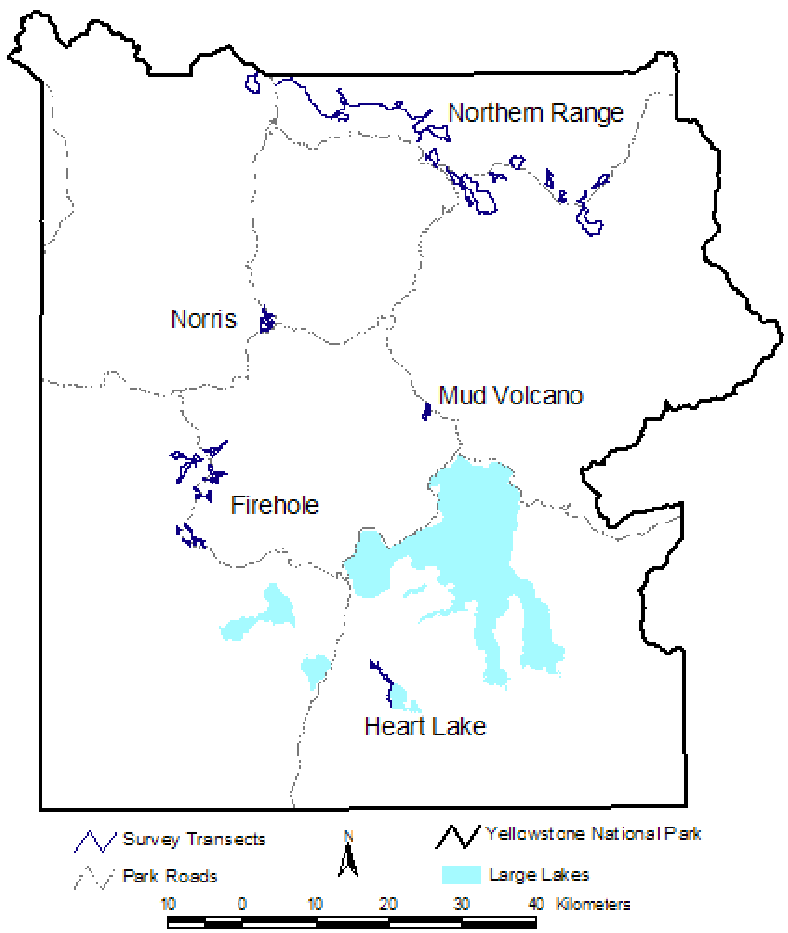

Fig. 4. Spring ungulate carcass survey transects in 5 areas of Yellowstone National Park.

In 2008, we recorded 116 ungulate carcasses for a total of 0.45 carcasses/km surveyed (Fig. 5).

Northern Range

We surveyed 12 routes on Yellowstone's Northern Range totaling 151.6 km traveled. One route was not surveyed to avoid disturbing an active wolf den. We used a Global Positioning System to more accurately measure the actual distance traveled on most of the routes. We counted 76 carcasses, including 2 mule deer, 71 elk, 2 bison, and 1 pronghorn, which equated to 0.50 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 grizzly bears was found at 4 elk carcasses. Evidence of use by wolves was found at 4 elk carcasses. Grizzly bear sign (e.g., tracks, scats, daybeds, or feeding activity) was observed along 8 of the routes and 1 grizzly was seen during the surveys. Black bear tracks were found along 1 survey route and 4 individuals were seen. The carcasses of 2 coyotes were also found.

Firehole River Area

We surveyed 8 routes in the Firehole drainage totaling 72.3 km. We found the remains of 33 bison and 2 elk, which equated to 0.48 carcasses/km traveled (Table 15). Definitive evidence of use by grizzly bears was found at 3 bison and 1 elk carcass. Grizzly bear sign was also found along 7 of the routes. We observed a mountain lion (*Felis concolor*) on 1 survey route, and lion tracks were seen on another survey route.

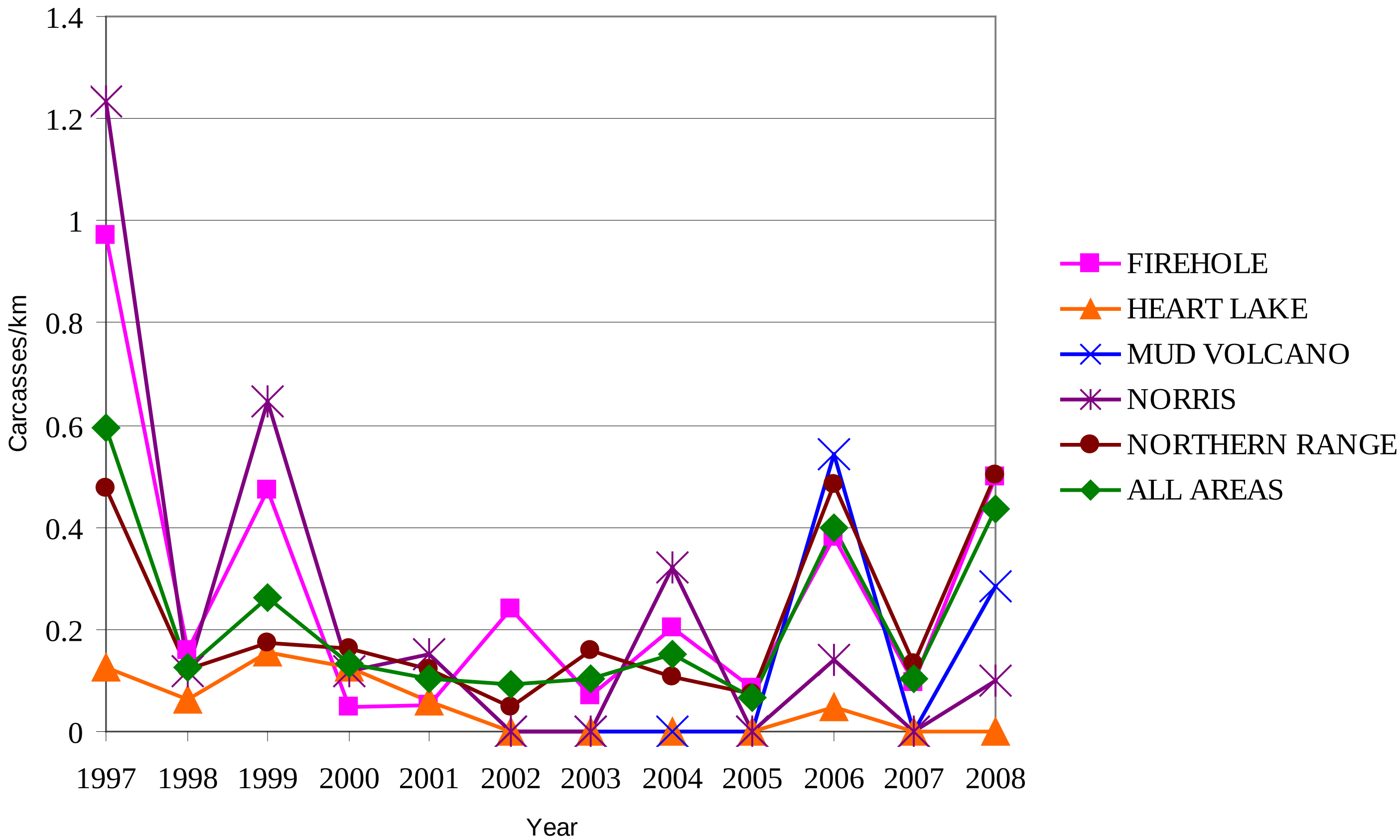

Fig. 5. Annual ungulate carcasses/km found on spring survey routes in winter ranges of Yellowstone National Park, Wyoming, 1997–2008.

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin totaling 19.9 km traveled. We observed 2 bison carcasses on these transects, and grizzly bear sign was observed along all 3 of the 4 routes.

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin covering 14.9 km. We observed no carcasses. Grizzly bear sign, including tracks, scats, and other feeding activities, was observed on all 3 routes.

Mud Volcano

We surveyed a single route in the Mud Volcano area covering 7 km. Two bison carcasses were observed this spring, and tracks and evidence of feeding by at least 1 grizzly bear was found at 1 carcass. Consumption of mineral soil by grizzly bears was also documented along the route.


National Park Service

Table 15. Ungulage carcasses found and visitation of carcasses by bears, wolves, and unknown large scavengers along surveyed routes in Yellowstone National Park during spring 2008.

Survey area (# routes)	Elk				Bison				
	Number of carcasses	# Visited by species			Number of carcasses	# Visited by species			Total carcasses/km
		Bear	Wolf	Unknown		Bear	Wolf	Unknown	
Northern Range (12)	71	6	4	52	2	0	0	2	0.50[a]
Firehole (8)	2	0	0	1	33	11	2	5	0.48
Norris (4)	0	0	0	0	2	1	1	0	0.10
Heart Lake (3)	0	0	0	0	0	0	0	0	0.00
Mud Volcano (1)	0	0	0	0	2	1	0	1	0.29

[a] Included 1 pronghorn and 2 mule deer carcasses.

Table 16. Age classes and sex of elk and bison carcasses found, by area, along surveyed routes in Yellowstone National Park during spring 2008.

	Elk (*n* = 73)						Bison (*n* = 39)					
	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total	Northern Range	Firehole	Norris	Heart Lake	Mud Volcano	Total
Age												
Adult	57	1	0	0	0	58	2	18	0	0	2	22
Yearling	1	0	0	0	0	1	0	13	0	0	0	13
Calf	2	0	0	0	0	2	0	1	2	0	0	3
Unknown	11	1	0	0	0	12	0	1	0	0	0	1
Sex												
Male	19	0	0	0	0	19	0	13	1	0	1	15
Female	30	1	0	0	0	31	2	15	0	0	1	18
Unknown	22	1	0	0	0	23	0	5	1	0	0	6

Spawning Cutthroat Trout (*Kerry A. Gunther, Todd M. Koel, Patrick Perrotti, Eric Reinertson, Phil Doepke, Brian Ertel, and Travis Wyman, Yellowstone National Park)*

Spawning cutthroat trout are a high quality, calorically dense food source for grizzly bears in YNP (Mealey 1975, Pritchard and Robbins 1990), and influence the distribution of bears over a large geographic area (Mattson and Reinhart 1995). In past years, grizzly bears were known to prey on cutthroat trout in at least 36 different tributary streams of Yellowstone Lake (Hoskins 1975, Reinhart and Mattson 1990). Haroldson et al. (2005) estimated that approximately 68 grizzly bears likely fished Yellowstone Lake tributary streams annually. 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) of the inlet creek to Trout Lake located in the northeast section of YNP.

The cutthroat trout population in Yellowstone Lake is now threatened by the introduction of nonnative lake trout (*Salvelinus namaycush*) and the exotic parasite (*Myxobolus cerebralis*) that causes whirling disease (Koel et al. 2005*a*, Koel et al. 2006). Lake trout and whirling disease have depressed the native cutthroat trout population and associated bear fishing activity. In addition to lake trout and whirling disease, drought may also be contributing to the decline of the Yellowstone Lake cutthroat trout population (Koel et al. 2005*b*). Due to the importance of cutthroat trout to grizzly bears and the potential threats from lake trout, whirling disease, and drought, monitoring of the cutthroat trout population is specified under the Conservation Strategy for the Grizzly Bear in the Greater Yellowstone Area (USFWS 2007*c*). The cutthroat trout population is currently monitored annually using counts at a fish trap located on a tributary along the east shore of Yellowstone Lake, and through visual stream surveys conducted along North Shore and West Thumb tributaries to Yellowstone Lake (Koel et al. 2005*a*, USFWS 2007*c*). 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 annually from a weir with a fish trap at the mouth of Clear Creek on the east side of Yellowstone Lake (Koel et al. 2005*a*). 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. A weir and fish trap on Bridge Creek, monitored for spawning cutthroat trout 1999–2005, has not been operated since due to the extremely low number of trout; only 1 cutthroat was counted there in 2004 and none were found in 2005.

In 2008, unusually high spring run-off damaged the Clear Creek weir and necessitated its removal prior to completing a count of spawning cutthroat trout ascending that creek. Two hundred-fifty-four cutthroat trout were counted before the weir was removed on 17 June. The cutthroat trout spawning run was still in progress when the weir was pulled. Since the fish count for 2008 was not completed, it cannot be compared to data from previous years (Fig. 6).

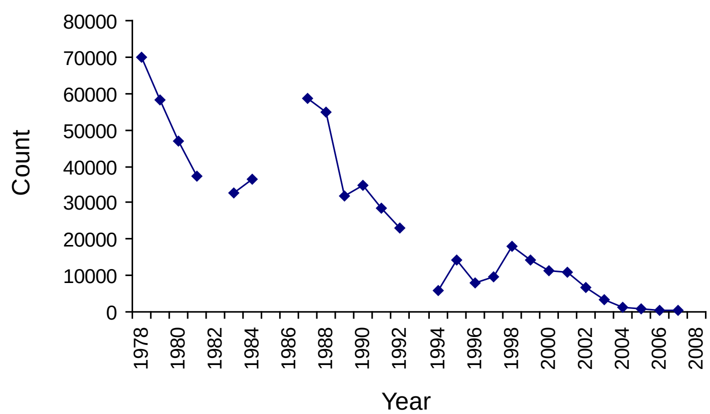

Fig. 6. Number of spawning cutthroat trout counted at the Clear Creek fish trap on the east shore of Yellowstone Lake, Yellowstone National Park, 1977–2008.

Spawning stream surveys.--Beginning 1 May each year, several streams including Lodge, Hotel, Hatchery, Incinerator, Wells, Bridge, Weasel, and Sand Point Creeks on the North Shore of Yellowstone Lake; and Sandy, Sewer, Little Thumb, and 1167 Creeks 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 spawn 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 2008 continued to show low numbers of spawning cutthroat trout in North Shore and West Thumb streams (Table 17). In North Shore streams, only 3 spawning cutthroat trout were counted. All were in Bridge Creek. No spawning cutthroat trout were observed in Lodge, Hatchery, Incinerator, or Wells Creeks. On West Thumb streams, only 20 spawning cutthroat trout were counted including 13 in Little Thumb Creek, 3 in 1167 Creek, 2 in Sandy Creek, and 2 in Sewer Creek. The number of spawners counted in the North Shore and West Thumb streams have decreased significantly since 1989 (Fig. 7). No evidence of grizzly bear or black bear fishing activity was observed along any of the 9 Yellowstone Lake tributaries surveyed in 2008.

Trout Lake

Spawning 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 conducted. On each sample day, 2 people

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, 2008.

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			No Spawn		0	
Hotel Creek			Not Surveyed			
Hatchery Creek			No Spawn		0	
Incinerator Creek			No Spawn		0	
Wells Creek			No Spawn		0	
Bridge Creek	6/16	6/16	1	1	3	3
Weasel Creek			Not Surveyed			
Sand Point Creek			Not Surveyed			
West Thumb Streams						
1167 Creek	6/2	6/2	1	1	3	3
Sandy Creek	6/9	6/9	1	1	2	2
Sewer Creek	6/9	6/9	1	1	2	2
Little Thumb Creek	6/23	6/23	1	1	13	13
Northern Range Stream						
Trout Lake Inlet	6/21	7/14	24	4	966	242

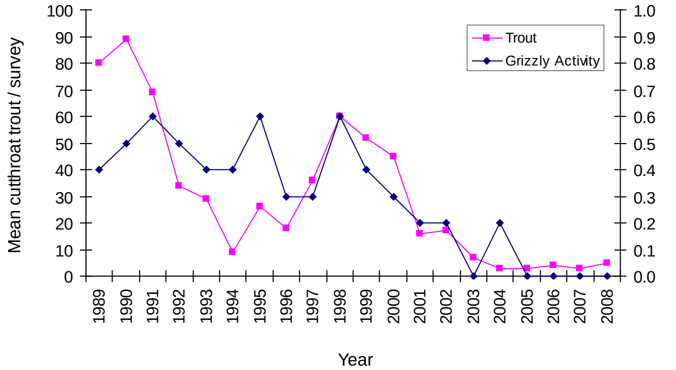

Fig. 7. Mean number of spawning cutthroat trout and mean activity by grizzly bears observed during weekly visual surveys of 8 North Shore and 4 West Thumb spawning streams tributary to Yellowstone Lake, Yellowstone National Park, 1989–2008.

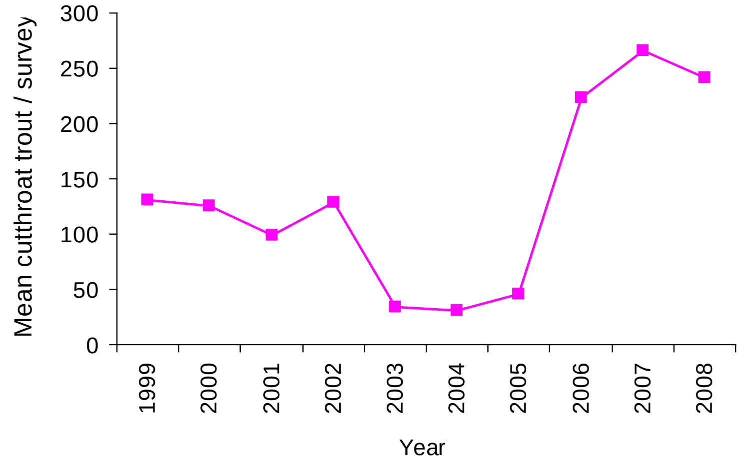

Fig. 8. Mean number of spawning cutthroat (and/or cutthroat x rainbow trout hybrids) observed during weekly visual spawning surveys of the Trout Lake inlet, Yellowstone National Park, 1999–2008.

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 spawn 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 period.

In 2008, the first movement of spawning trout from Trout Lake into the inlet creek was observed on 21 June. The spawn lasted approximately 24 days with the last spawning trout being observed in the inlet creek on 14 July. During the once per week visual surveys, 966 spawning cutthroat (and/or cutthroat trout x rainbow trout hybrids) were counted, an average of 242 per visit (Table 17). The number of fish observed per survey has ranged from a low of 31 in 2004 to a high of 266 in 2007 (Fig. 8).

No evidence of grizzly bear or black bear fishing activity was observed along the inlet creek during the surveys. A bear scat containing dandelion (*Taraxacum* spp.) was found next to the inlet creek on 26 June, during the spawning run.

Cutthroat trout outlook.--Using gill-nets, park fisheries biologists caught and removed 76,136 lake trout from Yellowstone Lake in 2008 as part of management efforts to protect the native cutthroat trout population (Koel et al. In press). Electroshocking of spawning grounds was not conducted in 2008. The catch per effort of cutthroat trout (unintentional by-catch) in smaller mesh size gillnets used to target juvenile lake trout increased in 2008, indicating an increase in cutthroat trout recruitment in recent years. During the fall cutthroat trout netting assessment on Yellowstone Lake, fisheries biologists noticed a slightly higher average catch of cutthroat trout per net than previous years, another indication that the cutthroat trout population may be rebounding.

Lake trout removed from Yellowstone Lake, 3 Oct 2007. Photo courtesy of Audrey Squires/NPS.

Grizzly Bear Use of Insect Aggregation Sites Documented from Aerial Telemetry and Observations
(Dan Bjornlie, Wyoming Game and Fish Department; and Mark 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 subsequently bears, showed specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. 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 annually 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 1997–1999, the method for defining insect aggregation sites was to inscribe a 1-km circle around the center of clusters of observations in which bears were seen feeding on insects in talus/scree habitats (Ternent and Haroldson 2000). This method allowed trend in bear use of sites to be annually monitored by recording the number of bears documented in each circle (i.e., site).

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 1 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 2008, actively feeding grizzly bears were observed on 4 sites classified as possible in past years. Therefore, these sites were reclassified as confirmed and analysis was done back to 1986. An observation of a grizzly bear actively feeding in 1 new area resulted in the identification of a new possible insect aggregation site. The reclassification of sites and a new possible site produced 35 confirmed sites and 17 possible sites for 2008.

The percentage of confirmed sites with documented use by bears varies annually, suggesting that some years have higher moth activity than others

(Fig. 9). For example, the years 1993–1995 were probably poor moth years because the percentage of confirmed sites used by bears (Fig. 9) and the number of observations recorded at insect sites (Table 18) were low. Overall, the percent of insect aggregation site use by grizzly bears increased by 6% in 2008 (Fig. 9). The number of observations or telemetry relocations at sites increased slightly from 2007, as well (Table 18). The number of insect aggregation sites used by bears in 2008 increased to 26 from 24 in 2007 (Table 18) and was slightly higher than the 5-year average of 22.0 sites/year from 2003–2007.

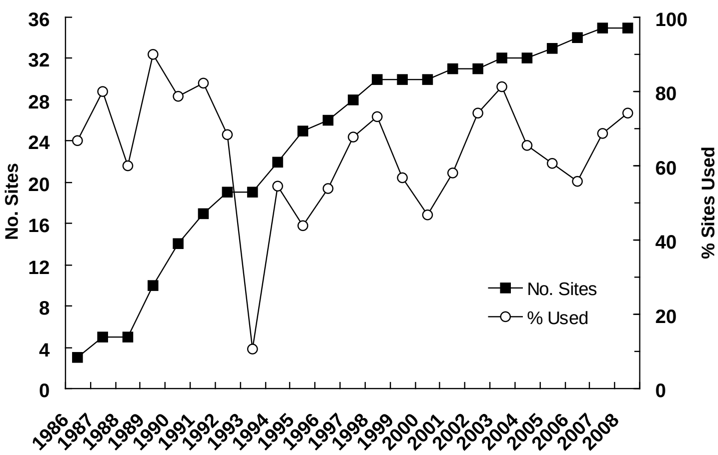

Fig. 9. Annual number of confirmed insect aggregation sites and percent of those sites at which either telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986–2008.

The IGBST maintains an annual list of unduplicated females observed with COY (see Table 5). Since 1986, 726 initial sightings of unduplicated females with COY have been recorded, of which 207 (29%) have occurred at (within 500 m, n = 181) or near (within 1,500 m, n = 26) insect aggregation sites (Table 19). In 2008, 11 of the 44 (25.0%) initial sightings of unduplicated females with COY were observed at insect aggregation sites, a decrease of 6 from 2007 (Table 19). This is lower than the 5-year average of 34.3% from 2003–2007.

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, an increasing trend in the annual number of unduplicated sightings of females with COY is still evident (Fig. 10), suggesting that some other factor besides observation effort at insect aggregation sites is responsible for the increase in sightings of females with cubs.

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 each site during 1986–2008.

Year	Number of confirmed moth sites[a]	Number of sites used[b]	Number of aerial telemetry relocations	Number of ground or aerial observations
1986	3	2	5	5
1987	5	4	4	11
1988	5	3	10	33
1989	10	9	10	41
1990	14	11	9	75
1991	17	14	11	165
1992	19	13	5	102
1993	19	2	1	1
1994	22	12	1	28
1995	25	11	7	35
1996	26	14	21	65
1997	28	19	15	80
1998	30	22	8	174
1999	30	17	25	152
2000	30	14	37	90
2001	31	18	22	119
2002	31	23	26	246
2003	32	26	9	158
2004	32	21	2	130
2005	33	20	15	175
2006	34	19	13	174
2007	35	24	11	174
2008	35	26	16	213
Total			283	2233

[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, 1986–2008.

Year	Unduplicated females with COY[a]	Number of moths sites with an initial sighting	Initial sightings: Within 500 m[b]		Initial sightings: 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	7	11	45.8	14	58.3
1992	25	4	6	24.0	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	4	4	12.1	7	21.2
1997	31	8	11	35.5	11	35.5
1998	35	11	13	37.1	13	37.1
1999	33	3	6	18.2	7	21.2
2000	37	6	7	18.9	10	27.0
2001	42	6	11	26.2	13	31.0
2002	52	10	14	26.9	17	32.7
2003	38	11	19	50.0	20	52.6
2004	49	10	15	30.6	16	32.7
2005	31	8	9	29.0	9	29.0
2006	47	11	13	27.7	15	31.9
2007	50	10	17	34.0	17	34.0
2008	44	7	11	25.0	14	31.8
Total	726		181		207	
Mean	31.6	5.5	7.9	22.2	9.0	25.5

[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 a insect aggregation site for this analysis, since some observations could be made of bears traveling to and from insect aggregation sites.

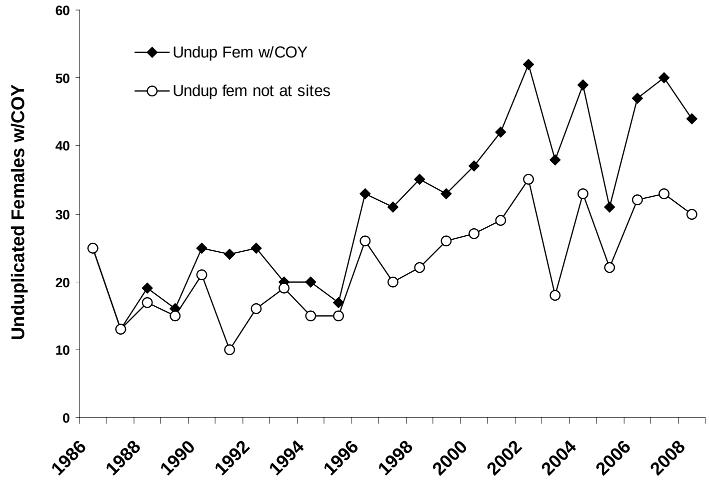

Fig. 10. The total number of unduplicated females with cubs-of-the-year (COY) observed annually in the Greater Yellowstone Ecosystem and the number of unduplicated females with COY <u>not</u> found within 1,500 m of known insect aggregation sites, 1986–2008.

Grizzly bear feeding on moths, 11 Jul 2008. Photo courtesy of Dale C. Ditolla.

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

Whitebark pine surveys showed generally poor cone production during 2008. Twenty-six transects (Fig. 11) were read, including 1 new transect (CSG, Fig. 11). All trees on 3 transects (F1, H, and T) were dead and suitable replacement trees could not be found within the stands; these transects will be retired. Overall, mean cones/tree was 8.6 (Table 20). The best cone production occurred on transects in the northwest portion of the ecosystem (Fig. 11); poorest was on transects J and CSA (Fig. 11 and Table 21). This is the first year since 2004 that cone production has been below average (Fig. 12).

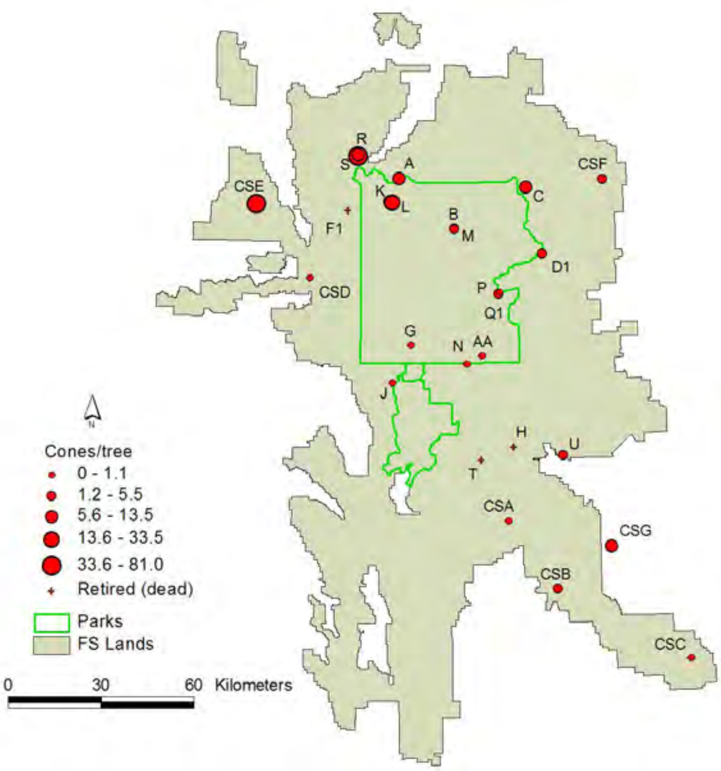

Fig. 11. Locations and mean cones/tree for 26 whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 2008.

Table 21. Whitebark pine (*Pinus albicaulis*) cone production transect results for 2008.

Transect	Cones	Trees	Mean	SD
A	56	10	5.6	14.6
B	34	10	3.4	3.3
C	71	9	7.9	7.0
D1	14	5	2.8	4.4
F1		Dead (retired)		
G	4	7	0.6	1.5
H		Dead (retired)		
J	0	10	0.0	0.0
K	85	10	8.5	7.1
L	139	10	13.9	12.4
M	19	10	1.9	2.6
N	2	9	0.2	0.7
P	18	10	1.8	3.2
Q1	7	10	0.7	1.2
R	304	9	33.8	53.1
S	89	9	9.9	17.3
T		Dead (retired)		
U	2	1	2.0	
AA	10	10	1.0	1.6
CSA	0	10	0.0	0.0
CSB	26	10	2.6	4.7
CSC	7	10	0.7	1.6
CSD	8	10	0.8	1.5
CSE	801	10	80.1	55.2
CSF	22	10	2.2	3.3
CSG	71	10	7.1	7.1

Table 20. Summary statistics for whitebark pine (*Pinus albicaulis*) cone production transects surveyed during 2008 in the Greater Yellowstone Ecosystem.

Total			Trees				Transect			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
1,789	209	23	8.6	24.2	0	161	77.8	167.6	0	801

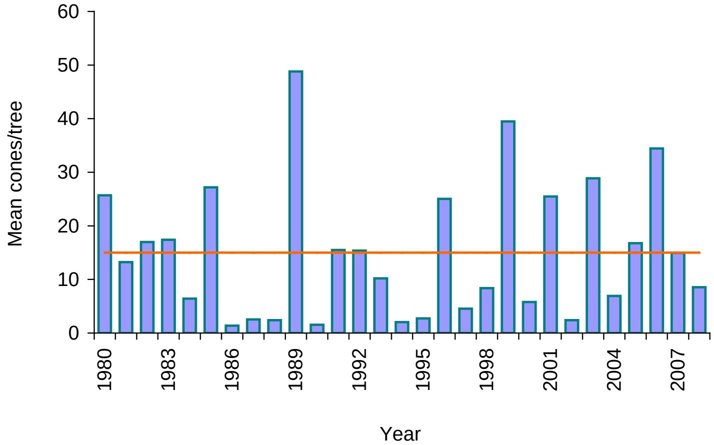

Fig. 12. Annual mean cones/tree on whitebark pine (*Pinus albicaulis*) cone production transects surveyed in the Greater Yellowstone Ecosystem during 1980–2008. The overall average for the period of 15 cones/tree is indicated by the horizontal line.

Mountain pine beetle activity continues at high levels on our original 19 transects. We observed an additional 24.1% (26/108) mortality among the live trees surveyed since 2002. Annual tree mortality during the last 6 years has ranged from 6.9% to 24.1%. Total tree mortality since 2002 is 56.8% (108/190) and 94.7% (18/19) of our original 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, there is a reduction in numbers of management actions during fall months with abundant cone availability. During August–October of 2008, 11 management captures of bears 2 years of age or older (independent) resulted in 8 transports and 3 removals. This result was near the overall average of 9 management actions for August–October 1980–2007. However, the number of bear mortalities from self-defense kill by hunters (see *Estimating sustainability of annual grizzly bear mortalities*) was high (n = 8, for independent aged bears) during August–October.

Whitebark pine stand on Windy Peak, Shoshone National Forest, showing evidence of blister rust, beetle kill, and fire, 9 Aug 2008. Photo courtesy of Jonathan Ball.

Habitat Monitoring

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

In 2008, total visitation in Grand Teton National Park was 3,832,016 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 2,485,987. Backcountry user nights totaled 27,521. Long- and short-term trends of recreational visitation and backcountry user nights are shown in Table 22 and Fig. 13.

Table 22. Average annual visitation and average annual backcountry use nights in Grand Teton National Park by decade from 1951 through 2008.

Decade	Average annual parkwide visitation[a]	Average annual backcountry use nights
1950s	1,104,357	Not available
1960s	2,326,584	Not available
1970s	3,357,718	25,267
1980s	2,659,852	23,420
1990s	2,662,940	20,663
2000s[b]	2,488,710	29,973

[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.

[b] Data for 2000–2008 only.

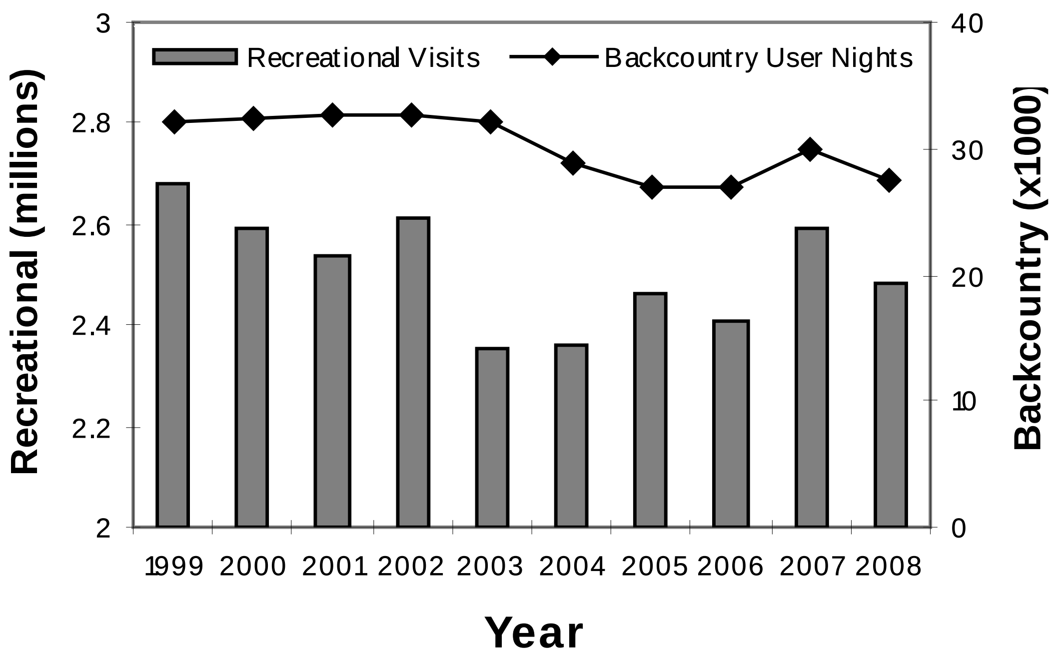

Fig. 13. Trends in recreational visitation and backcountry user nights in Grand Teton National Park during 1999–2008.

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

In 2008, total visitation to Yellowstone National Park was 3,945,130 people including recreational and non-recreational (e.g. traveling through the Park on U.S. Highway 191 but not recreating) use. Recreational visits alone totaled 3,066,578. These visitors spent 694,315 user nights camping in developed area roadside campgrounds and 39,302 user nights camping in backcountry campsites. The bulk of YNP's visitation occurs from May through September. Total recreational visits to the park in 2008 during that time were 2,797,250, an average of 18,283 visitors/day.

Average annual recreational visitation increased each decade from an average of 7,378 visitors/year during the late 1890s to 3,012,653 visitors/year in the 1990s (Table 23). Average annual recreational visitation has decreased slightly the first 9 years (2000–2008) of the current decade, to an average of 2,931,687 visitors/year. 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 23). The number of backcountry user nights is limited by both the number and capacity of designated backcountry campsites in the park.

Table 23. Average annual visitation, auto campground user nights, and backcountry user nights in Yellowstone National Park by decade from 1895 through 2008.

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
1920s	157,676	Not available	Not available
1930s	300,564	82,331[b]	Not available
1940s	552,227	139,659[c]	Not available
1950s	1,355,559	331,360	Not available
1960s	1,955,373	681,303[d]	Not available
1970s	2,240,698	686,594[e]	45,615[f]
1980s	2,344,485	656,093	39,280
1990s	3,012,653	647,083	43,605
2000s	2,931,687[g]	631,584[g]	40,434[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 years 2000–2008.

Trends in Elk Hunter Numbers within the Primary Conservation Area Plus the 10-mile Perimeter Area *(David S. Moody, 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 people hunting most major game species. We used state estimates for the number of elk hunters by hunt area as an index of hunter numbers for the PCA plus the 10-mile perimeter area. Because some hunt area boundaries do not conform exactly to the PCA and 10-mile perimeter area, regional biologists familiar with each hunt area were queried to estimate hunter numbers within the PCA 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 PCA and 10-mile perimeter area, their numbers are fairly small and many hunt in conjunction with elk, especially in Wyoming, where seasons overlap. Elk hunter numbers represent a reasonably accurate index of total hunter numbers within areas occupied by grizzly bears in the GYE.

We generated a data set from all states from 1998 to 2008 (Table 24, Fig. 14). Complete data do not exist for all years. Idaho and Montana do not calculate these numbers annually or, in some cases the estimates are not available in time for completing this report. As data become available it will be added in the future.

Overall, hunter numbers have decreased since 1998, with the exception of 2002 when hunter numbers increased in Wyoming, Idaho, and Montana. Until 2008, most of the decrease occurred in Wyoming and Montana. Idaho drastically reduced harvest objectives for females in 2008, which accounts for the decrease in hunter numbers this year. Hunter numbers in Wyoming have decreased from the peak of 15,439 in 1998 to 8,792 in 2008. It is anticipated that hunter numbers in Wyoming will probably stabilize at 2007 and 2008 levels into the future as harvest objectives have been realized. Hunter numbers also decreased in Montana since 2002 but at reduced levels compared to Wyoming. All 3 states liberalized elk seasons in the early 1990s through 2002 to reduce elk herds towards respective population objectives. The majority of the increased harvest was focused on females. Elk populations began approaching population objective around 2004. As a result, elk hunter numbers have stabilized.

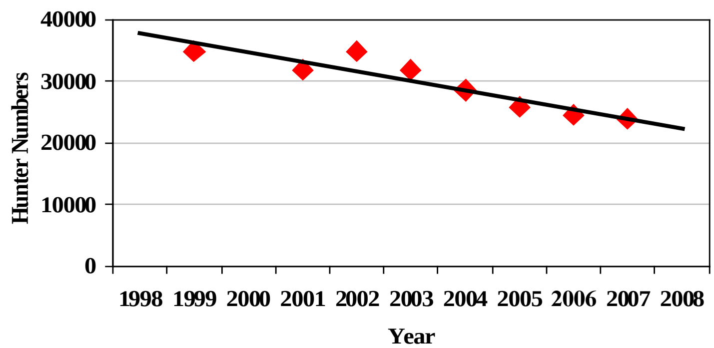

Fig. 14. Trend in elk hunter numbers within the Primary Conservation Area plus a 10-mile perimeter in Idaho, Montana, and Wyoming, 1998-2008.

Table 24. Estimated numbers of elk hunters within the Primary Conservation Area plus a 10-mile perimeter in Idaho, Montana, and Wyoming, for the years 1998–2008.

	Year										
State	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Idaho	2,785	2,883	[a]	2,914	3,262	3,285	3,454	3,619	3,016	2,592	1,763
Montana	[a]	16,254	17,329	15,407	17,908	16,489	14,320	12,365	12,211	12,635	[a]
Wyoming	15,439	15,727	12,812	13,591	13,709	11,771	10,828	9,888	9,346	8,716	8,792
Total		34,864		31,912	34,879	31,905	28,602	25,872	24,573	23,943	

[a] Hunter number estimates not currently available.

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; Steve L. Cain, Grand Teton National Park; Kevin Frey, Montana Fish, Wildlife and Parks; and Mark A. Haroldson and Charles C. Schwartz, Interagency Grizzly Bear Study Team)*

Conservation of grizzly bears in the GYE requires providing sufficient habitat (Schwartz et al. 2003) and keeping human-caused bear mortality at sustainable levels (IGBST 2005, 2006). 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 from occurring, land and wildlife managers need baseline information as to the types, causes, locations, and 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 described by Gunther et al. (2000, 2001). To identify trends in areas with concentrations of conflicts, we calculated the 80% isopleth for the distribution of conflicts from the most recent 3-year period (2006–2008), using the fixed kernel estimator in the Animal Movements (Hooge and Eichenlaub 1997) extension for ArcView GIS (Environmental Systems Research Institute 2002).

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 of average or above average abundance there tend to be few grizzly bear-human conflicts involving property damage and anthropogenic foods. When the abundance of native bear foods is below average, incidents of grizzly bears damaging property and obtaining human foods and garbage increase, especially during late summer and fall when bears are hyperphagic (Gunther et al. 2004). Livestock depredations tend to occur independent of the availability of natural bear foods (Gunther et al. 2004). In 2008, the number of winter-killed ungulate carcasses were above average in both thermally influenced ungulate winter ranges and on the Northern Ungulate Winter Range (see Spring Ungulate Availability) during early spring. Unusually persistent snow cover delayed spring green-up resulting in low abundance of vegetal bear foods during late spring, estrus and early-hyperphagia. In addition, very few spawning cutthroat trout were observed in monitored tributary streams of Yellowstone Lake (see Spawning Cutthroat Trout) during estrous. Many grizzly bears were observed at high elevation army cutworm moth aggregation sites (see Grizzly Bear Use of Insect Aggregation Sites) once snow had melted off of the talus slopes. During late hyperphagia, whitebark pine seed production was poor throughout most of the ecosystem (see Whitebark Pine Cone Production). However, berry production was noticeably good for the GYE during September. The high number of bear-human conflicts and human-caused bear mortalities in October suggest that preferred high quality bear foods were scarce at that time.

There were 190 grizzly bear-human conflicts reported in the GYE in 2008 (Table 25, Fig. 15). These incidents included bears obtaining anthropogenic foods (38%, n = 72), killing livestock (35%, n = 67), damaging property (20%, n = 38), obtaining vegetables and fruit from gardens and orchards (4%, n = 7), and injuring people (3%, n = 6). Most (58%, n = 111) conflicts occurred on private land in the states of Wyoming (30%, n = 57), Montana (21%, n = 42), and Idaho (6%, n = 12). Forty-two percent (n = 79) of the conflicts occurred on public land administered by the U.S. Forest Service (36%, n = 68) and National Park Service (6%, n = 11). Most (74%, n = 140) of the bear-human conflicts in 2008 occurred inside of the PCA. Twenty-five percent (n = 48) of the bear-human conflicts occurred outside of the PCA. The number of incidents of grizzly bear-human conflict in 2008 were similar to the long-term averages recorded from 1992–2007 (Table 26).

The conflict distribution map constructed using the fixed kernel 80% conflict distribution isopleths, identified 5 areas where most grizzly bear-human conflicts in the GYE occurred over the last 3 years (Fig. 16). These 5 areas contained 406 (75%) of the 539 conflicts that occurred from 2006–2008. The 5 areas where most conflicts occurred included: 1) the Gardiner Basin area; 2) the area encompassing the Clarks Fork River, Crandall Creek, Sunlight Creek, and the North and South Forks of the Shoshone River; 3) the Wood River/Cottonwood Creek/Grass Creek drainages, 4) the Green River/Dunoir Creek drainages, and 5) the area encompassing West Yellowstone and Island Park. These 5 areas should receive consideration when allocating state, federal, and private resources available for reducing grizzly bear-human conflicts in the GYE.

Grizzly bear habitat under different ownership and land management mandates exhibited different types of bear-human conflicts in 2008. On private land, incidents of property damage and bears obtaining anthropogenic foods (garbage, grain, bird seed) were the most common (80%, 89 of 111) type of grizzly conflict reported. On lands managed by the U.S. Forest Service, cattle depredations were the most common (77%, 52 of 68) type of conflict. On lands under National Park Service jurisdiction, there were very few grizzly bear-human conflicts of any type (n = 11), but habituation of bears to people was a significant management challenge. In Grand Teton National Park (GTNP), the number of incidents where habituated bears frequented roadside meadows and the outskirts of developments continued to increase in 2008. GTNP staff managed visitors and bears at 122 grizzly bear-jams in 2008. In YNP, the number of bear-jams was among the highest recorded since major changes in bear management were implemented in 1970. There were 298 grizzly bear-jams reported in YNP in 2008. In both parks, a significant amount of staff time was spent managing habituated bears and the visitors that want to view and photograph habituated bears that feed on native foods in roadside meadows.

Table 25. Number of incidents of grizzly bear-human conflicts reported within different land ownership areas in the Greater Yellowstone Ecosystem, 2008.

Land owner[a]	Property damages	Anthropogenic foods	Human injury	Gardens/ Orchards	Beehives	Livestock depredations	Total Conflicts
ID-private	0	12	0	0	0	0	12
ID-state	0	0	0	0	0	0	0
MT-private	12	24	0	5	0	1	42
MT-state	0	0	0	0	0	0	0
WY-private	14	28	0	2	0	13	57
WY-state	0	0	0	0	0	0	0
BLM	0	0	0	0	0	0	0
BDNF	0	0	0	0	0	0	0
BTNF	1	2	0	0	0	24	27
CNF	0	0	0	0	0	0	0
CTNF	0	0	0	0	0	1	1
GNF	2	1	2	0	0	0	5
SNF	3	2	2	0	0	28	35
GTNP/JDR	1	0	0	0	0	0	1
YNP	5	3	2	0	0	0	10
Total	38	72	6	7	0	67	190

[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.

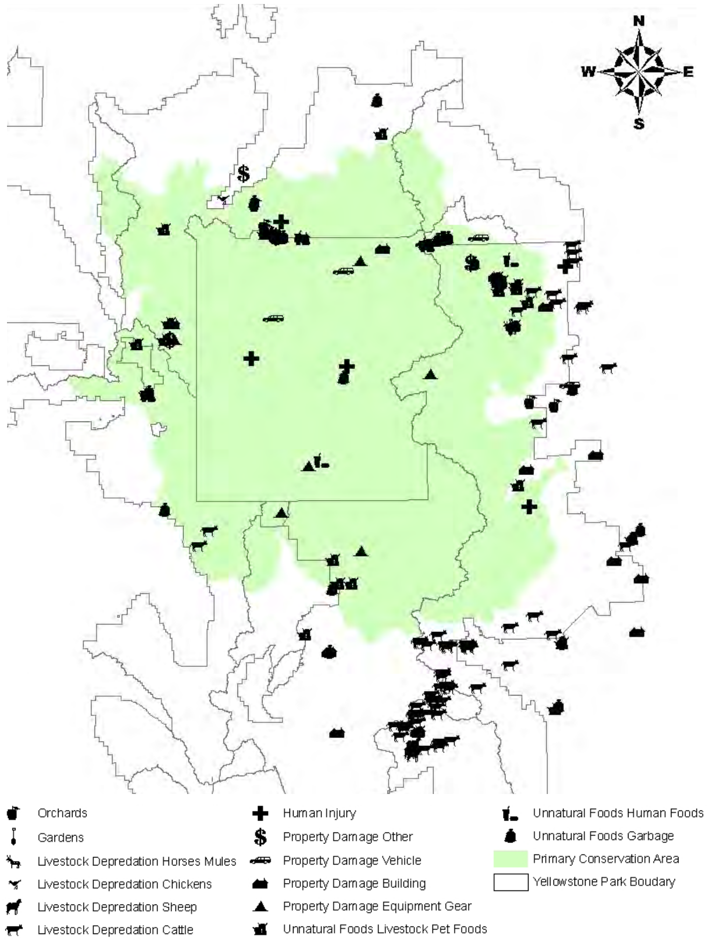

Fig. 15. Locations of different types of grizzly bear-human conflicts reported in the Greater Yellowstone Ecosystem in 2008. The shaded area represents the Greater Yellowstone Grizzly Bear Primary Conservation Area.

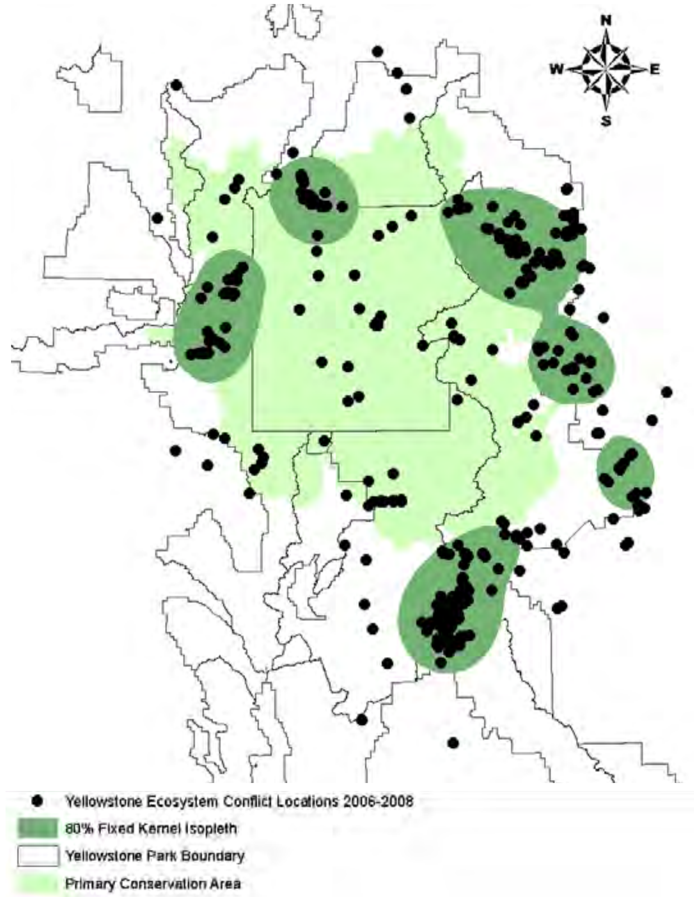

Fig. 16. Concentrations (dark shaded polygons) of grizzly bear-human conflicts that occurred from 2006–2008, identified using the 80% fixed kernel isopleth. The lightly shaded background area represents the Greater Yellowstone Grizzly Bear Primary Conservation Area.

Table 26. Comparison between the number of incidents of different types of grizzly bear-human conflicts in 2008 and the average annual number of conflicts recorded from 1992–2007 in the Greater Yellowstone Ecosystem.

Type of conflict	1992–2007 Average ± SD	2008
Human injury	4 ± 3	6
Property damage	20 ± 12	38
Anthropogenic foods	56 ± 39	72
Gardens/orchards	6 ± 5	7
Beehives	3 ± 4	0
Livestock depredations	51 ± 18	67
Total conflicts	139 ± 56	190

Literature Cited

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

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

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

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

Blanchard, B.M. 1990. Relationship between whitebark pine cone production and fall grizzly bear movements. Pages 362–363 *in* W.C. Schmidt and K.J. McDonald, compilers. Proceedings of symposium on whitebark pine ecosystems: ecology and management of a high-mountain resource. U.S. Forest Service General Technical Report INT-270. U.S. Department of Agriculture, Forest Service, Ogden, Utah, USA.

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

Blanchard, B.M., and R.R. Knight. 1996. Effects of wildfire on grizzly bear movements and foraging strategies. Pages 117–122 *in* J.M. Greenlee, editor. Proceedings of the second biennial scientific conference on the Greater Yellowstone Ecosystem. International Association of Wildland Fire, Fairfield, Washington, USA.

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

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

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

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

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

Cole, G.F. 1971. An ecological rationale for the natural or artificial regulation of native ungulates in parks. Transactions of the North American Wildlife and Natural Resources Conference 36:417–425.

Craighead, J.J., K.R. Greer, R.R. Knight, and H.I. Pac. 1988. Grizzly bear mortalities in the Yellowstone Ecosystem, 1959–1987. Report of the Montana Department of Fish, Wildlife and Parks; Craighead Wildlife Institute; Interagency Grizzly Bear Study Team; and National Fish and Wildlife Foundation.

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

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

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

Environmental Systems Research Insitute. 2002. ArcView GIS. Version 3.3. Environmental Systems Research Institute, Inc., Redlands, California, USA.

Farnes, P.E. 1991. A scaled index of winter severity. 59th Proceedings of the Western Snow Conference, 12–15 April 1991, Juneau, Alaska, USA.

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

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

Gunther, K.A., M.T. Bruscino, S. Cain, J. Copeland, K. Frey, M.A. Haroldson, and C.C. Schwartz. 2000. Grizzly bear-human conflicts confrontations, and management actions in the Yellowstone ecosystem, 1999. Pages 55–108 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1999. U.S. Geological Survey, Bozeman, Montana, USA.

Gunther, K.A., M.T. Bruscino, S. Cain, J. Copeland, K. Frey, M.A. Haroldson, and C.C. Schwartz. 2001. Grizzly bear-human conflicts confrontations, and management actions in the Yellowstone ecosystem, 2000. Pages 64–109 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 2000. U.S. Geological Survey, Bozeman, Montana, USA.

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

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

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

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

Henry, J., and D.J. Mattson. 1988. Spring grizzly bear use of ungulate carcasses in the Firehole River drainage: third year progress report. Pages 51–59 *in* R.R. Knight, B.M. Blanchard, and D.J. Mattson, authors. Yellowstone grizzly bear investigations: annual report of the Interagency Study Team, 1987. National Park Service, Bozeman, Montana, USA.

Hooge, P.N., and B. Eichenlaub. 1997. Animal movement extension to ArcView. Version 1.1. Alaska Biological Science Center, U.S. Geological Survey, Anchorage, Alaska, USA.

Hoskins, W.P. 1975. Yellowstone Lake tributary study. Interagency Grizzly Bear Study Team unpublished report, Bozeman, Montana, USA.

Houston, D.B. 1982. The northern Yellowstone elk. Macmillan Publishing Company, New York, New York, USA.

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

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

Interagency Grizzly Bear Study Team. 2008. Reassessing methods to distinguish unique female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem. Interagency Grizzly Bear Study Team, U.S. Geological Survey, Northern Rocky Mountain Science Center, Montana State University, Bozeman, Montana, USA.

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

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

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

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

Koel, T.M., J.L. Arnold, P.E. Bigelow, P.D. Doepke, B.D. Ertel, and D.L. Mahony. 2005*b*. Yellowstone Fisheries & Aquatic Sciences: Annual Report, 2004. National Park Service, Yellowstone Center for Resources, Yellowstone National Park, Wyoming, USA.

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

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

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

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

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

Mattson, D.J., B.M. Blanchard, and R.R. Knight. 1992. Yellowstone grizzly bear mortality, human-habituation, and whitebark pine seed crops. Journal of Wildlife Management 56:432–442.

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

Mattson, D.J., and D.P. Reinhart. 1995. Influences of cutthroat trout (*Oncorhynchus clarki*) on behavior and reproduction of Yellowstone grizzly bears (*Ursus arctos*), 1975-1989. Canadian Journal of Zoology 73:2072–2079.

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

Mealey, S.P. 1980. The natural food habits of grizzly bears in Yellowstone National Park, 1973–74. International Conference on Bear Research and Management 4:281–292.

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

Pritchard, G.T., and C.T. Robbins. 1990. Digestive and metabolic efficiencies of grizzly and black bears. Canadian Journal of Zoology 68:1645–1651.

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

Reinhart, D.P., and D.J. Mattson. 1990. Bear use of cutthroat trout spawning streams in Yellowstone National Park. International Conference on Bear Research and Management 8:343–350.

Schwartz, C.C., M.A. Haroldson, and S. Cherry. 2006*a*. Reproductive performance of grizzly bears in the Greater Yellowstone Ecosystem, 1983–2002. Pages 17–24 *in* C.C. Schwartz, M.A. Haroldson, G.C. White, R.B. Harris, S. Cherry, K.A. Keating, D. Moody, and C. Servheen, authors. 2006. Temporal, spatial and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Monographs 161:1–68.

Schwartz, C.C., M.A. Haroldson, S. Cherry, and K.A. Keating. 2008. Evaluation of rules to distinguish unique female grizzly bears with cubs in Yellowstone. Journal of Wildlife Management 72(2):543–554.

Schwartz, C.C., M.A. Haroldson, and G.C. White. 2006*b*. Survival of cub and yearling grizzly bears in the Greater Yellowstone Ecosystem, 1983–2001. Pages 25–31 *in* C.C. Schwartz, M.A. Haroldson, G.C. White, R.B. Harris, S. Cherry, K.A. Keating, D. Moody, and C. Servheen, authors. 2006. Temporal, spatial and environmental influences on the demographics of grizzly bears in the Greater Yellowstone Ecosystem. Wildlife Monographs 161:1–68.

Schwartz, C.C., S.D. Miller, and M.A. Haroldson. 2003. Grizzly bear. Pages 556–586 *in* G.A. Feldhammer, B.C. Thompson, and J.A. Chapman, editors. Wild Mammals of North America: biology, management, and conservation. Second edition. The John Hopkins University Press, Baltimore, Maryland, USA.

Seber, G.A.F. 1982. The estimation of animal abundance and related parameters. Macmillian Publishing Company, Incorporated, New York, New York, USA.

Ternent, M., and M. Haroldson. 2000. Grizzly bear use of insect aggregation sites documented from aerial telemetry and observations. Pages 36–39 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1999. U.S. Geological Survey, Bozeman, Montana, USA.

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

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

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

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

Bear tracks and digs in Pelican Valley, 10 May 2006. Photo courtesy of Steve Ard

2008 Annual Progress Report

Jennifer Fortin
Washington State University

Title: Assessing habitat and diet selection for grizzly (*Ursus arctos*) and American black bears (*Ursus americanus*) in Yellowstone National Park

Introduction: A broad study of grizzly (*Ursus arctos*) and black bears (*Ursus americanus*) using the area around Yellowstone Lake was initiated in the fall of 2006. The purpose of this 3-year study is to determine if spawning cutthroat trout (*Oncorhynchus clarkii*) 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 food resource, we want to determine what geographical areas and foods the bears are using and if those foods are an adequate replacement to maintain a healthy population of grizzly bears.

Capture and collaring: Bears were trapped around Yellowstone Lake during the fall of 2006 and early summer and fall of both 2007 and 2008. Sixteen grizzly bears (6 females and 10 males) and six male black bears have been captured and fitted with Spread Spectrum Technology (SST) Global Positioning System (GPS) collars.

Telemetry results: Nine grizzly bears (5 female and 4 male) and five male black bears were radio tracked during this year's field season (13 May–19 Oct 2008). Approximately 28,480 GPS locations were recorded by these collars during the 2008 field season. Two male grizzly bears, #568 and #570, captured in the fall of 2007 dropped their collars in the early spring of 2008 and collars were retrieved. Male grizzly bear 574's collar fell off prematurely on 21 July 2008. Female grizzly bear 541's collar fell off prematurely on 30 May and she was recollared on 22 July 2008. Male grizzly bear 585 died of natural causes on 12 August 2008 and female grizzly bear 149 also died of natural causes around 17 October 2008. Female grizzly #559's collar "released" as programmed on 1 September 2008. All collars were retrieved. Six grizzly bears (2 female and 4 male) and five male black bears will continue to wear their collars through the 2009 field season. Female grizzly bear 559 had one two year old in the spring of 2008.

Site visits: Four crews of two persons each (2 graduate students along with 6 volunteers) were employed for the 2008 field season. The field crews visited GPS locations to record bear activity, including habitat and dietary item use. We visited 1,416 GPS locations at which we collected 87 hair samples, 252 fecal samples, and forage samples. Of these sites, 529 were Level 1 only in their analysis, 887 continued to Level 2 analysis, and 167 to Level 3 analysis. All data was entered into an Access database.

Level 2 site visits that included feeding consisted of carcasses, insects, roots, false-truffles, and nuts. Carcasses consisted of 11 elk (*Cervus elaphus*), 4 bison (*Bison bison*) and 1 black bear (*Ursus americanus*). Insect sites consisted of 109 ant hills or log tears, 47 yellow jacket nests, 5 bee nests, and 56 other insect and/or earthworms sites. Roots were mainly yampa (*Perideridia gairdnerii*) at 57 sites with 7 biscuit root (*Lomatium* spp.). There were 65 fungi sites (*Rhizopogon* spp.), 10 rodent caches, and 5 whitebark pine (*Pinus albicaulis*) nut middens. It was a poor whitebark pine cone year with counts averaging 8.6 cones/tree in the Greater Yellowstone Ecosystem.

Level 3 foraging or grazing sites were composed of all three categories: graminoids, forbs, and berries. Graminoid site visits included: 32 rye grass (*Elymus* spp.), 17 bluegrass (*Poa* spp.), 12 each of bluejoint reedgrass (*Calamagrostis canadensis*), timothy (*Phleum spp.*) and onion grass (*Melica spp.*), 10 sedge (*Carex* spp.), 6 fescue (*Festuca* spp.), and 2 wheatgrass (*Agropyron* spp.). The dominant forbs at site visits were elk thistle (*Cirsium scariosum*) at 37 and dandelion (*Taraxacum* spp.) at 32. Other forbs used were: 19 of both fireweed (*Epilobium* spp.) and clover (*Trifolium* spp.), 9 lousewort (*Pedicularis* spp.), 4 of both licorice root (*Osmorhiza* spp.) and bistort root (*Polygonum bistortoides*), 3 both of angelica (*Angelica*) and sticky geranium (*Geranium viscosissimum*), 2 each of chives (*Allium* spp.), fern-leaved lovage (*Ligusticum filicinum*), arrowleaf balsamroot (*Balsamorhiza sagittata*) and horsetail (*Equisetum arvense*), and 1 each of pondweed (*Potamogeton*), meadow buttercup (*Ranunculus acris*), goat's beard (*Tragopogon* spp.), viola (*Viola* spp.) and common sowthistle (*Sonchus oleraceus*). Berry production was good in 2008 with use composed of: 32 globe huckleberry (*Vaccinium membranaceum*), 15 grouse whortleberry (*Vaccinium scoparium*), 11 elderberry (*Sambucus racemosa*), 3 buffaloberry (*Shepherdia canadensis*), and 1 each of dwarf huckleberry (*Vaccinium caespitosum*) and gooseberry (*Ribes* spp.).

Hair snares: Forty-eight hair snares were deployed on 35 streams on Yellowstone Lake. Hair snares were visited bi-weekly from mid-May through mid-August during which time 419 hair samples were collected. Stream surveys for spawning cutthroat trout were conducted in conjunction with hair snare visits. During stream surveys 14 hair samples and 34 fecal samples were collected. Of the 35 streams surveyed, 14 contained spawning cutthroat and 21 contained fry and/or fingerlings during at least one stream survey. Maximum number of cutthroat trout spawners seen during one stream survey was 15. Fry and/or fingerling counts were often estimated to be several hundred. One incident of fishing by bears was observed. All data was entered into an Access database.

2007 Hair Snare Results: In 2007, 761 hair samples were collected at hair snag corrals (n = 48) located along tributary streams of Yellowstone Lake from May to August. 438 samples were sent to Wildlife Genetics International (WGI) for genetic analyses. 371 (85%) of these samples were assigned to individual bears using a suite of seven microsatellite loci (observed heterozygosity, H_o, across seven loci = 0.743). From this assignment, we now know at least 40 grizzly bears (25 male : 15 female) and 16 black bears (11 male:5 female) visited tributary stream courses during this time. Of those bears identified, 8 black bears (50%) and 14 (35%) grizzly bears visited streams located near human development (front-country).

Sixteen of the 438 (3.7%) samples analyzed were blind positives from a captive population of grizzly bears at Washington State University (WSU). WGI correctly matched replicate samples of six individual bears from this facility. Further, the team of geneticists matched two of the blind samples to an actual bear (Star) whose genotype they had obtained during WGI's analysis of samples from the Northern Continental Divide Ecosystem (NCDE). Star became a member of the WSU colony after removal from the NCDE. Through the use of parentage techniques, WGI technicians also gained reason to believe that two bears within the dataset were putative offspring of Star and a male from the Greater Yellowstone Ecosystem (GYE). Their conjecture was correct, as WSU personnel provided the hair of two cubs from a cross between Star and a captive male from the GYE.

2008 Wyoming Bear Wise Community Project Update

Tara Hodges, Bear Wise Community Coordinator
Tara.Hodges@wgf.state.wy.us
Wyoming Game and Fish Department
2820 State Highway 120
Cody, WY 82414

Mike Boyce, Bear Management Specialist
Michael.Boyce@wgf.state.wy.us
Wyoming Game and Fish Department
420 North Cache
Jackson, WY 83001

Introduction

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

This report provides a summary of program accomplishments in 2008. Progress and past accomplishments are reported in the 2007 annual report of the Interagency Grizzly Bear Study Team (IGBST) (Hodges and Bruscino 2008).

Background

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

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

In 2005, the Wyoming Game & Fish Department (WGFD) began implementation of the Bear Wise Community program. Although the program's efforts were focused primarily in the Wapiti area, the WGFD also initiated a smaller scale project in Teton County to address the increasing number of black and grizzly bear conflicts in the Jackson area.

For the last three years, the Bear Wise Community programs in both Cody and Jackson have deployed a multi-facetted education and outreach campaign in an effort to minimize human-bear conflicts and promote proper attractant management. Although a wide array of challenges remain and vary between communities, many accomplishments have been made, and significant progress is expected to continue as Bear Wise efforts gain momentum.

Wapiti Project Update

The Wapiti Bear Wise Community program is at the end of the third year since implementation. Thus far, the program has utilized radio and television advertisements, newspaper and magazine articles, public workshops and programs, contact with youth organizations such as the Boy Scouts, 4H, and public schools, mass mailings, and the use of signing on private and public land to convey the educational messages surrounding human-bear conflict prevention. To compliment the educational initiatives, the program also uses an extensive outreach campaign that assists the community in obtaining and utilizing bear-resistant products and alternative methods of attractant management. Efforts and accomplishments for 2008 are as follows:

Ongoing Efforts:

1. In 2007, over 100 95-gallon bear resistant garbage carts were purchased with grant funding. The carts are offered to community members for the reduced price of $49.99. To date, 75 carts have been placed and 40 more are in stock and available to the public.

2. Partnership with the North Fork Bear Wise Group continues. The group, comprised of five local Wapiti citizens, meets monthly to articulate community needs and assist in the development of educational and outreach initiatives.

3. Continue to maintain three educational “Bear Aware” kiosks located in Wapiti and the Crandall/Sunlight area north of Cody. Message boards and literature are updated and revised four times during the non-denning season.

4. Public libraries across northwest Wyoming continue to offer *Staying Safe in Bear Country* and *Living in Bear Country* DVD’s or videos and the *Living in Bear Country* book by Linda Masterson that the Bear Wise Community program purchased and donated in 2006.

5. Bear Aware tips were included in the local Wapiti School calendar for the third consecutive year. Tips contain seasonally appropriate messages regarding bear behavior/biology and conflict prevention. The calendar is sold to local Wapiti residents as a school fundraiser each fall.

6. Bear Aware information is included in the “Welcome Wagon” gift bags put together by local businesses for new residents.

New Initiatives and Accomplishments:

1. A Bear Aware highway billboard was designed, purchased, and posted in 2008. The billboard is located on Highway 14-16-20 (North Fork Highway) in Wapiti and features a message that encourages residents to secure attractants so they are unavailable to bears (Figure 1).

Figure 1. North Fork highway informational billboard located on Highway 14-16-20 in Wapiti, Wyoming.

2. Seven "Bear Use Area" highway signs were posted in the spring of 2008. Two are located on the North Fork Highway in Wapiti and five on the Chief Joseph Highway north of Cody (Figure 2).

Figure 2. One of seven "Bear Use Area" signs posted throughout Wapiti and the Crandall/Sunlight area in Park County, Wyoming.

3. Over 30 presentations, workshop, and talks were given regarding human-bear conflict prevention to audiences including, but not limited to Wapiti, Eastside, Sunset, and Valley Elementary Schools, Girl Scouts, 4H, Park County Commissioners, Living on a Few Acres Seminar, Crandall community residents, Sportsman for Fish and Wildlife, and the Cody Optimists Club.

4. Hosted second annual Bear Aware Day event at the Wapiti school. Eighty students from three elementary schools participated and had the opportunity to learn a variety of skills including how to hang a bird feeder in bear country and how to behave in an encounter with a bear.

5. Implementation of the Carcass Management Program began in June 2008. The Carcass Management Program is a domestic livestock carcass removal service offered to livestock producers located in occupied grizzly bear habitat within Park County, Wyoming. The program offers an alternative to the use of on-site carcass dumps, which are a significant bear attractant and indirectly contribute to numerous human-bear conflicts.

6. Purchased and placed 20 bear-resistant grain storage barrels within the community.

7. Provided a Crandall area campground and restaurant with seven bear-resistant mailbox drop type garbage cans.

8. Provided recommendations concerning storage of garbage and other attractants for new development in occupied bear habitat to the Park County Planning and Zoning Commission. The Coordinator reviews developments on a case-by-case basis and attends monthly meeting. To date, these recommendations have been adopted as a condition of approval for six new developments within Park County.

9. Bear Aware information was included in the *Cody Relocation Guide* published by the Cody Chamber of Commerce. The full page of information is displayed in color and was included in the publication without charge. The *Guide* is produced for the purpose of conveying local information to non-residents interested in relocating to the Cody area.

10. Worked with the Outfitters and Guides Association and the Wild Sheep Foundation to produce and air two "Hunting Safely in Bear Country" public service announcements. The ads were aired on three local radio stations for four weeks in September 2008 immediately before the opening of the elk rifle season.

11. Worked with students from the Wapiti school to record a public service announcement regarding proper attractant management. The message aired for three weeks on two local radio stations in October 2008.

12. The Bear Wise Community program expanded in 2008 to include the Crandall/ Sunlight area north of Cody.

Objectives for 2009 include expansion of the program into the South Fork area southwest of Cody, development of an interactive Bear Aware traveling display for use by education institutions and libraries across northwest Wyoming, refocusing waste management efforts in Wapiti, and the development of a short Be Bear Aware and conflict avoidance DVD for children.

Although the Bear Wise Community program in Wapiti has made great strides in recent years, challenges remain. In Park County, there are no ordinances or laws prohibiting the feeding of bears or requiring that attractants be stored unavailable to bears. The Bear Wise Community program relies on voluntary compliance through educational efforts designed to discourage residents from feeding or attracting bears. The rural sections of Park County also lack organized groups, such as homeowner's associations, and have a large number of summer-only residents, limiting educational opportunities and contact with this portion of the community. Lastly, the past several years have been very inactive in terms of bear conflicts in the community of Wapiti. In fact, there were only five human-bear conflicts in Wapiti last year that were associated with bears receiving food rewards at developed sites. The lack of bear activity has resulted in complacency and lack of interest by some residents.

Jackson Hole Project Update

In 2008, the Bear Wise Jackson Hole program focused its public outreach efforts on education, signage, distribution of informational pamphlets, personal contacts, distribution of bear resistant garbage carts, and implementing the recently adopted Teton County "Bear Conflict Mitigation and Prevention" Land Development Regulation (LDR).

1. In 2007, WGFD staff developed a series of recommendations that would require private property owners within Teton County to store garbage and other attractants unavailable to bears. In April 2008, the Teton County Commissioners adopted these recommendations in the form of a LDR. The regulation requires that all residents and businesses within identified high conflict priority areas must store garbage and birdseed unavailable to bears. Sections of Teton County in phase one must comply by 1 July 2009, and other areas of the county in phase two must comply by 1 July 2010.

2. The WGFD worked closely with the Jackson Hole Wildlife Foundation on the sales and distribution of bear resistant garbage carts, which were made available to the public at a reduced cost. To date, 61 cans have been placed and 189 are in stock.

3. Numerous public service announcements (PSAs) were broadcast on four local radio stations for a total of eight weeks in duration. These announcements focused on storing attractants unavailable to bears and hunting safely in bear country.

4. Educational talks were presented to various groups including Moran and Teton Village residents, Jackson Hole Backcountry Horsemen, Boy Scouts, Girl Scouts, and school groups.

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

6. Booths containing information on bear identification, attractant storage, hunting and recreating safely in bear country, and properly using bear spray, were manned at the Jackson Hole Antler Auction and the Teton Science School's annual Science Fair.

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

8. Signage detailing information on hunting safely in bear country, recent bear activity, and proper attractant storage were placed at trailheads and entrances to residential areas throughout Teton County.

9. Consultations were conducted at multiple businesses and residences where recommendations were made regarding sanitation infrastructure and compliance with the Bear Conflict Mitigation and Prevention LDR.

Objectives for the Bear Wise Jackson Hole program in 2009 are focused on supporting Teton County and local waste management companies with projects that will help disseminate information and achieve compliance of the recently adopted Teton County Bear Conflict Mitigation and Prevention LDR. Specific objectives are as follows:

1. Develop, print, and distribute informational pamphlets containing information on responsible attractant management and the new Bear Conflict Mitigation and Prevention LDR.

2. Develop and place an "insert" in the Jackson Hole News and Guide detailing how to comply with the LDR.

3. Develop and post signage detailing the LDR. Signage will be placed in key locations throughout Teton County.

4. Develop, produce, and distribute Spanish language information pamphlet containing information on attractant storage in order to reach specific demographic segments of the Jackson community. The Teton County Latino Resource Center will be utilized to help distribute this information.

5. Develop and air public service announcements about the Bear Conflict Mitigation and Prevention LDR on local radio and television media outlets.

6. Work with local businesses to get bear resistant garbage carts distributed at retail locations.

The recent adoption and upcoming implementation of the Teton County Bear Conflict Mitigation and Prevention LDR will greatly reduce the amount of available attractants on the landscape and is a tremendous step forward for the Bear Wise Jackson Hole program. The new challenges that we face will be achieving full compliance with the county LDR from the residents of Teton County. Bear Wise Jackson Hole will convey the importance of compliance and offer ways to help residents comply through public outreach and education projects.

In order for the Jackson program to be successful, the program must continually identify information and education needs within the community while being adaptive to changing situations across different geographic areas. This will require us to coordinate with other government agencies and local non-government organizations working across multiple jurisdictions to develop a uniform and consistent message. If we achieve this level of coordination, we will be more effective in gaining support and building enthusiasm for Bear Wise Jackson Hole, directing resources to priority areas, and reaching all demographics.

References

Hodges, T., and M. Bruscino. 2008. 2007 Wapiti and Jackson Hole Bear Wise Community Projects update. Pages 111-114 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana, USA.

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

2008 Wind River Indian Reservation Grizzly Bear Camera Study

Prepared by: Samuel T. Lockwood, Lee I. Knox, Daniel D. Bjornlie, and Daniel J. Thompson

Wyoming Game and Fish Department
Trophy Game Section - Management/Research Branch

September 2008

INTRODUCTION

Recently there have been an increased number of grizzly bear (*Ursus arctos*) sightings reported in the Northern Wind River Range in central Wyoming, especially within the boundaries of the Wind River Indian Reservation (WRIR). Due to the topographically diverse and heavily timbered habitat associated with the region within the reservation, documentation of grizzly bears by aerial surveys is very difficult. Therefore we used remote cameras to document the presence/absence of grizzly bears within the WRIR (Barr et al. 2007).

Previous research validated the use of remote sensing cameras to document grizzly bear presence and probability of detection in forested regions of Wyoming (Barr et al. 2007, Wyoming Game and Fish Department [WGFD] 2008). Our objective was to determine if grizzly bears inhabited the southwestern portion of the WRIR. The region studied is at the southern edge of known grizzly bear distribution in Wyoming and therefore paramount in gaining a better working knowledge of their distribution and abundance throughout the ecosystem.

STUDY AREA

The study area was located in the southwestern corner of the WRIR, from Bull Lake to the Dinwoody Rim (Figure 1). The Wind River Indian Reservation includes both the Shoshone and Arapahoe tribes and wildlife species are managed in a joint effort between the tribes with assistance from the U.S. Fish and Wildlife Service.

We placed cameras in four sections of the study area; Willow Creek /Crow Mountain, Kirkland Park/ South Fork of Willow Creek, Bold Mountain, and Bob's Creek/Bob's Lake. Sites ranged in elevation from 7,643 ft (2,330 m) to 10,513 ft (3,204 m). Vegetative communities varied from stands of lodgepole pine (*Pinus contorta*), mixed conifers consisting of lodgepole pine, subalpine fir (*Pseudotsuga menziesii*), dispersed whitebark pine (*Pinus albicaulis*) and aspen (*Populus tremuloides*), and stands of whitebark pine at the higher elevation sites. We also had sites located at the edge of large open meadows containing various species of grasses and forbs, and along riparian areas containing sedges (*Carex* spp.) and willows (*Salix* spp.).

METHODS

We modified the original camera study methods (Barr et al. 2007, WGFD 2008) to better suit this area. In order to increase statistical rigor of the study, a 3 km x 3 km camera grid was created using ArcGIS. Grid cells with no suitable habitat for placement of cameras were removed. In the remaining grid cells a camera site was placed within the grid. Camera sites were chosen based on the probability that bears would use the area, with input from the tribal game wardens and by using natural wildlife corridors (i.e., drainages and game trails) (Figure 1). Each camera site consisted of two cameras and was checked once a week to replace memory cards and the blood lure if needed (Anderson and Haroldson 1997). Date, time, photo number, camera number, number of individuals, and unique characteristics of each individual (size, color, and markings) were recorded at each site (Barr et al. 2007, WGFD 2008). Photo detections of both black bears (*U. americanus*) and grizzly bears were recorded and used to document presence/absence within the WRIR.

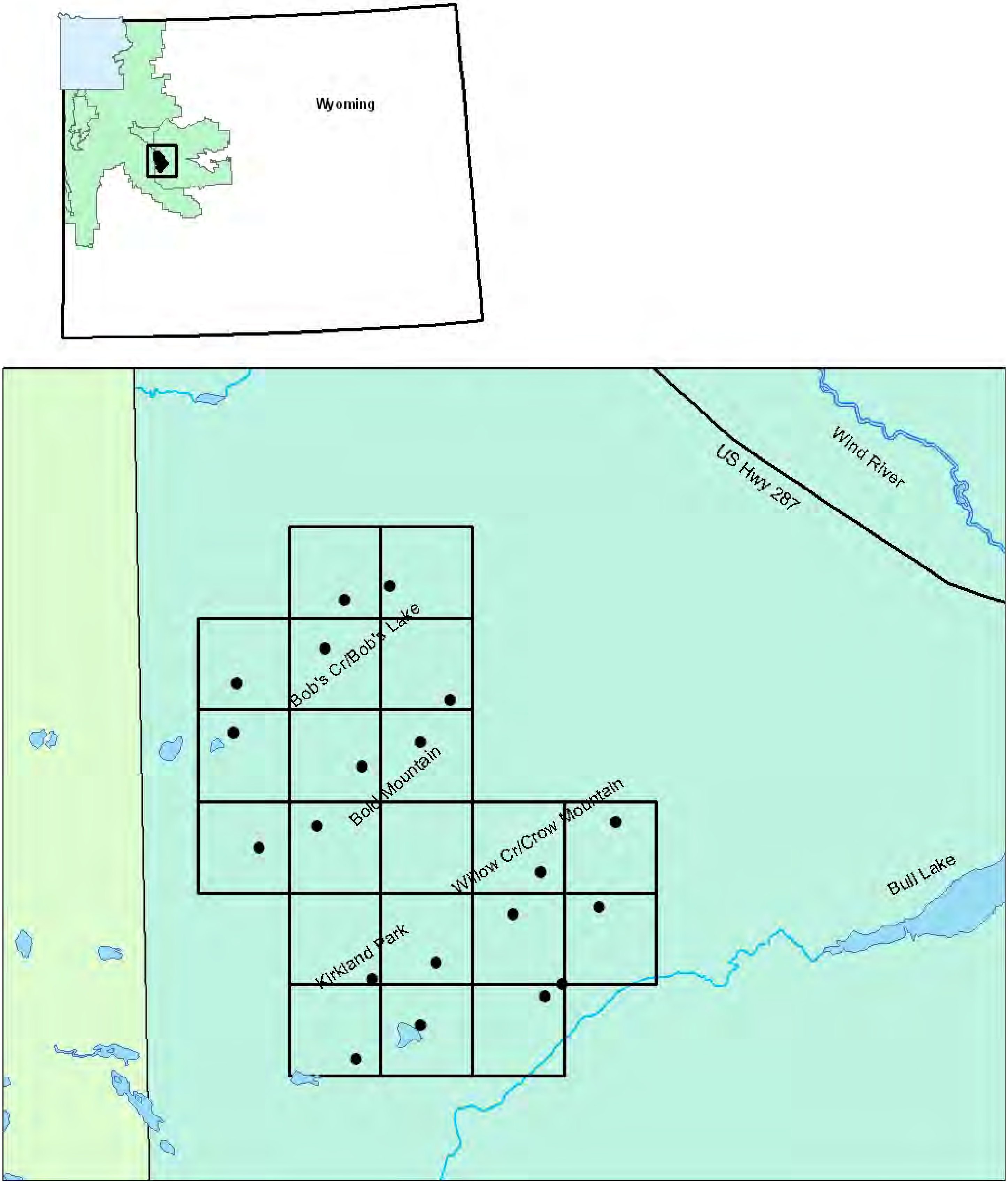

Figure 1. Wind River Indian Reservation camera study area, 2008.

RESULTS

The study was conducted for 52 days (7 Jul – 28 Aug 2008), with a total of 769 camera days (number of cameras times operational days). We collected a total of 122 bear detections, 114 of which were black bears. Of the eight grizzly bear photo detections, six were of a previously marked female with two yearling cubs; one was an adult male, and one of three two-year-old bears. The highest number of detections occurred during the first two weeks of the study (Figure 2). Black bears were detected during both diurnal and nocturnal periods, with an increased number of detections during crepuscular periods (Figure 3). Grizzly bears were detected with higher prevalence in the morning (Figure 4).

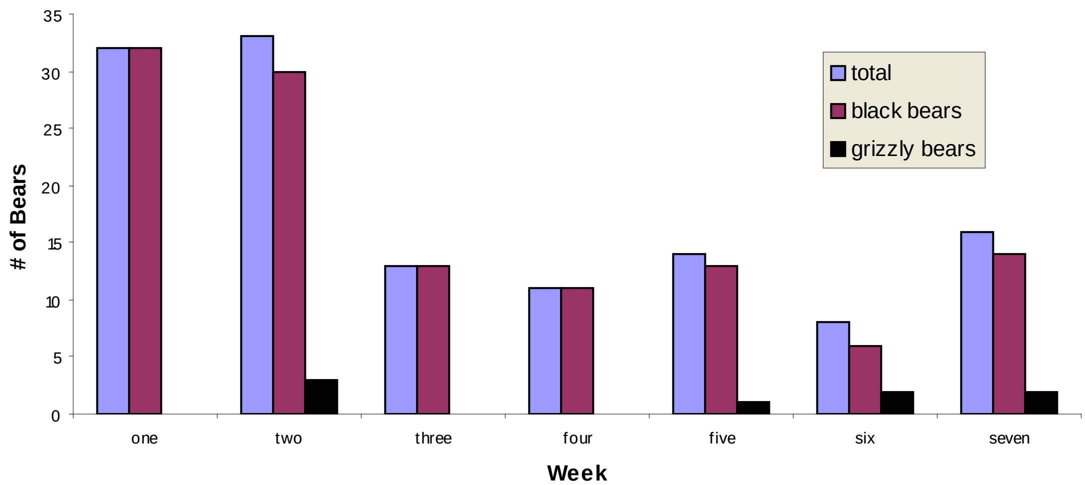

Figure 2. Weekly bear events WRIR, 2008.

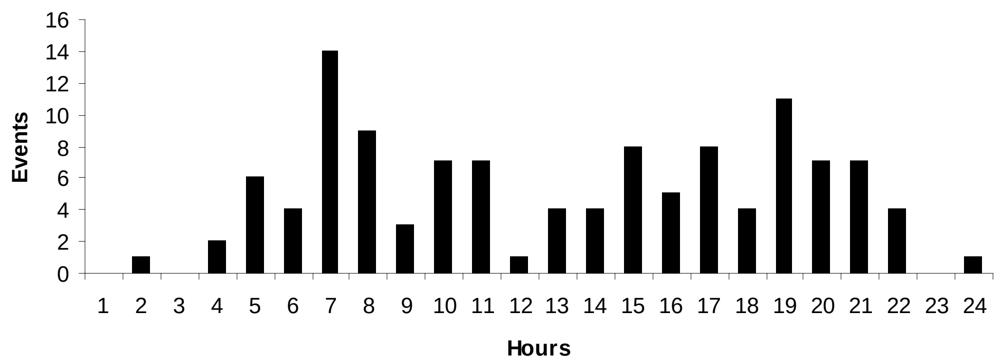

Figure 3. Photo detections by hour for black bears on the WRIR, 2008.

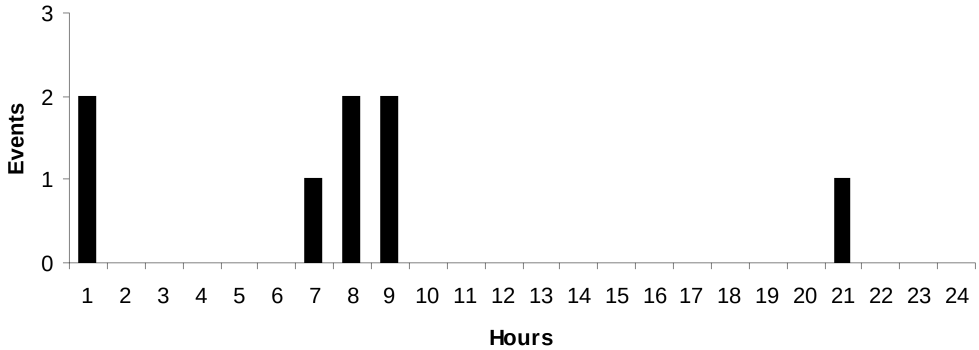

Figure 4. Photo detections by hour for grizzly bears on the WRIR, 2008.

Eighty-five percent of all bear events occurred at elevations higher than 9,200 feet (2,804 m). Eighty percent of black bear and all grizzly events were above this elevation. After correcting for the number of sites in each elevation range, bears of both species preferred sites above 10,000 feet (Figure 5).

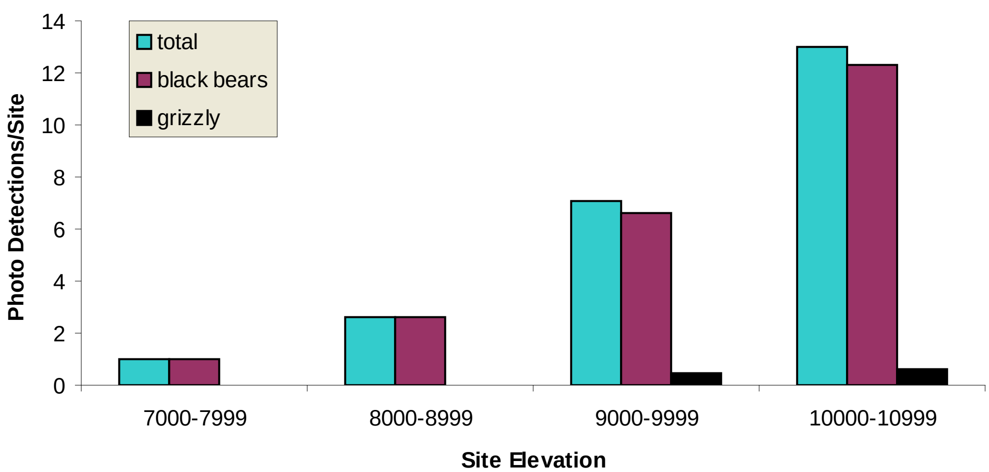

Figure 5. Bear detections by elevational gradients.

DISCUSSION

Bear visitation was highest during the first two weeks of the project, particularly with black bears. This pattern is likely due to the interest in the new blood lure in the area. Without a food reward, bears most likely lost interest in the sites after a short period of time, accounting for the decrease in detections during mid portions of the study. Grizzly bear visitation increased in the last three weeks of the study, which was also observed in Barr et al. (2007). This is most likely due to the seasonal abundance of food. Mace et al. (1994) documented bears moved less when seasonal food abundance was high, causing them to be less detectable by remote cameras.

Bear detection for both species was highest during diurnal and crepuscular periods with black bears being more diurnal and grizzly bears more crepuscular. This was also documented in Wyoming (Holm et al. 1999). Munro et al. (2006) found grizzly bear foraging activities to be highest during crepuscular periods and grizzly bears to be diurnal in areas with little human activity.

Black bear visitation increased at higher elevation sites. Grizzly bear visitations were also consistent with higher elevation sites that had a whitebark pine and sub-alpine fir habitat. This is mostly due to the seasonal availability of food sources, such as whitebark pine nuts, and the elevation at which they are present. Whitebark pine has been found to be an important food source for grizzly bears in late summer and fall (Haroldson and Podruzny 2008).

The first six sites on Crow Mountain had high black bear visitations but we did not document grizzly bear activity despite the presence of whitebark pine at the last few sites. This could be related to the lower elevation of the sites or that they were not located far enough up the drainage. The northern-most drainage (Little Bob), received very little activity from either species, even though this drainage was closest to established grizzly bear distribution in Wyoming (WGFD 2008). Many of the sites in this drainage were located at lower elevations in drier habitats, which may have lower food availability, resulting in fewer sightings. The sites higher in elevation had whitebark pine habitat and had the most visitations, but were still lower in total sightings when compared to other drainages.

Overall there were eight grizzly bear observations at five different sites. A previously marked female with two yearling cubs was sighted six times at three different sites in the Kirkland Park area, suggesting that she has established her home range within the WRIR. There was a sighting of an adult male grizzly bear and a sighting of three two-year-old grizzly bears at different locations. These data indicate that an established grizzly bear population exists on the WRIR.

ACKNOWLEDGMENTS

This project could not have taken place without the help of both the Shoshone and Arapahoe tribes and the tribal game wardens who were there every day to help with checking cameras, refilling blood, and giving us input and suggestions on bears and bear activity within the study area. The U.S. Fish and Wildlife Service also helped out a great deal in getting this project on its feet and throughout the duration of the study. This study was very important to help understand the movements and distribution of the growing grizzly bear population in Wyoming and it could not have taken place without the above-mentioned agencies.

LITERATURE CITED

Anderson, C., and M. Haroldson. 1997. Effectiveness of attractants to lure grizzly bears into hair collection sites for future DNA fingerprinting: the Blackrock/Spread Creek Area Study - 13–30 August 1996. Pages 37–47 *in* R.R. Knight, B.M. Blanchard, and M.A. Haroldson, authors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 1996. National Park Service, Bozeman, Montana, USA.

Barr, M.B., C.R. Anderson, D.S. Moody, and D.D. Bjornlie. 2007. Testing remote sensing cameras to count independent female grizzly bears with cubs of the year: pilot study. Wyoming Game and Fish Department, Trophy Game Section, Lander, Wyoming, USA.

Haroldson, M., and S. Podruzny. 2008. Whitebark pine cone production. Pages 37–38 *in* C.C. Schwartz, M.A. Haroldson, and K. West, editors. Yellowstone Grizzly Bear Investigations: annual report of the Interagency Grizzly Bear Study Team, 2007. U.S. Geological Survey, Bozeman, Montana, USA.

Holm, G.W., F.G. Lindzey, and D.S. Moody. 1999. Interactions of sympatric black and grizzly bears in northwest Wyoming. Ursus 11:99–108.

Mace, R.D., S.C. Minta, T.L. Manley, and K.E. Aune. 1994. Estimating grizzly bear population size using cameras sightings. Wildlife Society Bulletin 22:74–83.

Munro, R.M., S.E. Nielsen, M.H. Price, G.B. Stenhouse, and M.S. Boyce. 2006. Seasonal and diel patterns of grizzly bear diet and activity in West-Central Alberta. Journal of Mammalogy 87(6):1112–1121.

Wyoming Game and Fish Department. 2008. Testing remote cameras to count independent female grizzly bears with cubs of the year, 2006–2007. Wyoming Game and Fish Department, Trophy Game Section, Lander, Wyoming, USA.