Yellowstone Grizzly Bear Investigations 2001


Photo courtesy of Darren Ireland

Annual Report of the Interagency Grizzly Bear Study Team

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Report of the Interagency Grizzly Bear Study Team

2001

U.S. Geological Survey
Wyoming Game and Fish Department
National Park Service
U.S. Fish and Wildlife Service
Montana Fish, Wildlife and Parks Department
U.S. Forest Service
Idaho Fish and Game Department
Montana State University

Charles C. Schwartz and Mark A. Haroldson, Editors

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

This Report

The contents of this Annual Report summarize results of monitoring and research from the 2001 field season. The report also contains a summary of nuisance grizzly bear (*Ursus arctos horribilis*) management actions.

In addition to our normal monitoring, we completed an array of studies addressing the potential impacts of winter recreation on denning grizzly bears. This research was in response to a lawsuit filed against the Gallatin National Forest and subsequent need to develop a biological assessment addressing effects of snowmobile use on grizzly bears (Cherry 2001). Research results were also used by the National Park Service for a biological assessment and winter use plan (U.S. Department of the Interior 2001). The Interagency Grizzly Bear Study Team (IGBST) was able to use existing data collected from collared bears to address several issues and data needs for both agencies. Denning chronology (Haroldson et al. 2002), denning areas (Podruzny et al. 2002), and grizzly distribution (Schwartz et al. 2002) were all addressed. Information from these studies was presented at the International Association for Bear Research and Management (IBA) in Jackson Hole, Wyoming, in 2001, and all 3 manuscripts have been officially accepted for publication in the journal *Ursus*. Abstracts are attached to this report (Appendices A, B, and C). Additionally, members of the study team participated in a workshop held by the National Park Service to develop monitoring protocols addressing the impacts of snowmobiles on wildlife (Graves and Reams 2001).

The study team has also been working on issues associated with counts of unduplicated females with cubs-of-the-year (COY). These counts are used to establish a minimum population size, which is then used to establish mortality thresholds for the Recovery Plan (U.S. Fish and Wildlife Service [USFWS] 1993). Efforts by the Study Team to calculate more statistically sound estimates of population size have been underway for some time. Eberhardt and Knight (1996) applied a Peterson-type capture-mark-recapture estimator to unduplicated counts, and Boyce et al. (1999) recommended a maximum likelihood method. These methods assumed equal sightability of families, which was unrealistic for the Yellowstone population. Consequently, Boyce et al. (2001) recommended using a negative binomial distribution but found that they obtained reasonable results only when the coefficient of variation among sightings was assumed to be constant over time. This assumption is also difficult to justify.

Recent work by the study team (Keating et al. 2002) evaluated the application of 7 nonparametric estimators to assess their performance in determining the number of females with COY in a given year. This work identified 2 estimators that performed well using Monte Carlo simulations over a range of sampling conditions deemed plausible for the Yellowstone population: Chao's estimator (Chao 1984) and the sample coverage estimator (Chao and Lee 1992, Lee and Chao 1994). This work was presented at the IBA meeting in Jackson and the manuscript has been accepted in the journal *Ursus*. An abstract of this work is attached to this annual report (Appendix D). We are currently refining the application of these techniques to expand the predicted number of females with COY into a total population estimate. We anticipate completion of that work in 2002 or 2003.

The grizzly bear recovery plan (USFWS 1993) established mortality quotas at 4% of the minimum population estimate derived from female with COY data and no more than 30% of the 4% (1.2%) could be female bears. Simulation modeling (Harris 1984) established sustainable mortality at around 6% of the population. To accommodate for unknown and unreported mortalities, this value was reduced to 4%. There has been some concern that the 4% figure may not account for all unreported mortalities. The study team made an effort to develop a technique to estimate total human-caused mortality including the unreported component by using data from radio-collared bears. This work was reported at the IBA meetings in Jackson and has also been accepted in the journal *Ursus*. The abstract is appended to this report (Appendix E).

We also started a new graduate student project that will determine the potential application of stable isotopes and trace elements to quantify consumption rates of whitebark pine (*Pinus albicaulis*) and cutthroat trout (*Oncorhynchus clarki*) by grizzly bears. Isotopic work has been used in the past to quantify consumption rates of vegetable, meat, and salmon in bears elsewhere (Hilderbrand et al. 1998). Details of the first year's results are presented in this report.

Finally, in May of 2000, we began measuring body composition of captured bears. Body composition is a technique that is easy to apply and only takes about 5 minutes to perform, including obtaining the weight of the animal. Body fat is determined using bioelectrical impedance analysis (BIA), a technique that passes a small electrical current through the body. Resistance to the current flow is measured and correlated to the amount of water in the animal's body. Since body water is inversely related to body fat, it is possible to determine with some degree of precision the amount of body fat for each bear captured. We intend to make BIA a routine part of our data collection for each bear captured. These long-term records, particularly if our isotope and trace element projects are a success, will ultimately provide insight into the energetics of bears during years of good and bad food conditions. We are already detecting lower body fat measurements in problem bears trapped for management control when compared to random bears captured in the ecosystem. Although it is too early to do a rigorous analysis of these data, we provide a section in this annual report detailing what we have learned to date.

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 U.S. Geological Survey (USGS), National Park Service, U.S. Forest Service, USFWS, and the States of Idaho, Montana, and Wyoming. 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 was conducted by John and Frank Craighead. The book, "The grizzly bears of Yellowstone" provides a detailed summary of this early research (Craighead et al. 1995). With the closing of open-pit garbage dumps and cessation of the ungulate reduction program in Yellowstone National Park in 1967, bear demographics (Knight and Eberhardt 1985), food habits (Mattson et al. 1991*a*), and growth patterns (Blanchard 1987) for grizzly bears changed. Since 1975, the IGBST has produced annual reports and numerous scientific publications (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 Craig Whitman, Chris McQueary, Jeremiah Smith, Doug Blanton, Mark Biel, Travis Wyman, Dan Reinhart, Rick Swanker, Keith Aune, Neil Anderson, Mark Bruscino, Brian DeBolt, Craig Sax, Gary Brown, Max Black, John Emmerich, Larry Roop, Tim Fagan, Jerry Longobardi, Duke Early, Dennis Almquist, Doug McWhirter, Cole Thompson, Bill Long, Doug Crawford, Bonnie Gafney, Kerry Murphy, Tom Olliff, Pat Perrotti, Doug Smith, Kim Barber, Mark Hinschberger, Brian Aber, Adrian Villaruz, Connie King, Wendy Clark, Sue Consolo Murphy, Bill Chapman, Doug Chapman, Rich Hyatt, Gary Lust, Claude Tyrrel, Stan Monger, Jerry Spencer, Dave Stradley, Roger Stradley, Sheldon Rasmussen, Peter Gogan, Kim Keating, Casey Hunter, Merril Nelson, Jed Edwards, and Steve Cherry 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.

RESULTS AND DISCUSSION

Grizzly Bear Capturing, Collaring, and Monitoring

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

During the 2001 field season, 63 individual grizzly bears were captured and handled on 73 occasions (Table 1), including 25 females (17 adult) and 36 males (23 adult). Forty individuals were new bears not previously marked. On 2 occasions, captured bears were released without determining sex or marking the individual involved. The first instance involved a COY caught in a wolf trap set by Wildlife Services/Animal and Plant Health Inspection Service during a depredation capture effort. Wyoming Game and Fish personnel responded, released the cub, and vacated the area as soon as possible. The second instance involved a bear caught in a culvert trap by IGBST during extremely cold conditions not suitable for safe handling. This individual was released on site.

We conducted research trapping efforts for 602 trap days (1 trap day = 1 trap set for 1 day) in 9 Bear Management Units (BMUs) within the Grizzly Bear Recovery Zone (USFWS 1993) or their adjacent 10-mile perimeter area (Fig. 1). We captured 36 individual grizzly bears 41 times for a trapping success rate of 1 capture every 14.7 trap days.

There were 32 management captures of 28 individual bears in the GYE during 2001 (Tables 1 and 2), including 12 females (7 adult) and 15 males (7 adults). Bear #382 initially captured at a research setting was later caught during a management trapping effort. The non-target COY of unknown sex mentioned previously was released on site. Fifteen bears, 6 female and 9 male, were relocated due to conflicts situations during 2001 (Tables 1 and 2). Four of these bears became involved in subsequent conflicts and were removed from the population. In addition, 12 other grizzly bears were removed from the populations because of conflicts with humans.

We radio-monitored 82 individual grizzly bears during the 2001 field season, including 31 adult females (Tables 2 and 3). Fifty-two grizzly bears entered their winter dens wearing active transmitters in the GYE. Since 1975, 400 individual grizzly bears have been radio-marked.

Table 1. Grizzly bears captured in the Greater Yellowstone Ecosystem during 2001.

Bear	Sex	Age[a]	Date	General location[b]	Capture type	Release site	Trapper/Handler[c]
369	M	Adult	5/3	Carter Creek, Pr-WY	Management	Picket Creek, SNF	WYGF
377	M	Adult	5/4	Pilgrim Creek, GTNP	Research	On site	IGBST/GTNP
378	M	Adult	5/5	S Fork Shoshone, Pr-WY	Management	East Fork Wind, SNF	WYGF
			6/13	S Fork Shoshone, Pr-WY	Management	Removal	WYGF
379	M	Subadult	5/7	Pacific Creek, GTNP	Research	On site	IGBST/GTNP
380	M	Adult	5/11	N Fork Shoshone, SNF	Management	Needle Creek, SNF	WYGF
381	M	Subadult	5/13	Beam Gulch, SNF	Research	On site	WYGF
179	F	Adult	5/26	Spread Creek, GTNP	Research	On site	IGBST
382	M	Subadult	5/31	Jim Creek, BTNF	Research	On site	WYGF
			7/30	Wind River, Pr-WY	Management	Removal	WYGF
311	F	Adult	5/31	Sunlight Creek, SNF	Research	On site	WYGF
383	F	Subadult	6/9	Reef Creek, SNF	Research	On site	WYGF
372	M	Subadult	6/11	Deadman Creek, SNF	Research	On site	WYGF
			6/18	Deadman Creek, SNF	Research	On site	WYGF
384	F	Adult	6/16	Lodgepole Creek, SNF	Research	On site	WYGF
385	M	Subadult	6/16	Carter Creek, Pr-WY	Management	Lost Lake, BTNF	WYGF
			9/27	Wind River, Pr-WY	Management	Removal	WYGF
386	F	Adult	6/18	Deadman Creek, SNF	Research	On site	WYGF
355	M	Subadult	6/23	Eldridge Creek, GNF	Research	On site	IGBST
387	M	Adult	6/26	Eldridge Creek, GNF	Research	On site	IGBST
388	M	Adult	6/28	Wapiti Creek, GNF	Research	On site	IGBST
325	F	Adult	7/3	Yellowstone River, Pr-MT	Management	Removal	MTFWP
389	M	Adult	7/6	Wapiti Creek, GNF	Research	On site	IGBST
360	F	Adult	7/9	Wapiti Creek, GNF	Research	On site	IGBST
G72	M	Adult	7/13	Cooke Pass, Pr-MT	Management	Removal	MTFWP
Unm	Unk	COY	7/15	DuNoir River, Pr-WY	Management	On site	WYGF/USFWS
390	M	Adult	7/17	Plateau Creek, BTNF	Research	On site	WYGF
			7/21	Snake River, BTNF	Research	On site	IGBST
			8/7	Snake River, BTNF	Research	On site	IGBST
391	M	Subadult	7/19	Tepee Creek, BTNF	Management	Mormon Creek, SNF	WYGF
			9/29	DuNoir River, Pr-WY	Management	Removal	WYGF
392	M	Subadult	7/22	Lime Creek, BTNF	Management	Mormon Creek, SNF	WYGF
393	M	Adult	7/24	Snake River, BTNF	Research	On site	IGBST
201	M	Adult	7/28	Snake River, BTNF	Research	On site	WYGF
394	M	Adult	7/29	Klondike Creek, BTNF	Management	Mormon Creek, SNF	WYGF
395	F	Subadult	8/4	Snake River, BTNF	Research	On site	IGBST
G73	M	Adult	8/15	Silver Gate, Pr-MT	Management	Removal	MTFWP
396	M	Subadult	8/22	S Fork Madison, Pr-MT	Management	Eldridge Creek, GNF	MTFWP

Table 1. Continued.

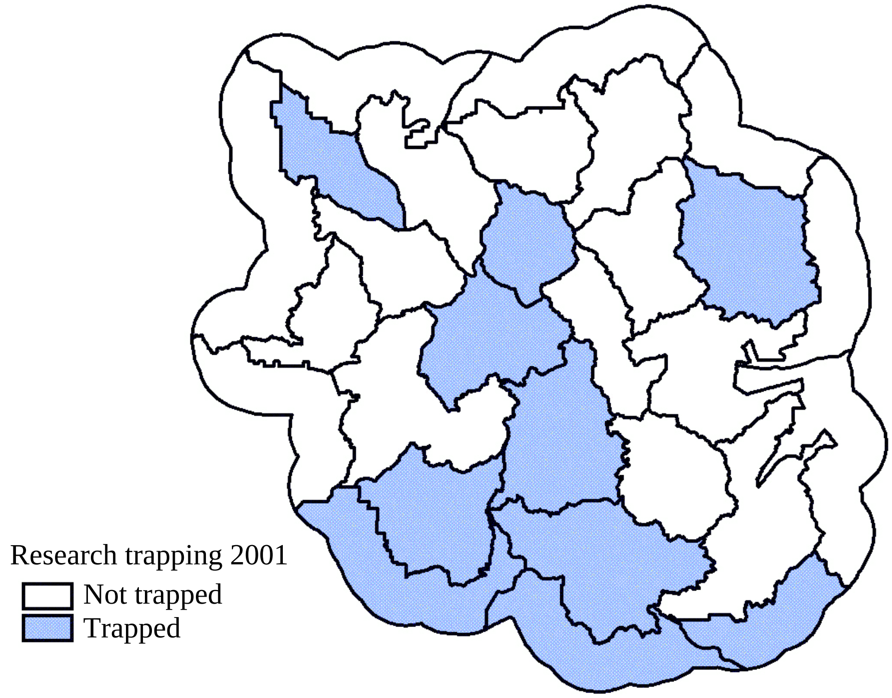
Bear	Sex	Age[a]	Date	General location[b]	Capture type	Release site	Trapper/Handler[c]
397	M	Adult	8/23	Gibbon River, YNP	Research	On site	IGBST
398	M	Adult	8/25	Lizard Creek, JDR	Research	On site	IGBST/GTNP
305	F	Subadult	8/26	E Fork Wind, Pr-WY	Management	Sunlight Creek, SNF	WYGF
327	F	Adult	8/26	Carter Creek, Pr-WY	Management	Boone Creek, TNF	WYGF
358	F	Adult	8/26	Horse Creek, SNF	Management	Removal	WYGF
G74	M	COY	8/26	Horse Creek, SNF	Management	Removal	WYGF
349	F	Adult	8/29	Gibbon River, YNP	Research	On site	IGBST
281	M	Adult	8/29	Cascade Creek, YNP	Research	On site	IGBST
			8/31	Cascade Creek, YNP	Research	On site	IGBST
399	F	Adult	8/29	Arizona Creek, GTNP	Research	On site	IGBST/GTNP
400	M	Adult	8/29	Lizard Creek, JDR	Research	On site	IGBST/GTNP
401	M	Adult	9/1	Pilgrim Creek, GTNP	Research	On site	IGBST
G76	F	Yearling	9/4	Dunn Creek, Pr-WY	Management	Thorofare, BTNF	WYGF
			10/28	Lava Creek, Pr-WY	Management	Removal	WYGF
G77	F	Yearling	9/4	Dunn Creek, Pr-WY	Management	Thorofare, BTNF	WYGF
G75	F	Adult	9/5	Dunn Creek, Pr-WY	Management	Removal	WYGF
135	F	Adult	9/12	N Fork Shoshone, Pr-WY	Management	Removal	WYGF
211	M	Adult	9/12	Cascade Creek, YNP	Research	On site	IGBST
			10/12	Antelope Creek, YNP	Research	On site	IGBST
196	F	Adult	9/14	Cascade Creek, YNP	Research	On site	IGBST
338	M	Adult	9/14	Cascade Creek, YNP	Research	On site	IGBST
128	F	Adult	9/14	Horse Creek, Pr-WY	Management	Removal	WYGF
G78	M	COY	9/14	Horse Creek, Pr-WY	Management	Removal	WYGF
G79	F	COY	9/14	Horse Creek, Pr-WY	Management	Removal	WYGF
G80	M	Adult	10/1	Gibbon River, YNP	Research	On site	IGBST
193	F	Adult	10/2	Gibbon River, YNP	Research	On site	IGBST
402	F	Subadult	10/2	Gibbon River, YNP	Research	On site	IGBST
295	F	Adult	10/3	Gibbon River, YNP	Research	On site	IGBST
323	M	Adult	10/4	Gibbon River, YNP	Research	On site	IGBST
373	M	Subadult	10/4	Gibbon River, YNP	Research	On site	IGBST
403	F	Adult	10/14	N Fork Shoshone, Pr-WY	Management	Long Creek, SNF	WYGF
G81	F	COY	10/14	N Fork Shoshone, Pr-WY	Management	Long Creek, SNF	WYGF
G82	M	COY	10/14	N Fork Shoshone, Pr-WY	Management	Long Creek, SNF	WYGF
Unm	Unk	Subadult	10/18	Antelope Creek, YNP	Research	On site	IGBST
153	M	Adult	11/7	Sunlight Creek, Pr-WY	Management	Removal	WYGF

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

[b] BTNF = Bridger-Teton National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, JDR = John D. Rockefeller, Jr. Memorial Parkway, SNF = Shoshone National Forest, TNF = Caribou-Targhee National Forest, YNP = Yellowstone National Park, Pr = private.

[c] IGBST = Interagency Grizzly Bear Study Team, U.S. Geological Survey; MTFWP = Montana Fish, Wildlife and Parks; WS = Wildlife Services/Animal and Plant Health Inspection Service; WYGF = Wyoming Game and Fish.

a)



b)

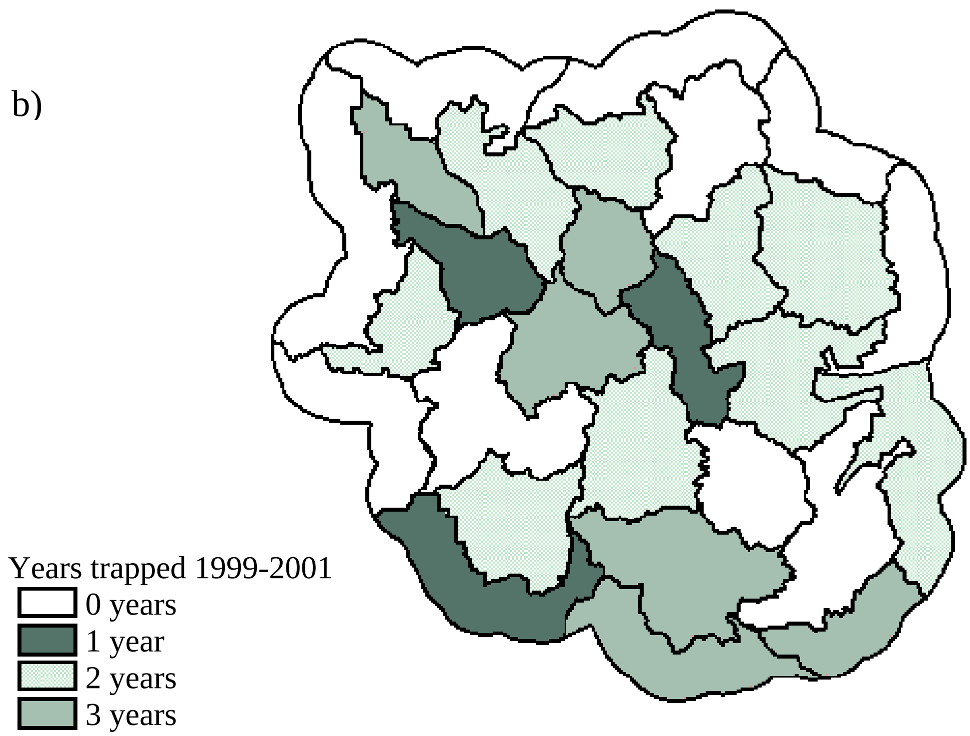


Fig. 1. Bear Management Units in which research trapping efforts were conducted during 2001 (a), and within the last 3 years (b).

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

Table 3. Grizzly bears radio monitored in the Greater Yellowstone Ecosystem during 2001.

				Monitored			
Bear	Sex	Age	Offspring[a]	Out of den	Into den	Current status	Transported
125	F	Adult	Unknown	Yes	Yes	Active	No
135	F	Adult	None	Yes	No	Removed	No
166	F	Adult	None	Yes	Yes	Active	No
179	F	Adult	3 COY	Yes	Yes	Active	No
193	F	Adult	None	No	Yes	Active	No
196	F	Adult	None	Yes	Yes	Active	No
201	M	Adult		Yes	No	Unresolved[b]	No
211	M	Adult		Yes	No	Cast	No
213	F	Adult	2 Yearlings	Yes	Yes	Active	No
267	F	Adult	2 COY	Yes	Yes	Active	No
270	F	Adult	1 COY	Yes	Yes	Active	No
281	M	Adult		Yes	No	Cast	No
291	M	Adult		Yes	No	Cast	No
292	M	Adult		Yes	No	Cast	No
295	F	Adult	2 Yearlings	Yes	Yes	Active	No
303	F	Adult	1 COY	Yes	Yes	Active	No
305	F	Subadult	None	Yes	Yes	Active	Yes
308	F	Adult	2 COY	Yes	Yes	Active	No
311	F	Adult	None	No	Yes	Active	No
313	M	Adult		Yes	No	Cast	No
320	M	Adult		No	Yes	Active	No
321	F	Adult	Unknown	Yes	Yes	Active	No
325	F	Adult	2 Yearlings	Yes	No	Removed	No
327	F	Adult	1 Yearling	Yes	No	Dead	Yes
334	F	Subadult	None	Yes	No	Cast	No
338	M	Adult		Yes	Yes	Active	No
339	M	Adult		Yes	Yes	Active	No
340	M	Adult		Yes	No	Missing	No
343	M	Subadult		Yes	No	Cast	No
346	F	Adult	2 COY, lost 1	Yes	Yes	Active	No
348	M	Adult		Yes	No	Unresolved[b]	No
349	F	Adult	None	Yes	Yes	Active	No
350	F	Subadult	None	Yes	Yes	Active	No
351	F	Adult	1 COY	Yes	Yes	Active	No
352	M	Subadult		Yes	Yes	Active	No
354	M	Adult		Yes	No	Missing	No

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current status	Transported
355	M	Subadult		Yes	Yes	Active	No
356	M	Adult		Yes	Yes	Active	No
357	F	Subadult	None	Yes	No	Dead	No
358	F	Adult	1 COY	Yes	No	Removed	No
359	M	Adult		Yes	Yes	Active	No
360	F	Adult	None	Yes	Yes	Active	No
361	M	Subadult		Yes	No	Missing	No
364	F	Adult	Unknown	Yes	No	Missing	No
365	F	Adult	Unknown	Yes	Yes	Active	No
366	F	Adult	3 COY	Yes	No	Missing	No
367	F	Adult	None	Yes	Yes	Active	No
368	M	Subadult		Yes	No	Dead	No
369	M	Adult		Yes	No	Missing	Yes
370	F	Adult	None	Yes	Yes	Active	No
372	M	Subadult		Yes	Yes	Active	No
373	M	Subadult		Yes	Yes	Active	No
374	M	Adult		Yes	No	Missing	No
375	M	Adult		Yes	No	Cast	No
376	M	Adult		Yes	No	Dead	No
377	M	Adult		No	No	Cast	No
378	M	Adult		No	No	Removed	Yes
379	M	Subadult		No	No	Missing	No
380	M	Adult		No	Yes	Active	Yes
381	M	Subadult		No	Yes	Active	No
382	M	Subadult		No	No	Removed	No
383	F	Subadult	None	No	Yes	Active	No
384	F	Adult	None	No	Yes	Active	No
385	M	Subadult		No	No	Removed	Yes
386	F	Adult	3 COY	No	Yes	Active	No
387	M	Adult		No	Yes	Active	No
388	M	Adult		No	Yes	Active	No
389	M	Adult		No	Yes	Active	No
390	M	Adult		No	Yes	Active	No
391	M	Subadult		No	No	Removed	Yes
392	M	Subadult		No	No	Missing	Yes
393	M	Adult		No	Yes	Active	No

Table 3. Continued.

Bear	Sex	Age	Offspring[a]	Monitored: Out of den	Monitored: Into den	Current status	Transported
394	M	Adult		No	Yes	Active	Yes
395	F	Subadult	None	No	Yes	Active	No
396	M	Subadult		No	Yes	Active	Yes
397	M	Adult		No	Yes	Active	No
398	M	Adult		No	Yes	Active	No
399	F	Adult	None	No	Yes	Active	No
400	M	Adult		No	Yes	Active	No
401	M	Adult		No	Yes	Active	No
402	F	Subadult	None	No	Yes	Active	No
403	F	Adult	2 COY	No	Yes	Active	Yes

[a] COY = cub-of-the-year.
[b] These transmitters were not retrieved in 2001, the sites will be visited as soon as possible in 2002 to determine status.

Unduplicated Females *(Mark A. Haroldson and Charles C. Schwartz, Interagency Grizzly Bear Study Team)*

Knight et al. (1995) detailed procedures used to distinguish “unduplicated” or “unique” females with COY. During 2001, we identified 42 unduplicated females accompanied by 78 COY in the GYE. Litter sizes observed during initial observations were 13 single cub, 22 twin, and 7 triplet litters with a mean of 1.95. The distribution of initial observations for unduplicated females within the GYE during 2001 is presented in Fig. 2. Distribution of initial sightings during 1999-2001 is shown in Fig. 3.

Of the 42 female with COY classified as unduplicated, 24% (10) were initially sighted by ground observers while 48% (20) were sighted during IGBST observation flights (Table 4). The high percentage of females initially sighted during observation flights in 2001 was due to the high number of females initially sighted feeding at insect aggregation sites.

Appendix F of the Grizzly Bear Recovery Plan (USFWS 1993:171) provides “Revised reporting rules for Recovery Plan Targets, July 12, 1992.” Rule 1 states that “unduplicated females with cubs will be counted inside or within 10 miles of the Recovery Zone line.” All 42 females were initially observed within 10-miles of Recovery Zone during 2001. The recovery plan also established as one of the demographic criteria that “15 females with cubs over a running 6-year average both inside the Recovery Zone and within a 10-mile area immediately surrounding the Recovery Zone” would be maintained (USFWS 1993:33). The current 6-year average (1996-2001) for unduplicated females with COY within the Recovery Zone and the 10-mile perimeter is 35 (Table 5). The 6-year average for total number of COY and average litter size observed at initial sighting were 69 and 2.0, respectively (Table 5).

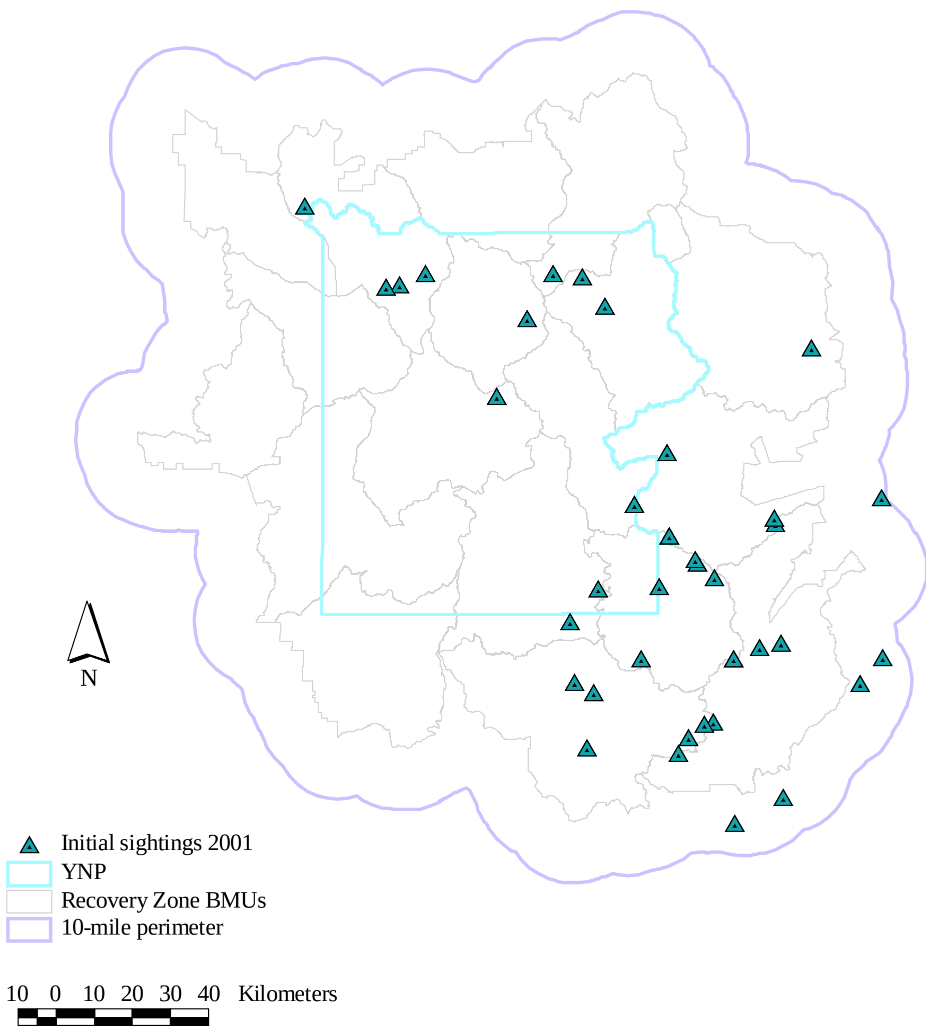


Fig. 2. Distribution of initial observations of unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Ecosystem during 2001. The Yellowstone Grizzly Bear Recovery Zone (USFWS 1993), Bear Management Units (BMUs) within the Recovery Zone, and Yellowstone National Park (YNP) boundaries are delineated.

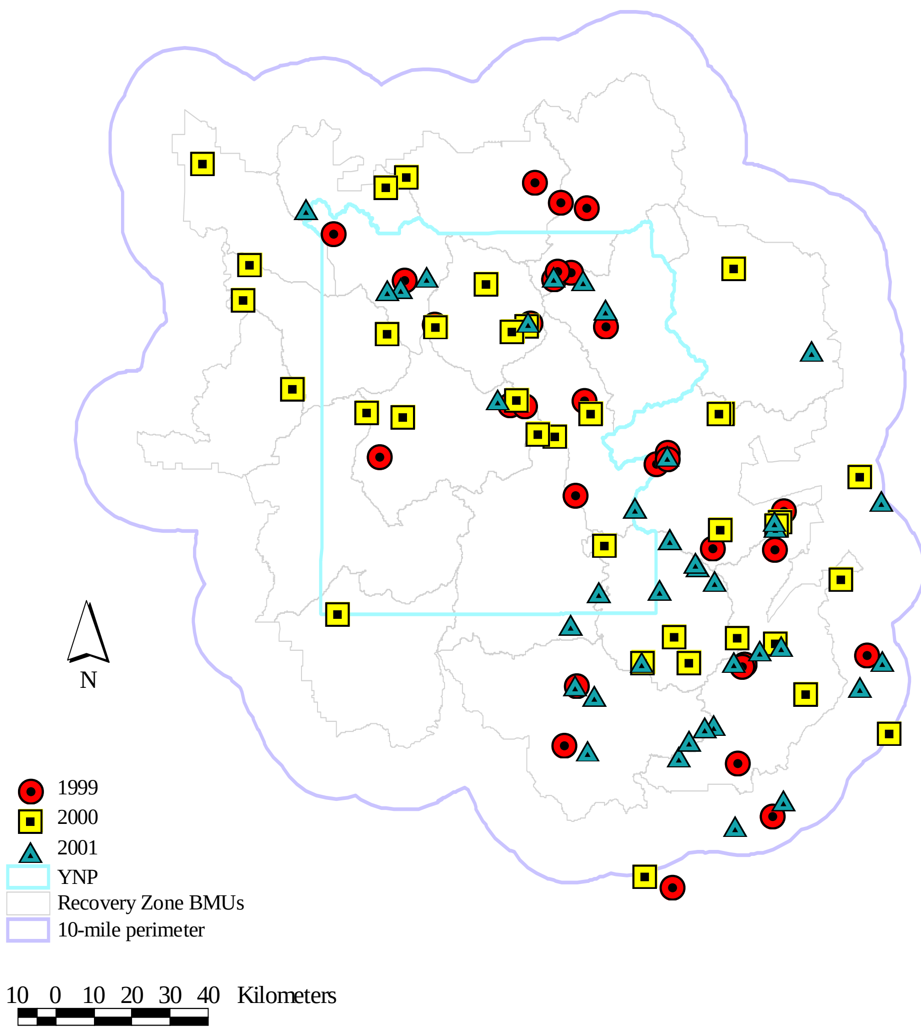


Fig. 3. Distribution of initial observations of unduplicated females with cubs-of-the-year in the Greater Yellowstone Ecosystem, 1999-2001. The Yellowstone Grizzly Bear Recovery Zone (USFWS 1993), Bear Management Units (BMUs) within the Recovery Zone, and Yellowstone National Park (YNP) boundaries are delineated.

Table 4. Numbers of sightings of unduplicated female grizzly bears with cubs-of-the-year by method of observation in the Greater Yellowstone Ecosystem, 1986-2001.

Year	Observation flights		Ground sightings	Radio flights/trap	Total
	IGBST[a]	Other[b]			
1986	9	2	10	4	25
1987	5	1	4	3	13
1988	7	1	7	4	19
1989	7	2	5	2	16
1990	8	0	12	4	24
1991	17	2	2	3	24
1992	10	4	6	3	23
1993	3	4	10	3	20
1994	12	4	2	2	20
1995	2	2	12	1	17
1996	13	1	10	9	33
1997	9	0	9	13	31
1998	15	1	12	7	35
1999	7	5	16	5	33
2000	7	5	17	8	37
2001	20	4	10	8	42

[a] IGBST = Interagency Grizzly Bear Study Team.
[b] Female with cubs-of-the-year seen during non-IGBST research flights by qualified observers.

Table 5. Number of unduplicated females with cubs-of-the-year (COY), number of COY, and average litter size at initial observation for the years 1973-2001 in the Greater Yellowstone Ecosystem. Six-year running averages were calculated using only unduplicated females with COY observed in the Recovery Zone and 10-mile perimeter.

	Greater Yellowstone Ecosystem			Recovery Zone and 10-mile perimeter 6-year running averages		
Year	Females	COY	Mean litter size	Females	COY	Litter size
1973	14	26	1.9			
1974	15	26	1.7			
1975	4	6	1.5			
1976	17	32	1.9			
1977	13	25	1.9			
1978	9	19	2.1	12	22	1.8
1979	13	29	2.2	12	23	1.9
1980	12	23	1.9	11	22	1.9
1981	13	24	1.8	13	25	2.0
1982	11	20	1.8	12	23	2.0
1983	13	22	1.7	12	23	1.9
1984	17	31	1.8	13	25	1.9
1985	9	16	1.8	13	23	1.8
1986	25	48	1.9	15	27	1.8
1987	13	29	2.2	15	28	1.9
1988	19	41	2.2	16	31	1.9
1989[a]	16	29	1.8	16	32	1.9
1990	25	58	2.3	18	36	2.0
1991[b]	24	43	1.9	20	41	2.0
1992	25	60	2.4	20	43	2.1
1993[a]	20	41	2.1	21	45	2.1
1994	20	47	2.4	21	46	2.1
1995	17	37	2.2	22	47	2.2
1996	33	72	2.2	23	50	2.2
1997	31	62	2.0	24	53	2.2
1998	35	70	2.0	26	55	2.1
1999[a]	33	63	1.9	28	58	2.1
2000[c]	37	72	2.0	31	62	2.0
2001	42	78	1.9	35	69	2.0

[a] One female with COY was observed outside the 10-mile perimeter.
[b] One female with unknown number of COY. Average litter size was calculated using 23 females.
[c] Two females with COY were observed outside the 10-mile perimeter.

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

Dispersion of reproductive females throughout the ecosystem is represented by verified reports of female grizzly bears with young (COY, yearlings, 2-year-olds, and/or young of unknown age) by BMU. The population recovery requirements (USFWS 1993:33) state that there will be “16 of the 18 BMUs occupied by females with young from a running 6-year sum of verified sightings and evidence,” and “no 2 adjacent BMUs shall be unoccupied.” Eighteen of 18 BMUs had verified observations of female grizzly bears with young during 2001 (Table 6). All 18 BMUs contained verified observations of females with young in at least 3 years of the last 6-year period.

Table 6. 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, 1996-2001.

Bear Management Unit	1996	1997	1998	1999	2000	2001	Years occupied
1) Hilgard		X		X	X	X	4
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	5
7) Shoshone	X	X	X	X	X	X	6
8) Pelican/Clear	X	X	X	X	X	X	6
9) Washburn	X	X	X	X	X	X	6
10) Firehole/Hayden	X	X	X	X	X	X	6
11) Madison		X	X	X	X	X	5
12) Henrys Lake		X	X		X	X	4
13) Plateau				X	X	X	3
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	12	17	14	17	18	18	

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

Two rounds of observation flights were conducted during 2001. Thirty-two of the 37 Bear Observation Areas (Fig. 4) were surveyed once during each round. Round 1 was flown 19 June – 11 July and round 2 was flown 16 July – 5 August. There were 72.3 and 72.4 hours of observation during rounds 1 and 2, respectively; the average duration of flights was 2.3 hours (Table 7). One hundred sixty-nine bear sightings, excluding dependent young, were recorded during observation flights. This included 6 radio-marked bears, 122 solitary unmarked bears, and 41 unmarked females with young (Table 7). Observation rates were 1.17 bears/hour for all bears or 0.31 females with young/hour. Seventy-five young (60 COY, 12 yearlings, and 3 of unknown age) were observed (Table 8). Observation rates were 0.25 females with COY/hour and 0.06 females with yearlings/hour.

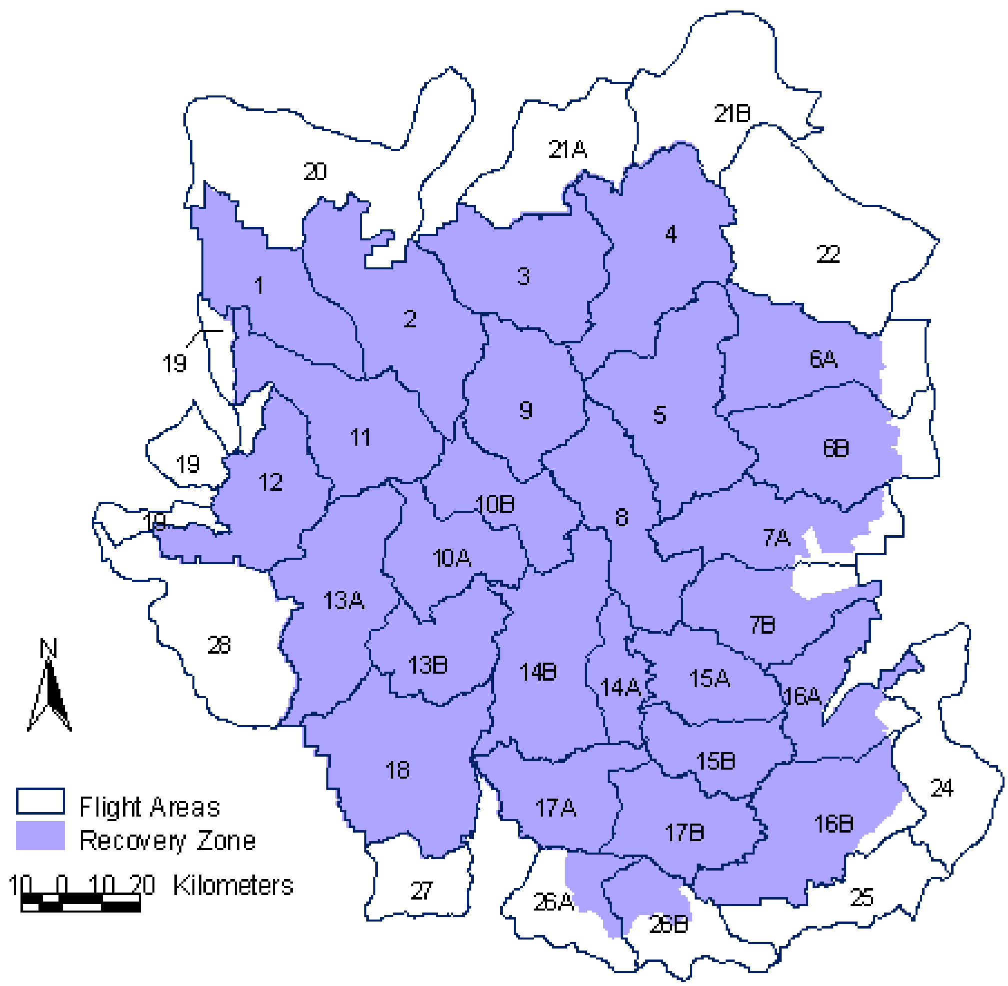


Fig. 4. Observation flight areas within the Greater Yellowstone Ecosystem, 2001. The numbers represent the 27 bear observation areas. Those units too large to search during a single flight were further subdivided into 2 units. Consequently, there were 37 search areas.

Table 7. Annual summary statistics for observation flights conducted in the Greater Yellowstone Ecosystem, 1987-2001.

					Bears seen					Observation rate (bears/hour)		
					Marked		Unmarked					
Date	Observation period	Total hours	Number of flights	Average hours/flight	Lone	With young	Lone	With young	Total	All bears	With young	With COY[a]
1987	Total	47.2	20	2.4					35[b]	0.74		
1988	Total	33.9	17	2.0					62[b]	0.66		
1989	Total	88.7	37	2.4					87[b]	0.98		
1990	Total	86.0	39	2.2					81[b]	0.94		
1991	Total	99.2	46	2.2					257[b]	2.59		
1992	Total	68.7	31	2.2					204[b]	2.97		
1993	Total	58.4	29	2.0					43[b]	0.74		
1994	Total	64.5	32	2.0					112[b]	1.75		
1995	Total	65.2	30	2.2					70[b]	1.07		
1996	Total	77.1	35	2.2					105[b]	1.36		
1997[c]	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[d]	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[e]	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[f]	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[g]	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

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

[b] Does not distinguish between marked and unmarked. Checking for radio-marks on observed bears was added to the protocol starting in 1997.

[c] Round 1 flights conducted 24 July – 17 August 1997; Round 2 flown 25 August – 13 September 1997.

[d] Round 1 flights conducted 15 July – 6 August 1998; Round 2 flown 3-27 August 1998.

[e] Round 1 flights conducted 7-28 June 1999; Round 2 flown 8 July – 4 August 1999.

[f] Round 1 flights conducted 5-26 June 2000; Round 2 flown 17 July – 4 August 2000.

[g] Round 1 flights conducted 19 June – 11 July 2001; Round 2 flown 16 July – 5 August 2001.

Table 8. Size and age composition of family groups seen during observation flights in the Greater Yellowstone Ecosystem, 1998-2001.

	Females with cubs-of-the-year (number of cubs)			Females with yearlings (number of yearlings)			Females with 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[b]									
Round 1	2	1	1	0	1	2	1	0	0
Round 2	1	2	0	0	3	1	0	1	0
Total	3	3	1	0	4	3	1	1	0
2000[c]									
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[d]									
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

[a] Round 1 flights conducted 15 July – August 1998; Round 2 conducted 3-27 August 1998.
[b] Round 1 flights conducted 7-28 June 1999; Round 2 conducted 8 July – 4 August 1999.
[c] Round 1 flights conducted 5-26 June 2000; Round 2 conducted 17 July – 4 August 2000.
[d] Round 1 flights conducted 19 June – 11 July 2001; Round 2 conducted 16 July – 5 August 2001.

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

Eighty-eight telemetry relocation flights were flown during 2001, resulting in 334.3 hours of search time (ferry time to and from airports excluded; Table 9). We flew from April through December, but over 90% of the flights occurred during May-November. During telemetry flights, 836 locations of bears equipped with radiotransmitters were collected, 82 (9.8%) of which included a visual sighting. Seventy-one sightings of unmarked bears were also obtained during telemetry flights, including 65 solitary bears, 3 females with COY, 2 females with yearlings, and 1 female with young of unknown age. Rate of observation for all unmarked bears during telemetry flights was 0.21 bears/hour. Rate of observing females with COY was 0.009/hour, which was considerably less than during observation flights (0.25/hour) in 2001.

Table 9. Summary statistics for radio-telemetry relocation flights in the Greater Yellowstone Ecosystem, 2001.

				Radioed bears			Unmarked bears observed				Observation rate (bears/hour)	
								Females				
Month	Hours	Number of flights	Mean hours per flight	Number of locations	Number seen	Observation rate (bears/hour)	Lone bears	With COY[a]	With yearlings	With young	All bears	Females with COY
January	0.00	0	-----	0	0	-----	0	0	0	0	-----	-----
February	0.00	0	-----	0	0	-----	0	0	0	0	-----	-----
March	0.00	0	-----	0	0	-----	0	0	0	0	-----	-----
April	13.43	3	4.48	42	5	0.37	2	0	0	0	0.15	0.000
May	52.72	14	3.77	135	8	0.15	9	1	0	0	0.19	0.019
June	28.14	9	3.13	76	3	0.11	2	0	0	0	0.07	0.000
July	48.86	14	3.49	123	22	0.45	14	1	0	0	0.31	0.020
August	64.79	16	4.05	160	32	0.49	19	1	2	1	0.35	0.015
September	33.64	10	3.36	89	5	0.15	18	0	0	0	0.54	0.000
October	34.05	9	3.78	81	1	0.03	1	0	0	0	0.03	0.000
November	38.10	10	3.81	105	6	0.16	0	0	0	0	0.00	0.000
December	20.57	3	6.86	25	0	0.00	0	0	0	0	0.00	0.000
Total	334.30	88	3.80	836	82	0.25	65	3	2	1	0.21	0.009

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

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

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 occurred, but no carcass is recovered, are classified as "probable" mortalities. When evidence is circumstantial, with no prospect for additional information, a "possible" mortality is designated.

The Grizzly Bear Recovery Plan (USFWS 1993:41-44) provides criteria for determining if known human-caused grizzly bear mortalities have exceeded annual thresholds. Although not clearly stated, Appendix F of the Grizzly Bear Recovery Plan (USFWS 1993) intended that only known human-caused grizzly bear mortalities occurring within the Yellowstone Grizzly Bear Recovery Zone and a 10-mile perimeter area count against mortality quotas. The U.S. Fish and Wildlife Service clarified this oversight with an amendment to the Recovery Plan. In addition, beginning in 2000, probable mortalities were included in the calculation of mortality thresholds, and COY orphaned as a result of human causes will be designated as probable mortalities (see Appendix A of Schwartz and Haroldson 2001). Prior to these changes, COY orphaned after 1 July were designated possible mortalities (Craighead et al. 1988). Sex of probable mortalities is randomly assigned as described in Appendix A of Schwartz and Haroldson (2001).

Of the 31 mortalities documented during 2001, 20 were human-caused. Of these 20, 19 were known and 1 was probable. Only 1 of the known human-caused grizzly bear mortalities occurred >10 miles outside the Recovery Zone, and as such, was not applied to the mortality threshold (Tables 10 and 11). This instance, which occurred during the spring black bear hunting season near Jackson, Wyoming, was also the only reported hunting-related grizzly bear death during 2001. Sixteen of the known human-caused mortalities were the result of management removals, 13 and 3 in Wyoming and Montana, respectively (Table 10). Nineteen known and probable human-caused grizzly bear mortalities, including 6 adult females and 2 subadults (8 total females), were applied to the calculation of mortality threshold (USFWS 1993) for 2001. Using these results, both total human-caused and female mortalities were under annual mortality thresholds (Table 12).

Five natural mortalities, including 4 known and 1 probable were documented during 2001 (Table 10). One of these bear deaths likely occurred during the fall of 2000. Evidence suggested that 2 known COY losses were the result of predation by wolves. Specific cause of death for the other 2 bears could not be determined, but circumstances suggested no human involvement. The 1 probable COY loss occurred during early July and involved the loss of a single cub from a radio-collared female that had been accompanied by twins.

Six mortalities from unknown causes were also documented during 2001 (Table 10). Three of these bears likely died during the fall of 2000. Their remains were

Table 10. Documented grizzly bear mortalities in the Greater Yellowstone Ecosystem, 2001.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
Unm	M	Adult	Fall/2000	Fishhawk Creek, SNF	Known	Unknown cause, bones and hair found along trail
Unm	Unk	Subadult	Fall/2000	Yellowstone River, YNP	Known	Unknown cause, probably natural, skull and bone found
290	M	Adult	Fall/2000	Twin Lakes, YNP	Known	Unknown cause
Unm	Unk	Adult	Fall/2000	BTNF	Known	Unknown cause
Mkd	M	Subadult	Spring/2001	SNF	Probable	Human-caused
376[d]	M	Adult	4/24/01	Rock Spring Canyon, BTNF	Known	Human-caused, killed by an archery hunter
104	F	Adult	5/14/01	N Fork. Shoshone, SNF	Known	Human-caused, killed by vehicle, 1 yearling survived
378	M	Adult	6/13/01	S Fork Shoshone, Pr-WY	Known	Human-caused, management removal for cattle depredation
Unm	M	Yearling	6/24/01	Pat O'Hara Mountain, SNF	Known	Unknown cause
Unm	Unk	Subadult	6/24/01	Otter Creek, YNP	Known	Natural, specific cause unknown
Unm	M	COY	7/1/01	Alum Creek, YNP	Known	Natural, predation, bite width consistent with wolf predation
Unm	Unk	COY	7/2-7/9/01	Grayling Creek, YNP	Probable	Natural, bear #346 lost 1 of 2 COY between 7/2 and 7/9
325	F	Adult	7/3/01	Yellowstone River, Pr-MT	Known	Human-caused, live management for nuisance activity, garbage, and livestock depredation
G72	M	Adult	7/13/01	Cooke Pass, Pr-MT	Known	Human-caused, management removal for garbage
382	M	Subadult	7/30/01	Wind River, WY Pr-WY	Known	Human-caused, management removal for camp depredation and food reward
Unm	F	COY	8/10/01	Lamar Valley, YNP	Known	Natural, predation by wolves
357	F	Subadult	8/10-21/01	Fivemile Creek, SNF	Known	Unknown cause
G73	M	Adult	8/16/01	Silver Gate, Pr-MT	Known	Human-caused, management removal for nuisance activity, property damage, and garbage
358	F	Adult	8/26/01	Horse Creek, SNF	Known	Human-caused, management removal repeated property damage, garbage, grain
G74	M	COY	8/26/01	Horse Creek, SNF	Known	Human-caused, management removal, COY of bear #358
G75	F	Adult	9/5/01	Dunn Creek, Pr-WY	Known	Human-caused, management removal numerous incidents, garbage, property damage, 2 yearlings relocated
135	F	Adult	9/12/01	N Fork Shoshone, Pr-WY	Known	Human-caused, management removal, property damage and food
128	F	Adult	9/14/01	Horse Creek, Pr-WY	Known	Human-caused, management removal, property damage and food
G78	M	COY	9/14/01	Horse Creek, SNF	Known	Human-caused, management removal, COY of bear #128
G79	F	COY	9/14/01	Horse Creek, SNF	Known	Human-caused, management removal, COY of bear #128

Table 10. Continued.

Bear[a]	Sex	Age[b]	Date	Location[c]	Certainty	Cause
385	M	Adult	9/27/01	Wind River, Pr-WY	Known	Human-caused, management removal, cattle and beehive depredation
391	M	Subadult	9/29/01	Warm Springs Creek, Pr-WY	Known	Human-caused, management removal, garbage and property damage
Mkd	F	Adult	Fall/2001	TNF	Probable	Unknown cause
Unm	M	Adult	Fall/2001	S Fork Shoshone, SNF	Known	Human-caused
G76	F	Yearling	10/28/01	Lava Creek, Pr-WY	Known	Human-caused, management removal food rewards
153	M	Adult	11/7/01	Sunlight Creek, Pr-WY	Known	Human-caused, management removal for property damage, and food reward

[a] Unm = unmarked bear, Mkd = marked. Number indicates bear number.
[b] COY = cub-of-the-year.
[c] BTNF = Bridger-Teton National Forest, SNF = Shoshone National Forest, TNF = Caribou-Targhee National Forest, YNP = Yellowstone National Park, Pr = private.
[d] Occurred >10 miles outside the Recovery Zone.

Table 11. Known and probable grizzly bear deaths in the Greater Yellowstone Ecosystem, 1973-2001.

	All bears				Adult females			
	Human-caused		Other[a]		Human-caused		Other	
Year	In[b]	Out[b]	In	Out	In	Out	In	Out
1973	14	0	3	0	4	0	0	0
1974	15	0	1	0	4	0	0	0
1975	3	0	0	0	1	0	0	0
1976	6	0	1	0	1	0	0	0
1977	14	0	3	0	6	0	0	0
1978	7	0	0	0	1	0	0	0
1979	7	1	0	0	1	0	0	0
1980	6	0	4	0	1	0	0	0
1981	10	0	3	0	3	0	2	0
1982	14	0	3	0	4	0	0	0
1983	6	0	1	0	2	0	0	0
1984	9	0	2	0	2	0	0	0
1985	5	1	7	0	2	0	0	0
1986	5	4	2	0	1	1	0	0
1987	3	0	0	0	2	0	0	0
1988	5	0	7	0	0	0	2	0
1989	2	0	1	0	0	0	0	0
1990	9	0	0	0	4	0	0	0
1991	0	0	0	0	0	0	0	0
1992	4	0	4	0	0	0	0	0
1993	3	0	2	0	2	0	1	0
1994	11	1	1	0	4	0	0	0
1995	17	0	1	0	3	0	0	0
1996	10[c]	0	4	1	3	0	0	0
1997	8	2	10[d]	0	3	0	0	0
1998	1	2	3	0	1	0	0	0
1999	7[e]	1	7	0	1	0	0	0
2000[f]	16	6	10	0	3	1	0	0
2001	19	1	11	0	6	0	1	0

[a] Includes deaths from natural and unknown causes.
[b] In refers to inside the Recovery Zone or within a 10-mile perimeter of the Recovery Zone. Out refers to >10 miles outside the Recovery Zone.
[c] Includes 1 known human-caused mortality from 1996 discovered during 1999.
[d] Includes 1 mortality from the fall of 1997 discovered in 1998.
[e] Includes 1 probable human-caused mortality from 1999 discovered in 2000.
[f] Starting in 2000, includes human-caused orphaned cubs-of-the-year (Appendix A of Schwartz and Haroldson 2001).

Table 12. Annual count of unduplicated females with cubs-of-the-year (COY), and known and probable[a] human-caused grizzly bear mortalities within the Recovery Zone and the 10-mile perimeter, 1991-2001. Calculations of mortality thresholds (USFWS 1993) do not include mortalities or unduplicated females with COY documented outside the 10-mile perimeter.

								U.S. Fish and Wildlife Service Grizzly Bear Recovery Plan mortality thresholds				
		Human-caused mortality			Human-caused mortality 6-year running averages				Total human-caused mortality		Total female mortality	
Year	Unduplicated females with COY	Total	Female	Adult female	Total	Female	Adult female	Minimum population estimate	4% of minimum population	Year result	30% of total mortality	Year result
1991	24	0	0	0	4.0	2.2	1.2	219	8.8		2.6	
1992	25	4	1	0	3.8	1.8	1.0	255	10.2		3.1	
1993	19	3	2	2	3.8	1.8	1.0	241	9.6	Under	2.9	Under
1994	20	10	3	3	4.7	2.0	1.5	215	8.6	Under	2.6	Under
1995	17	17	7	3	7.2	3.2	2.0	175	7.0	Exceeded	2.1	Exceeded
1996	33	10	4	3	7.3	2.8	1.8	223	8.9	Under	2.7	Exceeded
1997	31	7	3	2	8.5	3.3	2.2	266	10.7	Under	3.2	Exceeded
1998	35	1	1	1	8.0	3.3	2.3	339	13.6	Under	4.1	Under
1999	32	5	1	1	8.3	3.2	2.2	343	13.7	Under	4.1	Under
2000	35	16	6	3	9.3	3.7	2.2	354	14.2	Under	4.2	Under
2001	42	19	8	6	9.7	3.8	2.7	361	14.5	Under	4.3	Under

[a] Beginning in 2000, probable human-caused mortalities are used in calculation of annual mortality thresholds (Schwartz and Haroldson 2001).

discovered spring 2001 and subsequent investigation could not determine cause of death. The carcass of a yearling male bear was discovered in a sheep allotment where an illegal bear mortality occurred during 2000, but cause of death could not be determined. A radio-collared subadult female died during mid-August, but cause of death could not be determined. The remaining mortality involved the apparent loss of an adult female within a week after she was involved in a management action near Carter Creek, Wyoming, and was transported to the Caribou-Targhee National Forest. We currently consider this a probable mortality, pending additional investigation that will occur during the spring of 2002.

Key Foods Monitoring

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

It is well documented that grizzly bears use ungulates as carrion (Mealey 1980, Henry and Mattson 1988, Green 1994, Blanchard and Knight 1996, Mattson 1997) in Yellowstone National Park. Competition with recently reintroduced wolves (*Canis lupus*) for carrion and changes in bison (*Bison bison*) and elk (*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 Yellowstone National Park. In 2001, we surveyed 27 routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses.
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.

We are interested in relating the changes in ungulate carcass numbers to potential independent measures of winter die-off. Such measures include weather, winter severity, and forage availability. All are considered limiting factors to ungulate survival during winter (Cole 1971, Houston 1982). Long-term changes in weather and winter severity monitoring may be useful in predicting potential carcass availability. The Winter Severity Index (WSI) developed for elk (Farnes 1991), tracks winter severity, monthly, within a winter and is useful to compare among years. WSI uses a weight of 40% of minimum daily winter temperature below 0° F, 40% of current winter's snowpack (in snow water equivalent), and 20% of June and July precipitation as surrogate for forage production (Farnes 1991).

<u>Northern Range</u>

We surveyed 12 routes on Yellowstone's Northern Range totaling 186 km traveled. One route was not surveyed due to its proximity to an active wolf den. In 2001, we used a Global Positioning System to more accurately measure the actual distance traveled on most of the routes. We counted 24 carcasses, including 1 bison, 20 elk, 2 mule deer, and 1 pronghorn, which equated to 0.13 carcasses/km (Table 13). Sex and age of carcasses found are shown in Table 14. All carcasses were almost completely consumed by scavengers, no direct evidence of use by bears could be determined. Eight of the elk carcasses were probable or confirmed wolf-kills. Bear sign (e.g., tracks, scats, or feeding activity) was observed along 6 of the routes.

Table 13. Carcasses found and visitation of carcasses by bears, wolves, and unknown large scavengers along surveyed routes in Yellowstone National Park during spring 2001.

Survey area (# routes)	Elk				Bison				
	Number of carcasses	# Visited by species			Number of carcasses	# Visited by species			Total
		Bear	Wolf	Unknown		Bear	Wolf	Unknown	Carcasses/km
Northern Range (12)	20	0	0	20	1	0	0	1	0.13[a]
Firehole (8)	1	0	0	1	3	1	1	1	0.05
Norris (4)	3	0	0	3	0	0	0	0	0.15
Heart Lake (3)	1	1	1	0	0	0	0	0	0.06

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

Table 14. Age classes and sex of elk and bison carcasses found, by area, along surveyed routes in Yellowstone National Park during spring 2001[a].

	Elk (n = 25)					Bison (n = 4)				
	Northern Range	Firehole	Norris	Heart Lake	Total	Northern Range	Firehole	Norris	Heart Lake	Total
Age										
Adult	5	0	2	1	8	0	2	0	0	2
Yearling	0	0	0	0	0	1	1	0	0	2
Calf	6	0	0	0	6	0	0	0	0	0
Unknown	9	1	1	0	11	0	0	0	0	0
Sex										
Male	3	0	0	0	3	0	2	0	0	2
Female	2	0	1	0	3	0	0	0	0	0
Unknown	15	1	2	1	19	1	1	0	0	2

[a] Of other ungulate carcasses found along transect routes, 1 mule deer was a female calf; the sex and age classes of 1 other mule deer and 1 pronghorn could not be determined.

Firehole River Area

We surveyed 8 routes in the Firehole drainage totaling 79 km. We found the remains of 3 bison and 1 elk, which equated to 0.05 carcasses/km traveled (Table 13). Grizzly bear and wolf sign was observed at the adult male bison carcass (Table 13). Additionally, grizzly bear tracks, including those of 1 family group, were observed on 3 of the routes.

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin totaling 20 km traveled. We observed 3 elk carcasses, which equated to 0.15 carcasses/km (Table 13). All carcasses were completely scavenged. Although we found no direct evidence of use of the carcasses by bears or wolves, we did observed grizzly bear tracks on 3 routes and wolf tracks on 1 route.

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin covering 17 km. We counted an elk carcass (Table 13) that was possibly killed by wolves and had been used by a grizzly bear. Carcasses/km was 0.06. Grizzly bear sign was also observed on the 2 other routes.

According to the WSI, the winter of 2000-2001 presented milder-than-average conditions (Fig. 5). There were fewer carcasses observed than in previous years, and our index of carcass abundance was lower in 2000-2001 compared to the relatively severe winter of 1996-1997 (Fig. 6). We found a significant correlation between the WSI and numbers of carcasses observed on the Northern Range ($R^2 = 0.75$, $n = 8$, $F = 20.5$, $P = 0.0027$), and in the Firehole/Norris basins ($R^2 = 0.64$, $n = 13$, $F = 21.1$, $P = 0.0006$).

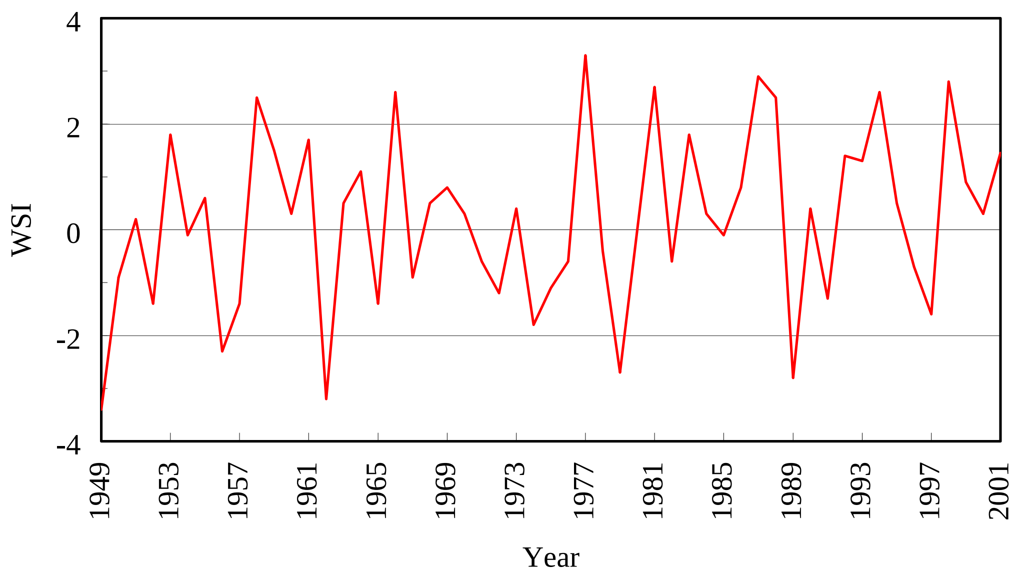


Fig. 5. Winter Severity Index (WSI) for elk on the Northern Range, Yellowstone National Park, 1948-2001. WSI values of 3 to 4 indicate very mild winters, 0 average, and -3 to -4 very severe winters.

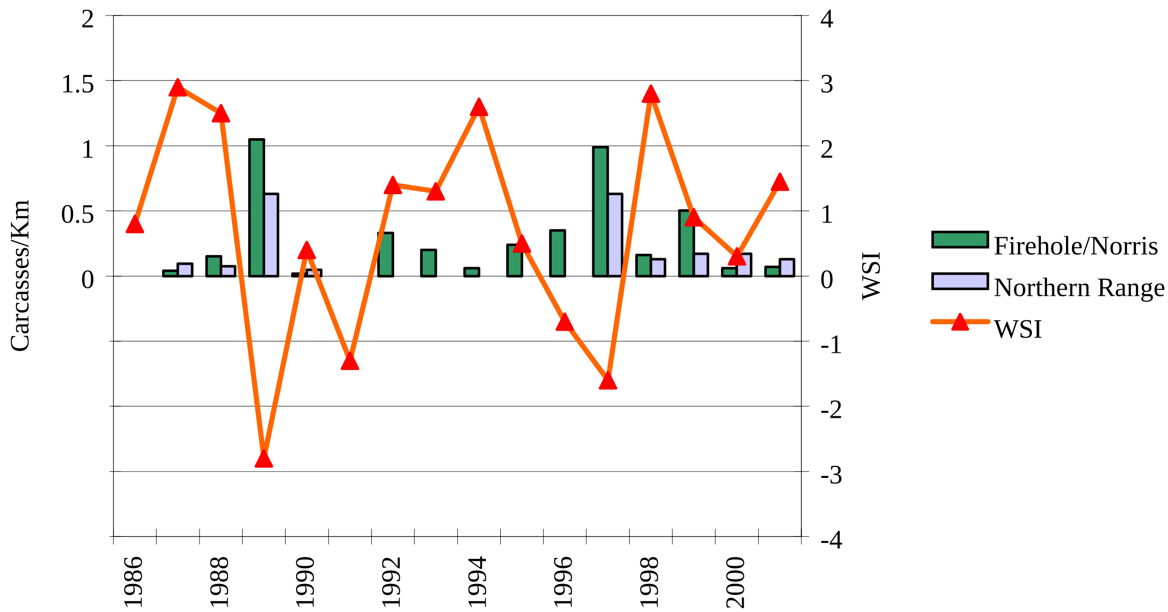


Fig. 6. Winter Severity Index (WSI) derived for elk on the Northern Range and ungulate carcasses/km along transects in 2 survey areas, Yellowstone National Park, 1986-2001.

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

Army cutworm moths (*Euxoa auxiliaris*) were first recognized as an important food source for grizzly bears in the GYE during the mid 1980s (Mattson et al. 1991*b*, French et al. 1994). Early observations indicated that moths, and subsequently bears, showed specific site fidelity. These sites are generally high alpine areas dominated by talus and scree adjacent to areas with abundant alpine flowers. 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 nearly impossible. Not all observations of bears feeding at insect aggregation sites are specifically recorded as such, and the boundaries of sites are not clearly known. It is also probable that size and location of insect aggregation sites fluctuated from year to year with moth abundance.

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 often overlooked. From 1997-99, the method for defining insect aggregation sites was to inscribe a 1-km-radius circle around clusters of observations in which bears were seen on insects in talus/scree habitats (Ternent and Haroldson 1999). This method allowed trend in bear use of moth 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 based on analysis from Ternent et al. (in preparation). Using this technique, sites were delineated by buffering locations of bears observed actively feeding at insect aggregation sites by 500 m. Borders of the overlapping buffers were then dissolved to produce a single polygon for each site. These sites were identified as "known" sites in 2000 (Bjornlie and Haroldson 2001). We change terminology and use "confirmed" sites to clarify what was known in past years. The new technique to delineate confirmed sites 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, analysis for this report was completed for all years using this new technique. Areas suspected as insect aggregation sites but dropped from the "confirmed" list and sites with only 1 location of an actively feeding bear, are termed "possible" sites and monitoring will continue. 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 moth sites in the past may change as new sites are confirmed; data from this annual report may not be the same as data in past reports.

Monitoring bear presence within the boundary of each insect site would be more desirable than defining a site by a buffer based on bear locations, but is not possible because the location of each unique boundary is presently unknown. In fact, only a few sites have been investigated by ground reconnaissance.

Presently, we know of 27 confirmed insect aggregation sites within the GYE (Table 15), with another 23 possible sites that will continue to be monitored. One possible site was reclassified as a confirmed site in 2001 due to an additional active feeding location at that site. No new sites were documented in 2001. Use of confirmed sites by bears changes annually, suggesting some years are better moth years than others (Fig. 7). For example, the years 1993-94 were probably poor moth years because the percentage of confirmed sites used by bears (Fig. 7) and the number of observations recorded at insect sites (Table 15) were low. These years also had more nuisance management activity than other years (Gunther et al. 2000). The number of insect aggregation sites used by bears increased from 14 in 2000 to 16 in 2001 and was slightly above the 5-year average of 15.2 sites/year from 1996-2000. The percentage of total confirmed sites used also increased in 2001 (Fig. 7), suggesting that grizzly bear use of insect aggregation sites in 2001 was slightly above average. There were 6 locations recorded on 3 possible sites in 2001.

Table 15. The annual number of confirmed moth sites in the Greater Yellowstone Ecosystem, the number used by bears, and the total number of telemetry relocations or aerial observations of bears recorded at each site, 1986-2001.

Year	Number of confirmed moth sites[a]	Number of moth sites used[b]	Number of locations or observations[c]
1986	5	2	8
1987	6	4	15
1988	7	4	43
1989	11	9	47
1990	13	10	69
1991	16	14	144
1992	19	15	88
1993	19	2	4
1994	20	7	14
1995	23	13	28
1996	24	14	69
1997	24	14	67
1998	26	17	124
1999	27	17	144
2000	27	14	78
2001	27	16	98
Total			1,040

[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 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.

[c] May include replicate sightings or telemetry relocations.

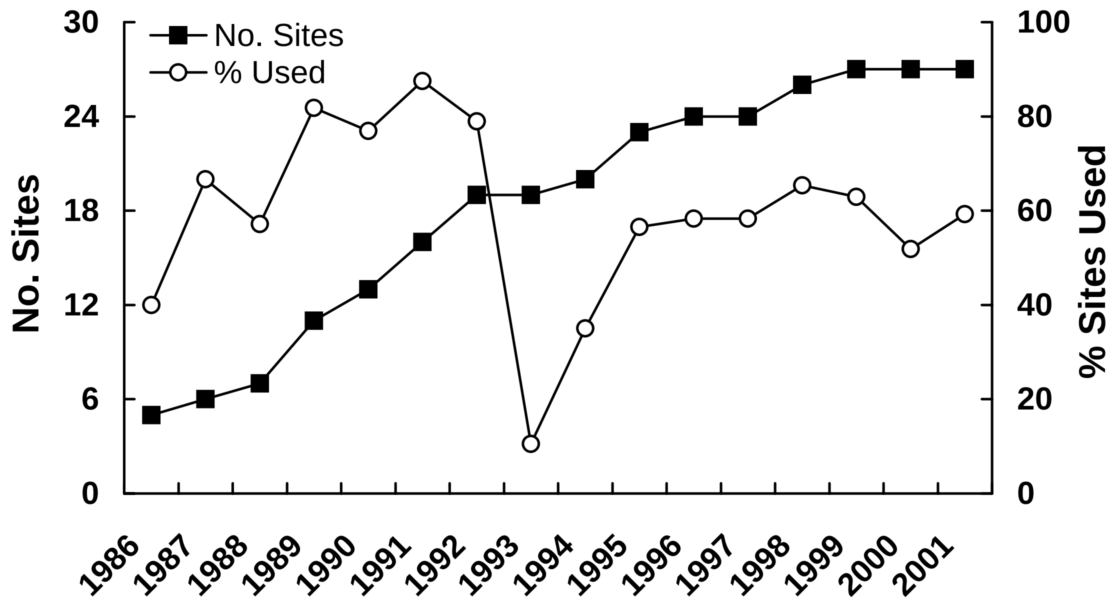


Fig. 7. Annual number of confirmed moth sites and percent of those sites at which either telemetry relocations or visual observations of unmarked bears were recorded, Greater Yellowstone Ecosystem, 1986-2001.

The IGBST maintains an annual list of unduplicated females observed with COY (see Table 4). Since 1986 (when moth sites were initially included in aerial observation surveys), 96 (23%) of 415 initial sightings of unduplicated females with COY have been recorded at (within 500 m, *n* = 66) or near (within 1,500 m, *n* = 30) moth sites (Table 16). Notably, peaks in the number of initial sightings recorded at moth sites correspond with annual trends in the total number of locations (Table 16) and the percent of moth sites with documented use (Fig. 7). In 2001, 6 of the 42 (14.3%) sightings of unduplicated females with COY were recorded at moth sites. This was slightly less than the 5-year average of 16.7% from 1996-2000.

Survey flights at insect aggregation sites obviously contribute to the count of unduplicated females with COY, however, it typically is low, ranging from 0 to 13 initial sightings/year since 1986 (Table 16). If these sightings are excluded, an increasing trend in the annual number of unduplicated sightings of females with COY is still evident. This suggests that some other factor besides observation effort at moth aggregation sites is responsible for the increase in sightings of female with COY.

Table 16. Number of initial sightings of unduplicated females with cubs-of-the-year (COY), number that occurred on or near moth sites, number of sites where such sightings were documented, and the mean number of sightings per site in the Greater Yellowstone Ecosystem, 1986-2001.

Year	Unduplicated females with COY[a]	Number of moth sites with an initial sighting[b]	Initial sightings: Within 500 m[b] N	Initial sightings: Within 500 m[b] %	Initial sightings: Within 1,500 m[c] N	Initial sightings: Within 1,500 m[c] %
1986	25	0	0	0.0	1	4.0
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	2	2	8.0	2	8.0
1991	24	8	9	37.5	13	54.2
1992	25	6	7	28.0	10	40.0
1993	20	2	2	10.0	2	10.0
1994	20	2	4	20.0	5	25.0
1995	17	1	1	5.9	2	11.8
1996	33	4	4	12.1	8	24.2
1997	31	4	7	22.6	8	25.8
1998	35	4	5	14.3	9	25.7
1999	33	4	7	21.2	8	24.2
2000	37	5	5	13.5	9	24.3
2001	42	4	6	14.3	6	14.3
Total	415		56		80	
Mean	25.9	3.0	3.9	14.0	5.4	19.3

[a] Initial sightings of unduplicated females with COY; see Table 4.
[b] Moth site is defined as a 500-m buffer drawn around locations of bears observed actively feeding at insect aggregation sites. Borders of the overlapping buffers are dissolved to produce a single polygon for each site. Twenty-seven sites have been identified as of 2001.
[c] This distance is 3 times what is defined as a moth site for this analysis, since some observations could be made of bears traveling to and from moth sites.

The Ecological Relationship between a Rocky Mountain Threatened Species and a Great Plains Agricultural Pest *(Hillary Robison, Ph.D. candidate, University of Nevada, Reno)*

Project Summary

Army cutworm moth (ACM) adults migrate from Great Plains agricultural areas to the Rocky Mountains and aggregate in high-elevation talus slopes. These ACM aggregations provide an important food resource for grizzly bears. Much is known about the agricultural aspect of the life history of ACMs. However, relatively little is known about their alpine and migratory ecology and their population genetics.

Summer and fall 2000, was the second field season of this study, which aims to elucidate how ACM ecology and population genetics may impact grizzly bear conservation. This information will help us understand factors that affect the number of ACMs reaching the high-elevation areas where they are a food source for bears.

The results of this study will provide groundwork for further investigations of the affects of moth variability and abundance on grizzly bear fecundity and mortality, as well as provide insights to biologists that may help them make management decisions.

Background and Significance

***A link between army cutworm moth migration and grizzly bear conservation*.--** In 1952, grizzly bears were found feeding on army cutworm moths and ladybird beetles (*Coccinella* spp. and *Hippodamia* spp.) aggregated in talus slopes (Chapman et al. 1955). Since this discovery, grizzly bears have been seen feeding on ACMs in the summer and fall at several remote high-elevation moth aggregation sites in Montana and Wyoming (Craighead et al. 1982, Servheen 1983, Klaver et al. 1986, Mattson et al. 1991*b*, French et al. 1994, O'Brien and Lindzey 1994, White 1996).

Army cutworm moths are a critical summer and fall food source for grizzly bears. Grizzly bears excavate the moths from the talus and consume them by the thousands from July through September (Pruess 1967, Chapman et al. 1955, Mattson et al. 1991*b*, French et al. 1994, White 1996). When compared to other food sources, ACMs are the highest source of digestible energy available to grizzly bears (Mealey 1975, Pritchard and Robbins 1990, French et al. 1994, Craighead et al. 1995, White 1996). It has been estimated that over a 30-day period, a grizzly bear feeding extensively on ACMs can consume 47% of its annual energy budget (White 1996).

When ACMs and whitebark pine nuts (WBPNs) are abundant in the fall, grizzly bears move to high elevations to forage on these rich food sources, and in doing so, geographically separate themselves from areas of human activity. Due to this geographic separation, far fewer grizzly bear management situations and grizzly bear mortalities are recorded during years when ACMs are present than during years when ACMs are absent (Gunther et al. 1993, 1994, 1995, 1996, 1997). Whitebark pine resources are similarly important, as abundance of WBPNs in the fall is positively correlated with increased grizzly bear fecundity, but inversely correlated with grizzly bear mortality and the number of grizzly bear management actions (Mattson et al. 1992; Gunther et al. 1993, 1995). Cyclic crashes in the WBPN crop and the potential damage to whitebark pine from blister rust (*Cronartium ribicola*) increase the importance of understanding the factors affecting ACM abundance at high-elevation grizzly bear foraging sites.

In 1991 and 1992, it was estimated that an average of 44% of all known grizzly bears in the GYE foraged at ACM aggregation sites in the Absaroka Mountains, Wyoming (O'Brien and Lindzey 1994). Female grizzly bears comprised 40% of these bears (O'Brien and Lindzey 1994).

Female grizzly bear survivorship and reproduction is important to grizzly bear population persistence (Bunnell and Tait 1981, Eberhardt 1990, Craighead and Vyse 1996). Cub production depends on adequate pre-hibernation weight gain and fat deposition by the female (Rogers 1987) and may reflect the quantity and quality of available food (Stringham 1990, McLellan 1994). Since female grizzly bears comprise a large percentage of all bears foraging at moth aggregation sites in the Absaroka Mountains and because the goal of the Endangered Species Act is to recover species and to ensure their persistence through time, the availability of ACMs to grizzly bears is important to the conservation of the population.

***Biology of the army cutworm moth*.--**The ACM is a native North American agricultural pest whose distribution ranges from California to Kansas and from Alberta, Canada, to Arizona and New Mexico. Adult moths lay their eggs in the fall (Strickland 1916, Burton et al. 1980). The larvae feed on a wide variety of host plants including small grains, alfalfa, and sugar beets until early winter and then over-winter underground. The adult moths emerge in May and migrate to high-elevation talus slopes in the Rocky Mountains (Pruess 1967). Once ACMs reach the mountains, they remain there from July through September. At night, the moths forage on the nectar of alpine flowers (Pruess 1967, French et al. 1994). During the day, the moths hide in talus rock slides (Pruess 1967, French et al. 1994, O'Brien and Lindzey 1994, White 1996). From late August through the beginning of October, the moths back-migrate to the Great Plains and oviposit into the soil (Pruess 1967, Burton et al. 1980).

Project Objectives

The main objectives of this study are to determine ACM origins, to determine whether ACMs interbreed or comprise different migratory groups, and to determine if ACMs harbor pesticides.

Genetic data have been used to answer migration questions and have proved to be efficient at differentiating populations or groups of populations (Queller et al. 1993, Estoup et al. 1995; Garcìa-Moreno et al. 1996, Rankin-Baransky et al. 1997, Bolten et al. 1997, Palsboll et al. 1997). Female moths can be examined in order to determine if they are mated (K. Pruess, University of Nebraska, personal communication; D. LaFontaine, Agriculture Canada, personal communication).

Determining ACM origins and site fidelity is important because pressures on ACMs in natal areas, whether natural (e.g., weather patterns) or human-caused (e.g., pesticides or habitat loss), may affect moth recruitment and the numbers of adults reaching high-elevation sites. Analysis of ACM microsatellite data will allow determination of where ACMs originate and whether ACMs are interbreeding at high-elevation sites. To complement genetic data, physical evidence will also be collected to determine whether ACMs mate in high elevation and, therefore, are capable of interbreeding there prior to their return to agricultural areas.

Work in Progress

***Field sampling - high elevation*.--**Black-light traps are used from mid-July to late August to catch ACMs at moth aggregation sites. Crews collect ACMs for genetic analyses, pesticide analysis, and evaluation of female reproductive status.

To date, we have collected ACMs from 11 high-elevation sites, including 9 sites in Wyoming, 1 site in Washington, and 1 site in New Mexico.

In summer 2000, we collected ACMs from the 5 high-elevation sites in Wyoming that were sampled in 1999 as well as from 4 new sites in Wyoming. The U.S. Fish and Wildlife Service, Washington state office, also sent ACM samples collected in the Cascades.

In summer 2001, we collected ACMs from 4 of the high-elevation sites visited in 1999 and 2000. The U.S. Fish and Wildlife Service, Washington state office, also sent ACM samples from the Cascades.

***Field sampling - low elevation*.--**In the late summer and early fall, field crews trap ACMs in agricultural areas with pheromone traps. The crews' trapping efforts are coordinated with the ACM trapping programs of university agricultural extension services in Nebraska, Montana, and South Dakota.

In fall 1999, ACMs were collected at 15 areas in the states of Montana, Wyoming, Nebraska, and South Dakota. In fall 2000, the number of agricultural areas sampled in these states increased to 39 and included 8 new sites in Idaho and 1 new site in northeastern Utah. The sampling effort was expanded in 2000 in order to sample a 360-degree radius around the high-elevation study areas. In fall 2001, we sampled the same 39 areas as in 2000 and obtained samples from 2 new sites.

Laboratory Procedures

I sent all the ACM samples that were collected for pesticide residue analysis during the 1999 field season to the USGS-Columbia Environmental Research Center laboratory in Missouri. The lab found only non-significant traces of pesticides in the samples. I did not collect ACMs for pesticide residue analysis during field season 2000. Later in 2000, a question arose as to whether the method used in 1999 was sensitive enough to pick up traces of pesticides in the ACMs. In 2001, I submitted a sample of ACMs to the Montana State University - Bozeman Analytical Laboratory for a different type of pesticide screening process; this sample came back negative for traces of pesticides.

I am analyzing the genetic data in the Laboratory for Ecological and Evolutionary Genetics at the University of Nevada, Reno. I must individually key out each of these several thousand ACMs and then individually extract their DNA. Small-scale extraction of DNA from the ACM samples collected in 1999 and 2000 began when funds became available in May 2000. Larger scale DNA extraction began after taxonomic help became available in March 2001 and is continuing. A genomic DNA library was developed for the ACM in January 2001. I screened this library for 11 microsatellite loci (hereafter called loci) and developed primers to amplify them. I sequenced 96 DNA fragments from the library in an effort to augment the number of loci. Nine of these 96 fragments contained potential microsatellites and I designed primers to amplify them. Polymerase chain reactions (PCRs) are being optimized for 11 of the 20 isolated loci. The remaining 9 of these 20 loci have been abandoned due to lack of variability or due to amplification problems. To date PCRs have been optimized for 2 of the 11 loci. I am analyzing the variability at these loci using Applied Biosystems (ABI) 310 and ABI 3700 microsatellite fragment analysis machines and GeneScan software.

Project Products

The results of this research will be written in manuscript form and submitted to several peer-reviewed journals. A Ph.D. thesis will be submitted to a dissertation committee at the University of Nevada, Reno, the results will be presented in a public defense, and the thesis will be bound and archived at the University of Nevada, Reno.

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Cooperators

Interagency Grizzly Bear Study Team, USGS
Yellowstone National Park Bear Management Office
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Wyoming Game and Fish Department

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

Whitebark pine cone production averaged 25.5 cones/tree on 19 transects read during 2001 (Table 17). Cone production was generally good throughout most of the ecosystem (Fig. 8). Three exceptions exhibiting poor cone production all occurred in the southeastern portion of the ecosystem; transects T, H, and U (Fig. 8).

Table 17. Summary statistics for the 2001 whitebark pine cone production transects in the Greater Yellowstone Ecosystem.

Total			Trees				Transects			
Cones	Trees	Transects	Mean cones	SD	Min	Max	Mean cones	SD	Min	Max
4,841	190	19	25.5	35	0	208	55.9	268.6	0	1,240

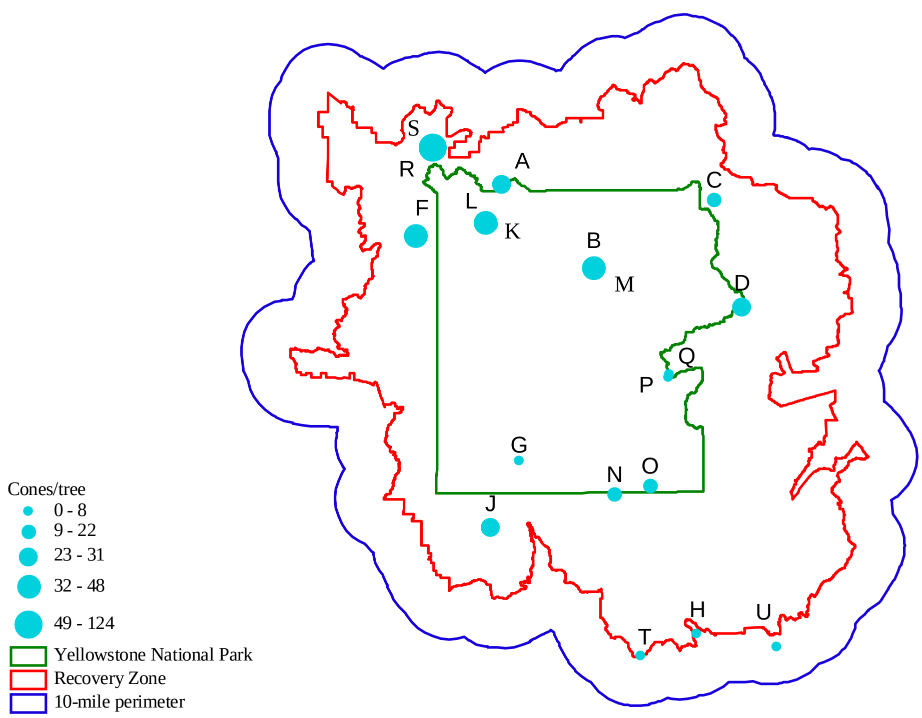

Fig. 8. Whitebark pine cone production transect results for 2001 in the Greater Yellowstone Ecosystem.

Near exclusive use of whitebark pine seeds occurs during years in which mean cone production on transects exceeds 20 cones/tree (Blanchard 1990, Mattson et al. 1992). During years of low whitebark pine seed availability, grizzly bears range wider and seek alternate foods, which often brings them in close proximity to human activities during the fall. This often results in an increase in the number of management captures and transports (Fig. 9), and human-caused mortality. During August through October of 2001, 11 management captures involving bears 2 years of age or older (independent) resulted in 4 transports and 7 removals of nuisance individuals. All but 1 of these actions occurred in southeastern portion of the ecosystem where cone production was poor.

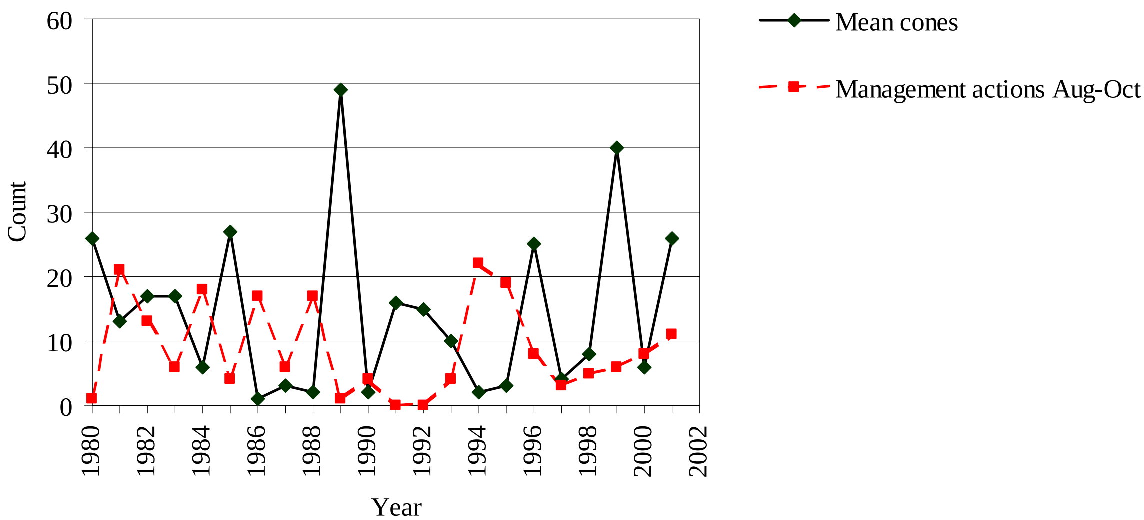

Fig. 9. Relationship between mean whitebark pine cone production and the number of August through October management actions of grizzly bears older than yearlings in the Greater Yellowstone Ecosystem.

Whitebark pine is threatened in the GYE by an introduced fungus, white pine blister rust. Blister rust has already decimated whitebark pine in northwest Montana (Keane and Arno 1993). Infection occurs in the GYE, but as yet has not caused extensive tree mortality (Smith and Hoffman 1998). The potential loss of whitebark pine seeds may be particularly devastating to grizzlies in the GYE because few alternative fattening foods are available during late summer and fall. During 2001, field crews completed blister rust surveys on all 19 established cone production transect. Fifty-eight percent (11 of 19) of transects visited contained trees that were definitely infected with blister rust. The remaining 42% (8 of 19) were possibly infected. We found a total of 7 dead trees on 4 transects. Of the 183 live trees examined, 33% were definitely infected with blister rust and an additional 45% were likely infected. Forty trees had no evidence of infection. Evidence of mountain pine beetles were found on 4 transects. Field crews also completed photo documentation of each tree on transects so that the rate of blister rust spread and potential mortalities can be ascertained. Replacement trees were chosen for 19 trees that were dead or top-dead from blister rust, mountain pine beetles, or other causes. We intend to revisit all transects in 2005 to repeat pathogen surveys and photo documentation.

Grizzly Bear Body Composition *(Charles C. Schwartz, Mark A. Haroldson, and Chad Dickinson, Interagency Grizzly Bear Study Team)*

Studies of the nutritional ecology of the Yellowstone grizzly bear have focused mainly on food habits (Mattson et al 1991*a*, Mattson and Reinhart 1995, Mattson 1997). However, because certain foods like meat and fish are highly digestible, identification of undigested food items from scats can be biased. Poorly digested foods like plants are over represented in the feces whereas highly digestible foods are underrepresented. Fecal correction factors can improve upon quantification of forage items (Hewitt and Robbins 1996), but one cannot determine the contributions of dietary components to the energetics of individuals.

Body mass and composition are good indicators of reproductive potential in bears (Rogers 1976, Blanchard 1987, Hilderbrand et al. 1999). In habitats with abundant food resources, age at first reproduction and reproductive interval are reduced, and litter size is large relative to poor habitats (Stringham 1990). Information detailing the body composition of bears can thus provide important ecological insight into the nutritional ecology of individuals and ultimately the population.

Farley and Robbins (1994) developed the method of utilizing bioelectrical impedance analysis to accurately predict body composition of bears. The technique is simple, and provides relatively accurate results. We used the BIA technique as detailed by Hilderbrand et al. (1998) to measure body composition in grizzly bears in the GYE.

We began collecting body composition data for captured grizzly bears in May 2000. We purchased additional equipment for the state of Wyoming in 2001 to increase sample sizes. During the past 2 years, we have obtained 44 body condition measurements, with 37 from bears randomly captured at research trap sites and 7 from targeted problem bears at management trap sites. Our sample is currently inadequate to compare sex-age classes by season, but preliminary results do suggest that problem bears tend to be significantly lower in body condition when compared to randomly caught bears (Fig. 10). We will continue to collect additional samples from captured bears and build our database for future analyses.

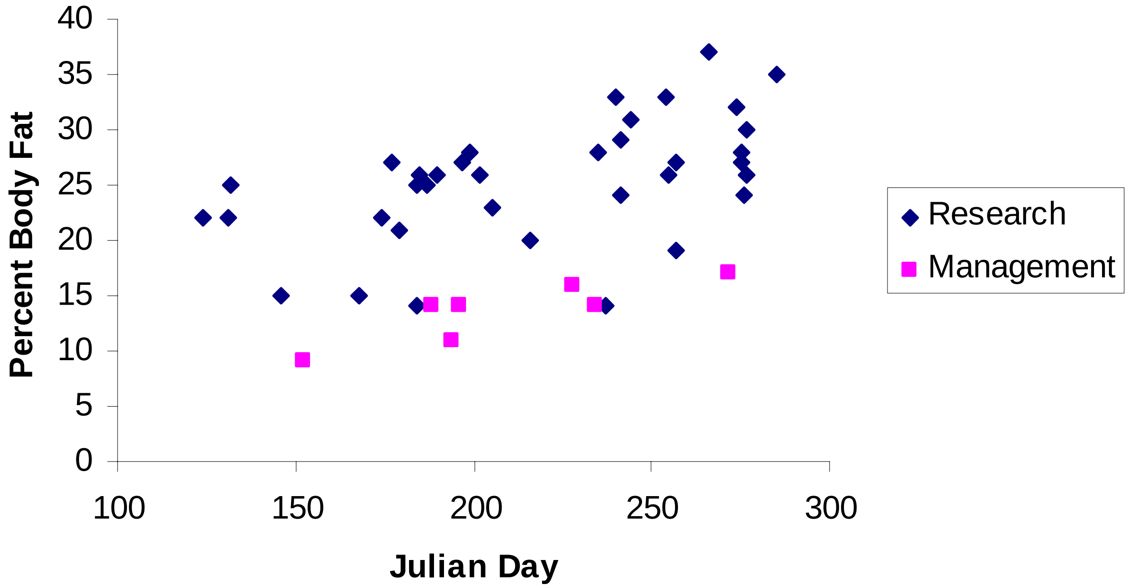

Fig. 10. Body fat determinations for 44 grizzly bears from the Greater Yellowstone Ecosystem, 2000-01. On average, management captured bears were significantly (t = 4.3, P = 0.001) lower in body fat (13.6%) than research captured bears (24.7%). Julian date (jday) 121 = 1 May, whereas jday 280 = 7 October.

Application of Stable Isotopes and Hg to Understanding the Potential Effects of Long-Term Changes in Food Resources to Yellowstone Grizzly Bear Productivity

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Introduction

Two of the major grizzly bears foods in the GYE are whitebark pine nuts, a significant fall food rich in fat (Lanner and Gilbert 1994) and cutthroat trout, a summer food rich in protein. The abundance of these foods varies both seasonally and annually. Whitebark pine, a masting species, produces significant cone crops at irregular intervals. Seed production varies from as many as 50 cones/tree to as few as 0 (Haroldson 2000). Consumption of pine seeds is considerable in years of abundant crops and becomes insignificant in years of poor cone production. Grizzly bear mortality is 1.8 to 3.3 times greater in years of poor seed crops (Mattson 1998). During years when grizzlies feed heavily on pine nuts, they are in high mountainous areas distant from roads and human facilities. During years when pine seeds are unavailable, bears forage in lower elevation habitats and are near humans with resulting conflicts and elevated mortality. Female grizzly bears especially tend to feed on pine nuts, which may be critical to their reproductive success (Mattson 2000).

Whitebark pine in the GYE is infected with an exotic fungus, white pine blister rust (Kendall and Keane 2000). In the western United States and Canada, 50-100% of the extant whitebark pine is either dead or dying. Recent surveys suggest that rust is spreading (Kendall and Keane 2000). Loss of whitebark pine has the potential of imposing significant environmental stress on the threatened Yellowstone grizzly bear.

Grizzly bear use of spawning cutthroat trout in tributaries of Yellowstone Lake has been well documented (Hoskins 1975, Mealey 1980, Reinhart 1990, Mattson and Reinhart 1995). During 1994, non-native lake trout (*Salvelinus namaycush*) were discovered in Yellowstone Lake. Estimates suggest that lake trout have been in Yellowstone Lake for 10-30 years. Lake trout are efficient predators and in the absence of management, have the potential to reduce the native cutthroat trout population by 80-90% (McIntyre 1996). A decline of this magnitude will negatively impact 28 wildlife species, including the threatened grizzly bear (Schullery and Varley 1996). Thus, at least 2 of the major food resources for grizzly bears in Yellowstone are threatened.

Quantifying the annual consumption of individual food items by grizzly bears with current technology is nearly impossible. Fortunately, a major breakthrough occurred approximately 10 years ago with the advent of stable isotope technology in biology. The USGS lab in Denver, Colorado, has been a leader in developing the methodology, and Washington State University (WSU) has been instrumental in applying the techniques to understanding grizzly bear biology (Hilderbrand et al. 1996, Jacoby et al. 1999). A key feature of this effort has been the raising of captive bears to calibrate the stable isotope fractionations in blood, hair, and muscle tissue that occur during their consumption of controlled diets. The 2 facilities working together previously used stable isotopes to understand the foraging ecology of Alaskan grizzly bears. However, because only carbon and nitrogen isotopes could be used previously, diets of bears could only be separated into plant versus animal foods. During the past several years, the Denver USGS lab in cooperation with the IGBST has been able to demonstrate a link between sulfur isotopes in bear tissue and whitebark pine nuts in bear's diet. Recently, the fish of Yellowstone Lake have been shown to have high Hg anomalies (Morgan et al. 2000). The hair of bears sampled near Yellowstone Lake has been shown to have high Hg anomalies while the hair from bears in other parts of the ecosystem shows no or smaller anomalies. The combination of stable isotopes and trace elements in easily collected and time-sampled bear hair offers an unprecedented, low-cost method to refine grizzly bear feeding ecology and demographics. For example the combination of isotope and Hg data can be used to determine what percent of the population eats cutthroat trout, how important cutthroat trout are to them, and how far bears move to feed on cutthroat trout near Yellowstone Lake as well as the importance of other food sources in their diets.

The IGBST has collected over 1,300 hair samples for genetic typing over the last 4 years. About 150 of these samples have paired blood samples. Only the hair follicle is needed for the DNA studies and the remainder of the hair filament has been retained and is available for trace element and isotopic work. In Yellowstone National Park, grizzly bears replace their hair annually. Therefore, isotopic ratios of the hairs collected represent the diet of the bear the preceding year. Laboratory studies of the nature proposed here require sequence sampling based on detailed knowledge of hair growth. Latitude, sex, and age influence molting of hair. In general, adult males begin to molt first, followed by young males and other lone individuals; females with dependent young molt last. Molt is generally complete by late July or August.

This study offers an unprecedented opportunity to initiate integrated quantitative multidisciplinary studies of ecosystems. The data on the bears can be compared to that of the rocks and provide the framework for understanding the earth to life transfer mechanisms that start with the plants at the base of the food chain. Modern geochemical studies of the Yellowstone area that began in the 1960s with Don White and his colleagues have continued with a younger generation of scientists. This enormous investment by the USGS has provided a quantitative understanding of the processes that have produced the geological, geochemical, and topographical features to which the present biological system has adapted. The S isotope distributions in the rocks at Yellowstone are well understood (Schoen and Rye 1970) as are the H isotope distributions of precipitation (Rye and Truesdell 1993, in press).

Problem/Hypothesis.--We will use a combination of stable isotope and Hg trace element chemistry on grizzly bear hair (to a lesser degree blood and muscle on killed bears) and bear food sources to determine the importance of whitebark pine nuts and cutthroat trout to bears in the GYE. Because the bears shed their hair yearly, the data will trace an individual bear's food sources for the previous year. We hope to evaluate the bear's ability to respond to the potential declines of the cutthroat trout and the pine nuts, both threatened by introduced exotics. The concurrent study of captive bears to calibrate fractionations using isotopically controlled diets and Hg levels will provide the key to interpretation of stable isotope and trace element data from existing and future collections of grizzly bear hair from the GYE.

Objectives.--The overall objective of this study is to provide managers with a scientific basis for decisions affecting grizzly bear survivability in the GYE by:

1) Using captive bears to develop calibration curves between tissue and diets of grizzly bears for the stable isotopes of carbon, nitrogen, and sulfur, and trace levels of mercury.
2) Using the information gained from the calibrated captive bears, to quantify the use of whitebark pine seeds and cutthroat trout by grizzly bears in the GYE as indicated by stable isotope and Hg analyses of hair and blood samples of wild bears.

Annual Review 2001

Mercury

In the summer of 2001, gillnetting crews collected 2,500 kg of lake trout for captive feeding trials. Because Hg levels in the lake trout and cutthroat trout are identical (W. C. Shanks, letter to Superintendent Finley dated 9 September 1999) and harvesting the lake trout to promote the conservation of the cutthroat trout was preferable to harvesting cutthroat trout, lake trout will be used in the feeding trials rather than cutthroat trout. The fish were frozen in waxed, cardboard boxes and are currently in a freezer at the Washington State University Bear Research, Conservation and Education Center. These fish will be fed to 12 captive bears housed at WSU to develop calibration curves relating Hg levels of bear tissue to Hg levels in their diet.

Small samples of the major, remaining bear foods (Mattson et al. 1991*a*) from throughout Yellowstone National Park have been collected and will be analyzed for Hg content to confirm that there are no other major sources of mercury available to the bears. Samples collected included meat from carrion or road-kills (elk, bison, and deer (*Odocoileus* spp.), horsetail (*Equisetum*), grasses (*Bromus, Agropyron, Phleum, Festuca* spp.), forbs (*Taraxacum, Trifolium, Cirsium*), whitebark pine nuts, fleshy fruits (*Vaccinium scoparium, V. golbulare,* and *Shepherdia canadensis)*, and bulbs and roots (*Lomatium* and *Perideridia gairdneri*). The purpose of this collection was not to get into an all-encompassing sampling; but based on our current understanding of the mercury distribution in bear foods, conclusively demonstrate that Yellowstone Lake’s cutthroat trout are the only significant source of mercury in the food chain.

Carbon, Nitrogen, and Sulfur Isotopes

Six yearling and 6 adult grizzly bears participated in a series of captive feeding trials throughout the spring, summer, and fall of 2001 to determine the relationship between C, N, and S isotopic ratios of bear tissues relative to the ratios in the bear diets.

Each bear was fed 1 of 6 diets for 21days. Diets included salmon (*Oncorhynchus* spp.), fresh domestic apples and dried domestic apples (*Malus pumila*), commercial dog food, and 2 feeds pelleted at the WSU feed mill. At the end of each trial blood was collected and the plasma was stored frozen for later isotopic analysis. We will determine the C, N and S isotopic ratios of the blood and develop the calibration curves in 2002.

Habitat Monitoring

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

In 2001, total visitation in Grand Teton National Park was 4,037,889 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 2,535,108. Backcountry user nights totaled 32,700. Long-term trends of total visitation and backcountry user nights by decade are shown in Table 19.

Table 19. Average annual visitation and average annual backcountry use nights in Grand Teton National Park by decade from 1951 through 2001.

Decade	Average annual parkwide visitation[a]	Average annual backcountry use nights
1950s	1,104,357	Data not available
1960s	2,326,584	Data not available
1970s	3,357,718	25,267
1980s	2,659,852	23,420
1990s	2,662,940	20,663
2000s[b]	2,562,866	32,516

[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 and 2001 only.

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

In 2001, 2,728,526 people visited Yellowstone National Park. These visitors spent 601,719 use nights camping in developed area roadside campgrounds and 43,302 use nights camping in backcountry campsites. Average annual park visitation increased each decade from an average of 333,835 visitors/year in the 1930s to an average of 3,023,916 visitors/year in the 1990s (Table 18). Average annual park visitation has decreased slightly the first 2 years (2000-2001) of the current decade, to an average of 2,783,380 visitors/year. Average annual backcountry use nights have been less variable between decades than total park visitation, ranging from 39,280 to 47,395 use nights/year (Table 18). The number of backcountry use nights is limited by both the number and capacity of designated backcountry campsites in the park.

Table 18. Average annual visitation and average annual backcountry use nights in Yellowstone National Park by decade from 1931 through 2001.

Decade	Average annual parkwide visitation	Average annual backcountry use nights
1931-39	333,835	Data not available
1940s	552,227	Data not available
1950s	1,355,559	Data not available
1960s	1,958,924	Data not available
1970s	2,243,737	47,395[a]
1980s	2,381,258	39,280
1990s	3,023,916	43,702
2000s[b]	2,783,380	41,386

[a] Backcountry use data available for the years 1973-1979.
[b] Data for the years 2000 and 2001 only.

Trends in Elk Hunter Numbers Within the Grizzly Bear Recovery Zone Plus the 10-Mile Perimeter Area *(Dave Moody, Wyoming Game and Fish Department; Lauri Hanauska-Brown, Idaho Department of Fish and Game; and Kurt Alt, Montana Department of Fish, Wildlife and Parks)*

The 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 Grizzly Bear Recovery Zone plus the10-mile perimeter area. Because some hunt area boundaries did not conform exactly to the Recovery Zone and 10-mile perimeter area, field personnel familiar with each area were queried to estimate hunter numbers within the Recovery Zone plus the 10-mile perimeter area. Elk hunters were used because they represent the largest cohort of hunters for individual species. While there are sheep, moose, and deer hunters using the Recovery Zone 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 effort within areas occupied by grizzly bears in the GYE.

We generated a complete data set from Idaho and Wyoming from 1991 to 2001 (Table 20); data from Montana were available from 1991 through 1996. Elk hunter numbers decreased from a low of 40,027 in 1991 to 37,429 in 1996. These numbers fluctuated less than 10% during that time period. This trend primarily reflects liberal elk seasons in the late 1980s and early 1990s in an attempt to stabilize or decrease elk herds in Wyoming and Montana. By the middle 1990s, elk populations began to stabilize and the number of permits was reduced in portions of this region, thus the decrease in hunter numbers. Beginning in 1988 through 1991, Idaho had reduced hunter numbers in an effort to increase bull:cow ratios in their elk herds. From 1992 to the present, hunting opportunity has increased and is reflected by increasing hunter numbers. The estimate for 2001 reflects a new accounting method in Idaho, so it is uncertain whether they actually experienced the level of increase in hunter numbers. Hunter numbers in Montana fluctuated slightly from 1991 through 1996. The fluctuation is not statistically significant. No data has been available for Montana since 1996. Hunter numbers in Wyoming remained consistent from 1991 through 1999. Numbers have decrease since 1999 and are the result of population objectives being met, which has decreased harvest and hunter numbers. It is difficult to evaluate trends in total hunter numbers due to limited data from 1997 to present.

In 2000, the number of grizzly bear mortalities associated with hunting reached a record number of 16. In 2001, only 1 mortality was hunting related. It is commonly accepted that some bear losses could be avoided if people followed the recommended standards for human behavior in bear country. To that end, state wildlife and federal land agencies have attempted to reduce the loss of bears to hunters by expanding information and education programs. “Living in Bear Country” workshops are conducted annually in most of the gateway communities in Wyoming, and licensed outfitters and guides have instituted increased training for their members and clientele. The success of these programs will be directly reflected in grizzly bear moralities associated with hunters. We will continue to monitor hunter numbers and grizzly bear hunter conflicts in an attempt to provide information that will help managers make ungulate hunting more compatible with grizzly bear conservation.

Table 20. Estimated numbers of elk hunters within the Grizzly Bear Recovery Zone plus a 10-mile perimeter in Idaho, Montana, and Wyoming for the years 1991-2001.

	Year										
State	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Idaho	2,292	2,573	2,962	2,682	2,366	3,102	2,869	2,785	2,883	[a]	3,784
Montana	21,502	19,321	18,238	20,042	18,783	18,044	[a]	[a]	[a]	[a]	[a]
Wyoming	16,233	17,154	17,105	17,053	17,464	16,283	17,458	15,439	15,727	12,812	13,591
Total	40,027	39,048	38,305	39,777	38,713	37,429					

[a] Hunter number estimates not currently available.

Habitat partitioning by grizzly and black bears in Yellowstone and Grand Teton National Parks (*Shannon Podruzny and Charles C. Schwartz, Interagency Grizzly Bear Study Team*)

We used field visits in combination with VHF telemetry locations to obtain detailed information about habitat use by grizzly and black bears. The beneficial aspect of this type of approach is that this allows for determination of what a bear was actually doing at a specific radiolocation. Simple coordinates (from GPS or VHF collar locations) placed on a map tell us where a bear was present, but they yield little information about how the bear was using the landscape at that location. Site visits allow us to determine if the bear was using that particular piece of real estate for feeding, resting, traveling, or some other activity. From this we can gain insight into the relative importance of measurable habitat variables to the life history of grizzly and black bears in the study area, and to compare spatial and temporal patterns between the species at a finer scale.

As part of a pilot project investigating ecological relationships between grizzly and black bears, habitat crews visited radio-locations of both species in Yellowstone and Grand Teton National Parks, June-August 2001. We investigated 24 aerial radiolocations of 7 grizzlies and 3 black bears in Yellowstone. We investigated 13 radiolocations of 2 grizzlies and 6 black bears in Grand Teton National Park and the adjacent Bridger-Teton National Forest.

We used a GPS to navigate to radiolocations. At the location coordinates, we searched thoroughly for any evidence of feeding or other activity. If activity was found, we centered a sample plot of approximately 30 m diameter where the activity was most concentrated. If no evidence of activity was found, we centered the plot on the radiolocation coordinates. Plots were inventoried using the methods of Mattson et al. (1991*a*). The habitat plots provided detailed ecological information about places where bears were located. We recorded physical site characteristics (e.g., slope, aspect, elevation, topographical position [e.g., ridge or mid-slope], GPS location of plot center). We recorded general habitat characteristics including: climax habitat type (Steele et al. 1983), successional stage (Despain 1990), ocular estimates of vegetal cover (i.e., graminoids, forbs, shrubs, and woody material), a standard variable radius timber plot, percent forest cover, average heights of foliage and shrubs, recent wildfire history, and distance to forest edge. We recorded a complete list of plant species within the plot, including categorical information about abundance, cover, and growth stage for each species. We recorded types of feeding activity and intensity of use. Non-feeding sign including day beds, rub trees, dens, and scats were also measured and recorded.

With the exception of 2 collar retrievals, sites were visited within a maximum of 16 days after the flight. We also investigated 11 locations in Yellowstone where unmarked black and grizzly bears were observed from fixed-wing aircraft or from the ground.

We found sign (both feeding and non-feeding) at 32.4% of all radiolocations visited. This included 2 shed grizzly bear radio-collars and 2 shed black bear radio-collars. Excluding 4 retrieved radio-collars, we found sign on 21.6% of locations visited.

In Yellowstone, we found evidence of grazing at 1 black bear location and cambium feeding at 1 grizzly bear location. In Grand Teton, we found evidence of black bears digging for ants at 3 locations and feeding on buffalo berries (*Shepherdia canadensis*) at 1 location. We did not find any evidence of feeding activity by grizzly bears at the sites we visited in Grand Teton. We found evidence of other activities at 2 grizzly and 2 black bear radiolocations in Yellowstone, and at 2 grizzly and 3 black bear radiolocations in Grand Teton. Non-feeding sign found at locations included tracks, scats, day beds, rub-trees, and dropped radio-collars.

Analysis of Methods

Difficulties with our methods during the field season of 2001 were mainly related to lack of success in finding sign at radiolocations. We found evidence of any activity on only 21.6% of radiolocations. One plausible explanation for this lies in the precision of VHF telemetry locations. Our estimated telemetry error (IGBST, unpublished data) for aerial VHF locations was approximately 300 m. Crews cannot effectively search an area of that radius (282,743 m^2 or 67 football fields) around each location. While the black bears were collared with store-on-board type GPS receivers, this technology does not allow us to visit GPS-acquired locations in a real-time manner. Small sample size posed additional problems. Only 3 and 6 black bears were collared in Yellowstone and Grand Teton, respectively. Infrequent flight reports precluded some site visits. When compared with the potential acquisition rate of roughly 5 GPS locations/bear/day, standard VHF telemetry yielded a poor location frequency of 1 location/bear/7-10 days.

The methodology at each plot also needed improvement. While we did employ a point-line transect method for determining percent ground cover of vegetation classes (i.e., grasses, forbs, and shrubs), we used ocular estimates for cover and abundance of individual plant species. Percent cover for each vegetation class was determined from counts of classes recorded at 1-m intervals along 4 10-m tapes laid out in the cardinal directions from plot center. Ocular estimates of percent cover for forest overstory and individual species were likely inconsistent among observers. We collected the full complement of information on sites with and without evidence of bear activity. This amounted to a significant amount of data being collected on locations without sign. We likely recorded highly visible activities (e.g., root digging and feeding on carcasses) at a rate closer to that of occurrence, with less visible activities (e.g., grazing) under-reported.

During 2001, we did not randomize our choice of sample sites. The potential bias in this lies in the tendency to pick easily accessible locations (i.e., those near roads) in order to maximize sample size. Additionally, we did not do plots at random locations to allow comparisons with “available” habitat or to determine if we were detecting activity at radiolocations at a rate different than what we would find at randomly selected sites.

Recommendations for Future Efforts

Field crew efficiency would be improved by limiting efforts geographically. One crew cannot physically travel and collect enough data in 1 field season when spread over the entire GYE. In the absence of additional help, a single crew may be sufficient to make inferences about local issues within the constraints of a more restricted study area. Efficiency would also be improved by reducing the amount of data collected at locations without sign. Basic information should still be collected on these sites, including a site description, habitat and cover type information, and estimates of cover percentages for vegetation classes. Efforts should also be made to reduce potential biases discussed above. Crews should randomly select which locations to sample. Additionally, data should be collected at random locations to provide a baseline. On sites where bear sign is found, more rigorous methods should be used.

We suggest the following protocol for the 2002 field season. Investigate randomly selected VHF locations of black and grizzly bears in and around the northern portion of Grand Teton National Park. Concurrently, investigate locations randomly selected from the landscape, following the same procedures used at bear locations. Use a GPS to navigate to sites and record locations of plot centers. On plots with evidence of feeding or other activity, center the plot at the greatest concentration of activity. Do a detailed site description, recording physical site characteristics and general habitat characteristics as done in 2001. Use the point-line transect method to estimate cover of understory vegetation, and a spherical concave densiometer to estimate forest cover. Use 10 Daubenmire quadrats (Daubenmire 1959) placed at regular intervals along the point-line transects to estimate percent cover, abundance category, and phenology of individual vegetal food items. Do not record a complete species list. Fully describe any evidence of feeding or other activities found at the site. On plots without evidence of activity, do the plot as described above, omitting the Daubenmire quadrats (i.e., no inventory of food items).

Other tools that may be useful in examining habitat use include scat analysis and GIS applications. Like site visits, scat analysis may be biased towards more detectable food items. However, combining food habits analysis with site visits should provide a more complete picture of how grizzly and black bears are using the landscape. Additionally, combining information from a small sample of site visits to remotely sensed information (e.g., VHF telemetry location data, GPS location data, various map data layers) may be the most productive use of both types of data.

GRIZZLY BEAR-HUMAN CONFLICTS AND MANAGEMENT ACTIONS IN THE GREATER YELLOWSTONE ECOSYSTEM 2001

INTERAGENCY GRIZZLY BEAR COMMITTEE YELLOWSTONE ECOSYSTEM SUBCOMMITTEE REPORT

Compiled by Yellowstone National Park – November 2002

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INTRODUCTION

Conservation of grizzly bears in the GYE (Fig. 11) requires protecting sufficient habitat and maintaining sustainable levels of human-caused mortality. Most human-caused grizzly bear mortalities are directly related to grizzly bear-human conflicts or confrontations. To effectively allocate resources for implementing management actions designed to prevent grizzly bear-human conflicts and confrontations from occurring, land and wildlife managers need baseline information as to the types, causes, locations, and trends in these types of incidents. To address this need, we record all grizzly bear-human conflicts, management captures, and known human-caused grizzly bear mortalities reported in the GYE annually.

The objective of this report is to promote the reduction and/or prevention of incidents of bear-caused human injuries, property damages, livestock depredations, and human-caused grizzly bear mortalities through dissemination of information to the public and preventative rather than reactive management actions involving grizzly bears. This report will assist both government agencies and non-government organizations in setting priorities for allocating resources to reduce bear-human conflicts. Prioritization will enable available personnel and funding to be focused on correcting the most prevalent types of bear-human conflicts occurring in the ecosystem.

This report is intended to be a summary. Interested parties should contact the appropriate agency with wildlife management jurisdiction for detailed information concerning any of the incidents listed in this document.

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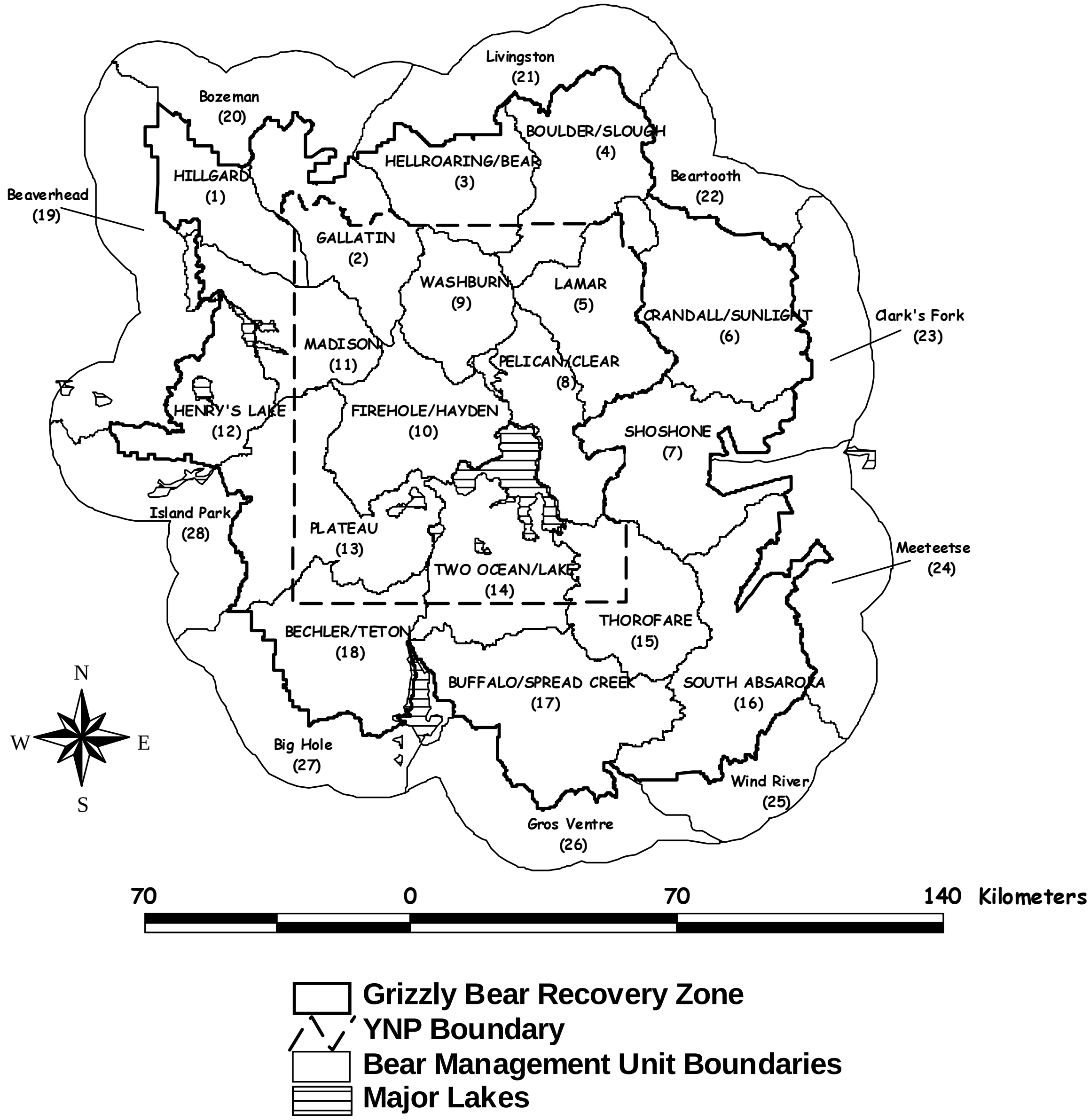

Fig. 11. Map of designated Bear Management Units inside (BMUs 1–18) and within 10 miles (BMUs 19–28) of the Greater Yellowstone Ecosystem grizzly bear Recovery Zone, 2001.

METHODS

Methods of data collection and definitions of terms and abbreviations used in this report are described in detail by Gunther et al. (2000) with minor changes in methods described in Gunther et al. (2001). Beginning with this report, grizzly bear-human confrontations will no longer be reported. Confrontations are not consistently reported by the public, are not recorded by some agencies, and reporting rates vary significantly between agencies.

RESULTS

Grizzly Bear-Human Conflicts

There were 227 grizzly bear-human conflicts reported in the GYE in 2001 (Table 21, Fig. 12). These incidents included bears obtaining anthropogenic foods (56%, n = 128), killing livestock (26%, n = 58), damaging property in unsuccessful attempts to obtain anthropogenic foods (12%, n = 26), obtaining fruits and vegetables from gardens and orchards (3%, n = 6), injuring people (2%, n = 5), and damaging beehives (2%, n = 4). Sixty-three percent (n = 143) of the reported incidents of grizzly bear-human conflict occurred on private land in the states of Wyoming (49%, n = 110) and Montana (15%, n = 34) (Table 22). There were no grizzly bear-human conflicts reported in the GYE portion of Idaho in 2001. Thirty-seven percent (n = 83) of the bear-human conflicts occurred on public land administered by the U.S. Forest Service (33%, n = 74), National Park Service (3%, n = 7), and the state of Wyoming (1%, n = 2) (Table 22).

Less than half (31%, n = 71) of the reported grizzly bear-human conflicts occurred within the designated Recovery Zone (Table 23). Most (69%, n = 156) conflicts occurred outside of the Recovery Zone boundary (Table 24), however, only 2% (n = 5) occurred >10 miles beyond the Recovery Zone. Incidents of bears obtaining anthropogenic foods were the most common type of conflict reported both inside (n = 47) and outside (n = 81) of the Recovery Zone. Livestock depredations were most prevalent outside (n = 47) of the Recovery Zone. Six BMUs inside the Recovery Zone (BMUs 2, 4, 8, 9, 13, 15) did not have any grizzly bear-human conflicts reported (Table 23). The number of reported conflicts increased substantially as compared to 2000 in the Meeteetse, Wind River, and Gros Ventre BMUs outside of the Recovery Zone, suggesting continued expansion by grizzly bears into these areas (Table 24).

Grizzly Bear Management Captures

There were 31 grizzly bears captured in 25 management actions in 2001 (Tables 25 and 26, Fig. 13). Multiple bears in family groups were caught in 4 of these incidents. Four individual bears (#378, 385, 391, and G76) were each caught twice in management actions. In 12 incidents, nuisance bears were captured and translocated to remote areas away from human activities. In 13 incidents, grizzly bears involved in conflicts were captured and removed from the ecosystem (1 bear was sent to a zoo and 12 incidents resulted in the bear(s) being euthanized). Twenty (80%) management actions, where grizzly bears were captured, occurred on private property, 16 in Wyoming and 4 in Montana (Table 27). Five (20%) incidents, where bears were captured in management actions, occurred on public land administered by the U.S. Forest Service. Less than half (28%, n = 7) of the incidents where grizzly bears were captured in management actions occurred within the designated Recovery Zone (Table 28), most (72%, n = 18) occurred outside of the Recovery Zone boundary (Table 29).

Human-Caused Grizzly Bear Mortalities

Nineteen individual grizzly bears are known to have died due to human causes in 16 separate incidents in 2001 (Tables 30 and 31, Fig. 14). Sixteen grizzly bears were removed in 13 management actions (1 sent to a zoo and 15 euthanized). One grizzly bear was mistaken for a black bear and killed by an archery hunter. One grizzly bear was struck and killed by a vehicle and 1 grizzly bear was killed illegally. Most (75%, $n = 12$) known incidents of human-caused grizzly bear mortality occurred on private land in the states of Wyoming ($n = 9$) and Montana ($n = 3$) (Table 32). Four (25%) incidents of human-caused mortality occurred on public land administered by the U.S. Forest Service (Table 32). Nine (56%) incidents of human-caused mortality occurred outside and 7 (44%) incidents occurred inside the Recovery Zone boundary (Tables 33 and 34). No incidents of human-caused grizzly bear mortality occurred >10 miles outside of the Recovery Zone boundary.

Table 21. Number of incidents of grizzly bear-human conflicts reported within different wildlife management agency jurisdictions in the Greater Yellowstone Ecosystem, 2001.

Agency[a]	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Beehives	Livestock depredations
GTNP/JDR	3	3	0	0	0	0	0
IDFG	0	0	0	0	0	0	0
MTFWP	39	1	3	33	0	0	2[b]
WYGF	181	1	22	92	6	4	56[c]
YNP	4	0	1	3	0	0	0
Total	227	5	26	128	6	4	58

[a] GTNP/JDR = Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway; IDFG = Idaho Department of Fish and Game; MTFWP = Montana Fish, Wildlife and Parks; WYGF = Wyoming Game and Fish Department; YNP = Yellowstone National Park.
[b] One incident involved sheep and the other involved chickens.
[c] Includes 28 incidents of cattle depredation, 27 incidents of sheep depredation, and 1 incident involving depredation on chickens and guinea fowl.

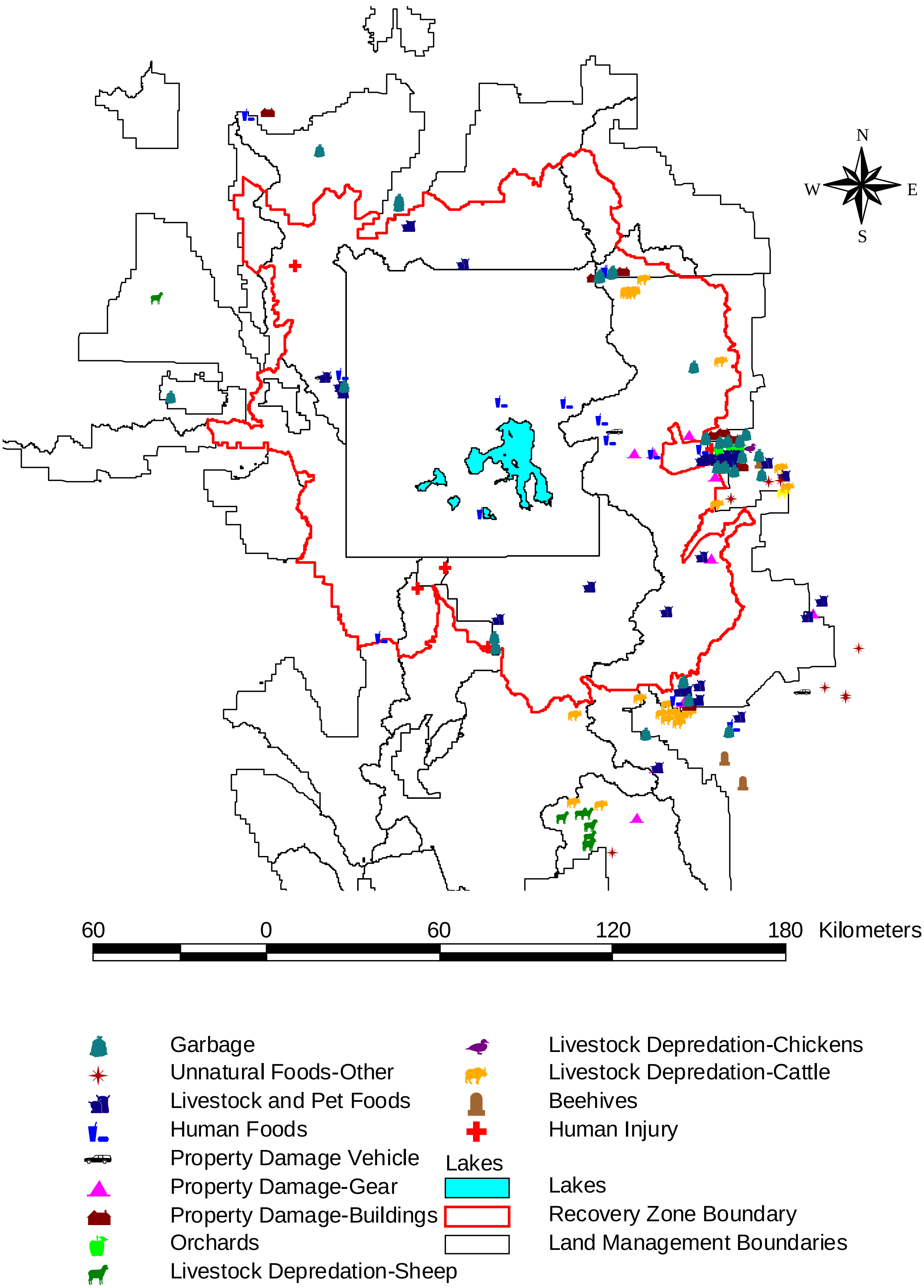

Fig. 12. Locations where incidents of grizzly bear-human conflicts were reported in the Greater Yellowstone Ecosystem, 2001.

Table 22. Number of incidents of grizzly bear-human conflicts reported within different land ownership areas in the Greater Yellowstone Ecosystem, 2001.

Land owner[a]	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Beehives	Livestock depredations
BLM	0	0	0	0	0	0	0
BNF	1	0	0	0	0	0	1
BTNF	34	0	1	2	0	0	31
CNF	0	0	0	0	0	0	0
GNF	4	1	0	3	0	0	0
GTNP/JDR	3	3	0	0	0	0	0
ID-private	0	0	0	0	0	0	0
ID-state	0	0	0	0	0	0	0
MT-private	34	0	3	30	0	0	1
MT-state	0	0	0	0	0	0	0
SNF	34	0	10	9	0	0	15
TNF	1	0	0	1	0	0	0
WY-private	110	1	11	80	6	2	10
WY-state	2	0	0	0	0	2	0
YNP	4	0	1	3	0	0	0
Total	227	5	26	128	6	4	58

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

Table 23. Number of incidents of grizzly bear-human conflicts reported within different Bear Management Units inside the designated Greater Yellowstone Ecosystem grizzly bear Recovery Zone, 2001.

Bear Management Unit name/number	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Beehives	Livestock depredations
Hilgard (1)	1	1	0	0	0	0	0
Gallatin (2)	0	0	0	0	0	0	0
Hellroaring/Bear (3)	11	0	0	10	0	0	1
Boulder/Slough (4)	0	0	0	0	0	0	0
Lamar (5)	12	0	2	10	0	0	0
Crandall/Sunlight (6)	11	0	0	1	0	0	10
Shoshone (7)	7	0	4	3	0	0	0
Pelican/Clear (8)	0	0	0	0	0	0	0
Washburn (9)	0	0	0	0	0	0	0
Firehole/Hayden (10)	1	0	0	1	0	0	0
Madison (11)	10	0	0	10	0	0	0
Henrys Lake (12)	2	0	1	1	0	0	0
Plateau (13)	0	0	0	0	0	0	0
Two Ocean Plateau (14)	1	0	0	1	0	0	0
Thorofare (15)	0	0	0	0	0	0	0
South Absaroka (16)	4	0	2	2	0	0	0
Buffalo/Spread Creek (17)	8	1	0	7	0	0	0
Bechler/Teton (18)	3	2	0	1	0	0	0
Total	71	4	9	47	0	0	11

Table 24. Number of incidents of grizzly bear-human conflicts reported in different Bear Management Units in the Yellowstone ecosystem outside of the designated Greater Yellowstone Ecosystem grizzly bear Recovery Zone, 2001.

Bear Management Unit name/number	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Beehives	Livestock depredations
Beaverhead (19)	0	0	0	0	0	0	0
Bozeman (20)	0	0	0	0	0	0	0
Livingston (21)	0	0	0	0	0	0	0
Beartooth (22)	0	0	0	0	0	0	0
Clark's Fork (23)	0	0	0	0	0	0	0
Meeteetse (24)	64	1	6	43	6	1	7
Wind River (25)	49	0	7	31	0	3	8
Gros Ventre (26)	38	0	3	4	0	0	31
Bighole (27)	0	0	0	0	0	0	0
Island Park (28)	0	0	0	0	0	0	0
>10 miles beyond Recovery Zone	5	0	1	3	0	0	1
Total	156	1	17	81	6	4	47

Table 25. Number of incidents where grizzly bears were captured in management actions within different wildlife management agency jurisdictions in the Greater Yellowstone Ecosystem, 2001.

Agency[a]	Total captures	Translocated	Released on site	Sent to zoo	Euthanized	Accidental management death
GTNP/JDR	0	0	0	0	0	0
IDFG	0	0	0	0	0	0
MTFWP	4	1	0	1	2	0
WYGF	21	11	0	0	10	0
YNP	0	0	0	0	0	0
Total	25	12	0	1	12	0

[a] GTNP/JDR = Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway; IDFG = Idaho Department of Fish and Game; MTFWP = Montana Fish, Wildlife, and Parks; WYGF = Wyoming Game and Fish Department; YNP = Yellowstone National Park.

Table 26. Grizzly bears captured during management actions[a] in the Greater Yellowstone Ecosystem, 2001.

Date	Bear	Sex	Age[b]	Location[c]	Reason captured	Release site[c]
05/03	369	M	Adult	Carter Creek, WY-private	Anthropogenic foods-cow carcasses	Picket Creek, SNF
05/05	378	M	Adult	South Fork Shoshone, WY-private	Livestock depredations-cattle	East Fork Wind River, SNF
05/11	380	M	Subadult	North Fork Shoshone, SNF	Anthropogenic foods-human foods	Needle Creek, SNF
06/13	378	M	Adult	South Fork Shoshone, WY-private	Livestock depredations-cattle	Management removal-euthanized
06/16	385	F	Adult	Carter Creek, MT-private	Livestock depredation-cattle	Lost Lake, BTNF
07/03	325	F	Adult	Yellowstone River, MT-private	Anthropogenic foods-garbage/grain	Sent to zoo (Milwaukee)
07/14	G72	M	Adult	Cooke Pass, MT-private	Anthropogenic foods-garbage	Management removal-euthanized
07/19	391	M	Subadult	Tepee Creek, BTNF	Livestock depredations-sheep	Mormon Creek, SNF
07/22	392	M	Subadult	Lime Creek, BTNF	Livestock depredations-sheep	Mormon Creek, SNF
07/29	394	M	Subadult	Klondike Creek, BTNF	Livestock depredations-sheep	Mormon Creek, SNF
07/30	382	M	Subadult	Wind River, WY-private	Anthropogenic foods-dog food/grain	Management removal-euthanized
08/15	G73	M	Adult	Silver Gate, MT-private	Anthropogenic foods-garbage	Management removal-euthanized
08/22	396	M	Subadult	South Fork Madison River, MT-private	Anthropogenic foods-bird Seed	Eldridge Creek, GNF
08/26	305	F	Subadult	East Fork Wind River, WY-private	Anthropogenic foods-garbage/grease	Sunlight Creek, SNF
08/26	327	F	Adult	Carter Creek, WY-private	Anthropogenic foods-grain	Boone Creek, TNF
08/26	358	F	Adult	Horse Creek, SNF	Anthropogenic foods-grain	Management removal-euthanized
08/26	G74	M	COY	Horse Creek, SNF	Anthropogenic foods-grain	Management removal-euthanized
09/04	G76	F	Yearling	Dunn Creek, WY-private	Anthropogenic foods-human foods	Thorofare Creek, BTNF
09/04	G77	F	Yearling	Dunn Creek, WY-private	Anthropogenic foods-human foods	Thorofare Creek, BTNF

Table 26. Continued.

Date	Bear	Sex	Age[b]	Location[c]	Reason Captured	Release Site[c]
09/05	G75	F	Adult	Dunn Creek, WY-private	Anthropogenic foods-human foods	Management removal-euthanized
09/12	135	F	Adult	North Fork Shoshone, WY-private	Anthropogenic foods-garbage	Management removal-euthanized
09/14	128	F	Adult	Horse Creek, WY-private	Anthropogenic foods-garbage/dog good	Management removal-euthanized
09/14	G78	M	COY	Horse Creek, WY-private	Anthropogenic foods-garbage/dog good	Management removal-euthanized
09/14	G79	F	COY	Horse Creek, WY-private	Anthropogenic foods-garbage/dog good	Management removal-euthanized
09/27	385	M	Subadult	Wind River, WY-private	Damageing beehives/cattle depredations	Management removal-euthanized
09/29	391	M	Subadult	DuNoir River, WY-private	Anthropogenic foods-garbage	Management removal-euthanized
10/14	403	F	Adult	North Fork Shoshone, WY-private	Apple orchard	Long Creek, SNF
10/14	G81	F	COY	North Fork Shoshone, WY-private	Apple orchard	Long Creek, SNF
10/14	G82	M	COY	North Fork Shoshone, WY-private	Apple orchard	Long Creek, SNF
10/28	G76	F	Yearling	Lava Creek, WY-private	Anthropogenic foods-garbage/bird seed	Management removal-euthanized
11/07	153	M	Adult	Sunlight Creek, WY-private	Anthropogenic foods-garbage	Management removal-euthanized

[a] Does not include non-target bears that were captured and released on site.
[b] COY = cub-of-the-year.
[c] BTNF = Bridger-Teton National Forest, GNF = Gallatin National Forest, SNF = Shoshone National Forest, TNF = Caribou-Targhee National Forest.

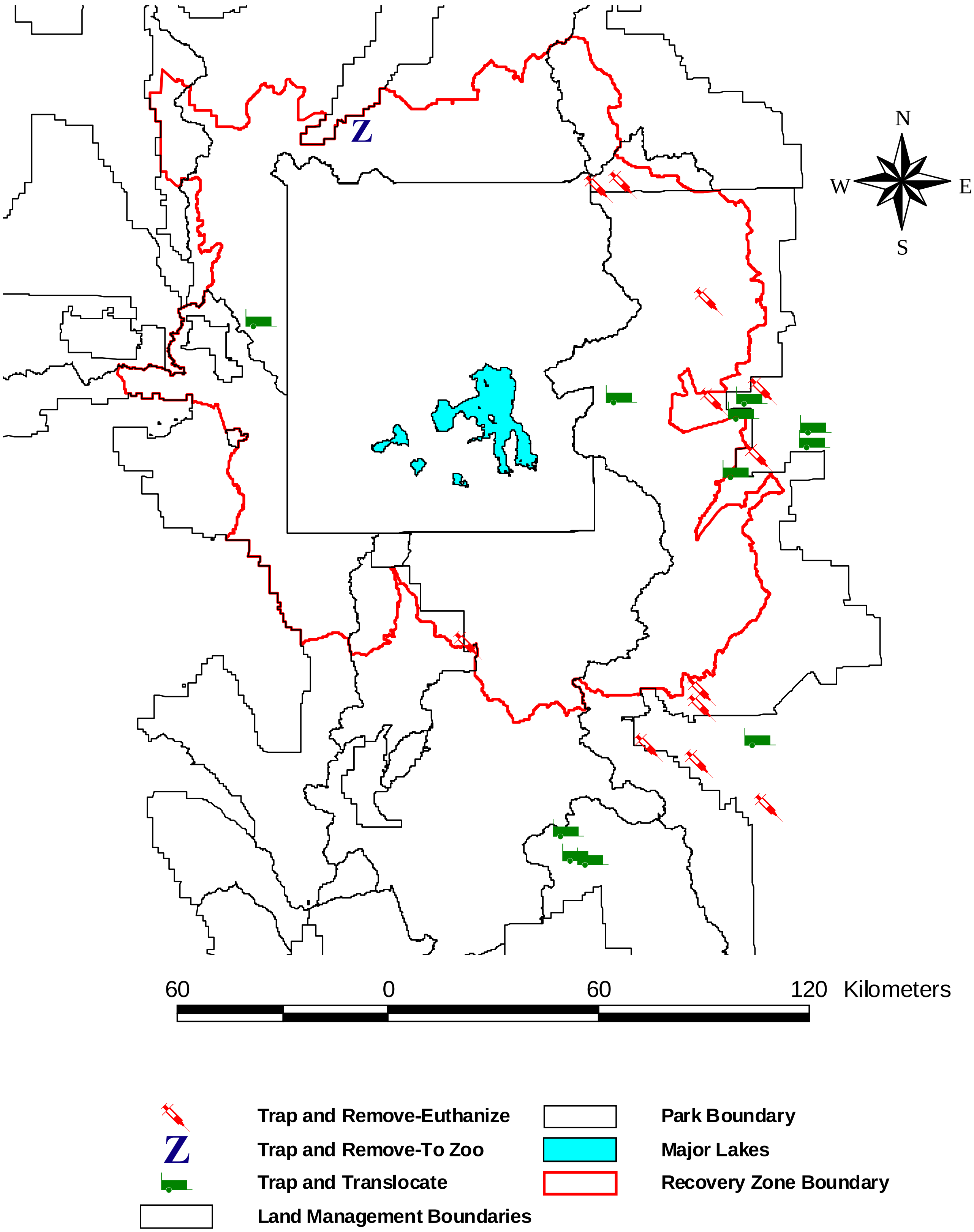

Fig. 13. Locations of management actions where grizzly bears were captured in the Greater Yellowstone Ecosystem, 2001.

Table 27. Number of incidents where grizzly bears were captured in management actions within different land ownership areas in the Greater Yellowstone Ecosystem, 2001.

Agency[a]	Total captures	Translocated	Released on site	Sent to zoo	Euthanized	Accidental management death
BLM	0	0	0	0	0	0
BNF	0	0	0	0	0	0
BTNF	3	3	0	0	0	0
CNF	0	0	0	0	0	0
GNF	0	0	0	0	0	0
GTNP/JDR	0	0	0	0	0	0
ID-private	0	0	0	0	0	0
MT-private	4	1	0	1	2	0
SNF	2	1	0	0	1	0
TNF	0	0	0	0	0	0
WY-private	16	7	0	0	9	0
WY-State	0	0	0	0	0	0
YNP	0	0	0	0	0	0
Total	25	12	0	1	12	0

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

Table 28. Number of incidents where grizzly bears were captured in management actions in different Bear Management Units inside the Greater Yellowstone Ecosystem grizzly bear Recovery Zone, 2001.

Bear Management Unit name/code	Total bears captured	Translocated	Released on site	Sent to zoo	Euthanized	Accidental management death
Hilgard (1)	0	0	0	0	0	0
Gallatin (2)	0	0	0	0	0	0
Hellroaring/Bear (3)	1	0	0	1	0	0
Boulder (4)	0	0	0	0	0	0
Lamar/Slough (5)	2	0	0	0	2	0
Crandall/Sunlight (6)	1	0	0	0	1	0
Shoshone (7)	1	1	0	0	0	0
Pelican/Clear (8)	0	0	0	0	0	0
Washburn (9)	0	0	0	0	0	0
Firehole/Hayden (10)	0	0	0	0	0	0
Madison (11)	0	0	0	0	0	0
Henrys Lake (12)	1	1	0	0	0	0
Plateau (13)	0	0	0	0	0	0
Two Ocean Plateau (14)	0	0	0	0	0	0
Thorofare (15)	0	0	0	0	0	0
South Absaroka (16)	0	0	0	0	0	0
Buffalo/Spread Creek (17)	1	0	0	0	1	0
Bechler/Teton (18)	0	0	0	0	0	0
Total	7	2	0	1	4	0

Table 29. Number of incidents where grizzly bears were captured in management actions in different Bear Management Units outside of the designated grizzly bear Recovery Zone in the Greater Yellowstone Ecosystem, 2001.

Bear Management Unit name/number	Total bear captured	Translocted	Released on site	Sent to zoo	Euthanized	Accidental management death
Beaverhead (19)	0	0	0	0	0	0
Bozeman (20)	0	0	0	0	0	0
Livingston (21)	0	0	0	0	0	0
Beartooth (22)	0	0	0	0	0	0
Clark's Fork (23)	0	0	0	0	0	0
Meeteetse (24)	9	6	0	0	3	0
Wind River (25)	5	1	0	0	4	0
Gros Ventre (26)	2	1	0	0	1	0
Bighole (27)	0	0	0	0	0	0
Island Park (28)	0	0	0	0	0	0
>10 miles beyond Recovery Zone	2	2	0	0	0	0
Total	18	10	0	0	8	0

Table 30. Number of incidents of human-caused grizzly bear mortality within different wildlife management agency jurisdictions in the Greater Yellowstone Ecosystem, 2001.

		Management removals			Other human-caused grizzly bear mortalities				
Agency[a]	Total	To zoo	Euthanized	Accidental	Research accident	Illegal	Self defense	Road-killed	Other
GTNP/JDR	0	0	0	0	0	0	0	0	0
IDFG	0	0	0	0	0	0	0	0	0
MTFWP	3	1	2	0	0	0	0	0	0
WYGF	13	0	10	0	0	1	0	1	1[b]
YNP	0	0	0	0	0	0	0	0	0
Total	16	1	12	0	0	1	0	1	1

[a] GTNP/JDR = Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway; IDFG = Idaho Department of Fish and Game; MTFWP = Montana Department of Fish, Wildlife and Parks; WYGF = Wyoming Game and Fish Department, YNP = Yellowstone National Park.
[b] Mistaken identification by archery black bear hunter.

Table 31. Known human-caused grizzly bear mortalities in the Greater Yellowstone Ecosystem, 2001.

Date	Bear	Sex	Age[a]	Location[b]	Cause
04/24	376	M	Adult	Rock Spring Canyon, BTNF	Mistaken I.D.-archery black bear hunter.
05/14	104	F	Adult	North Fork Shoshone, SNF	Vehicle strike.
06/13	378	M	Adult	South Fork Shoshone, WY-private	Management removal-euthanized, cattle killer
07/03	325	F	Adult	Yellowstone River, MT-private	Management removal-sent to zoo, food conditioned
07/14	G72	M	Adult	Cooke Pass, MT-private	Management removal-euthanized, food conditioned
07/30	382	M	Subadult	Wind River, WY-private	Management removal-euthanized, food conditioned
08/15	G73	M	Adult	Silver Gate, MT-private	Management removal-euthanized, food conditioned
08/26	358	F	Adult	Horse Creek, SNF	Management removal-euthanized, food conditioned
08/26	G74	M	COY	Horse Creek, SNF	Management removal-euthanized, food conditioned
09/05	G75	F	Adult	Dunn Creek, WY-private	Management removal-euthanized, food conditioned
09/12	135	F	Adult	North Fork Shoshone, WY-private	Management removal-euthanized, food conditioned
09/14	128	F	Adult	Horse Creek, WY-private	Management removal-euthanized, food conditioned
09/14	G78	M	COY	Horse Creek, WY-private	Management removal-euthanized, food conditioned
09/14	G79	F	COY	Horse Creek, WY-private	Management removal-euthanized, food conditioned
09/27	385	M	Subadult	Wind River, WY-private	Management removal-euthanized, beehives/cattle killer
09/29	391	M	Subadult	Warm Springs, WY-private	Management removal-euthanized, food conditioned
Fall 2001	Unmarked	M	Adult	South Fork Shoshone, SNF	Human-caused, under investigation
10/28	G76	F	Yearling	Lava Creek, WY-private	Management removal-euthanized, food conditioned
11/07	153	M	Adult	Sunlight Creek, WY-private	Management removal-euthanized, food conditioned

[a] COY = cub-of-the-year.
[b] BTNF = Bridger-Teton National Forest, SNF = Shoshone National Forest.

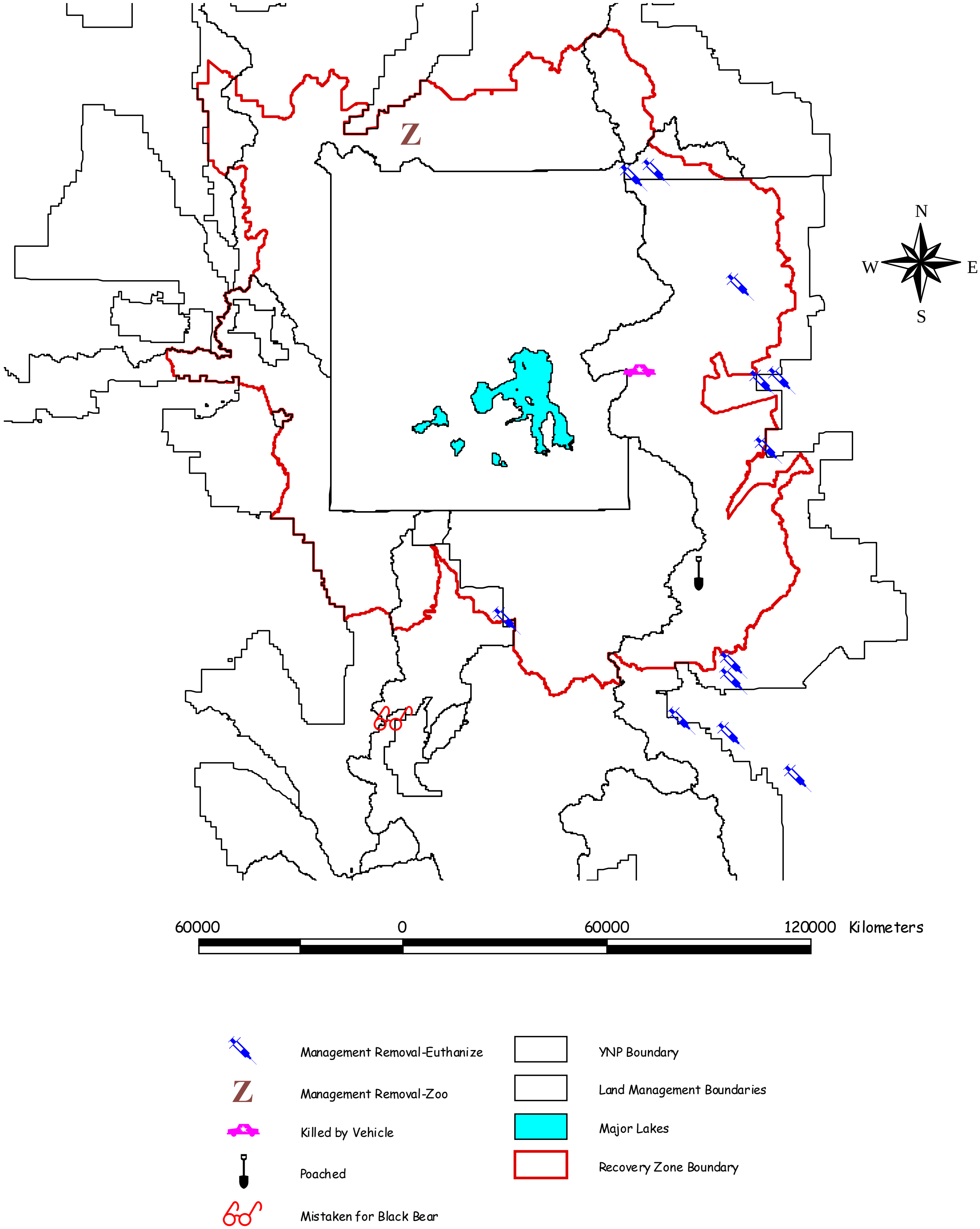

Fig. 14. Locations of known human-caused grizzly bear mortalities in the Greater Yellowstone Ecosystem, 2001

Table 32. Number of human-caused grizzly bear mortalities within different land ownership areas in the Greater Yellowstone Ecosystem, 2001.

		Management removals			Other human-caused grizzly bear mortalities				
Land owner[a]	Total	To zoo	Euthanized	Accidental	Research accident	Illegal	Self defense	Road-killed	Other
BLM	0	0	0	0	0	0	0	0	0
BNF	0	0	0	0	0	0	0	0	0
BTNF	1	0	0	0	0	0	0	0	1[b]
CNF	0	0	0	0	0	0	0	0	0
GNF	0	0	0	0	0	0	0	0	0
GTNP/JDR	0	0	0	0	0	0	0	0	0
ID-private	0	0	0	0	0	0	0	0	0
MT-private	3	1	2	0	0	0	0	0	0
SNF	3	0	1	0	0	1	0	1	0
TNF	0	0	0	0	0	0	0	0	0
WY-private	9	0	9	0	0	0	0	0	0
YNP	0	0	0	0	0	0	0	0	0
Total	16	1	12	0	0	1	0	1	1

[a] BLM = Bureau of Land Management, BNF = Beaverhead-Deerlodge National Forest, BTNF = Bridger Teton National Forest, CNF = Custer National Forest, GNF = Gallatin National Forest, GTNP/JDR = Grand Teton National Park/John D. Rockefeller, Jr. Memorial Parkway, SNF = Shoshone National Forest, TNF = Caribou-Targhee National Forest, YNP = Yellowstone National Park.
[b] Grizzly bear killed by archery black bear hunter.

Table 33. Number of incidents of human-caused grizzly bear mortality within each Bear Management Unit inside the Greater Yellowstone Ecosystem grizzly bear Recovery Zone, 2001.

		Management removals			Other human-caused grizzly bear mortalities				
Bear Management Unit name/code	Total	To zoo	Euthanize	Accidental	Research accident	Illegal	Self defense	Road-killed	Other
Hilgard (1)	0	0	0	0	0	0	0	0	0
Gallatin (2)	0	0	0	0	0	0	0	0	0
Hellroaring/Bear (3)	1	1	0	0	0	0	0	0	0
Boulder (4)	0	0	0	0	0	0	0	0	0
Lamar/Slough (5)	2	0	2	0	0	0	0	0	0
Crandall/Sunlight (6)	1	0	1	0	0	0	0	0	0
Shoshone (7)	1	0	0	0	0	0	0	1	0
Pelican/Clear (8)	0	0	0	0	0	0	0	0	0
Washburn (9)	0	0	0	0	0	0	0	0	0
Firehole/Hayden (10)	0	0	0	0	0	0	0	0	0
Madison (11)	0	0	0	0	0	0	0	0	0
Henrys Lake (12)	0	0	0	0	0	0	0	0	0
Plateau (13)	0	0	0	0	0	0	0	0	0
Two Ocean Plateau (14)	0	0	0	0	0	0	0	0	0
Thorofare (15)	0	0	0	0	0	0	0	0	0
South Absaroka (16)	1	0	0	0	0	1	0	0	0
Buffalo/Spread Creek (17)	1	0	1	0	0	0	0	0	0
Bechler/Teton (18)	0	0	0	0	0	0	0	0	0
Total	7	1	4	0	0	1	0	1	0

Table 34. Number of human-caused grizzly bear mortalities within each Bear Management Unit in the Greater Yellowstone Ecosystem that occurred outside of the designated grizzly bear Recovery Zone, 2001.

		Management removals			Other human-caused grizzly bear mortalities				
Bear Management Unit name/code	Total	To zoo	Euthanized	Accidental	Research accident	Illegal	Self defense	Road-killed	Accidental
Beaverhead (19)	0	0	0	0	0	0	0	0	0
Bozeman (20)	0	0	0	0	0	0	0	0	0
Livingston (21)	0	0	0	0	0	0	0	0	0
Beartooth (22)	0	0	0	0	0	0	0	0	0
Clark's Fork (23)	0	0	0	0	0	0	0	0	0
Meeteetse (24)	3	0	3	0	0	0	0	0	0
Wind River (25)	4	0	4	0	0	0	0	0	0
Gros Ventre (26)	1	0	1	0	0	0	0	0	0
Bighole (27)	1	0	0	0	0	0	0	0	1[a]
Island Park (28)	0	0	0	0	0	0	0	0	0
>10 miles beyond Recovery Zone	0	0	0	0	0	0	0	0	0
Total	9	0	8	0	0	0	0	0	1

[a] Mistaken identification by archery black bear hunter.

2001 Agency Summaries

<u>Grand Teton National Park</u>

No management actions were taken on nuisance grizzly bears in Grand Teton National Park in 2001. However, an unprecedented 4 human-grizzly bear confrontations, 3 with associated human injuries, occurred during the year.

The first confrontation of the year involved a cross-country skier in March, perhaps the first recorded such confrontation in North America. On 7 March 2001 at approximately 2130 hours, a Grand Teton National Park employee was attacked by a bear while skiing through the upper Berry Creek meadow enroute to the Upper Berry patrol cabin. Weather was clear and calm the night of the incident with a nearly full moon. Evidence at the scene indicated that the bear had approached the skier deliberately, walking through 300+ m of open meadow, finally charging when about 20 m from the victim. After dropping to the ground, the victim suffered bites to the arm and thigh in a short scuffle that ended when the bear walked away in the direction it had approached.

A second confrontation occurred about 12 km east of the first on 15 April 2001. In this case, an angler was approached by a subadult grizzly bear near the Snake River bridge at Flagg Ranch in the John D. Rockefeller, Jr. Memorial Parkway. The angler moved slowly away and eventually up onto the bridge where the bear continued to follow. While preparing to jump into the river from the bridge to avoid the bear, the bear approached the man and bit his jacket sleeve. The man then swung his arm at the bear, hitting it in the nose and receiving scratches from the bear's teeth. At this point, a vehicle was approaching the bridge and the bear departed.

The third confronation involved a permitted hunter during the Park's annual elk reduction program. On 15 October 2001 at around 1700 hours, 2 hunters ascended School House Hill just east of Moran for a short evening hunt. Near the top of the hill the 2 split up, 1 scouting an area near a recent gut pile and the other proceeding east along the ridge. After reaching the east end of the ridge, in moderately dense timber, the latter hunter saw a small bear below, running away from him. In another instant he was charged from his right side and mauled by another bear. Consistent with new park regulations in 2001, the hunter was carrying pepper spray and had it available on his belt. He did not have time to draw and fire the spray before being hit by the bear, however, and remained in a fetal position until the mauling stopped and the bear left. The victim received multiple puncture wounds to his body and displacement of part of his scalp, but was able to walk back to his partner and out of the backcountry without additional assistance. Evidence at the scene and the hunter's description of the incident were consistent with a sow and COY exhibiting normal defensive behavior.

Finally, a fourth confrontation occurred on 23 October 2001 at the Snake River picnic ground, less than half a kilometer from the location of the second incident involving the angler in April. A Grand Teton National Park maintenance employee was repairing a sign in the picnic area when he heard something behind him. He turned around to find a subadult grizzly bear standing, looking at him from less than 2 m away. After yelling at the bear to "go away" and getting no response, he backed slowly to his truck, which was about 40 feet away, and got inside (where his pepper spray laid on the seat). The bear then departed.

This bear and the one involved in the angler incident were of similar size and had a distinctive white marking resembling a collar around the neck and chest. A bear seen looking into the back of a pick-up truck at Flagg Ranch during the summer had similar markings.

Furthermore, a bear with similar features frequented the nearby Heart Lake area of Yellowstone National Park and approached camps and hikers.

Idaho

No definitive grizzly bear-human conflicts were documented in Idaho during 2001. Wildlife Services received 1 request for assistance with a nuisance bear on the Caribou-Targhee National Forest (Clark County). Three dead sheep were investigated 15 August, but due to the deteriorated condition, it was impossible to determine cause of death. Grizzly bear sign was found in the area, but no management action was initiated. In mid-August, an Idaho Department of Fish and Game officer received a call from a concerned citizen in the Big Bend Ridge area, north of Ashton, regarding a grizzly bear in the vicinity. No bear sign was found upon investigation. There were no other reports of grizzly bear-human conflicts or confrontations.

Montana

Conflicts.--There were 79 reported and investigated grizzly bear/human conflicts in Montana within the GYE during 2001. This was an increase of 21% from the 63 conflicts in 2000, which had increased by 16% from the 53 conflicts in 1999. For the preceding 10 years (1991-2000), the average number of bear/human conflicts in Montana is 38. Approximately 29% of the bear/human conflicts occurred on pubic land and 71% occurred on private land in 2001. Unnatural food attractants (unsecured and secured), accounted for 54% of all bear/human conflicts in Montana during 2001. This was an increase from 1999 and 2000, where unnatural food related conflicts accounted for 15% and 48% of all bear/human conflicts, respectively.

Extreme drought conditions began in early spring and continued through the fall season with poor availability of quality bear foods during the spring and summer. Numerous grizzly bear conflicts occurred, which were partially attributable to drought conditions that began in mid-April and continued through August, mostly involving bears that live near areas of human development. Fortunately, a substantial crop of whitebark pine cones was available for bear use in the northern portion of the GYE and helped reduce conflicts during September and October. Without a quality fall-food source (i.e., pine cones), conflicts and potential bear mortalities would have remained high for the fall season. Natural food abundance and availability has a direct correlation on the level of bear/human conflicts associated with unnatural foods at developed areas or backcountry camps.

On average, situations caused by non-secured unnatural foods, continue to be the major cause of bear/human conflicts in Montana. During 2001, 8 bears (2 adult males and 2 females with 2 yearling cubs each) were attributed to 48 of the unnatural food related conflicts. Most of these conflicts could be avoided if people made a serious effort to secure all unnatural food attractants. Except for 3 livestock depredations, all management captures of grizzly bears in southwest Montana during the past 11 years were a result of unnatural foods. Euthanization or live removal of bears due to unnatural foods during this period has resulted in 17 bears being eliminated from the GYE in Montana. This type of conflict is more easily addressed than confrontational conflicts and should be possible to minimize. Managing agencies should continue to make extensive efforts to solve the non-secured unnatural food problem.

As reported since 1997, confrontational bear/human conflicts continue to increase in Montana. Some of these confrontations have been very serious and have lead to human injuries and grizzly bear mortalities. During 2001, 1 person was injured and no grizzly bears were killed in backcountry conflict situations associated with big game hunting. One person was injured and

2 grizzly bears were killed in self-defense situations in the backcountry during 2000. In 1999 and 1998, no humans were injured by grizzly bears and no grizzly bears were killed due to hunting related activities in southwest Montana. Confrontational conflicts (19) comprised 24% of the total bear/human conflicts in 2001. Of these 19 confrontational conflicts, 17 occurred on public land, with 16 or 84% of these occurring in backcountry areas. During 2000, 27% or 17 of the total bear/human conflicts were confrontations, where 14 of the 17 confrontations occurred on public land and 12 or 86% occurred in the backcountry.

Human injuries.--On 15 September 2001 at approximately 1945 hours, 2 men who were archery hunting for elk in the Taylor Fork drainage, Gallatin National Forest, had stopped to bugle for elk. The men were sitting on the ground with their backpacks off. They had bugled once, used a cow call several times, and had de-scented approximately 45 minutes earlier. The hunters heard animal running sounds, 1 man got up, moved toward a small bunch of regrowth trees, assuming that elk were moving. The hunter glimpsed a bear running "full-out" downhill at them. An instant later, the bear had the hunter by the calf of the leg, trying to pull him out of the trees. The hunter fell backwards, hitting the bear with his bow. The bear then bit him on the thigh, the hunter again hit the bear. The bear then bit him on the upper arm and as the bear opened its mouth, the hunter and bear "banged" heads, cutting the hunter's scalp and ear. The hunter had tried to reach for his pistol as the bear came towards his head. The attack was so fast, that the bear was gone before he could reach it. He stated the entire attack lasted for only a few seconds. The hunter noticed a large cub nearby as the female bear stopped her attack. The hunter's injuries included a broken lower left leg, punctures and cuts to the left thigh, upper left arm, scalp, and ear. These injuries hospitalized the hunter for 2 days.

The second hunter had curled up in a fetal position as the bears (female with 2 yearling cubs) charged at them. The bears had run by/over the second hunter, focusing on the hunter moving around in the group of trees. The hunter that was being attacked, yelled for help as the bear first bit him. The second hunter jumped up and ran at the bears, spraying bear deterrent. The female bear stopped attacking the first hunter and was standing on her hind legs facing the second hunter, as he ran at the bear. The pepper spray did not work, as it was fired into the wind, causing the second hunter to collapse to the ground. The bears disappeared. Both hunters estimated that the bears had charged from at least 200 yards away. These were very experienced hunters and knowledgeable of bears. Investigation concluded that the bears were hunting elk and this was not a close-encounter defensive attack.

From 1992 through 2001, 12 people have been injured in 9 grizzly bear attack situations in the GYE in Montana. In these 9 attacks, 4 of the grizzly bears were killed in self-defense. Eight (89%) of the 9 attacks (injuring 11 people), involved chance encounters of female grizzly bears with cubs. Ten of the 12 injuries involved people hunting big game at the time of the mauling. There have been an additional 5 grizzly bears killed by hunters in self-defense situations, during the same time period.

Managing agencies and the public will need to accept that confrontational conflicts along with associated human injuries and bear mortalities will be a very difficult problem to minimize and still maintain a degree of human acceptance and tolerance of bears. Everyone should realize that certain activities (i.e., summer camping, hiking, fall hunting season, unsecured food storage) will continue to bring bears and humans together with associated risks of confrontation. The need continues for education and information about proper actions to help reduce all types of bear/human conflicts while recreating or living in bear country.

Conflict reduction.--Through cooperative efforts, the Bear Management Office in Yellowstone National Park, mailed bear information brochures to the residences in Cooke City and Silver Gate, during 2000 and 2001. Mailings were also distributed in West Yellowstone and Gardiner in 2000. These brochures were written by the Bear Management Office and Montana Fish, Wildlife and Parks and printed by Defenders of Wildlife. Numerous newspaper articles were written to inform the public in these areas, of the need to secure unnatural food attractants. Further cooperative efforts involved the Sierra Club placing a person in the field, going door to door distributing bear information to residences and businesses in Cooke City, Silver Gate, and Big Sky. Information posters were also put at key locations in Gardiner and West Yellowstone. In spite of all informational and educational efforts, 2 male bears were captured and euthanized in the Cooke City/Silver Gate area and 1 subadult male bear was captured and relocated out of the West Yellowstone area, all due to unsecured food attractants.

During early May, an electric fence was installed at a residence in Crevice Creek east of Jardine. Investigation revealed a female grizzly bear with 2 COY had been in the yard attempting to get into a poultry shed that contained birds and grain. After fencing around the poultry shed and pen, no other complaints were received from the owner and the bears left the area. This electric fencing was left in place until December, to assure that all bears in the area had denned. Electric fencing was successfully used during 2000 at this same location, to keep 3 individual grizzly bears from feeding on poultry grain or depredating poultry.

At Corwin Springs, past problems of black and grizzly bears feeding on unsecured garbage, led to construction of a bear-proof fenced enclosure during 2000. No reports of bears getting into garbage in the Corwin Springs area were received during 2001.

During the last 5 years, West Yellowstone has had grizzly bears frequenting the city limits and residences in the surrounding area, where the bears have received unnatural food rewards. Extensive personal contacts and public awareness efforts (radio, newspaper, mailing of information brochures) of bear conflict situations and food storage ordinances have help resolve some of the potential problems. However, bears continue to get unnatural food rewards from public campgrounds and residences due to non-compliance with guideline methods for food storage and the adopted ordinances. Cooperation with the U.S. Forest Service and Gallatin County Sheriff's Office to warn the public of the enforceable food storage ordinance in the rural area around West Yellowstone continues.

Aversive conditioning (electric fencing and cracker rounds - harassment) of several bears in the Hebgen Lake area alleviated the need for capture and relocation of those bears. Electric fencing of grain storage sheds was again used at 1 location that was of continual conflict with bears during 2000. The fencing methods have changed with numerous applications and have proven to be a reasonably good method of detouring bears away from residences and human activities.

The legislature passed a state fish and wildlife law (87-3-130), effective April 2001, that is illegal to: "....purposely or knowingly attracting bears with supplemental feed attractants;" and "....purposely or knowingly providing supplemental feed attractants in a manner that results in an artificial concentration of game animals that may potentially contribute to the transmission of disease or that constitutes a threat to public safety." This law was written and adopted to help address the problem of grizzly and black bear habituation, conflict, capture/relocation and removal in the future.

During the summer of 2001, efforts were initialized with the hauling service to install bear-proof garbage containers in the Big Sky area. This effort will continue into 2002, to comply with Gallatin County ordinances in the Gallatin Canyon and minimize the need to capture black and grizzly bears in unnatural food conflict situations. Educational efforts, securing attractants, and enforcement of regulations will be ever-demanding with the increasing human growth/development of the areas surrounding Yellowstone National Park along with recovery and expansion of the grizzly bear population.

During the summer months (May-August), grizzly bear awareness signs directed at campers and recreationists were posted in areas of high bear use. These areas vary from year to year, due to bear food availability and bear use. Campsites were monitored for compliance with food storage ordinances and individuals were warned of possible conflicts when camps were kept unsecured.

Extensive efforts were again made by the U.S. Forest Service, Gardiner Ranger District and Montana Fish, Wildlife and Parks to educate hunters and minimize bear/human conflicts in the Absoroka-Beartooth (AB-BT) Wilderness. This hunting area has a high concentration of hunters and grizzly bears during September and October. The grizzly bears have learned to utilize the created food source (elk viscera and carcasses). People and bears are in close proximity to one another during the fall season. Although documented confrontational bear/human conflicts happen regularly, relatively few serious conflicts occur considering the number of people and bears in the area. In past years, people have been injured and bears killed in the AB-BT area during the early fall elk hunting season, even with agency efforts to minimize bear/human conflicts there. Again, backcountry confrontational bear/human encounters are impossible to eliminate. During the 2001 hunting season, in the AB-BT area, no grizzly bears were killed or humans injured. Bear/human encounters were probably reduced due to grizzly bears utilizing the abundant crop of whitebark pine cones and through the continued efforts of the U.S. Forest Service backcountry crew and Montana Fish, Wildlife and Parks game wardens visiting camps and hunters in the field.

Educational efforts directed at big game hunters continued in the Gallatin, Yellowstone, and Madison River drainages from September through November. Within the primary conservation area (PCA) of the Yellowstone grizzly bear Recovery Zone, bear safety and information signs related to hunting, were posted and maintained at 43 different trailheads within these river drainages. Hunter camps were visited to inform the public of bear activity, proper food storage, and conflict avoidance.

Grizzly bear informational letters were again sent to all resident and non-resident hunters who received a special license to hunt goats and moose in hunting districts occupied by grizzly bears.

During September and October, when agency (Montana Fish, Wildlife and Parks; U.S. Forest Service) personnel were in the field, they were regularly informed of known grizzly bear activity to relay to the public.

Management captures.--During 2001, 4 grizzly bears were captured in Montana due to conflict situations. On 3 July, an adult female bear was captured north of Gardiner, along the Yellowstone River. On 13 July, an adult male bear was captured on Cooke (Colter) Pass. On 15 August, an adult male bear was captured in Silver Gate.

All of the adult bear captures were due to unsecured food attractants and increasingly bold behavior by the bears.

On 22 August, a subadult male bear was captured west of West Yellowstone. Two subadult siblings had been frequenting developed areas searching for foods. One subadult male bear was captured and relocated, due to obtaining birdseed, snooping for garbage, and the inability to secure all attractants at residences in the area that the bears were frequenting. This subadult male bear (#396), remained in the general area of its relocation site, using whitebark pine habitat and denning in mid-November. The second sibling bear was not captured and left the area after moving bear #396.

On average, 4 grizzly bears have been captured each year in Montana, due to management situations. Management captures of grizzly bears has varied from a low of 0 during 1990, 1992, 1993, and 1999, up to a high of 12 grizzly bear captures during 1995.

From 1991 through 2001, 32 individual grizzly bears have been captured 41 times due to conflict caused management actions. Of these management captures, 38 have been the result of non-secured unnatural foods and the sometimes associated property damage.

***Bear mortalities*.--**In southern Montana during 2001, 3 grizzly bears were removed from the ecosystem. An adult female bear (#325) was captured and placed in a zoo after being captured due to unnatural food rewards and bold behavior. Bear #325 had been captured/relocated in 1998 and had been involved in numerous conflict situations in 1999-2001. Aversive conditioning during 2000, kept bear #325 and her 2 COY out of capture situations. After abandoning her cubs in May 2001 and with drought conditions, bear #325 resorted to learned behavior of searching for unnatural foods. From 1998 through bear #325's capture in July 2001, there had been 55 management actions involving this bear, while trying to keep her in the ecosystem.

An adult male bear was euthanized on 16 July after being captured due to unnatural food conflicts, property damage, and exhibiting aggressive behavior in the Cooke City area. The Bear Management Office in Yellowstone National Park assisted in the capture. This bear had tried to break into a house while a person was inside. The bear had also been on porches and at doors and windows of other houses. Numerous attempts were made to discourage this bear from frequenting residences and human activities. Aversive rounds were fired at/near the bear, dogs were used, lights/noise and vehicles were all unsuccessful at keeping the bear from nuisance behavior.

A second adult male bear was euthanized on 16 August after being captured due to extensive property damage, unnatural food rewards and aggressive behavior in Silver Gate. This bear had broken into a camping trailer and greenhouse, causing extensive property damage. Necropsy of this adult male bear revealed a heavy infestation of parasitic round worms in its intestinal tract. This parasitic infestation probably contributed to the bear’s behavior in searching for unnatural foods.

Grizzly bears were in numerous unnatural food conflicts during 1999 and 2000 in the Cooke City/Silver Gate areas. Having received unnatural foods that were unsecured in the past, these male bears also resorted to this learned behavior and became bolder when searching for unnatural foods during drought conditions.

From 1992 through 2001, there have been 32 known grizzly bear deaths and 8 live removals (to zoos) out of the GYE within Montana. Of these 40 grizzly bear losses, 42% have been related to unnatural food conflicts, 22% have been related to hunting/self-defense conflicts, and 15% have been killed through illegal activities. Natural and unknown caused deaths, have each resulted in 8% of the known grizzly bear mortalities. Livestock depredation has resulted in 5% of the total loss of grizzly bears. Of this total (40) bear mortality, 23 or 57% have been assumed residents of Montana, 7 or 18% of the bears had moved into Montana after being translocated from Wyoming to Yellowstone National Park, 5 or 12% of the bears had naturally moved into Montana from Yellowstone National Park or Wyoming, 3 or 8% had used the border lands of Montana/Yellowstone National Park, and 5% of the bears had been translocated into Montana from Wyoming. This information helps document the grizzly bear's behavior and ability to move over a large geographic area which results in great difficulty in successfully relocating management situation bears. Over time, habituated bears can easily find another unnatural food source (usually unsecured) regardless of where the relocation site is.

There has been an increase in grizzly bear sightings (verified and non-verified), bear/human conflicts, and grizzly bear mortalities occurring in areas that are increasingly farther away from the recognized recovery line of the GYE. As the grizzly bear population recovers, as evident in Montana, Wyoming, and Yellowstone National Park, bears will use all available habitat within the GYE. The need for grizzly bear management efforts will become ever-demanding in the future. Assumptions can no longer be made that these areas are not occupied by grizzly bears or are black bear habitat only. In Montana, during 1998, a grizzly bear that caused livestock depredation 40 miles west of the recognized PCA was an example of this change. This again occurred during 2001, with a livestock depredation that occurred 25 miles west of the PCA and a sighting of a female grizzly with 1 cub, 35 miles north of the PCA. During recent years, grizzly bears have been observed within 10 miles of Livingston, Bozeman, and Ennis.

Wyoming (outside the National Park system)

There were 188 human-grizzly bear conflicts in Wyoming during 2001, an increase of 69% from the number of conflicts in 2000 ($n = 112$), and an increase of 215% from the previous 5-year average (1996-2000) of 88 incidents/year. The short-term increase is attributable to dry conditions during the summer and fall, resulting in bears searching widely for foods. The long-term trend is largely attributable to an increase in bear numbers and distribution. Bears have repopulated federal lands managed for multiple uses and private lands well outside of Yellowstone National Park and the surrounding wilderness areas during the past decade. This expansion has resulted in greater potential for conflicts with people or their property. Encounters between people and bears are numerous each year in Wyoming. The Wyoming Game and Fish Department does not systematically investigate or record ordinary encounters that do not result in conflict.

***Agriculture damage*.--**Twenty-nine cattle were killed or injured by grizzly bears in 28 incidents in Wyoming during 2001, a 25% reduction from losses ($n = 40$) in 2000, and a 27% decrease from the 5-year average (1996-2000) of 41 cattle/year. Fifteen cattle depredations occurred on grazing allotments on the Shoshone National Forest, 4 losses occurred on the Bridger-Teton National Forest, and 10 depredations occurred on private lands in the Cody and Dubois areas. Two male bears were captured and relocated for killing cattle on private lands and 1 was subsequently killed by management authorities after returning to the area where he killed an additional calf.

Thirty-eight sheep were killed in 27 incidents during 2001, which is a 450% increase in the number of incidents ($n = 6$), and a 36% increase in the number of sheep killed ($n = 28$) during 2000. The 27 incidents that occurred in 2001 is a 35% increase from the 5-year average (1996-2000) of 20 incidents/year. All sheep were killed on grazing allotments on the Bridger-Teton National Forest. Three subadult male grizzly bears were captured and relocated from the area during the summer grazing season. An additional grizzly bear killed sheep near the end of the grazing season, but attempts to capture and move the bear were unsuccessful.

Four incidents of apiary damage occurred during 2001, all in the Dubois area. The number of apiary damage problems has varied from 0 to 6/year during the past 5 years (1996-2000). Further damage was prevented in all instances by erecting electric fences to exclude bears from the hives or by moving the hives to a secure location. One male bear was killed by management authorities after damaging beehives. The bear had a history of cattle depredations in addition to damaging hives and frequenting residential areas. Electric fencing has been very successful at preventing damage to apiaries at many locations in Wyoming during the past 10 years.

Property damage.--Property damage incidents increased 292% in 2001 (n = 73) from the number of incidents in 2000 (n = 25), and increased 730% from the previous 5-year average of 10 incidents/year. Types of incidents included damage to camps, vehicles, bird feeders, fruit trees, and buildings. Forty-six incidents occurred on private lands, 17 on the Shoshone National Forest, and 1 on the Bridger-Teton National Forest. The Wyoming Game and Fish Department provided assistance with materials and technical advice, and managed bears when needed to prevent further property damage. Eight bears were killed by management authorities in 2001 after repeated property damage incidents. All of the bears killed had a history of conflicts with people. One bear was captured and relocated after damaging property.

Anthropogenic food rewards.--Bears were able to access non-natural foods in 125 incidents during 2001. In 54 of the incidents they caused property damage while attempting to obtain human food, garbage, pet or livestock feeds. Six incidents occurred on the Bridger-Teton National Forest, 15 incidents occurred on the Shoshone National Forest, one occurred on state owned lands, and 103 occurred on private lands. Three bears were killed by management authorities in 2001 after repeatedly seeking and receiving anthropogenic foods. All of the bears killed had a history of conflicts with people. Five bears were captured and relocated after being human food rewarded.

Harvested game animals.--The Wyoming Game and Fish Department received numerous reports of bears consuming harvested game animals that had been left in the field or improperly stored. Wild ungulates are natural foods for Yellowstone area grizzly bears, so incidents of bears consuming carcasses are not considered a conflict and are not detailed in this report. *Human injuries*.--One minor human injury occurred in Wyoming outside of the national parks in 2001. A man was scratched on the lower leg when he encountered a female bear with 2 yearlings on his property. His injuries did not require professional medical attention.

Human-caused bear deaths.--Sixteen human-caused bear mortalities and 1 injury occurred in Wyoming in 2001. Thirteen of the 16 bears were removed in agency management actions after repeated conflicts with people. One bear was mistakenly killed as a black bear. The hunter was successfully prosecuted for the violation. One bear was killed and 1 bear was injured after being struck by motor vehicles. One additional bear was killed illegally and the incident is currently under investigation.

Bear Management Activities.--Human-bear conflicts occurred throughout the non-denning period in Wyoming. Three years of dry conditions in northwest Wyoming and an increasing bear population has resulted in numerous bear-human conflicts. Conflicts began in March, increased in April and May, decreased in June, then peaked in July, August, and September. A few conflicts continued throughout October and ended in mid-November. Management personnel captured 22 bears a total of 26 times in actions to prevent or manage conflicts.

Personnel worked with Teton and Park county governments to distribute information on bear behavior and preventing conflicts. “Staying Safe in Bear Country” videos were distributed to 19 public libraries in northwest Wyoming. “Living in Bear and Lion Country” workshops were taught in communities throughout the State. Numerous contacts were made with recreationists, businesses, and property owners to provide assistance in preventing or managing conflicts with bears. Informational mailings containing conflict prevention tips were sent to Moran and Cody areas residents. Numerous media releases and interviews were conducted to disseminate information on preventing and avoiding conflicts with bears. Electric fence materials were distributed to apiarists in the Dubois and Cody areas. Bear proof barrels were provided to Cody and Dubois area residents for storing garbage and livestock feeds. Bear conflict prevention techniques were taught to all hunter safety classes conducted in northwestern Wyoming. Assistance with bear interpretive signing was provided to the city of Cody. Bear conflict management techniques were taught to thousands of children that attended the “Wyoming Hunting and Fishing Heritage Expo.” Bear conflict information was mailed to all limited quota big game license holders hunting in occupied grizzly bear habitat. Personnel filmed bear conflict prevention techniques for future public service announcements. Numerous public presentations on preventing bear conflicts and recreating in bear habitat were conducted during the year.

Yellowstone National Park

There was 1 incident where a grizzly bear damaged property and 3 incidents where grizzly bears obtained anthropogenic foods in Yellowstone National Park in 2001. There were no grizzly bear-inflicted human injuries in the park. Due to the relatively few conflicts that occurred, no grizzly bears were captured in management actions and there were no human-caused grizzly bear mortalities in the park.

Property damage--On 7 July 2001 at 0030 hours, a ranger at the Northeast Entrance housing area heard noises at his front door. When he opened the blinds of a window adjacent to the front door he saw a grizzly bear standing on 2 legs looking through the window. The bear had ripped the screen out of the front door and cracked the window panes on 2 windows adjacent to the front door. The ranger yelled loudly at the bear and it dropped to all 4 feet and slowly wandered away. The bear was considered unlikely to return since it had not received a food reward, so no management action was taken against the bear.

Anthropogenic foods.--On 9 June 2001 at approximately 1245 hours, 2 park concession employees were picnicking at the Buffalo Ford picnic area when they noticed a grizzly bear cross the Yellowstone River and enter the picnic area. They warned picnickers nearby that the bear may be coming their way, so most of them packed up their food and pulled out cameras. The bear entered the area near a picnic table where 2 people were still eating. When the visitors noticed the bear only a short distance away, they quickly got into their vehicle leaving food on the table. The bear climbed on top of the table and ate the contents of a paper sack and a drink.

At approximately 1700 hours on 24 July 2001, a subadult grizzly entered campsite 8H2 on the west shore of Heart Lake. The 2 campers at the site were eating dinner when they noticed the bear about 10 feet away. They immediately stood up and backed away from the bear and out of the campsite. The bear walked up to the camp stove where pasta was still in a pot. The bear ate a small amount of pasta, but did not finish it; it did not act aggressively toward the campers. The bear left the campsite and headed north along the lakeshore where it crossed through campsite 8H3. The campers at 8H3 yelled at the bear and it left.

On 21 August 2001, 2 backpackers stopped for lunch along the trail north of campsite 3T2. While doing their dishes near the creek they noticed a small grizzly bear walking towards them. They backed off and the grizzly rummaged through their packs and pulled out some freeze-dried food and a bag of Kool-Aid. The bear ate the Kool-Aid and bit into the freeze-dried food but did not eat it.

Concerns for the future in Yellowstone National Park.--Strong public education and sanitation programs have kept the number of bear-human conflicts and human-caused grizzly bear mortalities in Yellowstone National Park relatively low in recent years. Continuation of these programs is essential to further reducing and preventing bear-human conflicts within the park. Due to more than a decade with few conflicts, complacency in implementing and enforcing Yellowstone National Park's bear management sanitation programs is a concern, as few current park employees were around in past years when conflicts were common. Management of human habituated (but not food conditioned) grizzly bears feeding on natural foods adjacent to roadside corridors, often with hundreds of people watching and photographing within distances of 20 to 50 meters, continues to be the most challenging bear management issue in the park (Gunther and Biel 1999). In 2001, park staff responded to 116 bear-jams involving grizzly bears, to provide visitors with interpretive information and traffic control, as well as to monitor visitor's behavior in order to prevent them from approaching and/or feeding the bears involved. Habituated bears in Yellowstone National Park have learned to live in close proximity to people while being involved in relatively few conflicts. If park visitors can learn to behave appropriately around habituated bears in a manner that does not put themselves or the bears at risk, it can be beneficial to both bears and people. Bears would benefit by gaining access to high-quality habitat adjacent to park road corridors. Park visitors would benefit by being able to watch and photograph bears involved in natural behavior in their natural habitat. New innovative strategies for managing people and habituated bears at bear-jams need to be developed and funded to reduce the potential for bear-human conflicts with, and human-caused mortality of, habituated grizzly bears that frequent road corridors in Yellowstone National Park.

DISCUSSION

Year 2001 Overview

In 2001, there was a below average abundance of winter-killed ungulate carcasses in spring and spawning cutthroat trout during the estrous season. Both early and late hyperphagia were characterized by severe drought conditions. Army cutworm moths were abundant during early hyperphagia and whitebark pine seeds were abundant during late hyperphagia with the exception of the southeastern portion of the GYE where pine seeds were scarce. Most grizzly bear-human conflicts occurred in this area. Overall, likely due to the severe drought and poor whitebark pine seed production in the southeastern GYE, incidents of bears damaging property and obtaining anthropogenic foods as well as management removal of grizzly bears were higher than the long-term average recorded from 1992-2000 (Table 35).

Geographic Areas with High Numbers of Conflicts

Most of the grizzly bear-human conflicts that occurred in 2001, occurred in 6 distinct geographic areas of the ecosystem (Fig. 12). Many of the conflicts in these 6 areas were caused by just a few individual grizzly bears. The 6 areas where most conflicts occurred included the West Yellowstone and Cooke City/Silver Gate areas where bears got into garbage, bird feeders, and anthropogenic foods; the North Fork and South Fork areas of the Shoshone River where bears got into garbage, livestock grain and pet foods, and killed cattle; the Dunoir Creek area where bears killed cattle and ate livestock and pet foods; and the Green River area where bears killed sheep.

Table 35. Number of incidents of different types of grizzly bear-human conflicts in 2001 and average number of conflicts recorded from 1992-2000 in the Greater Yellowstone Ecosystem.

Type of conflict	Time period	
	1992-2000 Average	2001
Human injury	4 ± 3 SD	5
Property damage	13 ± 9 SD	26
Anthropogenic foods	37 ± 29 SD	128
Gardens/orchards	5 ± 3 SD	6
Beehives	4 ± 5 SD	4
Livestock depredations	48 ± 23 SD	58
Total conflicts	110 ± 43 SD	227

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Appendix A

GRIZZLY BEAR DENNING CHRONOLOGY AND MOVEMENTS IN THE GREATER YELLOWSTONE ECOSYSTEM

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Abstract: Den entrance and emergence dates of grizzly bears (*Ursus arctos*) in the Greater Yellowstone Ecosystem are important to management agencies that wish to minimize impacts of human activities on bears. Current estimates for grizzly bear denning events use data that were collected from 1975–80. We update these estimates by including data obtained from 1981–99. We used aerial telemetry data to estimate week of den entry and emergence by determining the midpoint between the last known active date and the first known date denned, as well as the last known date denned and the first known active date. We also investigated post emergence movement patterns relative to den locations. Mean earliest and latest week of den entry and emergence were also determined. Den entry for females began during the fourth week in September, with 90% denned by the fourth week of November. Earliest den entry for males occurred during the second week of October, with 90% denned by the second week of December. Mean week of den entry for known pregnant females was earlier than males. Earliest week of den entry for known pregnant females was earlier than other females and males. Earliest den emergence for males occurred during the first week of February, with 90% of males out of dens by the fourth week of April. Earliest den emergence for females occurred during the third week of March; by the first week of May, 90% of females had emerged. Male bears emerged from dens earlier than females. Denning period differed among classes and averaged 171 days for females that emerged from dens with cubs, 151 days for other females, and 131 days for males. Known pregnant females tended to den at higher elevations and, following emergence, remained at higher elevation until late May. Females with cubs remained relatively close (<3 km) to den sites until the last 2 weeks in May. Timing of denning events was similar to previous estimates for this and other grizzly bear populations in the southern Rocky Mountains.

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Appendix B

GRIZZLY BEAR DENNING AND POTENTIAL CONFLICT AREAS IN THE GREATER YELLOWSTONE ECOSYSTEM

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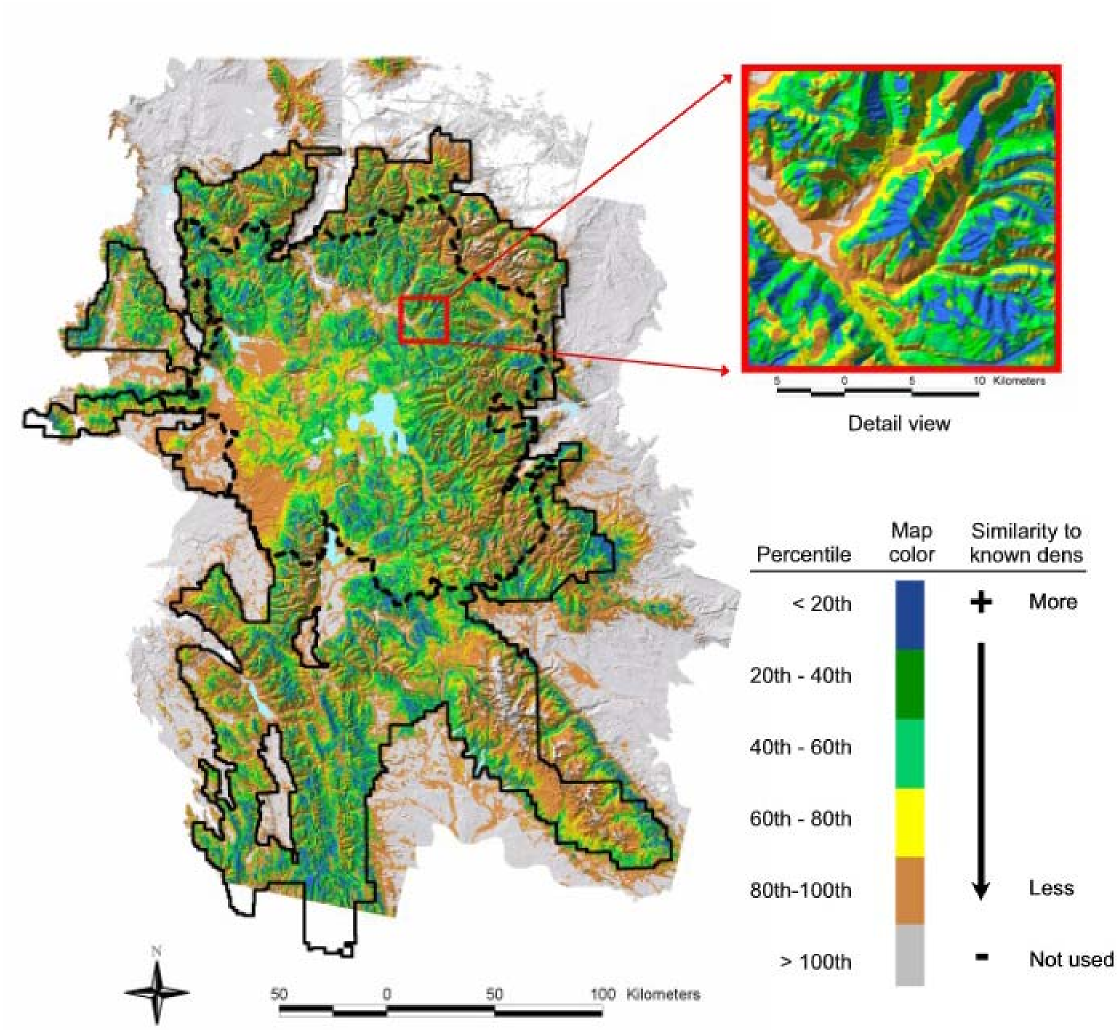
Abstract: Increasing winter use of steep, high-elevation terrain by backcountry recreationists has elevated concern about disturbance of denning grizzly bears (*Ursus arctos*) in the Greater Yellowstone Ecosystem (GYE). To help identify areas where such conflicts might occur, we developed a spatially explicit model to predict potential denning areas in the GYE. Using a scan area of 630 m around each location, we assigned site attributes to 344 den locations of radio-tracked grizzly bears from 1975–99. Attributes identified as predictors for the analysis included elevation, slope, an index of solar radiation, and forest cover. We used the Mahalanobis distance statistic to model the similarity between sites used by denning bears and each cell in the data layers. We used the final Mahalanobis distance model to produce maps of the study area. Potential denning habitat, based upon the model, is abundant within the GYE (Appendix Fig. 1). Our results can be used by land management agencies to identify potential conflict sites and minimize effects of regulated activities on denning grizzly bears. We illustrate how the Gallatin National Forest (GNF) used the model to examine the overlap between potential snowmobile use areas and potential denning habitat as part of a Biological Assessment submitted to the U.S. Fish and Wildlife Service.



Appendix Fig. 1. Map cells of the Mahalanobis distance statistic from the mean habitat vector of habitat associations for grizzly bear dens in the Greater Yellowstone Ecosystem, USA, 1975–99 on public land (heavy, solid line) and in the Yellowstone Grizzly Bear Recovery Zone (dashed line). Map cell values were recoded relative to percentiles of model values at known den locations. Map cells with values greater than the maximum value at a den location were not considered potential denning habitat. The map image was draped over a digital elevation model to show the underlying topography. Major lakes are shown in light blue.

Appendix C

CURRENT DISTRIBUTION OF GRIZZLY BEARS IN THE GREATER YELLOWSTONE ECOSYSTEM

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Abstract: The Yellowstone grizzly bear (*Ursus arctos horribilis*) has been expanding its range during the past 2 decades and now occupies historic habitats that had been vacant. A current understanding of the distribution of grizzly bears within the ecosystem is useful in the recovery process, and to provide guidance to the state and federal land management agencies and state wildlife agencies of Idaho, Montana, and Wyoming as they prepare management plans. We used kernel estimators to develop distribution maps of occupied habitats based on initial sightings of unduplicated females (n = 300) with cubs of the year, information from radio-marked bears (n = 105), and locations of conflicts, confrontations, and mortalities (n = 1,235). Although each data set was constrained by potential sampling bias, together they provide insight into areas within the Greater Yellowstone Ecosystem currently occupied by grizzly bears. The current distribution (1990-2000) extends beyond the Recovery Zone identified in the U.S. Fish and Wildlife Service Recovery Plan. Range expansion is particularly evident in the southern portion of the ecosystem in Wyoming. A comparison of our results from the 1990s to previously published distribution maps show an approximate increase in occupied habitat of 48% and 34% from the 1970s and 1980s, respectively. We discuss data biases and problems implicit to the analysis.

Appendix D

ESTIMATING NUMBERS OF FEMALES WITH CUBS-OF-THE-YEAR IN THE YELLOWSTONE GRIZZLY BEAR POPULATION

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Abstract**:** For grizzly bears (*Ursus arctos horribilis*) in the Greater Yellowstone Ecosystem, minimum population size and allowable numbers of human-caused mortalities have been calculated as a function of the number of unique females with cubs-of-the-year (F_{CUB}) actually seen during a 3-year period. This approach underestimates the total number of F_{CUB}, thereby biasing estimates of population size and sustainable mortality. Also, it does not permit calculation of valid confidence bounds. Many statistical methods exist that resolve or mitigate these problems, but there is no universal "best" choice. Instead, relative performances of different methods can vary with population size, sample size, and degree of heterogeneity among sighting probabilities for individual animals. We compared 7 nonparametric estimators, using Monte Carlo techniques to assess performances over the range of sampling conditions deemed plausible for the Yellowstone population. Our goal was to estimate the number of F_{CUB} present in the population each year. Our evaluation differed from previous comparisons of such estimators by including sample coverage methods and by treating individual sightings, rather than sample periods, as the sample unit. Consequently, our conclusions also differ from earlier studies. Recommendations regarding estimators and necessary sample sizes are presented, together with estimates of annual numbers of F_{CUB} in the Yellowstone population, with bootstrap confidence bounds.

Appendix E

ESTIMATING TOTAL HUMAN-CAUSED MORTALITY FROM REPORTED MORTALITY USING DATA FROM RADIO-INSTRUMENTED GRIZZLY BEARS

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Abstract: Tracking mortality of the Yellowstone grizzly bear (*Ursus arctos horribilis*) is an essential issue of the recovery process. Problem bears removed by agencies are well documented. Deaths of radiocollared bears are known or, in many cases, can be reliably inferred. Additionally, the public reports an unknown proportion of deaths of uncollared bears. Estimating the number of non-agency human-caused mortalities is a necessary element that must be factored into the total annual mortality. Here, we describe a method of estimating the number of such deaths from records of reported human-caused bear mortalities. We used a hierarchical Bayesian model with a non-informative prior distribution for the number of deaths. Estimates of reporting rates developed from deaths of radio-instrumented bears from 1983 to 2000 were used to develop beta prior probability distributions that the public will report a death. Twenty-seven known deaths of radio-instrumented bears occurred during this period with 16 reported. Additionally, fates of 23 radio-instrumented bears were unknown and are considered possible unreported mortalities. We describe 3 ways of using this information to specify prior distributions on the probability a death will be reported by the public. We estimated total deaths of non-instrumented bears in running 3-year periods from 1993 to 2000. Thirty-nine known deaths of non-instrumented bears were reported during this period, ranging from 0 to 7/year. Seven possible mortalities were recorded. We applied the method to both sets of mortality data. Results from this method can be combined with agency removals and deaths of collared bears to produce defensible estimates of total mortality over relevant periods and to incorporate uncertainty when evaluating mortality limits established for the Yellowstone grizzly bear population. Assumptions and limitations of this procedure are discussed.