Yellowstone Grizzly Bear Investigations 1999

Annual Report of the Interagency Grizzly Bear Study Team

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YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Report of the Interagency Grizzly Bear Study Team

1999

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

Charles C. Schwartz and Mark A. Haroldson, Editors

This report is published primarily for the use of the members of the Interagency Grizzly Bear Committee and the Yellowstone Ecosystem Subcommittee.

U.S. Department of the Interior
U.S. Geological Survey
September 2000

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

It was recognized as early as 1973, that in order to understand the dynamics of grizzly bears (*Ursus arctos horribilis*) throughout the Greater Yellowstone Area, there was a need for a centralized research group responsible for collecting, managing, analyzing, and distributing all data. To meet this need, agencies formed the Interagency Grizzly Bear Study Team (IGBST), a cooperative effort among the U.S. Geological Survey, National Park Service, U.S. Forest Service, U.S. Fish and Wildlife 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 Greater Yellowstone Area.

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 critical for evaluating the recovery process. The IGBST promotes data collection and analysis on an ecosystem scale, prevents overlap of effort, and pools limited economic and personnel resources.

Earlier research on grizzlies within Yellowstone National Park (Craighead et al. 1974) provides population data for the period 1959-67. However, closing the open-pit garbage dumps and cessation of the ungulate reduction program in Yellowstone National Park in 1967, markedly changed food habits (Mattson et al. 1991*a*), population demographics (Knight and Eberhardt 1985), and growth patterns (Blanchard 1987) for grizzly bears. Since 1975, the IGBST has produced an annual report summarizing all grizzly bear monitoring and research efforts within the Greater Yellowstone Area. As a result, distribution of grizzly bears within the Greater Yellowstone Area (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) have been previously addressed. Nevertheless, monitoring and updating continues so that status can be evaluated annually. This report contains the results of that monitoring during 1999, along with a summary of nuisance grizzly bear management actions, and results of new research. The conflict summary was previously a separate report (Gunther et al. 1993, 1994, 1995, 1996, 1997, 1998, 1999) but is included here in an effort to present all data relative to summarizing annual status of the grizzly bear in the Greater Yellowstone Area in 1 document.

Continuing IGBST research entails evaluating methods to identify important habitats and the impacts of humans on these habitats. We present initial results from an analysis of open and total road densities and percent secure area by Bear Management Unit (BMU) for the Grizzly Bear Recovery Zone (USFWS 1993). Movement and home range data

(cf. Blanchard and Knight 1991) suggest that the grizzly bears in Yellowstone are a semi-autonomous population. This makes it necessary to monitor population size at an ecosystem scale. We are evaluating techniques to monitor population trend and estimate population size. As in past years, we use the 1999 count of unduplicated females with cubs-of-the-year (COY) to generate an estimate of the minimum population size. Beginning in 1998, the IGBST modified the aerial observation protocol to evaluate the potential of capture-mark-resight to estimate population size. We use radio-collared bears as marks and to determine closure following the protocol described by Miller et al. (1997). We continue to monitor the number of unique grizzlies feeding on cutthroat trout (*Oncorhynchus clarki*) spawning streams of Yellowstone Lake. This study employs the use of DNA fingerprinting from hair samples. We also monitor the numbers of spawning cutthroat trout on selected streams of Yellowstone Lake. These data are compared to historic counts and used to develop an index of fish abundance to aid in tracking cutthroat trout population changes associated with the introductions of exotic lake trout (*Salvelinus namaycush)* and whirling disease. We continue to monitor spring ungulate carcass numbers and cone production of whitebark pine (*Pinus albicaulis*) on selected transects to index food abundance.

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).

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 Chad Dickinson, Mark Biel, Dan Reinhart, Travis Wyman, Jason Hicks, Maureen Hartmann, Craig Jamison, Derek Fagone, Rick Swanker, Hillary Robison, Kurt Alt, Keith Aune, Kevin Frey, Neil Anderson, Mark Bruscino, Dustin Shorma, Ron Grogan, Craig Sax, Gary Brown, John Emmrich, Larry Roop, Tim Fagan, Jerry Longobardi, Duke Early, Dennis Almquist, Brain Debolt, Doug McWhirter, Cole Thompson, Bill Long, Doug Crawford, Steve Cain, Wendy Clark, Sue Consolo-Murphy, Bonnie Gafney, Kerry Gunther, Kerry Murphy, Tom Olliff, Dave Price, Doug Smith, Peter Gogan, Jeff Copeland, Kim Barber, J.T. Stangl, Mark Hinschberger, Brian Aber, Adrian Villaruz, Connie King, Bill Chapman, Doug Chapman, Rich Hyatt, Gary Lust, Stan Monger, Jerry Spencer, Dave Stradley, Roger Stradley, Randy Arment, Kim Keating, Casey Hunter, Merril Nelson, Jed Edwards, and Steve Cherry for their contributions to data collection, analysis, and other phases of the study. Thanks also to Ray Paunovich for permission to use the photo on the cover. Without the collection efforts of many, the information contained within this report would not be available.

Yellowstone Grizzly Bear Investigations for 1995 through 1999 are now available at http://www.nrmsc.usgs.gov/research/IGBST-home.htm

BEAR MONITORING AND POPULATION TREND

Marked Animals *(Mark Haroldson, Interagency Grizzly Bear Study Team, and Mark Ternent, Wyoming Game and Fish Department)*

During the field season of 1999, we captured and handled 42 individual grizzly bears on 47 occasions (Table 1), including 15 females (8 adult) and 27 males (16 adult). Twenty-seven individuals were new bears not previously marked.

We conducted research trapping efforts for 816 trap days (1 trap day = 1 trap set for 1 day) in 11 BMUs or their respective 10-mile outer perimeter area (Figure 1) and captured 31 bears. This resulted in a trapping success rate of 1 bear for every 26.3 trap days.

There were 16 bears captured through separate management trapping efforts in the Greater Yellowstone Area during 1999 (Tables 1 and 2). One bear was euthanized as a result of second-offense cattle depredation, 1 bear was removed to a captive facility as a result of campground depredations in Yellowstone National Park, and 13 bears were captured and relocated within the Greater Yellowstone Area. Four of the 13 relocations were considered preventative since the captured bear was not associated with damage but was near ongoing conflicts and management trapping efforts. Three relocations occurred during 1 incident involving a female accompanied by 2 yearlings. One additional bear was captured in a management trapping effort and release on site because he was not the target individual.

We monitored 65 radio-collared grizzly bears during the 1999 field season, including 18 adult females (Tables 2 and 3). Thirty-four grizzly bears entered their winter dens wearing active transmitters in the Greater Yellowstone Area. Programmable ear transmitters, which are worn by another 14 grizzly bears, are scheduled to begin transmitting on 1 April 2000. Since 1975, we have radio-marked 347 individual grizzly bears.

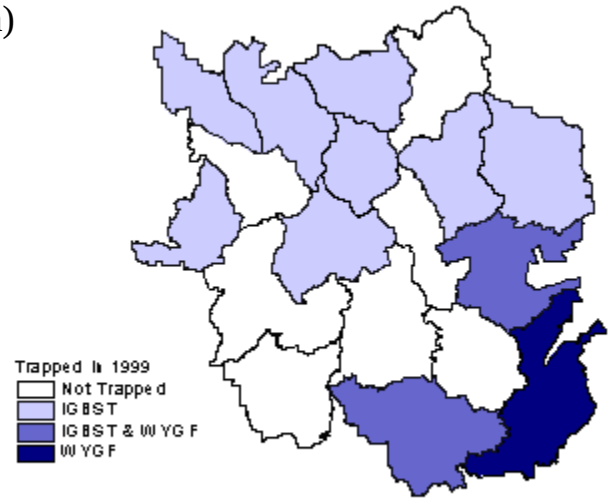
Table 1. Grizzly bear capture records for 1999.

Bear	Sex	Age	Date	General location[a]	Capture type	Release site[a]	Trapper/Handler[b]
326	male	subadult	4/27/1999	Wood River, Pr-WY	management	Elk Fork, SNF	WYGF
327	female	adult	4/29/1999	SF Shoshone, Pr-WY	management	Sweetwater Crk, SNF	WYGF/IGBST
328	male	adult	5/1/1999	SF Shoshone, Pr-WY	research	on site	WYGF
329	male	adult	5/6/1999	Mormon Crk, SNF	research	on site	IGBST
330	male	adult	5/12/1999	Mormon Crk, SNF	research	on site	IGBST
331	female	subadult	5/13/1999	Timber Crk, Pr-WY	research	on site	WYGF/IGBST
332	female	adult	5/13/1999	SF Shoshone, Pr-WY	research	on site	WYGF/IGBST
333	male	subadult	5/17/1999	Mormon Crk, SNF	research	on site	WYGF
334	female	subadult	5/18/1999	SF Shoshone, Pr-WY	management	Antelope Crk, YNP	WYGF
335	male	adult	5/18/1999	Mormon Crk, SNF	research	on site	WYGF
336	male	adult	5/20/1999	Mormon Crk, SNF	research	on site	WYGF
278	male	adult	5/20/1999	Beam Gulch, SNF	research	on site	IGBST
337	female	subadult	6/10/1999	Gravelbar Crk, SNF	research	on site	IGBST
338	male	subadult	6/18/1999	Gibbon River, YNP	research	on site	IGBST
339	male	adult	6/23/1999	SF Shoshone, Pr-WY	management	Oxbow Crk, YNP	WYGF/YNP
321	female	adult	6/24/1999	Cascade Crk, YNP	research	on site	IGBST
219	male	adult	6/30/1999	Cascade Crk, YNP	research	on site	IGBST
295	female	adult	6/30/1999	Gibbon River, YNP	research	on site	IGBST
			10/8/1999	Gibbon River, YNP	research	on site	IGBST
312	male	subadult	7/9/1999	SF Shoshone, Pr-WY	management	Parque Crk, SNF	WYGF
340	male	adult	7/10/1999	Buffalo Fork, BTNF	research	on site	WYGF
			7/14/1999	Buffalo Fork, BTNF	research	on site	WYGF
			8/9/1999	Buffalo Fork, BTNF	research	on site	WYGF
179	female	adult	7/12/1999	Buffalo Fork, BTNF	research	on site	WYGF
269	male	adult	7/12/1999	Crow Crk, BTNF	management	removal	WS
325	female	subadult	7/13/1999	Indian Crk, YNP	management	Otter Crk, YNP	YNP/IGBST
			8/23/1999	Stephens Crk, YNP	management	on site	YNP
341	male	adult	7/19/1999	Jasper Crk, YNP	research	on site	IGBST
342	female	adult	7/21/1999	Antelope Crk, YNP	research	on site	IGBST
224	male	adult	7/25/1999	Wallace Draw, BTNF	research	on site	WGFD
290	male	adult	7/30/1999	Coyote Crk, YNP	research	on site	IGBST
317	male	adult	8/3/1999	Coyote Crk, YNP	research	on site	IGBST
343	male	subadult	8/7/1999	Spread Crk, BTNF	research	on site	WYGF
344	male	subadult	8/11/1999	Game Crk, BTNF	research	on site	WYGF
213	female	adult	8/12/1999	Wapiti Crk, GNF	research	on site	IGBST
			8/26/1999	Wapiti Crk, GNF	research	on site	IGBST
345	male	adult	8/20/1999	Gros Ventre, BTNF	management	Oxbow Crk, YNP	WYGF
G64	male	subadult	8/22/1999	Obsidian Crk, YNP	management	removal	YNP
270	female	adult	8/27/1999	Bull Moose Crk, BTNF	management	Sunlight Crk, SNF	WS/WYGF
G65	female	yearling	8/28/1999	Bull Moose Crk, BTNF	management	Sunlight Crk, SNF	WS/WYGF
G66	male	yearling	8/27/1999	Bull Moose Crk, BTNF	management	Sunlight Crk, SNF	WS/WYGF
346	female	subadult	8/28/1999	Outlet Crk, TNF	research	on site	IGBST
347	male	subadult	9/1/1999	Dry Ridge, TNF	management	Mirror Plateau, YNP	WS/WYGF
185	male	adult	8/31/1999	Dunior River, Pr-WY	management	Parque Crk, SNF	WYGF
348	male	adult	9/6/1999	Carter Mtn, State-WY	management	Grassy Lake Rd, GTNP	WYGF
349	female	adult	9/16/1999	Gibbon River, YNP	research	on site	IGBST
287	male	adult	10/10/1999	Cascade Crk, YNP	research	on site	IGBST

[a] BTNF = Bridger-Teton National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, SNF = Shoshone National Forest, TNF = Targhee National Forest, YNP = Yellowstone National Park, Pr = private land.

[b] IGBST = Interagency Grizzly Bear Study Team, USGS; MTFWP = Montana Fish, Wildlife and Parks; WS = Wildlife Services – AHPIS; WYGF = Wyoming Game and Fish.

a)



b)

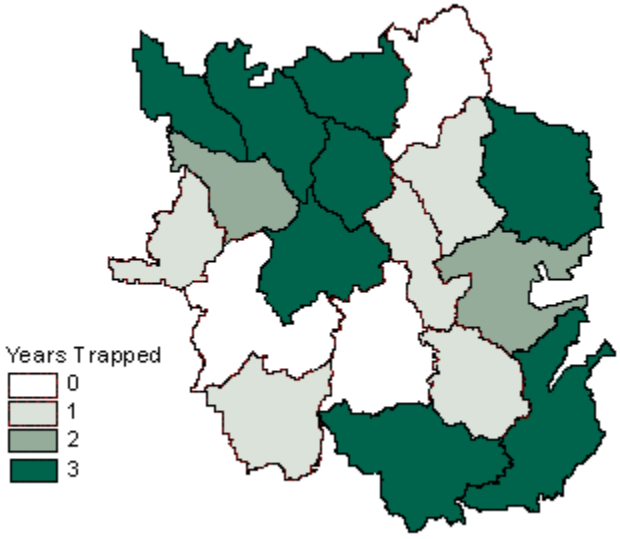


Figure 1. Bear Management Units (BMUs) in which research trapping efforts were conducted during 1999 (a), and within in the last 3 years (b). Trapping efforts by the Wyoming Game and Fish Department (WYGF) that occurred just outside the Recovery Zone boundary but were immediately adjacent to the Recovery Zone were considered part of the adjacent BMUs for this figure.

Table 2. Annual record of grizzly bears monitored, captured, and transported since 1980.

Year	Number monitored	Individuals trapped	Total captures		
			Management	Research	Transports
1980	34	28	0	32	0
1981	43	36	35	30	31
1982	46	30	25	27	17
1983	26	14	18	0	13
1984	35	33	22	20	16
1985	21	4	5	0	2
1986	29	36	31	19	19
1987	30	21	10	15	8
1988	46	36	21	23	15
1989	40	15	3	14	3
1990	35	15	13	4	9
1991	42	27	3	28	4
1992	41	16	1	15	0
1993	43	21	8	13	6
1994	60	43	31	23	28
1995	71	39	28	26	22
1996	76	36	15	25	10
1997	70	24	8	20	6
1998	58	35	8	32	5
1999	65	42	16	31	13

Table 3. Bear identification number, sex, age, offspring, and status of grizzly bears radio monitoring during 1999 in the Greater Yellowstone Area.

Bear	Sex	Age	Offspring	Monitored		Current status	Transported
				Out of den	Into den		
103	M	Adult		Yes	No	Unresolved[a]	No
128	F	Adult	1 COY	Yes	Yes	Active	No
179	F	Adult	3 COY	No	No	Cast	No
185	M	Adult		No	Yes	Active	Yes
211	M	Adult		Yes	No	Cast	No
212	M	Adult		Yes	Yes	Active	No
213	F	Adult	None	Yes	No	Cast	No
214	F	Adult	None	Yes	No	Cast	No
219	M	Adult		No	No	Cast	No
224	M	Adult		No	Yes	Active	No
251	M	Adult		Yes	No	Cast	No
264	F	Adult	2 COY, lost both May	Yes	Yes	Active	No
270	F	Adult	2 yearlings	No	Yes	Active	Yes
278	M	Adult		Yes	No	Cast	No
287	M	Adult		No	Yes	Active	No
289	F	Adult	None	Yes	Yes	Active	No
290	M	Adult		Yes	No	Cast	No
291	M	Adult		Yes	Yes	Active	No
292	M	Adult		Yes	Yes	Active	No
295	F	Adult	2 COY, lost both btwn 6-10/99	Yes	Yes	Active	No
296	F	Adult	1 COY	Yes	Yes	Active	No
298	F	Adult	2 COY	Yes	Yes	Active	No
299	M	Adult		Yes	No	Cast	No
304	M	Subadult		Yes	No	Cast	No
308	F	Adult	1 COY	Yes	Yes	Active	No
309	M	Adult		Yes	Yes	Active	No
310	M	Adult		Yes	No	Cast	No
311	F	Adult	2 yearlings	Yes	No	Cast	No
312	M	Subadult		No	Yes	Active	Yes
313	M	Subadult		Yes	Yes	Active	No
314	M	Adult		Yes	No	Cast	No
315	F	Subadult	None	Yes	Yes	Active	No
316	F	Adult	2 COY	Yes	Yes	Active	No
317	M	Adult		Yes	No	Cast	No
319	M	Subadult		Yes	No	Cast	No
320	M	Adult		Yes	No	Missing	No
321	F	Adult	None	Yes	No	Cast	No
322	F	Subadult	None	Yes	Yes	Active	No
323	M	Subadult		Yes	No	Battery failure	No
324	M	Subadult		Yes	No	Dead	No
325	F	Subadult	None	Yes	Yes	Active	Yes
326	M	Subadult		No	No	Dead	Yes

Table 3. Continued.

Bear	Sex	Age	Offspring	Monitored		Current status	Transported
				Out of den	Into den		
327	F	Adult	None	No	Yes	Active	Yes
328	M	Adult		No	Yes	Active	No
329	M	Adult		No	No	Cast	No
330	M	Adult		No	No	Cast	No
331	F	Subadult	None	No	No	Cast	No
332	F	Adult	2 yearlings	No	No	Unresolved[a]	No
333	M	Subadult		No	Yes	Active	No
334	F	Subadult	None	No	Yes	Active	Yes
335	M	Adult		No	Yes	Active	No
336	M	Adult		No	Yes	Active	No
337	F	Subadult	None	No	No	Cast	No
338	M	Subadult		No	No	Cast	No
339	M	Adult		No	Yes	Active	Yes
340	M	Subadult		No	Yes	Active	No
341	M	Adult		No	No	Cast	No
342	F	Adult	None	No	Yes	Active	No
343	M	Subadult		No	No	Cast	No
344	M	Subadult		No	Yes	Active	No
345	M	Adult		No	Yes	Active	Yes
346	F	Subadult	None	No	Yes	Active	No
347	M	Subadult		No	Yes	Active	Yes
348	M	Adult		No	Yes	Active	Yes
349	F	Adult	None	No	Yes	Active	No

[a] These collars were not retrieved in 1999, the sites will be visited as soon as possible in 2000 to determine status.

Unduplicated Females *(Mark Haroldson, Interagency Grizzly Bear Study Team)*

Knight et al. (1995) detailed the procedures used to determine whether observed females with COY were unique. Appendix F of the Grizzly Bear Recovery Plan (USFWS 1993) 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." Here we report data for counts of unduplicated females with COY following this revised rule.

During 1999, we identified 33 unique females accompanied by 63 COY in the Greater Yellowstone Area. Three females were initially observed outside the Recovery Zone; 1 of these females was observed more than 10 miles from the Recovery Zone boundary (Figure 2). Including all females, the average litter size at initial observation was 1.9. Using only females sighted within the Recovery Zone and the 10-mile perimeter area, 61 total COY were observed and average litter size remained 1.9. The current running 6-year average (1994-99) for unduplicated females with COY within the Recovery Zone and the 10-mile perimeter area is 28 (Table 4). The 6-year average for total number of COY and average litter size observed at initial sighting were 58 and 2.1, respectively (Table 4).

Of the 33 female with COY classified as unduplicated, 48% (16) were initially sighted by ground observers while 21% (7) were sighted during IGBST observation flights (Table 5). The low percentage of females sighted during observation flights in 1999 likely reflects the late spring and poor sightability due to persistent snow cover in high-elevation open habitats.

Unduplicated females with COY were observed in 10 of 18 BMUs within the Recovery Zone (Figure 2) during 1999. During the last 3 years (1997-99), only the Henrys Lake and Plateau BMUs did not contain observations of a female with COY (Figure 3).

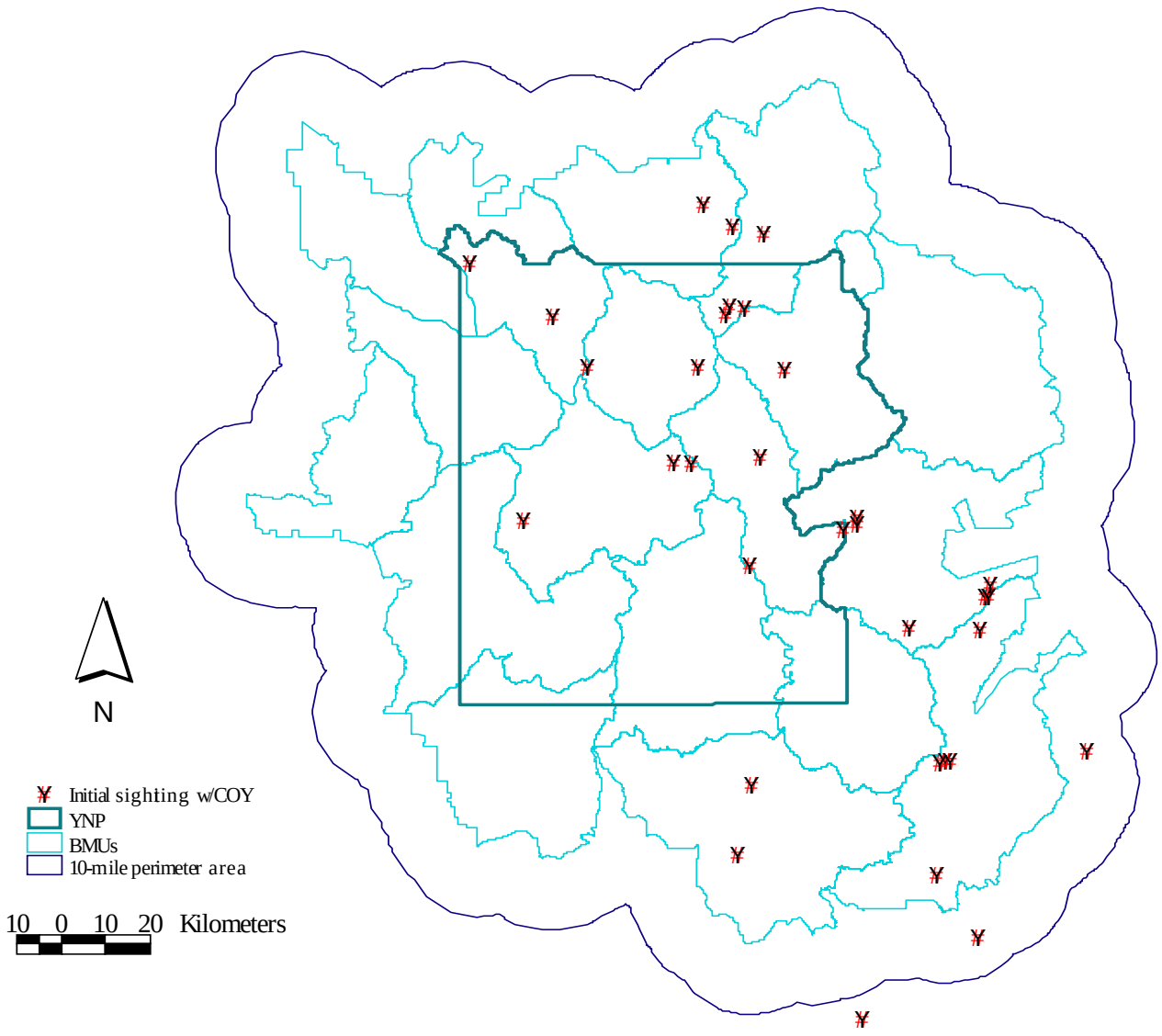


Figure 2. Distribution of initial observations of unduplicated female grizzly bears with cubs-of-the-year in the Greater Yellowstone Area during 1999.

Table 4. Number of unduplicated females with COY, number of COY, and average litter size at initial observation for the years 1973-99 in the Greater Yellowstone Area. Six-year running averages were calculated using only unduplicated females with COY observed in the Recovery Zone and the 10-mile perimeter area. Averages differ slightly from previous reports where running averages were calculated using all unduplicated females in the Greater Yellowstone Area.

				6-Year running averages		
Year	Female with COY[a]	Total # of cubs	Mean litter size	Female with COY	Cubs	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[b]	16	29	1.8	16	32	1.9
1990	25	58	2.3	18	36	2.0
1991[c]	24	43	1.9	20	41	2.0
1992	25	60	2.4	20	43	2.1
1993[b]	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[b]	33	63	1.9	28	58	2.1

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

Table 5. Numbers of sightings of unduplicated female grizzly bears with cubs-of-the-year (COY) by method of observation, 1986-99.

Year	Observation flights[a]		Ground sightings	Radio flights/trap	Total
	IGBST and Wyoming	Other			
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

[a] IGBST = Interagency Grizzly Bear Study Team, Other = female with COY seen during non-IGBST research flights by qualified observers.

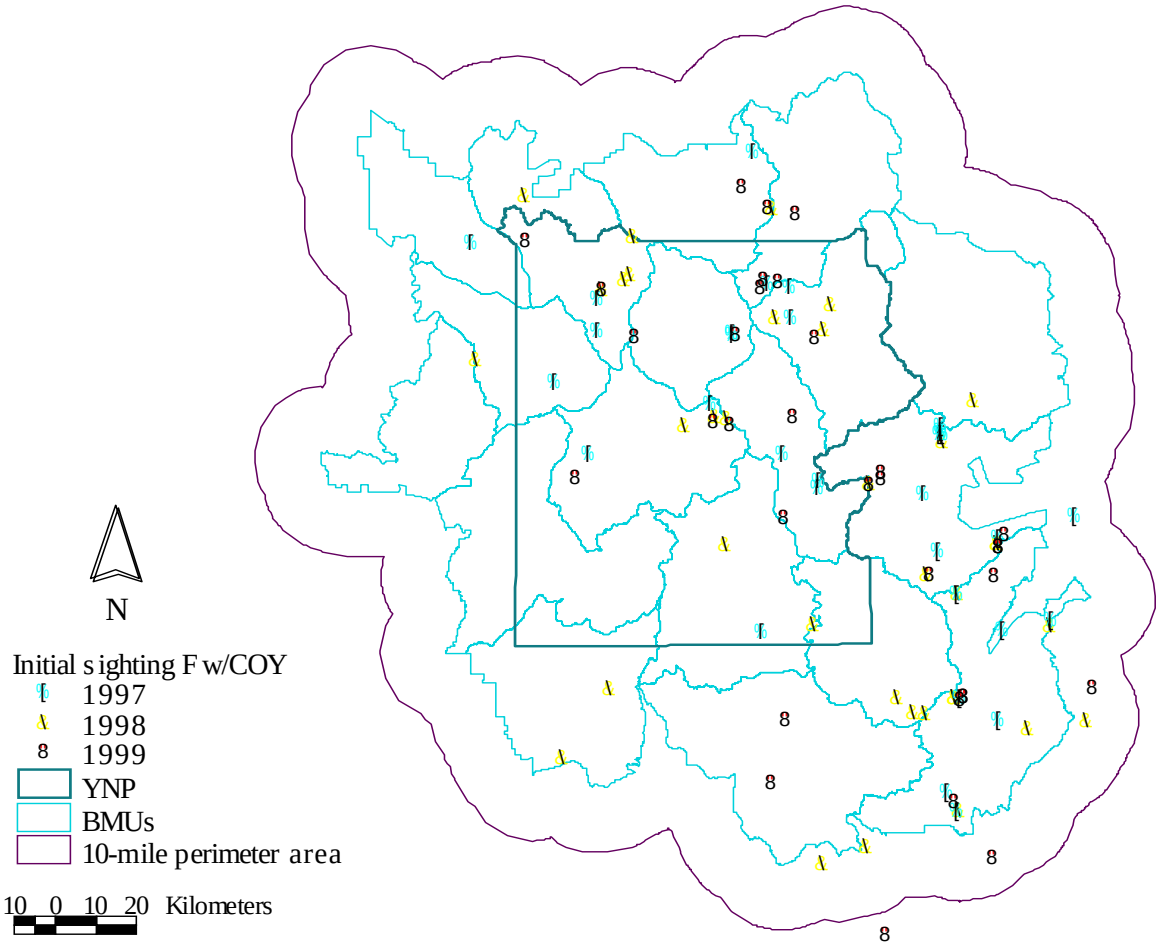


Figure 3. Initial sightings of unduplicated females with COY in the Greater Yellowstone Area, 1997-99.

Occupancy of BMUs 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) include occupancy of 16 of the 18 BMUs by females with young on a running 6-year sum with no 2 adjacent BMUs unoccupied. Seventeen of 18 BMUs had verified observations of female grizzly bears with young during 1999 (Table 6). Eighteen of 18 BMUs contained verified observations of females with young in at least 2 years of the last 6-year period. The occupancy database was carefully scrutinized in 1999; data contained in Table 6 have been updated from previous annual reports based on original records of verified observations.

Table 6. Bear Management Units occupied by females with young (cubs-of-the-year, yearlings, 2-year-olds, or young of unknown age), as determined by verified reports, 1994-99.

Bear Management Unit	1994	1995	1996	1997	1998	1999	Years occupied
1) Hilgard	X	X		X		X	4
2) Gallatin	X	X	X	X	X	X	6
3) Hellroaring/Bear				X		X	2
4) Boulder/Slough		X	X	X		X	4
5) Lamar	X	X	X	X	X	X	6
6) Crandall/Sunlight		X		X	X	X	4
7) Shoshone	X	X	X	X	X	X	6
8) Pelican/Clear	X	X	X	X	X	X	6
9) Washburn	X		X	X	X	X	5
10) Firehole/Hayden	X	X	X	X	X	X	6
11) Madison	X			X	X	X	4
12) Henry's Lake		X		X	X		3
13) Plateau	X					X	2
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	4
Totals	13	13	12	17	14	17	

Evaluation of a Capture-Mark-Recapture Estimator to Determine Grizzly Bear Numbers and Density in the Greater Yellowstone Area *(Charles C. Schwartz, Interagency Grizzly Bear Study Team)*

During 1999, we evaluated the application of a capture-mark-recapture (CMR) technique to estimate grizzly bear numbers in the ecosystem. We modified the protocol from 1998 as recommended in last year's annual report (Schwartz 1999). Basically, observation flights were conducted earlier in the year, prior to bears moving to cutworm moth (*Euxoa auxiliaris*) sites. Details of the technique are discussed in Schwartz (1999).

Methods

We followed the basic methods described by Miller et al. (1987, 1997). Annually, the IGBST attempts to maintain a sample of about 35-40 radio-marked bears within the ecosystem. In 1999, during the months of June and July, we had approximately 51 marked bears within the Recovery Zone boundaries and the 10-mile perimeter area. We used these bears as our sample of marked individuals (M_i) within the population.

We used fixed-wing aircraft to systematically survey the search area. We repeated these searches twice, here referred to as "survey rounds". Searches were constrained to an area in size to permit the pilot and observer adequate time to visually inspect most open habitats during about a 2-hour survey flight. The Recovery Zone for the Yellowstone grizzly bear (USFWS 1993), plus a 10-mile perimeter area around the Recovery Zone represented our "study area" (Figure 4). Our study area was divided into 27 bear observation areas (BOAs). Ten of the BOAs were too large to search during a single flight, so they were subdivided into 2 areas. Consequently, there were 37 search areas.

During a survey round, each BOA was searched once during the early morning. The observer and pilot recorded all bears and groups ($\geq$1) of bears observed during a search. A group of bears was defined as more than 1 individual within 100 m of another. Most often groups >1 were females with dependent young. For each bear sighted, the observer recorded location, vegetation type, group size, and whether the bear was in sunshine or shade when observed. For each bear spotted, the observer turned on the radio-receiver and determined if the animal was radio-collared. Observed radio-collared bears represented recaptured marks (m_i). Following the completion of a search, the pilot and observer then radio-tracked and located all marked bears in the search area. We used these radio-tracking flights to determine the numbers of marks available (M_i) and account for closure. We tallied observations from all BOAs within a round to generate m_i, M_i, and n_i.

Round 1 began on 6 June and ended 28 June 1999. Round 2 began on 8 July and ended on 4 August 1999. Pilots were instructed to fly adjacent areas on subsequent days to minimize movements of marked bears among survey areas.

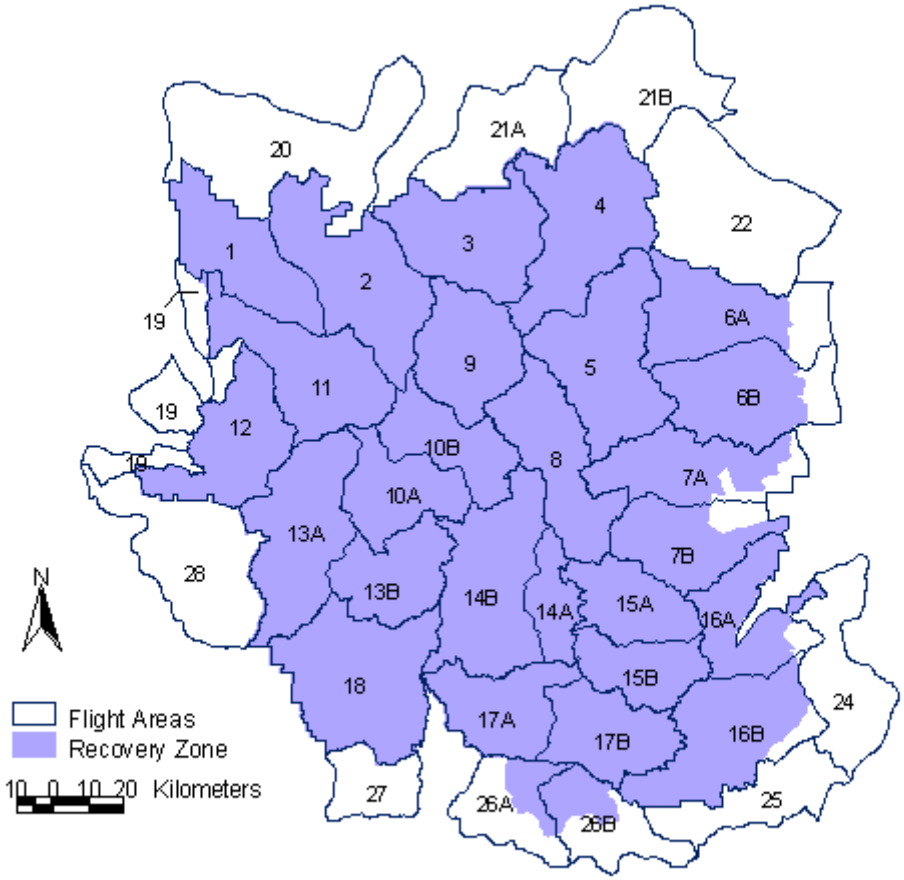


Figure 4. Observation flight areas within the Greater Yellowstone Area, 1999. The numbers represent the 27 bear observation areas. Those units too large to search during a single flight were further subdivided into 2 units. Consequently, there were 37 search areas.

We used the Lincoln-Petersen estimate derived by Chapman (1951) as described by White and Garrott (1990). We used the computer program NOREMARK (White 1996) to generate our estimates. Data are presented for both rounds combined into a single estimate using the hypergeometric maximum likelihood estimate (JHE) (Bartmann et al. 1987, White and Garrott 1990, Neal et al. 1993).

Assumptions and biases.--Details of the assumptions and biases associated with the technique can be found in Schwartz (1999). During 1998, we had concerns that our estimates were biased because of unequal distribution of bears within the ecosystem. Principally, we were concerned about bears at cutworm moth sites. This resulted in a possible bias of marked bears being seen less than unmarked individuals, resulting in an overestimate of the population. We know that in the southeast part of the ecosystem bears feed on army cutworm moths in open alpine scree habitats. These bears have a very high sightability compared to bears elsewhere in the ecosystem, based on observations of radio-marked bears. O'Brien and Lindzey (1998) estimated the visibility of bears on moth sites from fixed-wing aircraft was 0.85-0.92 of bears known to have been feeding at the site based on ground observations. Additionally, we had few radio-marked bears that utilized moth sites. The consequence of this uneven distribution of marks was a potential overestimation of the population. Consequently, we modified the protocol to conduct the survey prior to bears moving to these sites. In 1999, we surveyed in June and July, rather than July and August as in 1998.

Results and Discussion

We flew a total of 79.7 hours during round 1 and observed 40 bears in 24 groups. The mean group size was 1.67. None of the bears observed was radio-collared and 29 collared bears were determined to be within the search area. Likewise, we flew 74.5 hours during round 2 and observed 26 groups with 45 bears. The mean group size was 1.73. One bear observed was radio-collared and 31 marks were determined to be within the search area. For our estimate, we used "groups" rather than individuals as total animals seen during searches because of the lack of independence among individuals within a group. Consequently, our estimates are for "groups of bears". We used mean group size to extrapolate to total bear numbers.

Our estimate of all bear groups in the entire study area (Recovery Zone plus 10-mile perimeter area) was 1,530 groups. The 95% confidence interval for this estimate ranged from 369 to 26,377 groups. Mean group size for both rounds of survey was 1.7. The total number of bears, generated by multiplying the group size estimate times the lower bound of the confidence interval was 627 bears.

The CMR technique offers the ability to generate an unbiased estimate of bear numbers if all assumptions are met. We feel this year's protocol nearly met that criterion. We experienced problems similar to 1998 with relocating all collared bears presumed to be in the search areas. Our previous tracking and collaring efforts indicated that we had 39-47 radio-collared bears in the ecosystem during the 2 survey rounds. However, during the radio-tracking portion of observation flights, only 29 and 31 marked bears were located.

Some bears were obviously missed. This reduced M_i with the consequence of an underestimation of the population. Additionally, spring came late to the ecosystem in 1999. During round 1 of observation flights, many areas were still snow covered and bear sightability seemed much lower than what we observed in 1998. Also our recapture rate was deplorably low (1.67%). With such low recapture rates, the certainty about our estimate was understandably poor. We do not believe that our recapture rate reflects differences in the behavior or location of collared versus uncollared bears. Marked bears were relocated in similar habitats to those of uncollared bears. Likewise, collared bears when tracked did not exhibit behavioral traits that suggested fear of the aircraft or hiding behavior. Although we have no quantitative data to test or prove it, we have no reason to think that the sightability of unmarked bears differed from our marks. Because of poor spring conditions, we recommend that the IGBST continue for at least 1 more year to evaluate the potential application of this CMR estimator to determine grizzly bear numbers in the Greater Yellowstone Area. However, unless we increase the number of marks available or increase the number of rounds, we will likely generate another estimate with a high degree of uncertainty.

Grizzly Bear Mortalities *(Mark Haroldson, Interagency Grizzly Bear Study Team)*

We continue to use the definitions provided in Craighead et al. (1988) to classify grizzly bear mortalities in the Greater Yellowstone Area. Thus those cases in which a carcass is physically inspected or when a management removal occurs are classified as "known" mortalities. Those instances where substantial evidence exists to suggest a mortality has occurred but no carcass is found are classified as a "probable" mortality. When evidence that a mortality has occurred is circumstantial, with no strong evidence and no prospect for additional information a "possible" mortality is designated.

We documented 9 known, 5 probable, and 2 possible grizzly bear mortalities during 1999 (Table 7). Of these, 6 known, 1 probable, and 2 of the possible mortalities were human-caused. The 2 possible mortalities resulted from the known death of a female grizzly bear accompanied by 2 COY. This incident occurred on 2 October. By definition (Craighead et al. 1988), COY that are orphaned after 1 July are classified as possible mortalities.

The Grizzly Bear Recovery Plan (USFWS 1993, pages 41-44) provided criteria for determining if know 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 mortalities within the Yellowstone Grizzly Bear Recovery Zone and a 10-mile perimeter area count against mortality quotas. The U.S. Fish and Wildlife Service has clarified this oversight with an amendment to the Recovery Plan.

During 1999, 5 of the known human-caused grizzly bear mortalities occurred within the Recovery Zone and the 10-mile perimeter area. The single human-caused mortality that occurred greater than 10 miles outside the recovery zone was a management removal of an adult male involved in cattle depredation for the second time. Using the Grizzly Bear Recovery Plan (USFWS 1993) criteria, 5 human-caused grizzly bear mortalities, including 1 female, apply to the calculation of mortality thresholds for 1999. Thus both total human-caused and female mortalities were under annual mortality thresholds (Table 8).

Six natural mortalities, including 2 known and 4 probable losses, involved COY. Evidence suggested that 2 known cub losses were likely due to predation by bears. Four probable cub losses involved 2 radio-collared females, that each lost a litter of twins during the spring of 1999. An additional known grizzly bear mortality due to unknown cause was discovered on 2 October. Bear #326 had been captured and relocated on 27 April. Aerial telemetry indicated the bear was active until 6 May. Aerial searches lost contact with bear #326 until he was reacquired on 28 June, at which time telemetry indicated a stationary collar. Researchers visited the location on 2 October and found the scavenged remains of bear #326 near a daybed. Investigation of the carcass and the site revealed no evidence as to cause of death.

Table 7. Grizzly bear mortalities documented during 1999 in the Greater Yellowstone Area.

Bear	Sex	Age	Date	Location[a]	Type	Cause
Unm	Unk	COY	4/26-6/30	Firehole River, YNP	Probable	Natural, unknown cause, 1 of 2 cubs of bear #295
Unm	Unk	COY	4/26-6/30	Firehole River, YNP	Probable	Natural, unknown cause, 1 of 2 cubs of bear #295
277	M	Adult	5/6	Blackrock Creek, BTNF	Known	Human-caused, illegal
326	M	Subadult	5/6-6/28	Five Mile Creek, SNF	Known	Unknown, found near daybed 10/2, cause undetermined
Unm	Unk	COY	5/19-23	Gardners Hole, YNP	Probable	Natural, unknown cause, 1 of 2 cubs of bear #264
Unm	Unk	COY	5/19-23	Gardners Hole, YNP	Probable	Natural, unknown cause, 1 of 2 cubs of bear #264
Unm	F	COY	6/11	Lewis Canyon, YNP	Known	Natural, probable predation by bear
Unm	M	COY	6/15	Taylor Fork, GNF	Known	Natural, probable predation by bear
269[b]	M	Adult	7/13	Crow Creek, BTNF	Known	Human-caused, management removal, cattle depredation
G64	M	Subadult	8/22	Obsidian Creek, YNP	Known	Human-caused, management removal, camp marauder
324	M	Subadult	9/1	S Fork Buffalo River, BTNF	Known	Human-caused, hunter killed in camp
Unm	Unk	Adult	9/1	Fox Creek, BTNF	Probable	Human-caused, hunter shot bear in camp, no carcass
Unm	F	Adult	10/2	Crow Creek, SNF	Known	Human-caused, hunter killed charging female, 2 COY
Unm	Unk	COY	10/2	Crow Creek, SNF	Possible	Human-caused, 1 of 2 COY, mother killed by hunter
Unm	Unk	COY	10/2	Crow Creek, SNF	Possible	Human-caused, 1 of 2 COY, mother killed by hunter
Unm	M	Subadult	10/19	Dunoir River, SNF	Known	Human-caused, illegal

[a] BTNF = Bridger-Teton National Forest, GNF = Gallatin National Forest, SNF = Shoshone National Forest, YNP = Yellowstone National Park.
[b] Occurred >10 miles outside the Recovery Zone.

Table 8. Annual count of unduplicated females with cubs-of-the-year (COY) and known human-caused grizzly bear mortality within the Recovery Zone and the 10-mile perimeter area, 1990-99. Calculations of mortality thresholds (USFWS 1993) do not include mortalities or unduplicated females with cubs documented outside the 10-mile perimeter area.

								U.S. Fish and Wildlife Service Grizzly Bear Recovery Plan mortality thresholds				
		Known human-caused mortality			Known human-caused mortality 6-year running averages				Total human-caused mortality		Total female mortality	
Year	Unduplicated females with COY	Total	Total female	Adult female	Total	Total female	Adult female	Minimum population estimate	4% of minimum population	Year result	30% of total mortality	Year result
1990	25	9	6	4	4.8	2.7	1.5	204	8.1		2.4	
1991	24	0	0	0	4.0	2.2	1.2	222	8.9		2.7	
1992	25	4	1	0	3.8	1.8	1.0	259	10.4		3.1	
1993	19	3	2	2	3.8	1.8	1.0	244	9.8	Under	2.9	Under
1994	20	10	3	3	4.7	2.0	1.5	219	8.7	Under	2.6	Under
1995	17	17	7	3	7.2	3.2	2.0	178	7.1	Exceeded	2.1	Exceeded
1996	33	10	4	3	7.3	2.8	1.8	226	9.0	Under	2.7	Exceeded
1997	31	7	3	2	8.5	3.3	2.2	270	10.8	Under	3.2	Exceeded
1998	35	1	1	1	8.0	3.3	2.3	344	13.8	Under	4.1	Under
1999	32	5	1	1	8.3	3.2	2.2	348	13.9	Under	4.2	Under

Annual Home Range Size and Movements *(Greg Holm, Wyoming Game and Fish Department)*

During 1999, we located 34 bears (19 females, 15 males) at least once during each of 3 tracking seasons (spring, summer, and fall) and ≥12 times throughout the entire year. Minimum convex polygon home ranges for these bears ranged from 58 to 2,640 km^2 (Table 9). A lone female (bear #342) displayed the smallest home range size (58 km^2) of any individual, while a subadult male (bear #338) had the largest home range (2,640 km^2). Females with yearlings displayed the smallest home range size ($\bar{x}$ =137 km^2; SD = 85; n = 8) of any cohort, while subadult males had the largest home ranges ($\bar{x}$ = 848 km^2; SD = 910; n = 6). However, when the extremely large home range size of subadult male bear #338 was excluded, adult males had the largest home range size ($\bar{x}$ = 785 km^2; SD = 519; n = 9).

Bear #338 displayed a home range that was dramatically larger than all other bears during 1999. This was primarily due to 2 long-distance movements. Bear #338 was not located for approximately 2 months, from late August to late October. When he was located in October he had made a 63-km movement to the southeast, traveling from the northeast portion of Yellowstone Lake to the upper end of Thorofare Creek (Bridger-Teton National Forest). During the third week of November bear #338 then traveled 55 km due west from Thorofare Creek to the Big Game Ridge area in Yellowstone National Park. Although bear #338's home range was extremely large, the boundary completely surrounded Yellowstone Lake, making the usable portion of his home range much smaller than 2,640 km^2. Only 4 other grizzly bears, all adult males, displayed home ranges that were greater than 1,000 km (Table 9). The greatest movement recorded in 1 day was 26 km for grizzly bear #103, an adult male that made a fall movement from the west side of the Washburn Range to Trout Creek (Yellowstone National Park). Adult male #329 made a 15-km 1-day movement during summer, and adult female #295 made an 8-km 1-day movement during the spring tracking season. The farthest movement between successive locations was 77 km and 70 km for bear #328. During a bear population survey in the summer season bear #328 was located 70 km south of Wapiti Ridge area, where he had been located 5 days earlier and had resided since his capture. Three weeks passed before he was relocated 77 km north of his previous southern location, back in the vicinity of Wapiti Ridge. While it is possible that bear #328 was misidentified far south of his normal home range, movements of this magnitude are not impossible and do occur, especially among adult male bears.

We calculated the mean distance (km) traveled per day per animal across cohorts during 1999 (Table 10). While average movement rates between tracking seasons (all cohorts combined) were very similar, the greatest mean seasonal movement occurred during the summer ($\bar{x}$ = 1.21 km; SD = 0.5). Both the fall ($\bar{x}$ = 1.06 km; SD = 0.6), and spring ($\bar{x}$ = 1.05 km; SD = 0.3) movement rates were very similar. During both spring and fall of 1999, adult and subadult males exhibited the greatest rates of movement. However, during the summer, adult males exhibited the largest movement rates, followed closely by subadult females.

Table 9. Annual range sizes (km^2) of grizzly bears located ≥12 times and during all 3 seasons of 1999.

Cohort	ID	Number of locations	MCP[a]	1975-87 Cohort mean MCP	(SD)
Females					
Adult	----	----	156[b]	281	(196)
With cubs	128	21	88	231	(136)
	179	20	222		
	296	19	148		
	298	24	304		
	308	18	150		
	316	29	115		
With yearlings	332	14	225	338	(244)
Lone adult	213	18	80	236	(114)
	214	15	121		
	264	17	88		
	289	22	199		
	295	18	149		
	321	18	82		
	327	22	315		
	342	15	58		
Subadult	315	35	327	365	(191)
	322	27	436		
	325	25	371		
	334	24	224		
Males					
Adults	103	26	1,527	874	(630)
	224	15	1,358		
	290	20	1,212		
	291	24	576		
	309	12	235		
	328	24	1,048		
	329	13	218		
	335	31	197		
	336	25	697		
Subadult	304	20	910	698	(598)
	313	22	442		
	333	24	548		
	338	13	2,640		
	340	20	346		
	344	15	199		

[a] Minimum Convex Polygon.
[b] Mean range size for all adult female bears.

Table 10. Seasonal rates of movement for radio-marked grizzly bears during 1996-99.

		Mean km/day/animal					
						1975-87	
Season	Cohort	1996	1997	1998	1999	Mean	SD
Spring	Adult females with COY	0.6	0.9	0.9	0.9	0.7	(0.3)
	Females with yearling	N/A	2.2	0.2	0.7	1.1	(0.7)
	Lone adult females	1.2	1.5	1.1	0.9	1.0	(0.6)
	Unknown adult females	0.5	0.1	1.1	N/A	N/A	N/A
	Subadult females	0.4	2.2	0.7	1.0	N/A	N/A
	Adult males	0.8	2.3	1.1	1.1	1.3	(0.8)
	Subadult males	0.8	0.3	0.9	1.6	1.1	(0.6)
Summer	Adult females with COY	0.9	0.6	1.6	1.2	1.3	(1.0)
	Females with yearling	N/A	2.1	0.9	0.6	1.7	(0.9)
	Lone adult females	0.5	1.1	1.8	1.0	1.3	(0.7)
	Unknown adult females	0.6	N/A	1.7	0.9	N/A	N/A
	Subadult females	1.2	1.6	1.5	1.7	N/A	N/A
	Adult males	1.8	2.4	1.7	1.9	1.9	(1.1)
	Subadult males	1.7	1.6	1.5	1.1	1.1	(0.9)
Fall	Adult females with COY	0.7	1.0	1.5	1.2	1.2	(1.0)
	Females with yearling	N/A	1.4	1.3	0.1	1.6	(0.9)
	Lone adult females	0.2	2.1	0.8	0.7	1.0	(0.7)
	Unknown adult females	0.5	N/A	1.1	N/A	N/A	N/A
	Subadult females	0.7	1.1	0.5	1.0	N/A	N/A
	Adult males	1.0	1.1	1.6	1.8	1.4	(0.8)
	Subadult males	0.8	1.0	1.0	1.6	1.1	(0.8)

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 the carrion of ungulates (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 Greater Yellowstone Area 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 1999, we surveyed 25 routes in ungulate winter ranges to monitor the relative abundance of spring ungulate carcasses.

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

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).

Northern Range

We surveyed 13 routes on Yellowstone's Northern Range totaling 233.5 km traveled. We counted 39 elk carcasses, which equated to 0.17 carcasses/km (Table 11). We observed grizzly bear sign at 1 carcass site, black bear sign at 1 site, and sign from undetermined bear species at 3 carcass sites. We observed wolf sign at 5 carcass sites. Percentages of ungulate carcasses visited by bears, wolves, and unknown large scavengers are presented in Table 11. Numbers of carcasses found by sex and age class are presented in Table 12.

Table 11. Carcasses found and percent of carcasses visited by bears, wolves, and unknown large scavengers along surveyed routes in Yellowstone National Park during spring, 1999.

	Elk				Bison				
		% Visitation by species				% Visitation by species			
Survey area (# routes)	No. carcasses	Bear	Wolf	Unknown	No. carcasses	Bear	Wolf	Unknown	Total carcass/km
Firehole (8)	27	19	7	59	11	27	0	55	0.46
Norris (4)	9	11	0	78	2	0	0	0	0.65
Heart Lake (3)	5	0	0	60	0	N/A	N/A	N/A	0.16
Northern Range (13)	39	13	13	87	0	N/A	N/A	N/A	0.17

Table 12. Age classes and sex of carcasses found, by species and area, along surveyed routes in Yellowstone National Park during spring, 1999.

	Elk (n = 80)					Bison (n = 13)				
	Northern Range	Firehole	Norris	Heart Lake	Total	Northern Range	Firehole	Norris	Heart Lake	Total
Age										
Adult	12	13	1	2	28	0	3	2	0	5
Yearling	5	3	5	1	14	0	7	0	0	7
Calf	10	7	2	0	19	0	0	0	0	0
Unknown	12	4	1	2	19	0	1	0	0	1
Sex										
Male	3	6	2	0	11	0	1	1	0	2
Female	13	16	3	1	33	0	2	0	0	2
Unknown	23	5	4	4	36	0	8	1	0	9

Firehole River Area

We surveyed 8 routes in the Firehole River area totaling 82.5 km. We counted 27 elk and 11 bison on these routes, which equated to 0.46 carcasses/km traveled (Table 11). We observed grizzly bear sign at 3 carcass sites, black bear sign at 1 site, and evidence of use by an undetermined species of bear at 4 carcass sites. We observed wolf sign at 2 carcasses.

Norris Geyser Basin

We surveyed 4 routes in the Norris Geyser Basin totaling 17 km. We counted 9 elk and 2 bison carcass, which equated to 0.65 carcasses/km traveled (Table 11). We found evidence of use by an undetermined bear species at 1 of the carcass sites (Table 11).

Heart Lake

We surveyed 3 routes in the Heart Lake thermal basin covering 32 km. We counted 5 elk carcasses equating to 0.16 carcasses/km. All carcasses were used by coyotes or other unidentified large scavengers (Table 11).

Winter Severity Index

According to the WSI, the winter of 1998-99 presented average conditions (Figure 5). There were more ungulate carcasses observed than in the previous year, and our index of carcass abundance was lower in 1998-99 compared to the relatively severe winter of 1996-97 (Figure 6). We found a significant correlation between the WSI and numbers of carcasses found on the Northern Range ($R^2 = 0.75$, $n = 7$, $F = 16.82$, $P = 0.009$) and in the Norris and Firehole Geyser Basins ($R^2 = 0.71$, $n = 12$, $F = 24.72$, $P = 0.001$). We will continue these surveys for at least 2 more years, in part to determine if the strong relationship between the number of observed carcasses and the WSI persists.

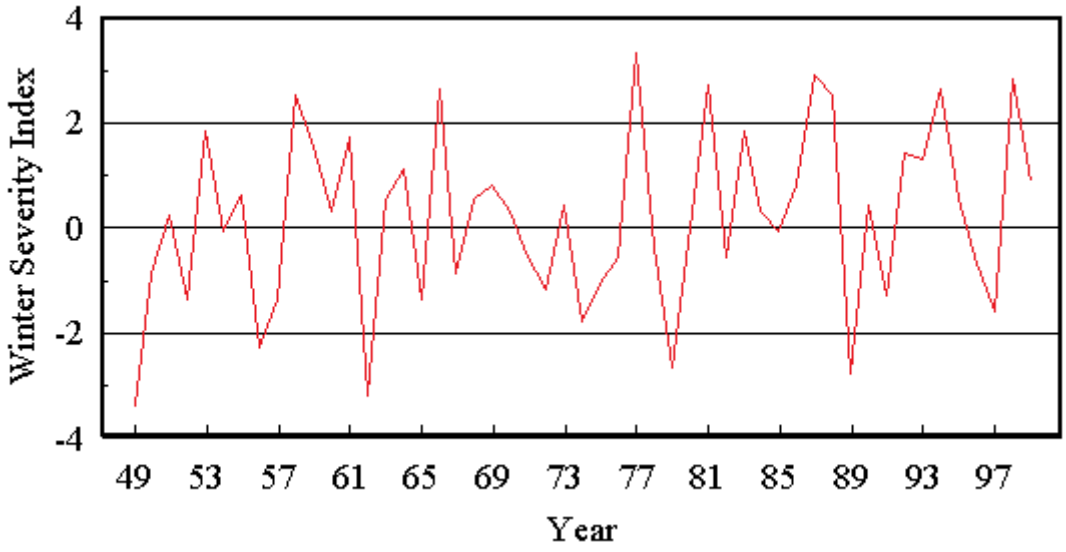


Figure 5. Winter Severity Index (WSI) for elk on the Northern Range, Yellowstone National Park, 1948-99. WSI values of 3 to 4 indicated very mild winters, 0 average, and –3 to –4 very severe winters. A WSI value for 1999 represents the winter of 1998-99.

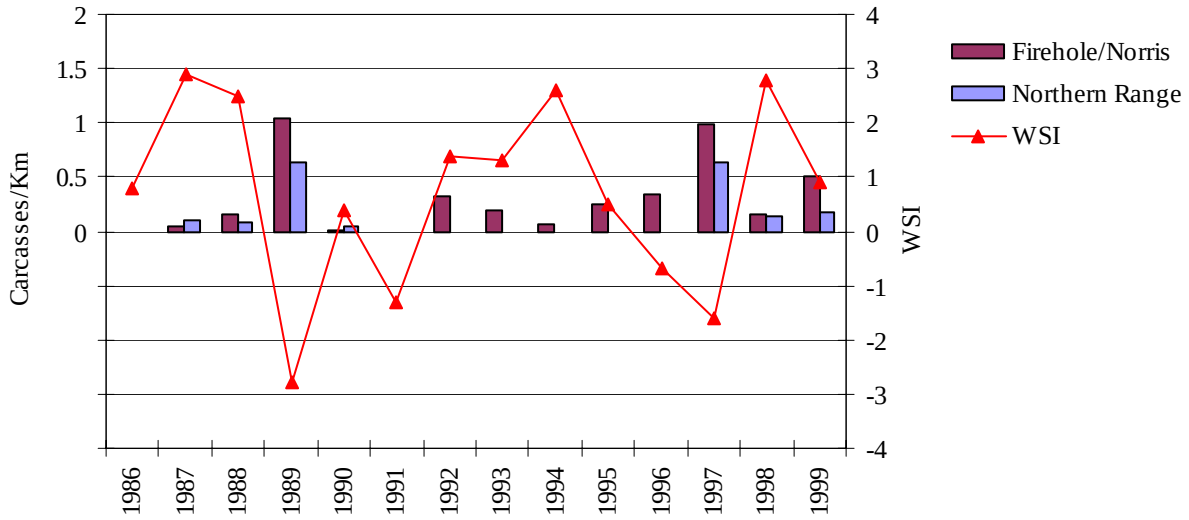


Figure 6. Winter Severity Index (WSI) derived for elk on the Northern Range and ungulate carcasses/km along transects in 2 survey areas, Yellowstone National Park, 1986-99. A WSI for 1999 represents the winter of 1998-99.

Spawning Cutthroat Trout Numbers on Tributary Streams to Yellowstone Lake and Grizzly Bear use of Spawning Trout *(Mark Haroldson and Shannon Podruzny, Interagency Grizzly Bear Study Team; Dan Reinhart and Kerry Gunther, Yellowstone National Park; Lisette Waits and Chris Cegleski, University of Idaho)*

Grizzly bear use of spawning cutthroat trout in small tributary streams of Yellowstone Lake has been well-documented (Hoskins 1975, Mealey 1980, Reinhart 1990, Mattson and Reinhart 1995). During 1994, non-native lake trout were discovered in Yellowstone Lake. Estimates suggest that lake trout have been in Yellowstone Lake for 10 to 30 years (J. Ruzycki, Aquatic Resources, Yellowstone National Park, personal communication). 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 that utilize cutthroat trout as food, including the threatened grizzly bear (Schullery and Varley 1996). This is due to the fact that lake trout live and spawn in deep water and are mostly unavailable to avian and terrestrial predators.

Since the early 1990s, resource managers in the Yellowstone National Park have observed a downward trend in numbers of spawning cutthroat trout and associated grizzly bear use on some front country streams (Reinhart et al. In press). It is unknown whether these trends are an anomaly associated with increased use by people in the vicinity of these front country streams, an effect of the 1988 fires, or are related to the presence of lake trout. In 1997, the IGBST in cooperation with Yellowstone National Park began a study to determine if similar trends were evident throughout the Yellowstone Lake tributary system. We were also interested in estimating the minimum number of grizzly bears in the Greater Yellowstone Area population that feed on cutthroat trout and may be impacted by a decline in trout numbers. Reinhart (1990) and Haroldson et al. (1998) have previously described the study area and methods. Results of the 1999 field surveys are presented here. We also briefly summarize results from our effort to enumerate individual grizzly bears from hair samples collected at cutthroat trout spawning streams during 1997-99.

We surveyed 13 front and 13 backcountry streams in 4 different areas of Yellowstone Lake during 1999 (Figure 7). The ice was gone from Yellowstone Lake by 17 May, and we observed the first spawning activity on 24 May (Table 13). The latest spawning activity we observed on surveyed streams occurred on 17 August. We documented the mean peak number of spawning cutthroat trout in the Lake and West Thumb streams on 15 June and 17 June, respectively. East shore streams lagged behind West shore streams by approximately a month; average dates for peak numbers were 10 July and 14 June for east and west shore streams, respectively, excluding Trail Creek, an east shore stream. Spawner numbers peaked in Trail Creek on 24 June.

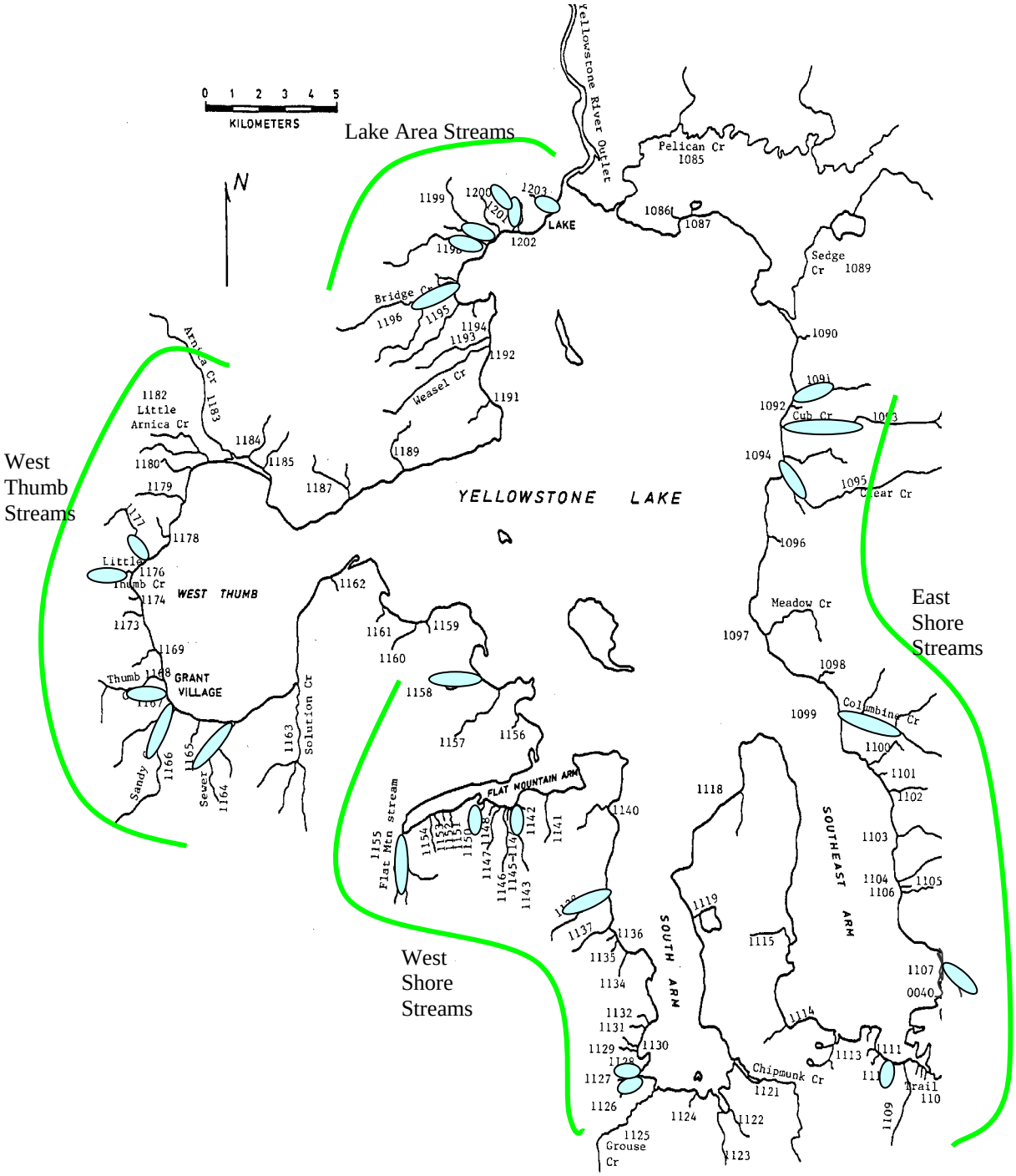


Figure 7. Location of cutthroat trout spawning streams surveyed for fish numbers and grizzly bear use during 1999.

Table 13. Beginning, peak, and ending dates and peak number of spawning cutthroat trout observed by stream, 1999.

Stream name (SONYEW number)	Beginning date	Peak date	Peak number	End date
Front country streams				
Lake Area streams				
Lodge Creek (1203)	5/24	6/21	29	6/28
Hotel Creek (1202)	no fish observed			
Hatchery Creek (1201)	5/31	6/14	94	7/5
Incinerator Creek (1199)	6/14	6/14	5	6/21
Bridge Creek (1196)	5/31	6/14	438	7/5[a]
Wells Creek (1198)	6/7	6/14	49	7/5
West Thumb Area streams				
Stream 1167 (1167)	6/10	6/10	22	6/24
Sandy Creek (1166)	6/10	6/17	86	7/15[a]
Sewer Creek (1164)	6/10	6/10	24	7/1
Little Thumb Creek (1176)	6/17	6/24	152	7/15
Stream 1177 (1177)	6/11	6/23	59	7/25
Backcountry streams				
East shore				
Little Creek (1091)	6/17	6/29	56	7/13
Cub Creek (1093)	7/1	7/13	855	8/10
Clear Creek (1095)	7/6	7/13	4,429	8/17
Columbine Creek (1099)	7/6	7/13	1,249	8/17
Foam Creek (1107)	7/6	7/13	99	7/27[a]
Trail Creek (1112)	6/17	6/24	111	8/3
West shore				
East Eagle Creek (1126)	6/2	6/15	79	6/30
West Eagle Creek (1127)	6/9	6/15	40	7/7[a]
Stream 1138 (1138)	6/3[b]	6/15	648	7/28[a]
Flat Mountain Creek (1155)	6/3[b]	6/15	1,398	8/10[a]
Stream 1150 (1150)	6/9	6/15	89	7/21[a]
Delusion Lake Outlet (1158)	6/3[b]	6/10	28	6/17[a]

[a] Last survey date, generally <4 fish observed.
[b] Data indicated that the cutthroat spawn had begun prior to initiation of surveys.

When we averaged peak spawner numbers on east and west shore backcountry streams for the current study (1997-99), they were similar to numbers observed during 1985-87 (Figure 8). We also did not observe a difference between spawner numbers on front country streams surveyed in the Lake area when compared to previous studies. However, streams in the West Thumb area continued to show a substantial reduction in average peak numbers of spawning trout when compared to the previous study period (Figure 8).

Lake trout abundance continues to be a likely explanation for the observed decline in cutthroat trout spawner numbers in the West Thumb area. Numbers of netted lake trout grew from 2 in 1994 to 7,792 during 1998. A total of 5,748 lake trout were netted during 1999. Most of the netting effort and 96% of the lake trout captures occurred in the West Thumb area (Jeff Lutch, Aquatic Resources, Yellowstone National Park, personal communication). Most deep-water hydro-acoustic targets also point to higher lake trout densities in the West Thumb area (J. Ruzycki, Aquatic Resources, Yellowstone National Park, personal communication). As of 1999, lake trout have also been caught in the furthest extent of all arms of Yellowstone Lake (Dan Mahony, Aquatic Resources, Yellowstone National Park, personal communication).

We measured bear tracks discovered during each stream survey to estimate the minimum number of unique bears that visited and foraged on a particular stream during the spawning period (Table 14). However, these values represent only an index to the number of unique individual bears using surveyed streams because we cannot determine if an individual visits more than 1 stream. Track data suggests that more bears visited backcountry streams, which exhibited higher peak numbers of spawning fish, than front country streams, which contained fewer fish.

Methodology used for DNA extraction from hair samples and identification of individual grizzly bears that visited cutthroat trout spawning streams are described in Haroldson et al. (1999). During 1997-99, 85 individual bears have been identified from hair samples obtained in association with cutthroat trout spawning streams (Table 15). Sixty-nine bears have only been identified from samples in 1 out of 3 years, 12 individuals have been identified as having been at streams in 2 years, and 4 individual have been identified in all 3 years of the study. During 1999, approximately 46% (n = 17) of the cutthroat trout spawning streams on which bear fishing activity is known to occur were sampled for bear hair. The highest number of individual grizzly bears identified was 44 and coincided with our expanded effort in 1999.

Although we originally intended to conclude this effort in 1999, we will continue spawning stream surveys and hair collection efforts during the 2000 field season to provide an additional year of hair sampling for DNA analysis. It is our intention to try to identify as many individual grizzly bears as possible that potentially use spawning cutthroat trout as a seasonal food. An additional year of data collection might also allow us to use additional models to derive an annual estimate of the total number of grizzly bears that visit cutthroat trout spawning streams.

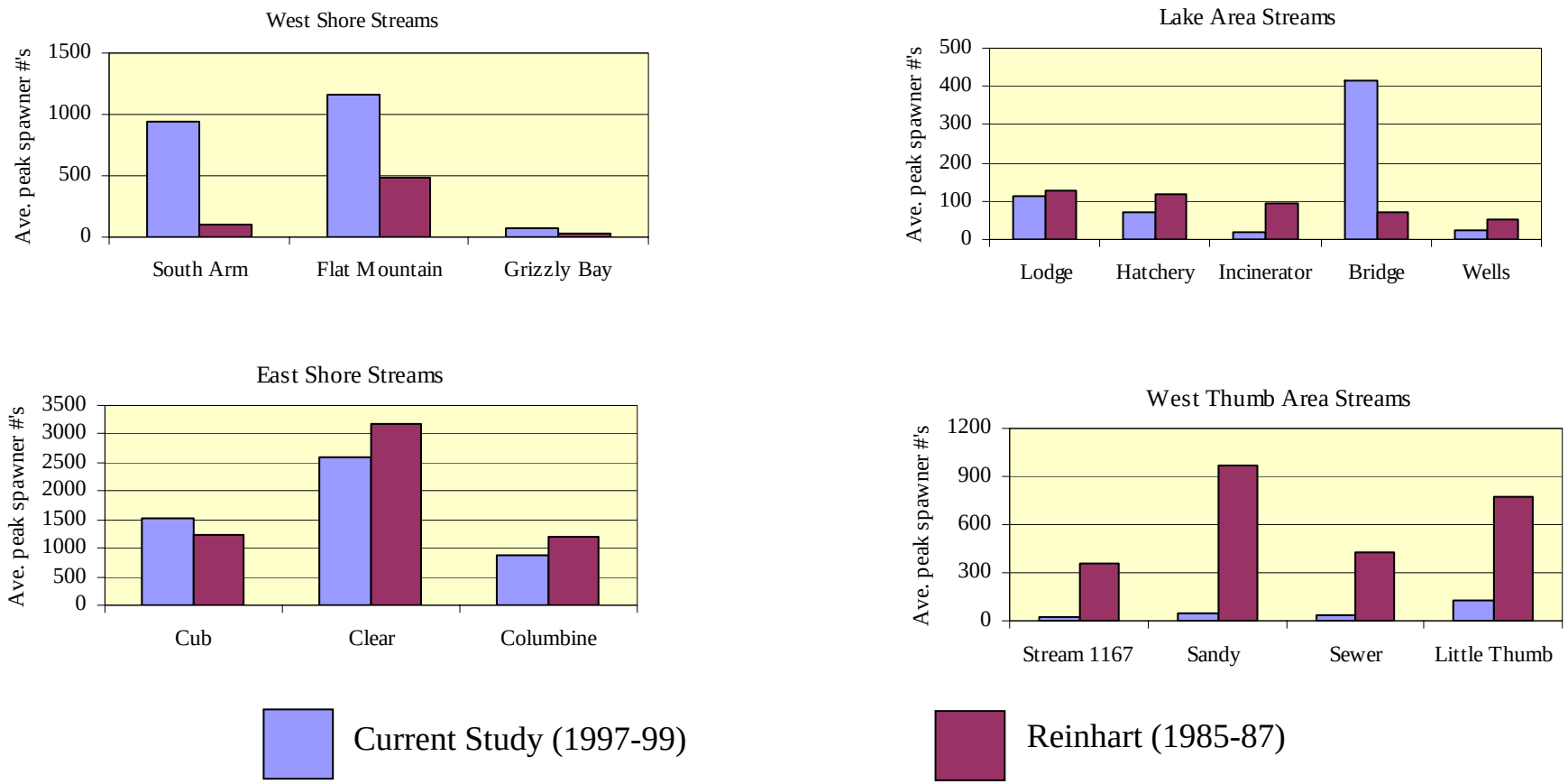


Figure 8. Comparisons of average peak numbers of spawning cutthroat trout between study periods for 4 different areas of Yellowstone Lake

Table 14. Estimated number of bears[a] by species as indicated by detailed track analysis, and number of hair samples collected using hair collection corrals (HCC) by stream during 1999.

Stream (SONYEW number)	Number of grizzly bears	Number of black bears	Hair samples collected
Front country streams			
Lake Area streams			
Lodge Creek (1203)	1	0	0
Hotel Creek (1202)	0	0	no HCC
Hatchery Creek (1201)	0	0	0
Incinerator Creek (1199)	0	0	no HCC
Bridge Creek (1196)	2	0	18
Wells Creek (1198)	0	0	no HCC
West Thumb Area streams			
Stream 1167 (1167)	0	0	no HCC
Sandy Creek (1166)	2	0	1
Sewer Creek (1164)	2	1	5
Little Thumb Creek (1176)	2	1	24
Stream 1177 (1177)	2	2	24
Backcountry streams			
East shore			
Little Creek (1091)	3	0	48
Cub Creek (1093)	4	2	73
Clear Creek (1095)	3	1	48
Columbine Creek (1099)	3	2	37
Foam Creek (1107)	2	2	18
Trail Creek (1112)	3-4	2	71
West shore			
East Eagle Creek (1126)	3	2	39
West Eagle Creek (1127)	2	2	no HCC
Stream 1138 (1138)	5	3	67
Stream 1143	3	1	12
Flat Mountain Creek (1155)	4-5	3	69
Stream 1150 (1150)	2	0	28
Delusion Lake Outlet (1158)	0	0	4

[a] Number of bears using each stream does not sum to a definite number of bears visiting spawning streams as movements of bears between streams are not considered.

Table 15. Summary of bear hair samples collected at cutthroat trout spawning streams and analyzed for individual identification, 1997-99.

Year	# Streams sampled	# Hair samples collected	# Hair samples with > 10 stands	# Samples DNA extracted	Species identification		# Samples identified to individual grizzly	# Individual grizzly bears	Cumulative # of unique grizzly bears
					Grizzly bear	Black bear			
1997	10	360	193	143	101	42	65	22	22
1998	12	332	173	158	113	45	96	39	51
1999	17	529	318	301	238	63	179	44	85

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

Army cutworm moths were first recognized as an important food source for grizzly bears in the Greater Yellowstone Area 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 typified as 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 might be possible that size and location of these sites fluctuates 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 overlooked. The current method for defining moth aggregation sites is to inscribe a 1-km circle around clusters of observations where bears are observed feeding on insects in talus/scree habitats (Ternent and Haroldson 1999). This method allows trend in bear use of moth sites to be annually monitored by recording the number of bears documented in each circle (i.e., site). Monitoring bear presence within the unique boundary of each site would be more desirable than using a generic 1-km circle, but it is not possible because the location of each unique boundary is presently unknown. In fact, only a few sites have been investigated by actual ground reconnaissance. Besides monitoring trend in use each year, ongoing research is also attempting to answer other questions such as where do migrating moths originate and what are the implications for bears from agricultural moth control efforts (Robison 1999).

Presently, we know of 47 insect aggregation sites within the Greater Yellowstone Area. Additional sites are identified each year; and in 1999, 1 new site was documented (Table 16). The percentage of known sites with documented use by bears changes annually, suggesting that some years are better moth years than others (Figure 9). For example, the years 1993-95 were probably poor moth years because the percent of known sites used by bears (Figure 9) and the number of observations recorded at each site (Table 16) were low. These years also had substantially more nuisance management activity than other years. Use of insect aggregation sites by bears in 1999 was lower than what has been observed each year since 1996 (Table 16 and Figure 9). Since 1993, use increased in concert with our growing knowledge about insect aggregation sites, but in 1999, the percent use decreased, suggesting that use in 1999 was below average.

Table 16. The number of moth sites researchers were aware of each year, the number actually used by bears, and the total number of telemetry relocations or aerial observations of bears recorded at each site during 1986-99.

Year	# Moth sites known[a]	# Moth sites used[b]	# Locations or observations[c]
1986	6	2	10
1987	9	6	31
1988	12	7	62
1989	19	13	76
1990	23	12	133
1991	25	18	261
1992	31	22	139
1993	31	4	11
1994	33	15	41
1995	36	13	52
1996	39	22	148
1997	43	27	81
1998	46	30	156
1999	47	22	68
Total			1,269

[a] The year of discovery was considered the first year a telemetry location or aerial observation of a grizzly bear was documented at a site. Sites were considered known 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] Might include replicate sightings or telemetry relocations.

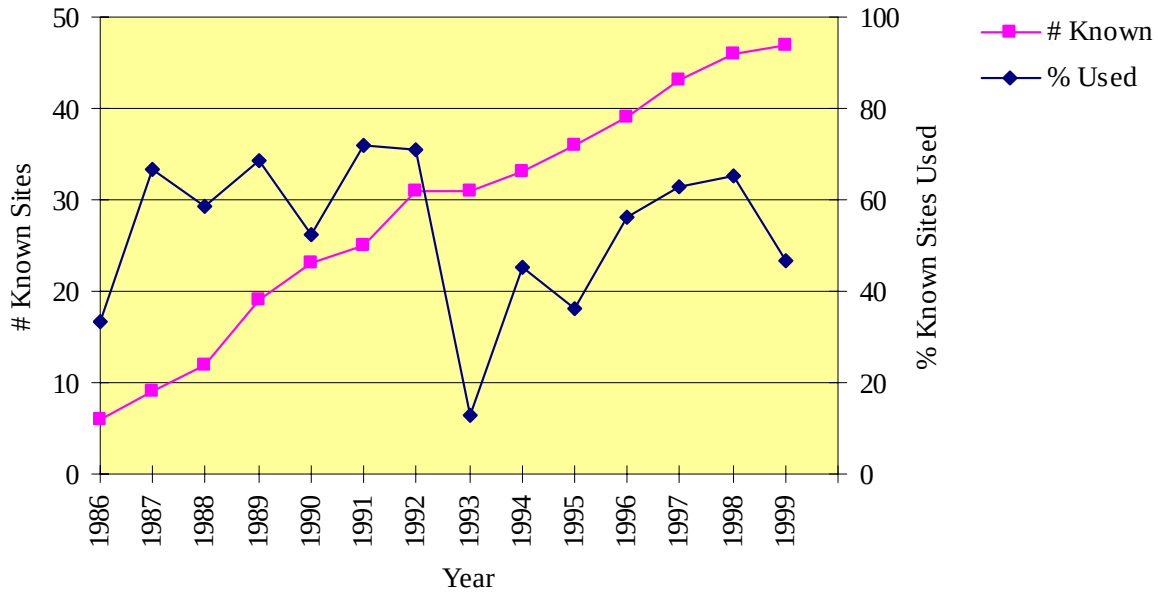


Figure 9. Annual number of known and suspected moth sites and percent of sites at which either telemetry relocations of marked bears or visual observations of unmarked bears were recorded, Greater Yellowstone Area, 1986-99.

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, 337 initial sightings of unduplicated females with COY were recorded, of which 88 (26%) occurred at (within 1 km, n = 68) or near (within 2 km, n = 20) moth sites (Table 17). Notably, peaks in the number of initial sightings recorded at moth sites correspond with annual trends in the total number of locations (Table 17) and the percent of moth sites with documented use (Figure 9). This further corroborates that 1993 to 1995 were poor moth years. In 1999, 7 (21%) of the 33 sightings of unduplicated females with COY were recorded at moth sites. This was slightly higher than the long-term average of 4.9, but less than what had been observed in the past 2 years (34-40%; Table 17).

Survey flights of insect aggregation sites obviously contribute to the count of unduplicated females with COY, however, the number of unique females initially observed at or near (within 2 km) moth sites is quite variable; ranging from 0 to 16 (0-62%) initial sightings per year since 1986 (Table 17). If these sightings are excluded, an increasing trend in the annual number of unduplicated sightings of female with COY is evident. This implies that some other factor besides observation effort at moth aggregation sites is responsible for the increase in sightings of female with cubs.

Table 17. Number of initial sightings of unduplicated females with cubs-of-the-year that occurred on or near moth sites, number of sites where such sightings were documented, and the mean number of sightings per site.

Year	Unduplicated females with COY[a]	Number of moth sites with an initial sighting[b]	Initial sighting of unduplicated females with COY			
			Within 1 km of moth site[b]		Within 2 km of moth site[c]	
			N	%	*N*	%
1986	25	1	1	4.0	2	8.0
1987	13	0	0	0.0	0	0.0
1988	19	1	2	10.5	2	10.5
1989	16	1	1	6.3	1	6.3
1990	25	3	3	12.0	3	12.0
1991	24	9	9	37.5	16	66.7
1992	25	5	6	24.0	11	44.0
1993	20	2	2	10.0	2	10.0
1994	20	2	4	20.0	5	25.0
1995	17	1	1	5.9	3	17.6
1996	33	7	7	21.2	9	27.3
1997	32	9	11	34.4	13	40.6
1998	35	12	14	40.0	14	40.0
1999	33	4	7	21.2	7	21.2
Total	337		68		88	
Mean	24.1	4.1	4.9	17.6	6.3	23.5

[a] Initial sightings of unduplicated females with COY; see Table 4.
[b] Moth site is defined as a 1-km-radius circle drawn around the average coordinates of a cluster of moth-related observations. Forty-seven sites have been identified as of 1999.
[c] Twice the distance of what is thought to represent a general moth site size, since some observations could be made of bears traveling to and from moth sites.

The Ecological Relationship Between Grizzly Bears and Army Cutworm Moths; First Year Summary *(Hillary Robison, PhD Candidate University of Nevada, Reno)*

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 population genetics.

Summer and fall 1999, was the first field season of a 3-year study to elucidate aspects of ACM ecology and population genetics that might 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 might help them make management decisions.

Background and Significance

In 1952, grizzly bears were found feeding on ACMs and ladybird beetles (*Coccinella* spp. and *Hippodamia* spp.) aggregated in alpine talus (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 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). 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 increase the importance of understanding the factors affecting ACM abundance at high elevation grizzly bear foraging sites.

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 grizzly bear population.

Biology of the army cutworm moth

The ACM is a native North American agricultural pest that is distributed 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 thousands of eggs per individual into the soil (Pruess 1967, Burton et al. 1980).

Project Objective

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

Genetic data have been used to answer migration questions, to differentiate species and subspecies 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). Weather data have been used to understand long-range migrations in the black cutworm (*Agrotis ipsilon*) (Domino et al. 1983, Showers et al. 1989). Female moths can be examined in order to determine if they are mated (K. Pruess, University of Nebraska-Lincoln, personal communication).

Determining ACM origins and site fidelity is important because pressures on ACMs in specific natal areas may affect moth recruitment and the numbers of adults reaching high elevation sites. Analysis of ACM genetic 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.

Managers will be able to use the information gathered in this study to help foresee the availability of ACMs to bears in high-elevation areas. This approach may prove more feasible in predicting ACM availability than visiting the remote aggregation sites.

Methods

At high elevations, crews use both backlight and pheromone traps from mid-July to late August to catch ACMs at moth aggregation sites. Crews collect moths for genetic and pesticide analyses, as well as for evaluation of female reproductive status. In addition, a sample of female ACMs are set aside for later analysis of reproductive status. Crews also collect weather data at high-elevation aggregation sites. Large-scale weather data are collected from the National Weather Service (NWS) (see Showers et al. 1989).

In the fall, crews trap ACMs in low-elevation agricultural areas. These trapping efforts will be coordinated with the ACM trapping programs of university agricultural extension services in Nebraska, Montana, South Dakota, and Wyoming. Montana State University agricultural extension agents trap ACMs throughout the fall and send moth samples from their respective trapping areas. Large-scale weather data are collected from the NWS.

Processing and analysis of ACM DNA collected from different geographic locations will take place in the Laboratory for Ecological and Evolutionary Genetics. Samples collected for pesticide residue analysis will be sent to and analyzed by the U.S. Geological Survey's Columbia Environmental Research Center (CERC) diagnostic lab. Determination of the reproductive status of captured female ACMs (Pruess 1967, Byers 1978) will take place at the University of Nevada, Reno.

Results

A crew visited 5 high-elevation moth aggregation sites in Wyoming. A total of 360 moth samples were collected for DNA analysis and 450 moth samples were collected for pesticide residue analysis. Weather data were collected at each site; large-scale weather data were collected from the NWS. For comparison with the Wyoming samples, ACM samples also were collected for DNA and pesticide residue analysis from a moth aggregation site which black bears use in New Mexico. Personnel from the Yellowstone National Park Bear Management Office visited potential moth sites in Yellowstone National Park to assess ACM presence. All samples collected for pesticide analysis

during the 1999 field season were sent to and analyzed by the CERC laboratory. A report detailing these findings was prepared (Lebo et al. 2000)

During September and October 1999, a total of 280 ACM samples were collected for DNA analysis from 9 agricultural areas in Montana, 4 in Wyoming, 1 in Nebraska, and 1 in South Dakota. Large-scale weather data were collected from the NWS.

The genetic and ecological data collected for this project are being compiled and analyzed at the University of Nevada, Reno over the next 3 years. Genetic work and data analysis are being carried out in the Laboratory for Ecological and Evolutionary Genetics at the University of Nevada, Reno. Analysis of weather data collected at sampling sites and from the National Weather Service is being carried out at the University of Nevada, Reno.

Funding sources: Rob and Bessie Welder Wildlife Foundation; Yellowstone National Park Foundation; American Museum of Natural History; U.S. Forest Service Region 1; Yellowstone National Park Bear Management Office; Interagency Grizzly Bear Study Team; Wyoming Game and Fish Department.

Cooperators: U.S. Forest Service Region 1; Yellowstone National Park Bear Management Office; Montana State University, Bozeman Agricultural Extension Agents; Wyoming Game and Fish Department.

Whitebark Pine Cone Production *(Mark Haroldson, Interagency Grizzly Bear Study Team)*

Whitebark pine cone production averaged 39.5 cones per tree during 1999 (Table 18). Only 5 of the 19 transects produced mean results lower than 20 cones per tree (Table 19). Transect G (Figure 10) on the Pitchstone Plateau produced no cones for the third consecutive year (Figure 11). Overall this was the second highest cone crop recorded since transects were initiated in 1980. The highest count averaged 49 cones per tree in 1989.

Grizzly bears make nearly exclusive use of whitebark pine seeds occurs during years in which mean cone production on transects exceeds 20 cones per 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 proximately to human activities during the fall. This often results in an increase in the incidence of management capture and transport (Figure 12), and human-caused mortality. During August through October of 1999, only 6 management captures involving bears 2 years of age or older (independent bears) resulted in transport of nuisance individuals. Of these 6 instances, only 1 occurred in the core of the Recovery Zone. Most (5 of 6) of the management actions occurred on the edge or outside the Grizzly Bear Recovery Zone: 2 events occurred outside the 10-mile perimeter area.

Table 18. Summary statistics for the 1999 whitebark pine cone production transects.

Total			Trees				Transects			
Cones	Trees	Transects	Mean cones	SD	Min.	Max.	Mean cones	SD	Min.	Max.
7,386	187	19	39.5	52.1	0	303	388.7	359	0	1,558

Table 19. Whitebark pine cone production transect results for 1999.

Transect	Cones	Trees	Mean	SD
A	123	9	13.7	10.7
B	361	10	36.1	31.1
C	199	9	22.1	14.8
D	174	9	19.3	19.6
F	507	10	50.7	37.1
G	0	10	0.0	0.0
H	296	10	29.6	21.9
J	75	10	7.5	12.9
K	495	10	49.5	31.1
L	568	10	56.8	53.5
M	568	10	56.8	66.7
N	1,558	10	155.8	100.4
O	220	10	22.0	12.5
P	110	10	11.0	9.6
Q	272	10	27.2	21.2
R	926	10	92.6	82.6
S	209	10	20.9	21.0
T	286	10	28.6	19.0
U	439	10	43.9	22.7

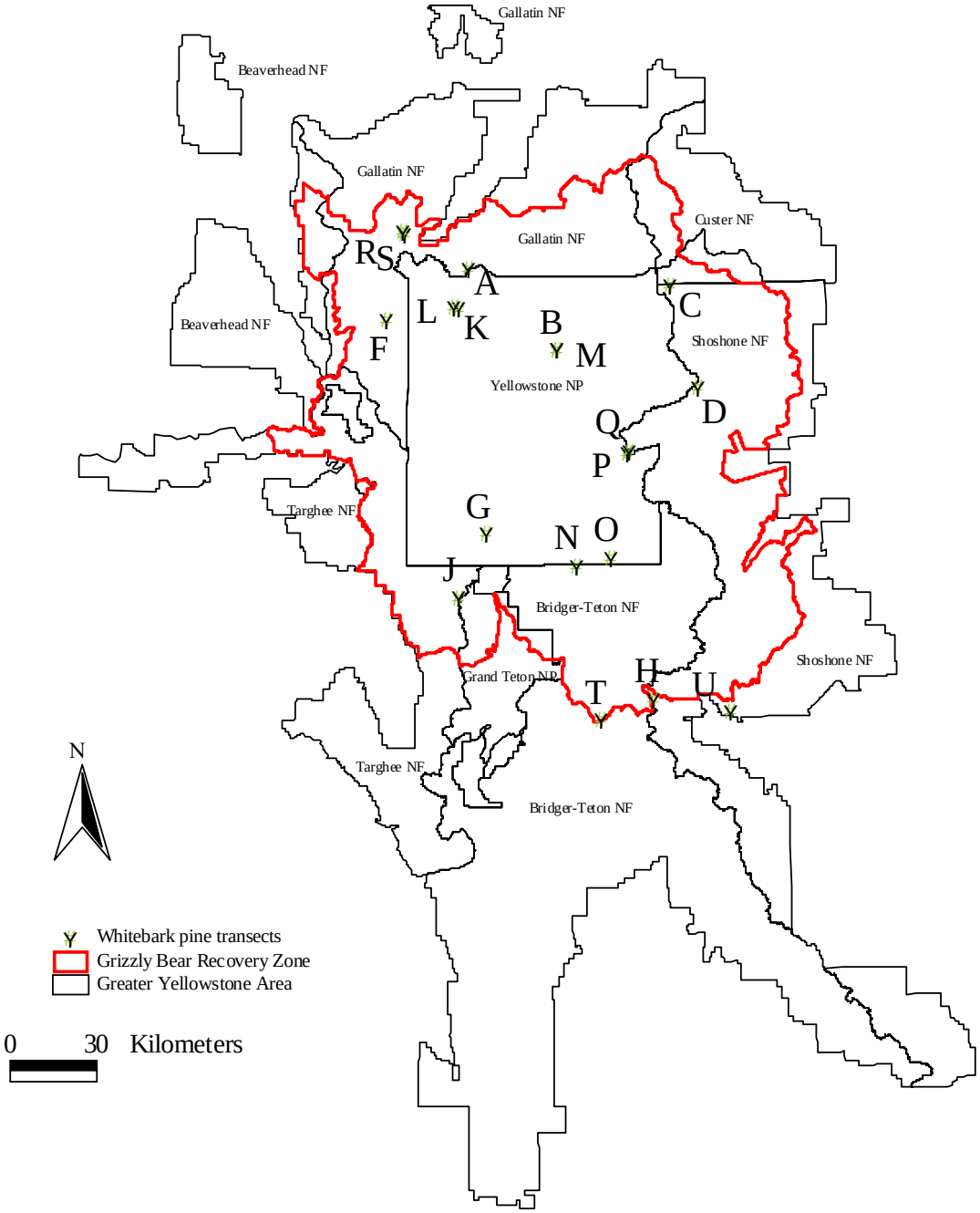


Figure 10. Location of whitebark pine cones production transects in the Greater Yellowstone Area.

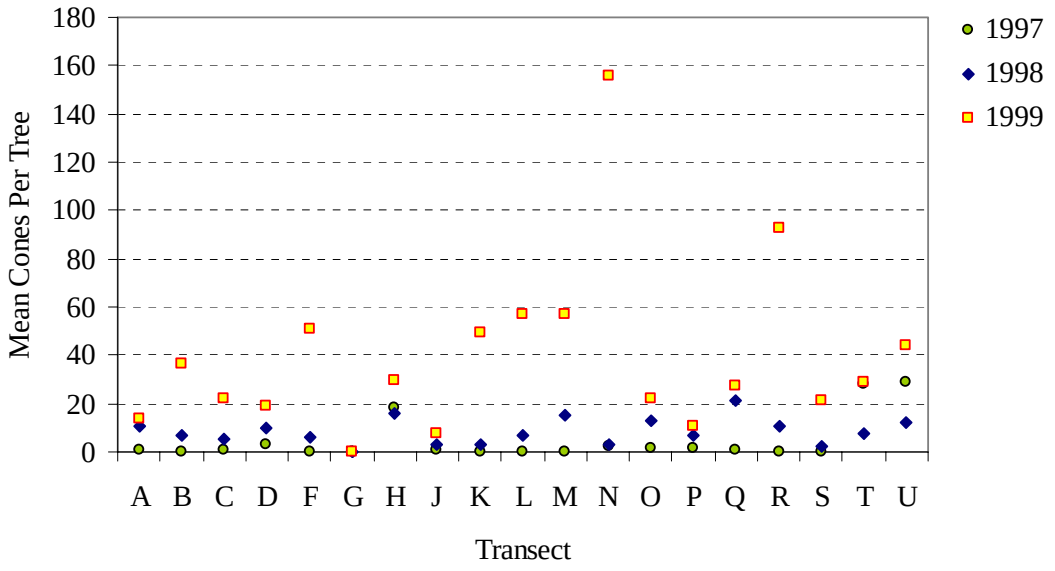


Figure 11. Mean cones per tree for 19 whitebark pine cone production transects conducted during 1997-99.

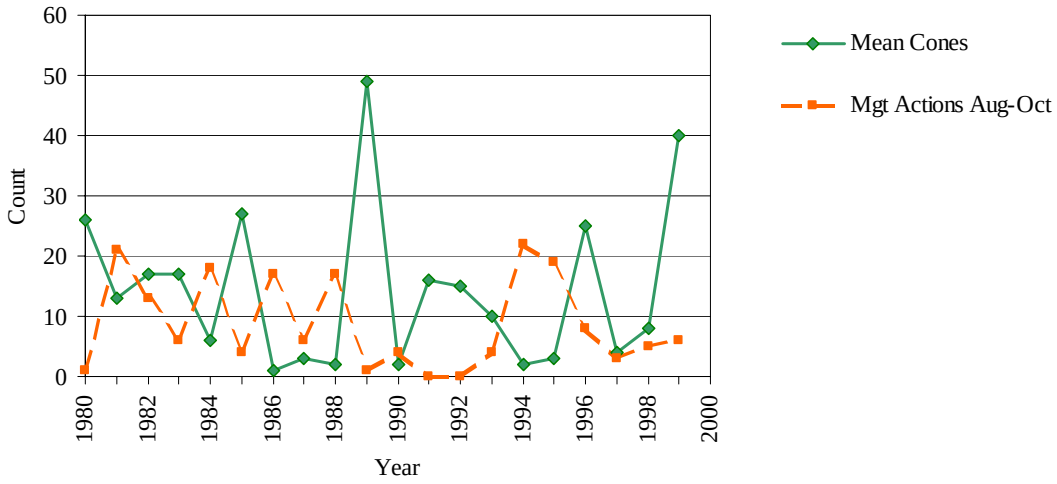


Figure 12. Relationship between mean whitebark pine cone production and the number of August through October management actions of grizzly bears older than yearlings in the Greater Yellowstone Area.

HABITAT MONITORING

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

In 1999, 3,131,381 people visited Yellowstone National Park. These visitors spent 679,230 use nights camping in developed area roadside campgrounds and 43,540 use nights camping in backcountry campsites. Average annual park visitation has increased each decade from an average of 333,835 visitors per year in the 1930s to an average of 3,023,916 visitors per year in the 1990s (Table 20). Average annual backcountry use nights have been less variable between decades than total park visitation, ranging from 39,280 to 47,395 user nights per year (Table 20). The number of backcountry user nights is limited by both the number and capacity of designated backcountry campsites in the park.

Table 20. Average annual visitation and average annual backcountry user nights in Yellowstone National Park by decade from 1931 through 1999.

Decade	Average annual parkwide visitation	Average annual backcountry user 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
1990-99	3,023,916	43,702

[a] Backcountry use data available for the years 1973-79.

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

In 1999, total visitation in Grand Teton National Park was 3,632,167 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 2,662,940. Backcountry user nights totaled 32,169. Long-term trends of total visitation and backcountry user nights by decade are shown in Table 21.

Table 21. Average annual visitation and average annual backcountry user nights in Grand Teton National Park by decade from 1951 through 1999.

Decade	Average annual parkwide visitation[a]	Average annual backcountry user 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
1990-99	2,662,940	20,663

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

The Effect of Environmental Variability on Grizzly Bear Habitat Use: Year One *(Doug Ouren, Interagency Grizzly Bear Study Team)*

The overall design of this project is to utilize existing data, expertise, and newly collected data from advanced technologies to evaluate the impact of anthropogenic influences on grizzly bear habitat selection. Initially, this study will have 3 areas of emphasis:

1) Impact of motorized and non-motorized trails on grizzly bear habitat selection.
2) Habitat selection by grizzly bears within Yellowstone National Park versus those outside of Yellowstone National Park.
3) Similarities and dissimilarities in delineating grizzly bear home ranges when collecting locational information with different technologies (e.g. Global Positioning System technology versus radio telemetry technology).

The first-year objective of this project was to deploy Global Positioning System (GPS) collars on grizzly bears in northern and northwestern portions of Yellowstone National Park and surrounding U.S Forest Service land. Acquisition of location data is the first step in addressing the emphasis areas. The collars selected for this project were Advanced Telemetry Systems (ATS), Isanti, Minnesota, GPS collars for large mammals. These collar are instrumented with a 12-channel GPS receiver and Very High Frequency (VHF) beacon and ATS's Wildlink remote release mechanism, which allows the collar to be removed from the air or the ground without handling the bear a second time.

The use of GPS technology provides many advantages including minimized handling of each bear, increased safety to researchers, reduction of the number of aircraft flights over the area of interest, reduced cost and the potential for locations around the clock. For the initial data collection period, the collars were programmed to collect locations every 7 hours. Thus, there was a potential of collecting a maximum of 3 locations each day as compared to VHF technologies where researchers obtained a location approximately once every 10 days.

The GPS unit on the collar utilizes the Navigation Satellite Timing and Ranging Global Positioning System (NAVSTAR) constellation of 24 satellites that are orbiting the earth. Each of these satellites is continuously transmitting radio signals to earth (Moen et al. 1996). Locational attempts by the GPS unit, if successful, result in 1 of 2 types of locations: a 2-Dimensional (2D) location or a 3-Dimensional (3D) location. A 3D location, requiring 4 satellites to be visible to the GPS instrument, provides longitude, latitude, and elevation. A 2D location, requiring 3 satellites to be visible to the GPS instrument yields a location fix with elevation determined by the last 3D location (Rempel et al. 1995). 3D locations are preferred as they provide the additional current elevation information. During the 1999 field season 54% of the locations were 3D and 46% of the locations were 2D. Data fields stored on the collar include date, time, location, and information related to the quality of a reported location (Table 22).

Table 22. Data fields downloaded from the ATS GPS collar.

Output data	Description
Date	UTC day/month/year and hour/min/sec UTC time
X Coordinate	UTM Northing
Y Coordinate	UTM Easting
Elevation	Elevation in meters
2D or 3D	Type of location
Satellite Print File	Satellite information
PDOP	Position dilution of precision
Time for fix	Amount of time, in seconds, required for fix

Position Dilution of Precision (PDOP) can be used as an initial assessment of GPS location quality. The PDOP is a calculated likelihood of location error based on the present position of satellites being tracked. In order for a location to be useful it must have a PDOP of less than 6 (Carroll et al. 1996). The PDOP values for the initial year ranged from 1 to 13 with an average of 4. Approximately 10% of the locations had a PDOP of greater than 6.

For this study, the IGBST was able to instrument 12 grizzly bears during the 1999 season. Of the 12 grizzly bears collared, 5 were adult females and 7 were males. The first collar was deployed on 6 May and the last collar was deployed on 12 August. Collars collected data throughout the non-denning season before they were remotely released. To date 9 of the 12 collars have been retrieved and data downloaded. Of the 3 remaining collars 1 was not retrieved because of inclement weather conditions and collar location, the second collar was dropped in or near the denning site and the third collar had a manufacturing error. On the third collar the release mechanism was epoxied to the data logger thus making it impossible for the release mechanism to work properly. The first 2 collars will be retrieved as soon as weather permits and there will be an attempt to capture the bear wearing the remaining collar.

The retrieved collars ranged in success of location acquisition rate from a high of 48% to a low of 0% with an average of 23% (Figure 13). This average is well below the reported average success of GPS location acquisition reported in literature (Moen et. al. 1996, Rempel and Rodgers 1997, Rempel et al. 1995, Moen et al. 1997), which is between 60 and 70%. Only preliminary data analysis has been completed at this time. Early results show that approximately 63% of the successful locations were collected when the bears were in a forested environment and 37% of the locations were collected while the bears were in a nonforested area. As previously mentioned, an advantage of using GPS technology is that the GPS receiver can be programmed to collect data at any time during the night or day. Data from the first year illustrate (Figure 14) that the GPS locations were gathered relatively uniformly throughout the day. This provides a more complete picture of grizzly bear habitat use compared to VHF data collected between 0600 and 1000 hours. More detailed analysis will be completed in the following year as more data become available.

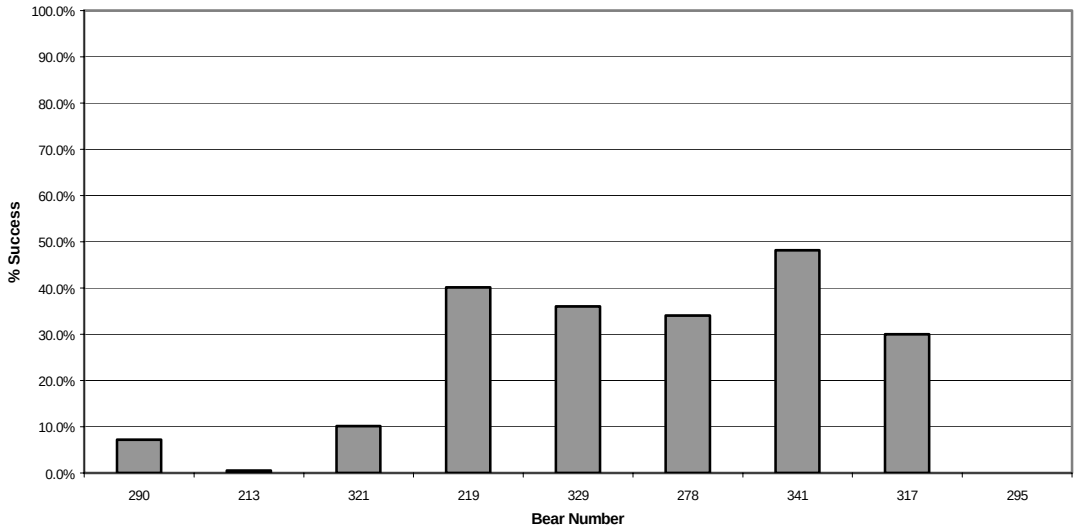


Figure 13. Success rates for GPS collars.

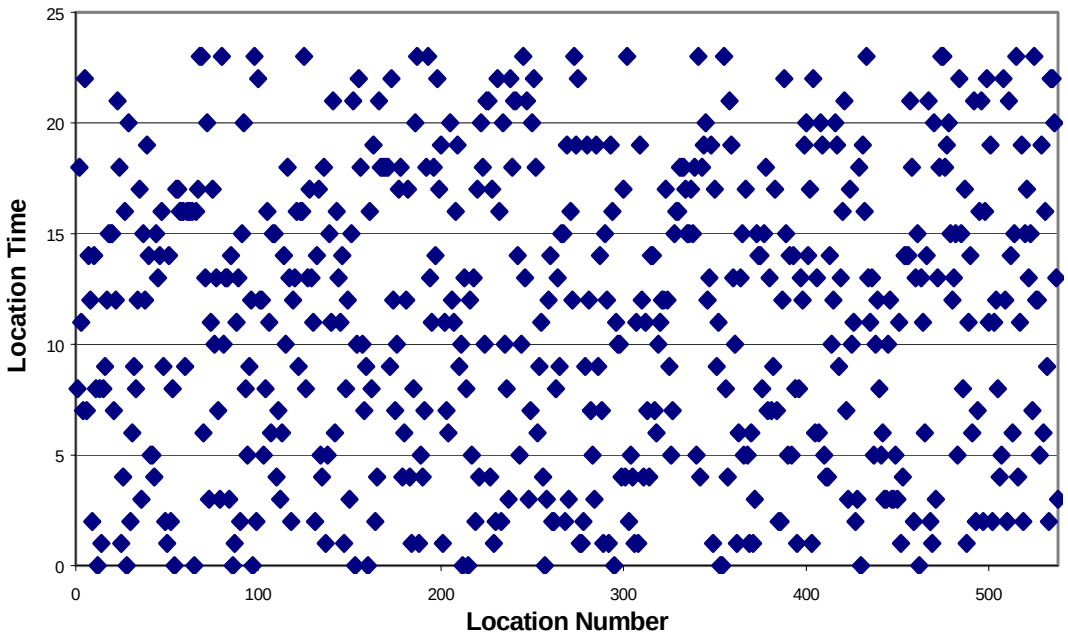


Figure 14. Successful GPS location versus time, 1999.

In the year 2000, project researchers will attempt to deploy 16 Telonics GPS collars that will remain on the bears for 12 months; GPS locations will be collected during the non-denning months (15 April through 15 November) at a rate of approximately 9 locations per day. These collars will be programmed to shut down during the dening period. The new collars will automatically drop off at a predetermined time in the summer of 2001. The specific date will be programmed into collar release mechanisms prior to collar deployment. For the year 2000, 4 general areas for collar deployment will be targeted: Grand Teton National Park, Gallatin National Forest, Yellowstone National Park, and the Bridger-Teton National Forest.

We also will conduct an experiment to look at the effects of vegetation type, slope, elevation, and aspect on the ability of collars to successfully collect GPS locations. For this experiment, researchers will use 3 Telonics GPS collars instrumented identically to those placed on bears and place the collars in various vegetation types, elevations, slopes, and aspects as per a pre-defined sampling scheme. The objective of this project will be to assess bias of GPS locations. In addition to the GPS collaring, collar testing, and data collection efforts, this project will collect various ancillary geo-spatial data sets to help in the analysis of grizzly bear habitat selection. These data sets include but are not limited to satellite imagery and aerial photography at various resolutions, climate data, topographic information, land use/change information, and data on roads and trails throughout the ecosystem.

In summary, the initial year of the project has allowed us to evaluate the utility of GPS systems in forested versus non-forested areas. Sixty-three percent of the successful locations were in forested areas, suggesting that forest cover does not interfere with this technology. In addition, we did not detect a time bias as locations were collected uniformly throughout the 24-hour day. With the ability to shut off new collars during the denning season and turn back on, as programmed, at approximately the time the bear emerges from the den, these collars have great potential to provide more complete information on grizzly bear habitat selection, particularly during early spring.

Monitoring Effects of Human Activities on Grizzly Bear Habitat *(Kim Barber, Shoshone National Forest)*

An evaluation of motorized access and secure areas was completed during 1999 for those areas within the Grizzly Bear Recovery Zone, an area of 9,242 square miles (Barber and Ouren 1999). Data reflected motorized access and secure areas as of 1998. Land management agencies are in the process of updating the database used and will reevaluate motorized access and secure areas for the 2000 Annual Report. In addition, land management agencies will summarize all human impacts on federal lands by BMU subunits as of 1998 and provide that information for presentation in the 2000 Annual Report.

Trends in Elk Hunter Numbers within the Grizzly Bear Recovery Zone plus a 10-Mile Perimeter Area *(David Moody, Wyoming Game and Fish Department; Jeff Copeland, Idaho Department of Fish and Game; and Kevin Frey, 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. Hunter numbers for these states during 1999 were unavailable. Results will be reported in the 2000 Annual Report.

GRIZZLY BEAR - HUMAN CONFLICTS, CONFRONTATIONS, AND MANAGEMENT ACTIONS IN THE YELLOWSTONE ECOSYSTEM 1999

INTERAGENCY GRIZZLY BEAR COMMITTEE YELLOWSTONE ECOSYSTEM SUBCOMMITTEE REPORT

Compiled by Yellowstone National Park – June 2000

Written By:

Kerry A. Gunther - Yellowstone National Park

Mark T. Bruscino - Wyoming Game and Fish Department

Steve Cain - Grand Teton National Park

Jeff Copeland - Idaho Department of Fish and Game

Kevin Frey - Montana Fish, Wildlife, and Parks

Mark A. Haroldson - Interagency Grizzly Bear Study Team

Charles C. Schwartz - Interagency Grizzly Bear Study Team

OBJECTIVES

For many years records of grizzly bear-human conflicts, confrontations, and subsequent management actions in the Yellowstone Ecosystem were dispersed among many agencies and individuals. These records varied in level of detail, criteria, and definition of terms used. This situation hindered consistent review of documented bear-human conflicts in the ecosystem and potentially delayed prediction, evaluation, correction, and prevention of grizzly bear-human conflict situations.

The Yellowstone Ecosystem Subcommittee (YES) of the Interagency Grizzly Bear Committee assigned Yellowstone National Park (YNP) the task of compiling an annual ecosystem wide summary of grizzly bear-human conflicts occurring in the Yellowstone Ecosystem. The objective of this report is to promote the reduction and/or prevention of bear-caused human injuries, property damages, livestock depredations, conflicts, 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, especially those that lead to the highest numbers of human-caused grizzly bear mortalities. In the past, high profile types of conflicts often received most of the publicity even if they did not lead to significant numbers of grizzly bear mortalities. Reduction of human-caused grizzly bear mortalities in conjunction with habitat protection are 2 of the most important factors that can lead to recovery and long-term viability of grizzly bears in the Yellowstone 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.

ACKNOWLEDGMENTS

Special thanks to Mark Biel for GIS analysis and producing maps of the data. In addition to the authors listed, the following individuals were instrumental in supplying, summarizing, or clarifying data:

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Heath Corrigan (Bear Management Office, Yellowstone National Park)
Darren Ireland (Bear Management Office, Yellowstone National Park)
Dave Moody (Wyoming Game and Fish Department)
Helga Pac (Montana Fish, Wildlife, and Parks)
Shannon Podruzny (Interagency Grizzly Bear Study Team)
Heather Zachary (Bear Management Office, Yellowstone National Park)

METHODS

Each wildlife management agency within the Yellowstone Ecosystem submitted records of grizzly bear-human conflicts, confrontations, management captures, and human-caused grizzly bear mortalities that occurred within areas under their jurisdiction. Agencies with bear management jurisdiction in the Yellowstone Ecosystem include Grand Teton National Park; the Idaho Department of Fish and Game; Montana Fish, Wildlife and Parks; Wyoming Game and Fish Department; and Yellowstone National Park. Data collected from these agencies were then compiled into tables by type of conflict, confrontation, management capture, or human-caused grizzly bear mortality and summarized according to wildlife management agency jurisdiction, land ownership, and Bear Management Unit (Figure 15) in which the incident occurred.

In an effort to keep grizzly bears out of further trouble, as well as to give wildlife agency personnel time to correct situations that lead to bear-human conflicts, grizzly bears involved in conflicts with people are sometimes captured and translocated to other areas of the ecosystem. In some cases these bears are then involved in bear-human conflicts in areas they would not otherwise have frequented. For bears that had been previously translocated in management actions, tables of nuisance bear management captures and human-caused grizzly bear mortalities list both the area the incident occurred as well as the area where the bear originally became a problem and from which it was translocated.

All grizzly bear human conflicts, confrontations, management captures, and human-caused grizzly bear mortalities reported in 1999 were plotted on the GIS maps contained in this report. However, due to the small scale of the figures in the report, not all incident locations will be visible due to overlap between symbols.

Within the Yellowstone Ecosystem, grizzly bears utilize several food sources that are limited in distribution and availability but are extremely important to segments of the population or to the population as a whole. These food sources include winter-killed ungulate carcasses, newborn elk calves (*Cervus elaphus*), spawning cutthroat trout (*Oncorhynchus clarki*), roots, army cutworm moths (*Euxoa auxiliaris*), and whitebark pine (*Pinus albicaulis*) seeds. Whitebark pine cone production is systematically monitored throughout the ecosystem (Knight and Blanchard 1997). In addition, the abundance of winter-killed ungulate carcasses and spawning cutthroat trout are monitored within the YNP portion of the ecosystem (Gunther et al. 2000). The relative abundance of these food sources as reported in this document was derived from these monitoring programs. The relative abundance of elk calves, vegetal foods, roots, and army cutworm moths are not systematically monitored, but were estimated by experienced biologists using diagnostic field sign. We qualitatively classified the abundance of seasonal bear foods as average, above average, or below average for between year comparisons.

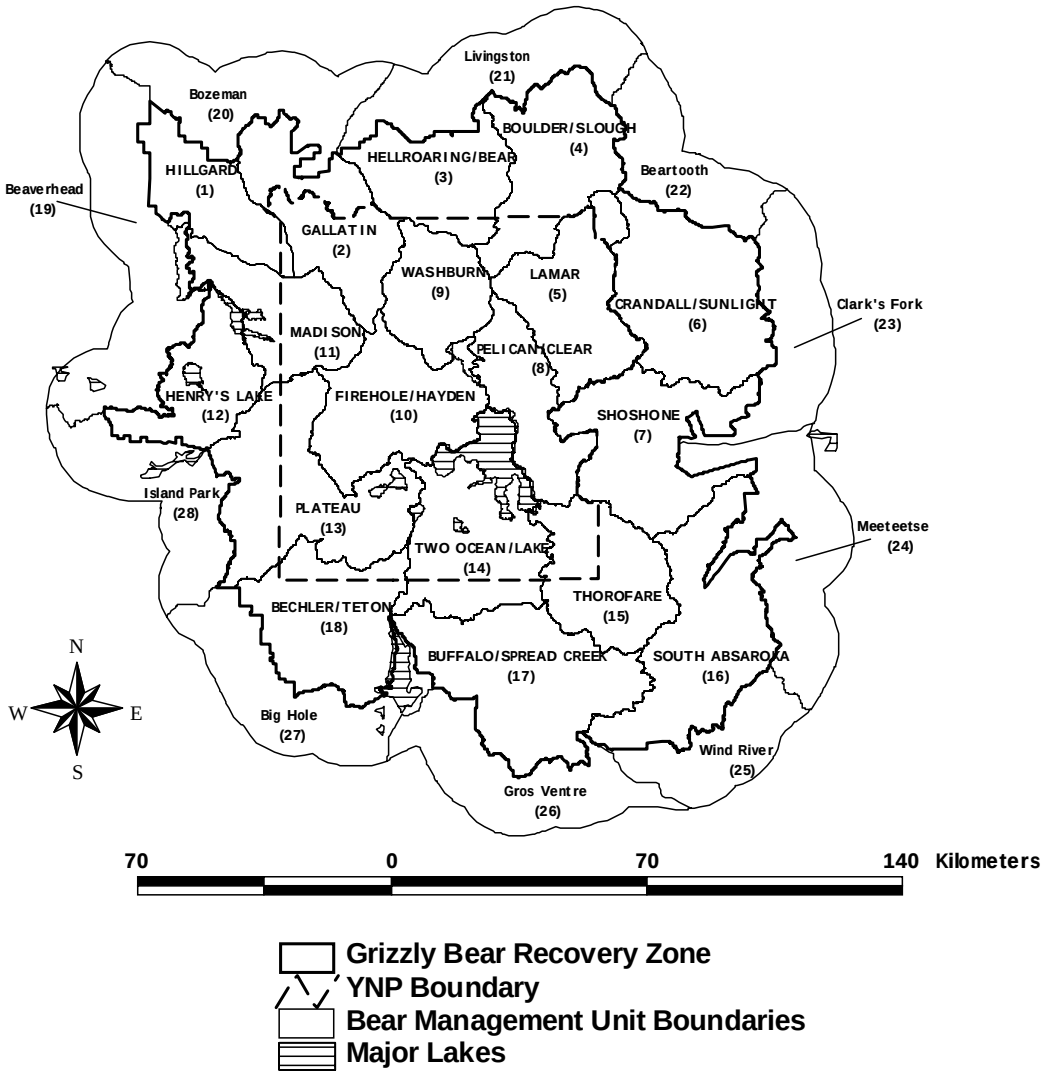

Figure 15. Map of designated Bear Management Units inside (BMUs 1–18) the Yellowstone Ecosystem Grizzly Bear Recovery Zone and designated BMUs outside (BMUs 19–28) of the Recovery Zone boundary but within the 10-mile perimeter area, 1999.

Definitions Of Terms And Abbreviations

Definitions Of Terms:

***Accidental Management Death*:** The unintentional death of any bear during management related capture, trapping, handling, aversive conditioning, or management hazing.

Adult: Grizzly bears 5 years of age and older.

***Aggressive Encounter*:** Incidents where grizzly bears charged, popped their teeth, growled, woofed, slapped the ground, hop-charged, or in any other way acted aggressively toward people.

***Anthropogenic Foods*:** Incidents in which bears obtained human foods, beverages, garbage, grease, pet food, bird feed, livestock feed, or other edible human-related attractants. Many incidents in which bears obtain human foods also involve property damage. However, in cases where both human foods were obtained and property was damaged, the incidents are listed under the Anthropogenic Foods category because a food reward often leads to repeated conflicts. The terms anthropogenic foods, human foods, and unnatural foods are commonly used interchangeably.

***Backcountry*:** All areas located outside of frontcountry areas and roadside corridors.

***Bear Approached*:** Incidents in which a bear appeared to be aware of a person's presence and knowingly approached or followed them.

***Bear-Human Conflict*:** Incidents in which bears injured people, damaged property, killed or injured livestock, damaged beehives, obtained anthropogenic foods, or damaged or obtained garden and orchard fruits and vegetables. We believe that a high proportion, but not all, bear-human conflicts occurring in the Yellowstone Ecosystem are reported to bear managers.

***Bear-Human Confrontation*:** Incidents in which bears charged, approached, or acted aggressively towards people, entered occupied backcountry camps, or frequented areas immediately adjacent to occupied homes, cabins, lodges or other human developments but did not injure people. Incidents where bears injured people are listed as bear-human conflicts. Confrontations have a lower reporting rate than conflicts and the reporting rate varies between agencies. Confrontations are assumed to have a higher reporting rate in National Parks due to the number of ranger stations, visitor centers, and uniformed employees available to take reports. Less experienced backcountry recreationalists may be more likely to report bear-human confrontations than are experienced backcountry users.

***Bear In Camp*:** Incidents in which bears entered occupied backcountry camps.

***Bear In Development*:** Incidents where people perceived that human safety was compromised by the presence of grizzly bears adjacent to occupied homes, residences, cabins, lodges, yards, or other human developments. These incidents are listed as confrontations due to the potential threat to human safety even if the bears involved did not behave aggressively.

Bear-Jam: Incidents where bears were close enough to park roads to cause large numbers of people to stop their vehicles to view and/or photograph them. When these incidents cause large enough traffic jams to require patrol rangers, resource managers, interpretive or other park staff to be called out for traffic control and monitoring the behavior of park visitors to prevent visitors from approaching or feeding bears, they are referred to as bear-jams. YNP is currently the only agency keeping records of bear-jams. Within the last 2–3 years, bear-jams have started to occur in areas adjacent to YNP.

***Bear Management Unit (BMU)*:** To monitor grizzly bear population trends and to analyze the consequences of human activities and development on bears, grizzly bear habitat within the Yellowstone Ecosystem has been divided into 27 units (Figure 15). BMUs 1 through 18 are within the designated Yellowstone Ecosystem Grizzly Bear Recovery Zone as defined in the Grizzly Bear Recovery Plan (USFWS 1993). BMUs 19 through 28 are outside of the designated Recovery Zone but are within 10 miles of the Recovery Zone boundary. Female grizzly bears with cubs and human-caused grizzly bear mortalities within BMUs 19 through 28 are counted towards the population recovery parameters listed in the Grizzly Bear Recovery Plan (USFWS 1993). Female grizzly bears with cubs and human-caused grizzly bear mortalities further than 10 miles beyond the Recovery Zone boundary do not count towards population recovery parameters. All 28 BMUs are within what is commonly referred to as the Greater Yellowstone Area or Yellowstone Ecosystem. At the present time, grizzly bears occupy and come into conflict with people in areas further than 10 miles beyond the Recovery Zone boundary. However, BMUs have not been designated in areas further than 10 miles beyond the Recovery Zone boundary. Conflicts that occur further than 10 miles beyond the Recovery Zone boundary are listed as such, and are not assigned to a BMU.

***Bluff Charge*:** Incidents in which bears charged at, but did not make contact with or injure people.

Boar: A male grizzly bear.

Campground: Designated areas used for camping that can be accessed from a road.

Campsite: Backcountry area used for camping that does not have road access and can be accessed only by trail or cross-country travel.

Cub-of-the-Year (COY): Offspring in their first year of life (less than 12 months old). Also commonly referred to as young-of-the-year or cub.

***Developed Area*:** All areas within or immediately adjacent to campgrounds, hotels, lodges, cabins, homes, buildings, restaurants, stores, or other human developments.

***Euthanize*:** Bears removed from the ecosystem for management reasons that were trapped, removed from the wild, and humanely destroyed.

Fall Season: The months of September, October, and November.

***Food Conditioned*:** Bears that have learned to associate humans or human developments as a source of anthropogenic foods due to prior food reward.

***Frontcountry*:** All areas within or immediately adjacent to roadside corridors and developed areas.

***Gardens/Orchards*:** Incidents in which bears damaged or obtained fruits or vegetables from gardens or orchards.

Greater Yellowstone Area: See definition of Yellowstone Ecosystem.

Grizzly Claimed Carcass: Incidents where grizzly bears take possession of, defend, and are reluctant to give up hunter-killed wildlife carcasses that were left in the field.

***Habituated*:** Bears that have learned to tolerate people, vehicles, and human activity at close distances. Habituation is a decline in a grizzly bear's behavioral response to people, vehicles, and/or human developments following repeated inconsequential exposure to these stimuli. Habituation often allows bears access to locally abundant food sources in proximity to areas with a high density of human activity.

***Hazing*:** The use of rubber bullets, rubber batons, water bottle projectiles, shell crackers, helicopters, auditory deterrents, visual deterrents, or other non-lethal methods to chase bears out of livestock grazing areas, developments, or other human use areas where bear activity is not considered appropriate by land and wildlife managers.

***Human Fatality*:** Incidents in which people were killed by bears. These incidents are listed under the Human Injury category in all tables in this document.

***Human Injury*:** Incidents in which people were injured or killed by bears. Cases where multiple people were injured in the same incident are listed as 1 incident of bear inflicted human injury. Data on the number of individual people injured by grizzly bears each year are listed in Appendix A.

***Illegal Kill*:** Incidents in which investigation determined that bears were killed unlawfully. This category does not include cases in which investigation indicated bears were killed lawfully in defense of life or to prevent bodily injury.

Incident: All conflicts committed by 1 bear on the same night are listed as 1 conflict. For example, if an individual grizzly bear damages 2 tents on the same night, it is listed as 1 incident of property damage. If the same bear damages another tent on the following night it is listed as another incident of property damage.

Known Mortality: Incidents where a grizzly bear carcass is recovered or there is enough evidence to indicate a mortality occurred (such as evidence of cut-off radio collar). Known human-caused mortalities are the only type of grizzly bear mortality listed in this document. Occasionally some human-caused grizzly bear mortalities are not reported, discovered, or investigated and cause of death determined, until after this report has been completed. Contact MFWP for the most current list of mortalities for past years.

Livestock Depredations: Incidents in which grizzly bears killed or injured domestic cattle, horses, sheep, turkeys, ducks, or other domestic animals. In all annual reports prior to 1999, incidents where bears injured but did not kill livestock (and the livestock recovered from the injuries) were listed as Property Damages. Starting with this report (1999), livestock that are injured by bears will be listed as livestock depredations. Appendix B of this report reflects this change in definition for livestock depredations for past years (1992-98).

***Management Action*:** Incidents in which bears involved in bear-human conflict or confrontation situations are captured and marked, released on site, translocated, or removed from the Yellowstone Ecosystem grizzly bear population.

Management Capture: See definition of Management Action.

***Management Removal*:** The planned lethal or non-lethal removal of a bear from the wild by agency personnel due to conflicts or confrontations with humans.

***Mark*:** Incidents in which nuisance bears are captured and marked with a radio collar, radio backpack, radio implant, radio ear-tag, numbered ear-tag, tattoo, dye, or paint.

***Nuisance Bear*:** Any bear involved in a bear-human conflict situation.

Poaching: Incidents of malicious killing, radio collars found cut-off of marked bears, and bears killed and left in the field unreported.

Possible Mortality: Incidents for which there is rumor or presumptive evidence of a human-caused grizzly bear mortality, but for which there is no immediate prospect of validation. Possible mortalities are not listed is this document. Records of possible mortalities are kept by the MFWP.

Primary Conservation Area (PCA): The Primary Conservation Area is the present Yellowstone Grizzly Bear Recovery Zone, consisting of 23,833 km^2 (9,209 mi^2) as defined by the Grizzly Bear Recovery Plan (USFWS 1993). The term *PCA* and Recovery Zone are used interchangeably throughout this document.

***Private*:** Land in private ownership.

Probable Mortality: Incidents for which there is strong evidence to indicate a human-caused grizzly bear mortality occurred, reported by a highly reliable source, but no carcass was recovered. Probable mortalities are not listed is this document. Records of probable mortalities that occur in the Yellowstone Ecosystem are kept by the MFWP.

***Property Damage*:** Incidents in which bears damaged personal property including camping equipment, pets that were injured but not killed, vehicles, cabins, barns, sheds or other personal property. Many incidents in which bears obtain anthropogenic foods also involve property damage. However, in cases where both anthropogenic foods were obtained and property was damaged, the incidents are listed under the anthropogenic foods category because a food reward often leads to repeated conflicts.

Recovery Zone: The Yellowstone Ecosystem Grizzly Bear Recovery Zone encompasses 23,833 km^2 (9,209 mi^2, 5,930,400 acres) of habitat in the states of Idaho, Montana, and Wyoming as defined in the Grizzly Bear Recovery Plan (USFWS 1993). Bear Management Units 1 through 18 are inside the Recovery Zone. The terms Recovery Zone and Primary Conservation Area are commonly used interchangeably throughout this document.

***Release On Site*:** Incidents in which nuisance bears are captured during management actions, marked for monitoring, and released at the trap site. In this report, incidents where non-target grizzly bears are captured during management actions and then released on site are not counted as management actions.

***Relocate*:** Incidents in which nuisance bears are trapped and relocated, usually by helicopter, truck, or boat, to remote areas away from human activity. The terms relocate and translocate are commonly used interchangeably.

***Road-kill*:** Incidents in which bears were hit and killed by vehicles.

***Roadside*:** All areas within or immediately adjacent to the road corridor.

***Sanitation*:** Methods designed to prevent bears from obtaining anthropogenic foods.

***Self Defense*:** Incidents in which investigation indicates that bears were shot and killed in defense of life.

***Sow*:** Adult female grizzly bear.

Sow-with-Young: Adult female grizzly bear accompanied by COY, yearlings, 2-year-olds, or occasionally 3-year-old offspring.

Spring Season: The months of March, April, and May.

Subadult: Grizzly bears from 2 to 4 years old (24 to 48 months old).

Summer Season: The months of June, July, and August.

Three-year-old: Offspring in their fourth year of life (36 – 48 months).

***To Zoo*:** Bears that are removed from the ecosystem for management reasons and sent to zoos or captive research facilities.

Translocate: See definition of relocate.

Two-year-old: Offspring in their third year of life (24 to 36 months).

Unnatural Foods: See definition of anthropogenic foods.

Universal Transverse Mercator Grid (UTM): Metric map grid system used on most large and intermediate scale land topographic charts and maps for calculating position. All UTM coordinates contained in this report are based on North American Datum 1927 maps.

Yearling: Offspring their second year of life (12 to 24 months old).

Yellowstone Area: See definition of Yellowstone Ecosystem. These 2 terms are commonly used interchangeably throughout this document.

Yellowstone Ecosystem: The Yellowstone Ecosystem grizzly bear population currently occupies over 6 million acres of habitat in the states of Montana, Idaho, and Wyoming as identified in the Grizzly Bear Recovery Plan (USFWS 1993). Occupied habitat includes all or portions of land areas managed by Yellowstone and Grand Teton National Parks, the Gallatin, Shoshone, Bridger-Teton, Targhee, and Beaverhead National Forests as well as some state and private lands within or adjacent to these federal lands. In addition, grizzly bears may occupy portions of the Custer National Forest and some BLM lands. The term Yellowstone Ecosystem, and Greater Yellowstone Area, and Yellowstone Area are commonly used interchangeably.

Young: Cubs, yearlings, 2-year-olds, or occasionally 3-year-old offspring accompanying their mother.

Definitions Of Abbreviations Used:

***Ad*:** Adult

***BC*:** Backcountry

***BLM*:** Bureau of Land Management

***BNF*:** Beaverhead National Forest (426,800 acres)

***BTNF*:** Bridger-Teton National Forest (2,740,800 acres)

***CNF*:** Custer National Forest (517,500 acres)

***COY*:** Cub-of-the-year

***Cr*:** Creek

***Dev*:** Developed Area

F: Female

***FC*:** Frontcountry

***GNF*:** Gallatin National Forest (1,735,400 acres)

***GTNP*:** Grand Teton National Park (345,600 acres)

GYA: Greater Yellowstone Area

GYE: Greater Yellowstone Ecosystem

***IFG*:** Idaho Department of Fish and Game

***IGBST*:** Interagency Grizzly Bear Study Team (Comprised of team members representing the USGS, USFWS, USFS, YNP, GTNP, WGF, MFWP, IFG, and MSU)

***JDR*:** John D. Rockefeller, Jr. Memorial Parkway (managed by Grand Teton National Park)

M: Male

***MFWP*:** Montana Fish, Wildlife, and Parks

MSU: Montana State University

***Pr*:** Private

***R*:** River

***SAd*:** Subadult

***SNF*:** Shoshone National Forest (2,223,900 acres)

***TNF*:** Targhee National Forest (1,477,200 acres)

***Unk*:** Unknown

***Unm*:** Unmarked

USFS: U.S. Forest Service

USFWS: U.S. Fish and Wildlife Service

USGS: U.S. Geological Survey

UTM: Universal Transverse Mercator Grid, North American Datum 1927

***WGF*:** Wyoming Game and Fish Department

***YNP*:** Yellowstone National Park (2,221,722 acres all within the Recovery Zone)

***Yrl*:** Yearling

RESULTS

Availability of Bear Foods

Most high quality bear foods in the Yellowstone Ecosystem were considered to be of average to above average abundance in 1999. Whitebark pine cone production, as measured at transect sites, was significantly above average.

The winter of 1998-99 was considered to be a fairly normal, mild winter in the Madison/Firehole and the upper and lower Northern winter ranges (Farnes et al. 1999). Despite the mild winter, the number of winter-killed elk and bison (*Bison bison*) carcasses counted on transect sites were higher than the long-term average recorded from 1992-98. Winter-killed ungulate carcasses are an important high quality food source for bears in early spring before most vegetal foods become available to bears (Mattson and Knight 1992).

During early to mid-spring, scavenging ungulate carcasses was the most commonly observed grizzly bear feeding activity in YNP. During spring, grizzly bears also dug up pocket gopher (*Thomomys talpoides*) caches in localized areas where they were abundant. Elk calves, an important late spring and early summer food source (Gunther and Renkin 1990), were preyed upon extensively by some individual bears. The numbers of spawning cutthroat trout counted in Yellowstone Lake tributaries were similar to the long-term averages (1989-98) on most streams except for those in the West Thumb area which were below average (see Spawning Cutthroat Trout Numbers). Spawning cutthroat trout are available to bears with home ranges adjacent to Yellowstone Lake during the late spring and early summer (Reinhart 1990), and rank as one of the highest sources of net digestible energy available to bears in the Yellowstone Ecosystem (Pritchard and Robbins 1990).

Throughout the summer season, grizzly bears grazed clover (*Trifolium* spp.) and dug yampa roots (Perideridia gairdneri) in localized areas where these foods were abundant. During late summer, evidence of grizzly bears digging false truffles (*Rhizopogon* spp.) was evident in the Montana portion of the ecosystem. Throughout the summer season, some individual bears scavenged livestock carcasses (cattle and sheep) and preyed upon livestock on private land and public grazing allotments in Wyoming.

Army cutworm moths, an important late summer and fall bear food (Mattson et al. 1991*a*, 1991*b*), were present and attracted large numbers of bears to high elevation moth aggregation sites on the eastern side of the ecosystem. In the Henry's Lake area, grizzly bears fed on the fall migration of kokanee salmon (*Oncorhynchus nerka*). The production of whitebark pine cones during the fall, as measured at transects sites, was above average in most areas of the ecosystem. The one exception was the Pitchstone Plateau area where few cones were observed. Excavations of red squirrel (*Tamiasciurus hudsonicus*) middens for whitebark pine seeds was the most frequently observed fall grizzly bear feeding activity. In some areas, we found evidence that grizzly bears had

climbed up into whitebark pine trees and broken off branches to obtain cones. Whitebark pine seeds are an important fall food because of their high fat content and their potential abundance as a prehibernation food source (Mattson and Jonkel 1990). During the late fall (October), localized areas where grizzly bears had dug up pocket gopher caches were again evident.

Grizzly Bear-Human Conflicts

There were 113 grizzly bear-human conflicts reported in the Yellowstone Ecosystem in 1999 (Table 23, Figure 16, Appendix C). These incidents included bears killing livestock (64%, *n* = 72), obtaining anthropogenic foods (17%, *n* = 19), damaging property (12%, *n* = 13), damaging beehives (4%, *n* = 4), obtaining fruits and vegetables from gardens and orchards (3%, *n* = 3), and injuring people (2%, *n* = 2). Seventy percent (*n* = 79) of the bear-human conflicts occurred on public land administered by the U.S. Forest Service (53%, *n* = 60), the National Park Service (15%, *n* = 17), the state of Wyoming (1%, *n* = 1), and the state of Idaho (1%, *n* = 1) (Table 24). Thirty percent (*n* = 34) of the reported incidents of grizzly bear-human conflict occurred on private land in the states of Wyoming (19%, *n* = 22) and Montana (11%, *n* = 12).

Less than half (39%, *n* = 44) of the reported grizzly bear-human conflicts occurred within the designated Recovery Zone (Table 25). Most (61%, *n* = 69) of the reported conflicts occurred outside of the Recovery Zone boundary (Table 26). Most (66%, *n* = 29) incidents of bear-human conflict inside the Recovery Zone occurred in just 2 of the 18 BMUs, the Gallatin (41%, *n* = 18) and Bechler/Teton BMUs (25%, *n* = 11) (Table 25). Nine BMUs (1, 4, 6, 7, 9, 13, 14, 15, 17) inside the Recovery Zone did not have any grizzly bear-human conflicts reported (Table 25).

Grizzly Bear-Human Confrontations

Ninety-six grizzly bear-human confrontations were reported in the Yellowstone Ecosystem in 1999 (Table 27, Figure 17, Appendix D). There were 46 (48%) incidents of grizzly bears entering developed areas, 29 (30%) incidents where grizzly bears acted aggressively (but did not injure people) during encounters with people, 13 (14%) incidents where grizzly bears entered occupied backcountry camps, 5 (5%) incidents where grizzly bears approached or followed people, 2 (2%) incidents where grizzly bears were frequenting private ranch lands, and 1 (1%) incident where a grizzly bear claimed and would not give up a hunter-killed wildlife carcass. Most (89%, *n* = 85) reported confrontations occurred on public land (Table 28). Only 11% (*n* = 11) of the reported confrontations occurred on private land. Most (86%, *n* = 83) reported confrontations with grizzly bears occurred within the designated Yellowstone Ecosystem Grizzly Bear Recovery Zone (BMUs 1 - 18) (Table 29). Relatively few (14%, *n* = 13) grizzly bear-human confrontations occurred outside of the designated Recovery Zone boundary (Table 30). Grizzly bear-human confrontations occurred most often in the Gallatin (25%, *n* = 21) BMU. Six BMUs (6, 12, 13, 15, 16, 18) inside the Recovery Zone did not have

any confrontations reported. Wyoming does not systematically record grizzly bear-human confrontations as they are numerous and often go unreported.

Grizzly Bear Management Captures

There were 15 individual grizzly bears captured in 13 separate management actions in 1999 (Table 31, Figure 18, Appendix E). One incident involved a female grizzly bear accompanied by 2 yearlings. In 11 of the management actions, nuisance bears were captured and translocated to remote areas away from human activities (Table 32). Two grizzly bears involved in conflicts (1 killing cattle, 1 crushing tents) were captured and removed from the ecosystem (cattle killer euthanized, tent crusher sent to a zoo). Seven incidents where bear captures occurred on public land administered by the National Forest Service (n = 4), National Park Service (n = 2), and state of Wyoming (n = 1). Six management actions where grizzly bears were captured occurred on private property, all in Wyoming (Table 33). Less than half (23%, n = 3) of the incidents where grizzly bears were captured in management actions occurred within the designated Recovery Zone (Table 34). Most (77%, n = 10) of the incidents where grizzly bears were captured in management actions occurred outside of the Recovery Zone boundary (Table 35).

Human-Caused Grizzly Bear Mortalities

There were 6 known human-caused grizzly bear mortalities in the Yellowstone Ecosystem in 1999 (Table 36, Figure 19, Appendix F). Two grizzly bears that had been involved in conflicts (1 in livestock depredations, 1 crushing tents) were captured and removed from the ecosystem (cattle killer euthanized, tent crusher sent to a zoo) in management actions (Table 37). Two grizzly bears were killed illegally (poached) and 2 were killed by hunters in self-defense. All 6 human-caused mortalities occurred on public land administered by the U.S. Forest Service (83%, n = 5) or National Park Service (17%, n = 1) (Table 38). Five human-caused grizzly bear mortalities occurred inside (Table 39) and 1 outside of the Recovery Zone boundary (Table 40).

Table 23. Number of different incidents of grizzly bear-human conflicts reported within different wildlife management agency jurisdictions in the Yellowstone Ecosystem, 1999.

Agency	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Beehives	Livestock depredations
GTNP/JDR	2	0	0	0	0	0	2[a]
IFG	2	0	0	0	0	0	2[b]
MFWP	15	0	2	8	0	0	5[c]
WGF	79	0	4	8	0	4	63[d]
YNP	15	2	7	3	3	0	0
Total	113	2	13	19	3	4	72[e]

[a] Both incidents involved cattle.
[b] One incident involved cattle and 1 involved sheep.
[c] One incident involved sheep, 1 involved turkeys, and 3 incidents involved chickens.
[d] Includes 16 incidents of sheep and 47 of cattle depredations.
[e] Includes 50 incidents of cattle, 18 of sheep, 3 of chickens, and 1 of turkey depredations.

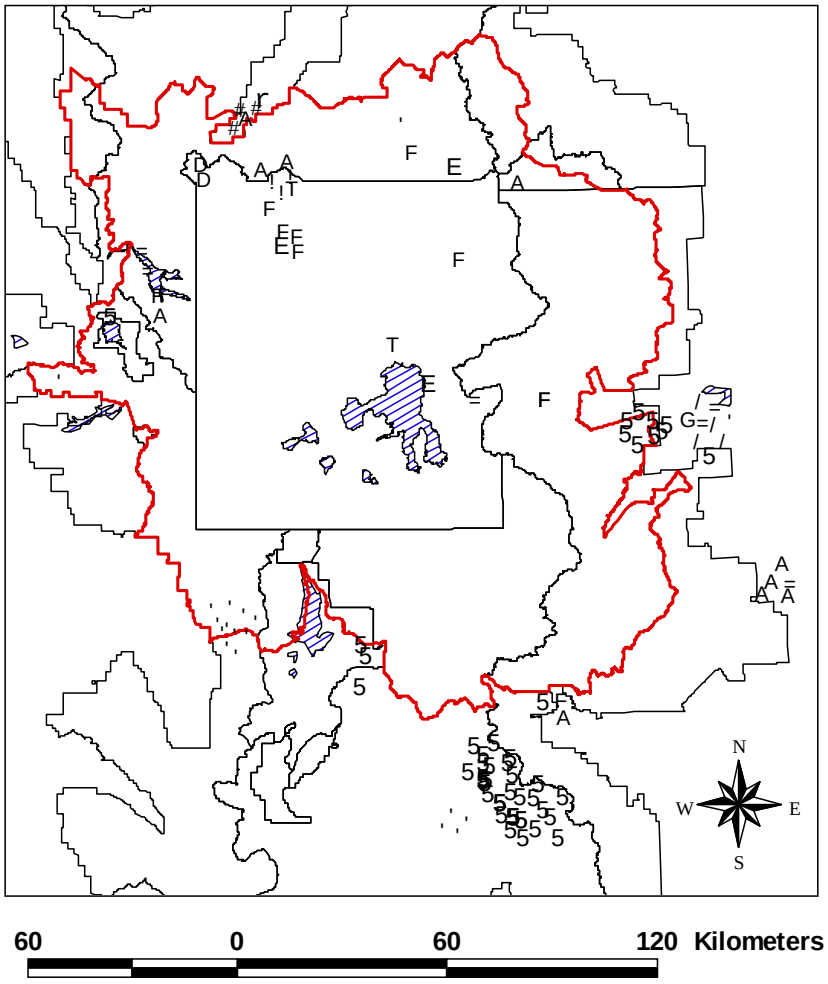

Figure 16. Locations of grizzly bear-human conflicts reported in the Yellowstone Ecosystem, 1999.

Table 24. Number of incidents of grizzly bear-human conflict reported within different land ownership areas in the Yellowstone Ecosystem, 1999.

Land owner	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Bee hives	Livestock depredations
BNF	0	0	0	0	0	0	0
BTNF	40	0	0	0	0	0	40
CNF	0	0	0	0	0	0	0
GNF	3	0	1	1	0	0	1
GTNP/JDR	2	0	0	0	0	0	2
ID-private	0	0	0	0	0	0	0
ID-state	1	0	0	0	0	0	1
MT-private	12	0	1	7	0	0	4
MT-state	0	0	0	0	0	0	0
SNF	5	0	2	0	0	0	3
TNF	12	0	0	0	0	0	12
WY-private	22	0	2	8	0	4	8
WY-state	1	0	0	0	0	0	1
YNP	15	2	7	3	3	0	0
Total	113	2	13	19	3	4	72

Table 25. Number of incidents of grizzly bear-human conflict reported within different Bear Management Units that occurred inside the designated Yellowstone Ecosystem Grizzly Bear Recovery Zone, 1999.

Bear Management Unit name/number	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Bee hives	Livestock depredations
Hilgard (1)	0	0	0	0	0	0	0
Gallatin (2)	18	2	5	4	3	0	4
Hellroaring/Bear (3)	3	0	1	1	0	0	1
Boulder/Slough (4)	0	0	0	0	0	0	0
Lamar (5)	2	0	1	1	0	0	0
Crandall/Sunlight (6)	0	0	0	0	0	0	0
Shoshone (7)	0	0	0	0	0	0	0
Pelican/Clear (8)	2	0	0	2	0	0	0
Washburn (9)	0	0	1	0	0	0	0
Firehole/Hayden (10)	1	0	1	0	0	0	0
Madison (11)	4	0	1	3	0	0	0
Henry's Lake (12)	2	0	0	0	0	0	2
Plateau (13)	0	0	0	0	0	0	0
Two Ocean Plateau (14)	0	0	0	0	0	0	0
Thorofare (15)	0	0	0	0	0	0	0
South Absaroka (16)	1	0	0	0	0	0	1
Buffalo/Spread Creek	0	0	0	0	0	0	0
Bechler/Teton (18)	11	0	0	0	0	0	11
Total	44	2	9	11	3	0	19

Table 26. Number of incidents of grizzly bear-human conflict reported in different Bear Management Units in the Yellowstone Ecosystem that occurred outside of the designated Grizzly Bear Recovery Zone, 1999.

Bear Management Unit name/number	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/ orchards	Bee hives	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)	20	0	3	4	0	4	9
Wind River (25)	3	0	1	1	0	0	1
Gros Ventre (26)	3	0	0	0	0	0	3
Bighole (27)	0	0	0	0	0	0	0
Island Park (28)	0	0	0	0	0	0	0
>10 miles beyond Recovery Zone	43	0	0	3	0	0	40
Total	69	0	4	8	0	4	53

Table 27. Number of incidents of grizzly bear-human confrontations reported within different wildlife management agency jurisdictions in the Yellowstone Ecosystem, 1999.

Agency	Total confrontations	Aggressive encounter	Bear approached	Bear in camp	Bear in development	Other
GTNP/JDR	0	0	0	0	0	0
IFG	0	0	0	0	0	0
MFWP	38	19	0	5	13	1[a]
WGF[b]	6	2	0	2	0	2[c]
YNP	52	8	5	6	33	0
Total	96	29	5	13	46	3

[a] Grizzly claimed and would not give up hunter-killed carcass.
[b] Wyoming does not systematically record and investigate confrontations as they are numerous and often go unreported.
[c] Both incidents involved grizzly bears frequenting private ranch property.

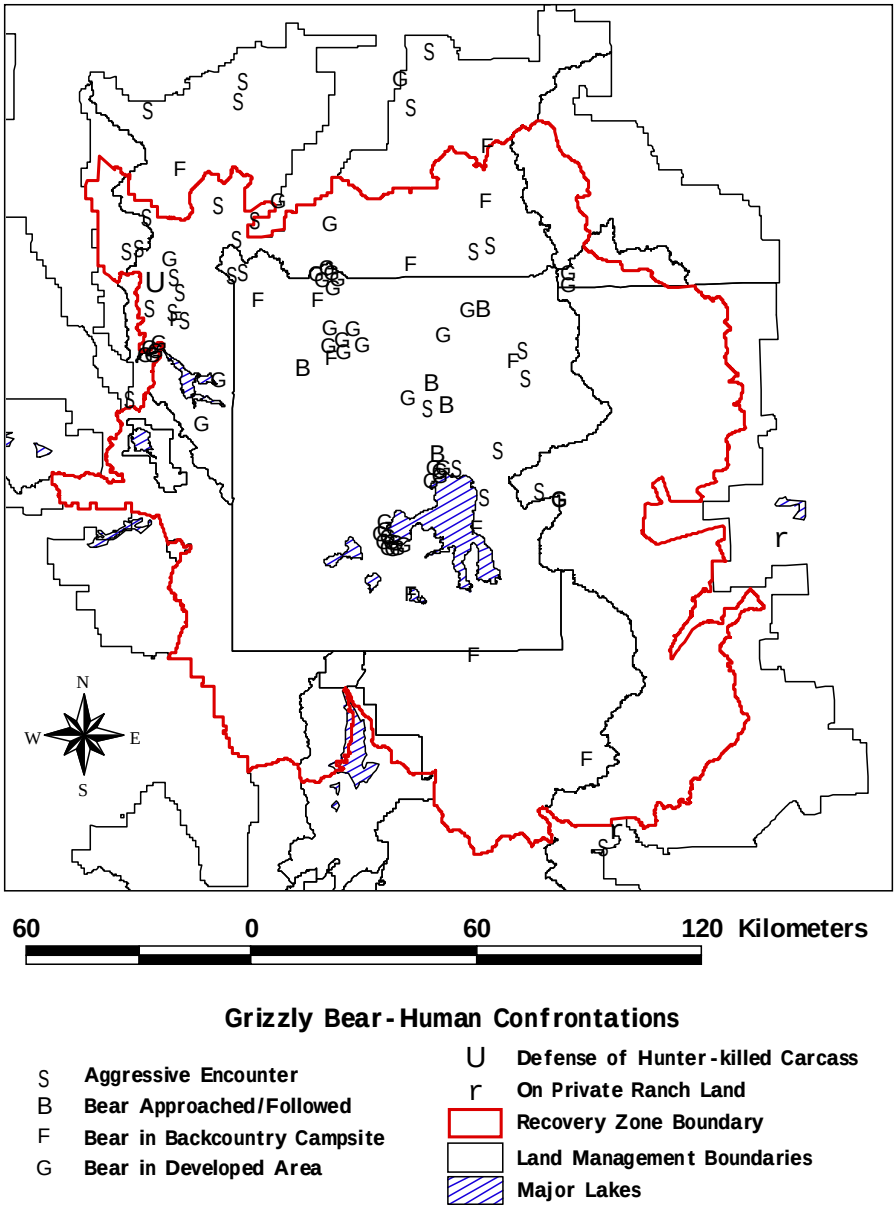

Figure 17. Locations of grizzly bear-human confrontations reported in the Yellowstone Ecosystem, 1999.

Table 28. Number of incidents of grizzly bear-human confrontations reported within different land ownership areas in the Yellowstone Ecosystem, 1999.

Land owner	Total confrontations	Aggressive encounter	Bear approached	Bear in camp	Bear in development	Other
BNF	0	0	0	0	0	0
BTNF	2	0	0	2	0	0
CNF	0	0	0	0	0	0
GNF	29	17	0	5	6	1[a]
GTNP/JDR	0	0	0	0	0	0
ID-private	0	0	0	0	0	0
ID-state	0	0	0	0	0	0
MT-private	9	2	0	0	7	0
MT-state	0	0	0	0	0	0
SNF	2	2	0	0	0	0
TNF	0	0	0	0	0	0
WY-private	2	0	0	0	0	2[b]
WY-state	0	0	0	0	0	0
YNP	52	8	5	6	33	0
Total	96	29	5	13	46	3

[a] Grizzly bear claimed and would not give up a hunter-killed elk carcass.
[b] Both incidents involved grizzly bears frequenting private ranch lands.

Table 29. Number of incidents of grizzly bear-human confrontations reported within different Bear Management Units that occurred inside the Yellowstone Ecosystem Grizzly Bear Recovery Zone, 1999.

Bear Management Unit name/code	Total confrontations	Aggressive encounters	Bear approached	Bear in camp	Bear in development	Other
Hilgard (1)	7	5	0	0	1	1[a]
Gallatin (2)	21	5	1	3	12	0
Hellroaring/Bear (3)	4	2	0	1	1	0
Boulder/Slough (4)	3	0	1	1	1	0
Lamar (5)	5	2	0	1	2	0
Crandall/Sunlight (6)	0	0	0	0	0	0
Shoshone (7)	1	1	0	0	0	0
Pelican/Clear (8)	7	4	0	1	2	0
Washburn (9)	4	0	2	0	2	0
Firehole/Hayden (10)	6	0	1	0	5	0
Madison (11)	11	3	0	1	7	0
Henry's Lake (12)	0	0	0	0	0	0
Plateau (13)	0	0	0	0	0	0
Two Ocean Plateau (14)	13	0	0	2	11	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	1	0	0
Bechler/Teton (18)	0	0	0	0	0	0
Total	83	22	5	11	44	1

[a] Defense of hunter-killed wildlife carcass.

Table 30. Number of incidents of grizzly bear-human confrontations reported in different Bear Management Units in the Yellowstone Ecosystem that occurred outside of the designated Grizzly Bear Recovery Zone, 1999.

Bear Management Unit name/number	Total confrontations	Aggressive encounters	Bear approached	Bear in camp	Bear in development	Other
Beaverhead (19)	1	1	0	0	0	0
Bozeman (20)	2	0	0	1	1	0
Livingston (21)	1	0	0	1	0	0
Beartooth (22)	0	0	0	0	0	0
Clark's Fork (23)	0	0	0	0	0	0
Meeteetse (24)	1	0	0	0	0	1[a]
Wind River (25)	2	1	0	0	0	1[a]
Gros Ventre (26)	0	0	0	0	0	0
Bighole (27)	0	0	0	0	0	0
Island Park (28)	0	0	0	0	0	0
>10 miles beyond Recovery Zone	6	5	0	0	1	0
Total	13	7	0	2	2	2

[a] Grizzly bear frequenting private ranch lands.

Table 31. Number of incidents where grizzly bears were captured in management actions within different wildlife management agency jurisdictions in the Yellowstone Ecosystem, 1999.

Agency	Total captures	Translocated	Released on site	Sent to zoo	Euthanized	Accidental management death
GTNP/JDR	0	0	0	0	0	0
IFG	0	0	0	0	0	0
MFWP	0	0	0	0	0	0
WGF	11	10	0	0	1	0
YNP	2	1	0	1	0	0
Total	13	11	0	1	1	0

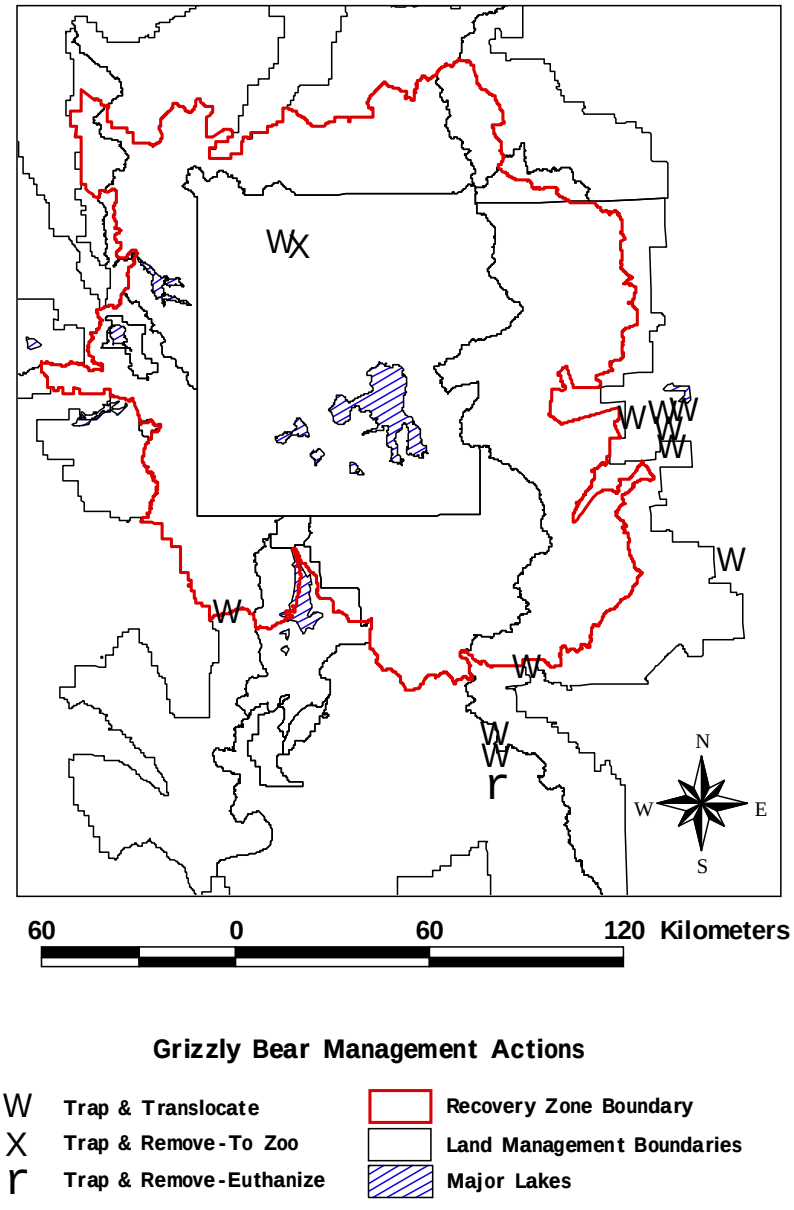

Figure 18. Locations of management actions where grizzly bears were captured in the Yellowstone Ecosystem, 1999.

Table 32. Grizzly bears captured during management actions in the Yellowstone Ecosystem, 1999. Areas in bold parenthesis indicate area where bear was first involved in bear-human conflicts and was translocated from.

Date	Bear	Sex	Age	Location	Reason captured	Release site
04/27	326	M	SAd	Wood River, WY-private	Anthropogenic foods-bird feeders	Elks Fork, SNF
04/29	327	F	Ad	South Fork Shoshone, WY-private	On private ranch-near apiary and calving area	Sweetwater Creek, SNF
05/18	334	F	SAd	South Fork Shoshone, WY-private	Sheep depredation	Antelope Creek, YNP
06/23	339	M	Ad	South Fork Shoshone, WY-private	Cattle depredation	Oxbow Creek, YNP
07/09	312	M	SAd	Sheep Creek, WY-private	Damaging beehives	Parque Creek, SNF
07/12	269	M	Ad	Crow Creek, BTNF	Cattle depredations	Euthanize
07/13	325	F	SAd	Indian Creek Campground, YNP (from Gardiner, MT-private, 1998)	Trapped due to tent damage occurring in campground-later exonerated of involvement	Otter Creek, YNP
08/20	245	M	Ad	North Pinion Ridge, BTNF	Near area cattle depredations occurred	Oxbow Creek, YNP
08/22	G64	M	SAd	Indian Creek Campground, YNP	Damaging tents	Live Removal-Sent to Zoo
08/27	270	F	Ad	Bull Moose Creek, BTNF	Cattle depredations	Sunlight Creek, SNF
08/27	G65	F	Yrl	Bull Moose Creek, BTNF	Dependent young of cattle depredator	Sunlight Creek, SNF
08/27	G66	M	Yrl	Bull Moose Creek, BTNF	Dependent young of cattle depredator	Sunlight Creek, SNF
08/31	185	M	Ad	Dunoir River, WY-private	On private ranch lands-near cattle	Parque Creek, SNF
09/01	347	M	SAd	Dry Ridge, TNF	Sheep depredation	Mirror Plateau, YNP
09/06	348	M	Ad	Bull Creek, WY-State land	Cattle depredation	Grassy Lake Road, JDR

Table 33. Number of incidents where grizzly bears were captured in management actions within different land ownership areas in the Yellowstone Ecosystem, 1999.

Agency	Total captures	Translocated	Released on site	Sent to zoo	Euthanized	Accidental management death
BNF	0	0	0	0	0	0
BTNF	3[a]	2	0	0	1	0
CNF	0	0	0	0	0	0
GNF	0	0	0	0	0	0
GTNP/JDR[a]	0	0	0	0	0	0
ID-private	0	0	0	0	0	0
MT-private	0	0	0	0	0	0
SNF	0	0	0	0	0	0
TNF	1	1	0	0	0	0
WY-private	6	6	0	0	0	0
WY-State	1	1	0	0	0	0
YNP	2	1	0	1	0	0
Total	13	11	0	1	1	0

[a] One of the 3 incidents involved a female with 2 yearlings.

Table 34. Number of incidents where grizzly bears were captured in management actions within different Bear Management Units inside the Yellowstone Ecosystem Grizzly Bear Recovery Zone, 1999.

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)	2	1	0	1	0	0
Hellroaring/Bear (3)	0	0	0	0	0	0
Boulder (4)	0	0	0	0	0	0
Lamar/Slough (5)	0	0	0	0	0	0
Crandall/Sunlight (6)	0	0	0	0	0	0
Shoshone (7)	0	0	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
Henry's Lake (12)	0	0	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)	0	0	0	0	0	0
Bechler/Teton (18)	1	1	0	0	0	0
Total	3	2	0	1	0	0

Table 35. Number of incidents where grizzly bears were captured in management actions in different Bear Management Units in the Yellowstone Ecosystem outside of the designated Grizzly Bear Recovery Zone, 1999.

Bear Management Unit name/number	Total bears 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)	4	4	0	0	0	0
Wind River (25)	1	1	0	0	0	0
Gros Ventre (26)	0	0	0	0	0	0
Bighole (27)	0	0	0	0	0	0
Island Park (28)	0	0	0	0	0	0
>10 miles beyond Recovery Zone	5	4	0	0	1	0
Total	10	9	0	0	1	0

Table 36. Number of human-caused grizzly bear mortalities within different wildlife management agency jurisdictions in the Yellowstone Ecosystem, 1999.

		Management removals			Other human-caused grizzly bear mortality				
Agency	Total	To zoo	Euthanized	Accidental	Research accident	Illegal	Self defense	Road-killed	Other
GTNP/JDR	0	0	0	0	0	0	0	0	0
IFG	0	0	0	0	0	0	0	0	0
MFWP	0	0	0	0	0	0	0	0	0
WGF	5	0	1	0	0	2	2	0	0
YNP	1	1	0	0	0	0	0	0	0
Total	6	1	1	0	0	2	2	0	0

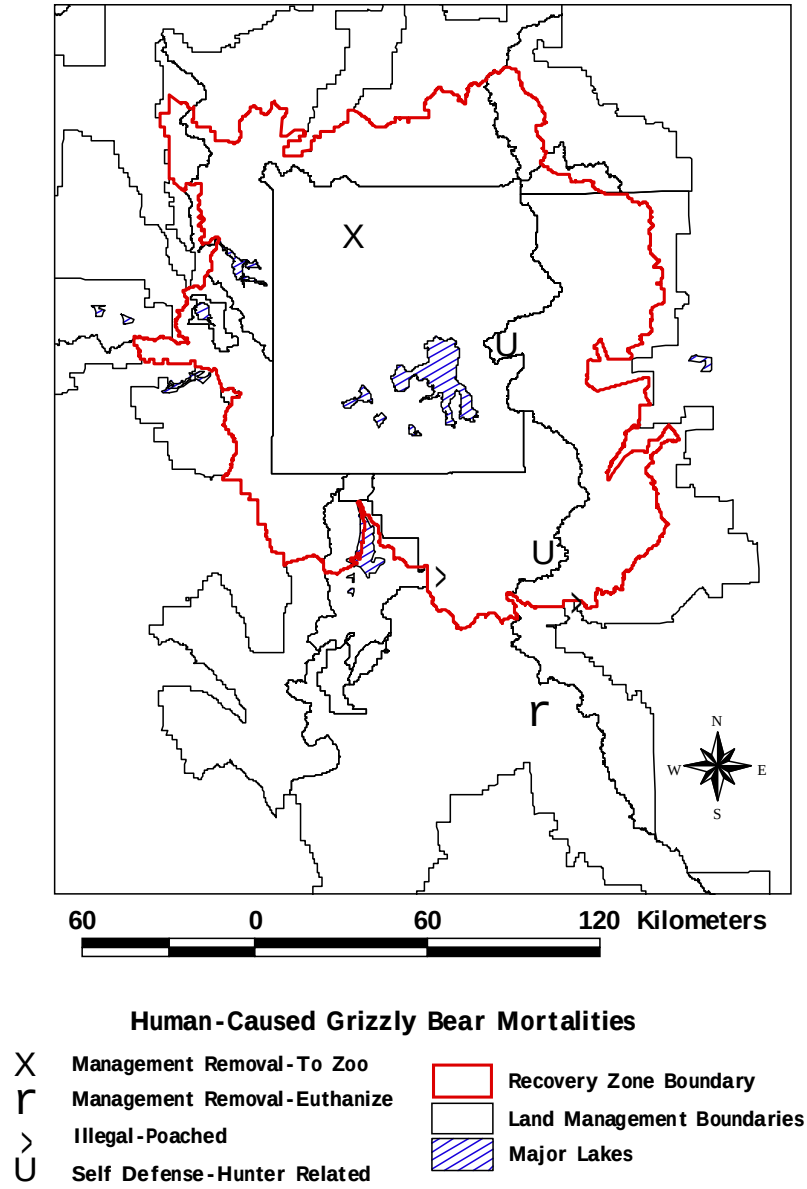

Figure 19. Locations of known human-caused grizzly bear mortalities in the Yellowstone Ecosystem, 1999.

Table 37. Known human-caused grizzly bear mortalities in the Yellowstone Ecosystem, 1999.

Date	Bear	Sex	Age	Locations	Cause
05/06	277	M	7	Buffalo Fork, BTNF (from Diamond Lake, BTNF 1996)	Illegal-poaching
07/13	269	M	10	Crow Creek	Management removal-euthanized, cattle killer
08/22	G64	M	SAd	Indian Creek Campground	Management removal-sent to zoo, tent crusher
09/01	324	M	SAd	South Fork Buffalo Creek	Hunter self defense-bear entered camp
10/02	Unm	F	Ad	Crow Creek	Hunter self defense-sow charged, hunter shot and killed sow
10/19	Unm	M	SAd	Dunoir River	Illegal-poaching

Table 38. Number of human-caused grizzly bear mortalities within different land ownership areas in the Yellowstone Ecosystem, 1999.

		Management removals			Other human-caused grizzly bear mortalities				
Land owner	Total	To zoo	Euthanized	Accidental	Research accident	Illegal	Self defense	Road-killed	Accidental
BNF	0	0	0	0	0	0	0	0	0
BTNF	3	0	1	0	0	1	1	0	0
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	0	0	0	0	0	0	0	0	0
SNF	2	0	0	0	0	1	1	0	0
TNF	0	0	0	0	0	0	0	0	0
WY-private	0	0	0	0	0	0	0	0	0
YNP	1	1	0	0	0	0	0	0	0
Total	6	1	1	0	0	2	2	0	0

Table 39. Number of human-caused grizzly bear mortalities within different Bear Management Units inside the Yellowstone Ecosystem Grizzly Bear Recovery Zone, 1999.

		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
Hilgard (1)	0	0	0	0	0	0	0	0	0
Gallatin (2)	1	1	0	0	0	0	0	0	0
Hellroaring/Bear (3)	0	0	0	0	0	0	0	0	0
Boulder (4)	0	0	0	0	0	0	0	0	0
Lamar/Slough (5)	0	0	0	0	0	0	0	0	0
Crandall/Sunlight (6)	0	0	0	0	0	0	0	0	0
Shoshone (7)	1	0	0	0	0	0	1	0	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
Henry's 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)	2	0	0	0	0	1	1	0	0
Bechler/Teton (18)	0	0	0	0	0	0	0	0	0
Total	5	1	0	0	0	2	2	0	0

Table 40. Number of human-caused grizzly bear mortalities within different Bear Management Units in the Yellowstone Ecosystem that occurred outside of the designated Grizzly Bear Recovery Zone, 1999.

		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)	0	0	0	0	0	0	0	0	0
Wind River (25)	0	0	0	0	0	0	0	0	0
Gros Ventre (26)	0	0	0	0	0	0	0	0	0
Bighole (27)	0	0	0	0	0	0	0	0	0
Island Park (28)	0	0	0	0	0	0	0	0	0
>10 miles beyond Recovery Zone	1	0	1	0	0	0	0	0	0
Total	1	0	1	0	0	0	0	0	0

1999 AGENCY SUMMARIES

Grand Teton National Park

No management actions were taken on nuisance grizzly bears in GTNP in 1999. Nuisance grizzly bear activity included 2 incidents of cattle depredation that occurred on an authorized grazing allotment within the park but outside of the recovery area. In these incidents, 2 calves were killed and mostly consumed, and 1 additional calf was injured but survived. Another calf was killed on 2 August 1999 in the same area but determination of the predator involved was inconclusive. A pack of wolves frequented the cattle allotment within the park as well, but were not confirmed as being involved in any of the depredations. No other grizzly bear-human conflicts were documented during the year.

In cooperation with the IGBST, 3 culvert traps were set for a total of 64 trap nights between 23 July and 27 August. Trapping was conducted in an effort to capture grizzlies for radio collaring. No bears were captured. In general, incidental bear sightings of both species were low in 1999, probably due to the availability of abundant bear foods away from developed areas, but the proportion of grizzly bear sightings was similar to recent years. The IGBST monitored 6 different radio-collared bears using areas in or immediately adjacent to GTNP.

Idaho

Grizzly bear-human conflicts in Idaho were minimal in 1999. Two livestock conflicts were investigated in July. Unmarked grizzly bears were involved in both incidents. On 12 July, a bear was observed scavenging on a dead calf on state of Idaho lands north of Henry's Lake. The owner noted that several calves had died of natural causes but believed that an additional calf had been killed by a grizzly bear. A culvert trap was set at 2 locations for 1 trap night at each site. The bear was not captured and was not subsequently observed again. On 18 July, a grizzly bear killed several U.S. Sheep Experiment sheep as they were being trailed to Sheep Station lands in the Centennial Range. Snares were set for 1 night by Wildlife Services. The bear was not captured or subsequently observed. No aggressive encounters or anthropogenic food incidents were reported. Grizzly bear #346 was present in the Island Park (28) and Plateau (13a) BMUs, using the kokanee spawning run for much of the fall.

Montana

During 1999, total reported and investigated grizzly bear/ human conflicts in Montana reached a minimum number of 53 within the Yellowstone Ecosystem. This was an increase of 64% from the 34 conflicts in 1998. An average of 36 conflicts have been reported and investigated each year, since 1992. Approximately 60% of the bear/human conflicts occurred on public land and 40% occurred on private land. The average (1992-98), of conflicts on public versus private land was 58% and 42%, respectively.

Unnatural food-related conflicts accounted for 15% of the total bear/human conflicts, during 1999. Of all bear/human conflicts, the percentage of unnatural food-related conflicts have averaged 52%, since 1992. Confrontational conflicts continued to rise, with 21 (40%) of all bear-human conflicts reported and investigated in 1999. Nineteen of the 21 confrontations occurred on public land and 17 of the confrontations occurred in the backcountry. As reported by Montana in the last 4 years, confrontational bear-human conflicts will be difficult to minimize due to increasing human numbers and activities, along with the increasing/expanding grizzly bear population in a large geographic area. As in 1998, there were no grizzly bears killed and no bear-caused human injuries during confrontational conflicts related to hunting activities in 1999.

Management Captures--During 1999, no grizzly bears were captured or translocated in management situations. On average (1991-98), 4 grizzly bears have been captured each year due to management situations. Management grizzly bear captures vary year to year, mostly due to natural food abundance and availability. Management captures have varied from a low of 0 during 1991, 1992, and 1999, up to a high of 12 grizzly bear captures during 1995.

Bear Mortalities.--There were no management related or human-caused bear mortalities in the Montana portion of the Yellowstone Ecosystem in 1999. One natural grizzly bear mortality was reported and investigated during 1999. A male cub-of-the-year (COY) was found the Taylor's Fork Drainage of the upper Gallatin River on 15 June. The COY was killed and fed upon by another bear.

Wyoming

The number of grizzly bear-human conflicts in 1999 (n = 90) increased 7% from 1998 (n = 84) and was down 2% from the previous 5-year (1994-98) average of 92/year. Most (76%) incidents in 1999 involved livestock damage (n = 68) on public land grazing allotments or on private lands, with the majority of the conflicts occurring in the upper Green River drainage, Union Pass, 1 grazing allotment on the TNF, and in the Cody area. Relatively minor livestock losses occurred in the Dubois areas.

During 1999, 52 cattle and 30 sheep were killed or injured by grizzly bears. Three cattle were killed or injured on grazing allotments within the SNF and 38 were killed on BTNF allotments. Seven cattle were killed or injured on private lands, 6 of which occurred in the South Fork of the Shoshone River drainage west of Cody. One cow was injured on private land in the upper Dunoir valley northwest of Dubois. Twenty-two sheep from 1 band were killed in 11 incidents on a grazing allotment in the TNF. This situation appeared to have been caused by 1 adult female grizzly with cubs, however, an adult male was captured and relocated after he was believed to have been involved in at least 1 depredation incident. Four sheep also were confirmed killed from 1 band grazed in the Gros Ventre Wilderness in the upper Green River drainage on the BTNF. A grizzly bear

killed 3 sheep and injured 1 additional animal in a corral at a private residence in the South Fork of the Shoshone River west of Cody.

Grizzly bear predation on domestic livestock has become a chronic management problem in Wyoming in the past 7 years. Alternative management strategies are currently being explored to reduce the number of grizzly bear-livestock problems.

Although livestock incidents were the most common problem during 1999, property damage incidents increased by 43% (n = 7) from 1998 (n = 4), but were down 50% from the previous 5-year average of 14 incidents/year. In 3 incidents, bears received non-natural (livestock feed or bird seed) food rewards. Five incidents occurred on private property and the remaining 2 occurred at the Buffalo Bill Boy Scout Camp in the SNF. One grizzly bear damaged property and received non-natural food rewards at a private residence in the Wood River west of Meeteetse. Unlike past years, property damage incidents in 1999 did not become chronic. At all locations, the attractants were secured and bears received no further rewards and caused no further damage. With the high number of property damage incidents that occurred in recent years, the public has become more aware of the need to secure attractants around residential areas. This likely has contributed to a reduction in the number of property damage incidents in those areas.

Four incidents of apiary damage occurred at 2 sites in 1999. All were at apiaries that had been previously protected by electric fencing. Some fencing was in disrepair, once corrected, no further damage occurred. Plans for 2000 include fencing additional sites as needed, and maintaining existing exclosures.

In an additional 5 incidents, bears were able to obtain non-natural food rewards without causing property damage. In all incidents the bears obtained either garbage (n = 2), livestock or pet food (n = 2), or a combination of livestock food and garbage (n = 1). This is down 69% from the 5-year average of 16 incidents of food rewards/year. One incident occurred at a rural residence near Dubois when a female grizzly with 2 yearlings was observed eating a bag of livestock feed in the back of a pickup truck. The feed was secured and the bear did not return to the area. On 2 successive nights a female bear with 3 yearlings was able to obtain garbage by tipping over a dumpster at a ranch in the South Fork of the Shoshone River. The dumpster was secured inside a barn and the bears left the area. In 2 separate incidents, 4 months apart at a ranch near Meeteetse, a bear was able to obtain garbage from a burn barrel and several pounds of livestock feed and birdseed from feeders and a storage bin. A grizzly bear was captured and relocated in the first incident. The bear involved in the second incident did not return to the site after the first night. All food reward incidents in 1999 occurred on private lands.

For the first year since 1993, there were no grizzly bear-caused injuries to humans in Wyoming. This is down substantially from 1998 when there were 4 humans injured by grizzly bears.

There were 5 known human-caused grizzly bear mortalities in Wyoming in 1999. One bear (male #269) was removed from the upper Green River drainage by State officials after involvement in a series of cattle losses. Two bears were killed illegally, 1 on the SNF (unmarked male) and 1 on the BTNF (male #277). Two bears were killed legally in self-defense situations. One on the SNF (unmarked female) after charging a hunter in the field, and 1 on the BTNF (male #324) after charging a hunter in a camp. In addition, 1 bear was injured by a gunshot in an encounter with people in a camp. It is unknown if the bear survived the injuries. The remains of 1 bear were retrieved that was illegally killed in 1996. The investigation of this incident is ongoing.

During the 1999 Wyoming hunting season, there was only 1 reported incident where hunters lost game meat to grizzlies. Losing meat left in the field to bear scavenging has become a common and expected occurrence in northwestern Wyoming. Reporting rate is likely low because of the expectation of losing meat to bears. There are undoubtedly unreported incidents where hunters lost game meat to grizzly bears during the 1999 hunting season. The WGF does not systematically record or investigate these incidents. Reports are taken on an opportunistic basis so the number of incidents recorded is not necessarily indicative of a trend on bears claiming carcasses. Good fall food availability, particularly an abundant whitebark pine nut crop likely contributed to the low number of reported losses of game meat to bears.

Ten bears were captured for conflict management purposes in Wyoming in 1999. Of the 10 bears captured, 9 were relocated to areas away from where the conflicts occurred and 1 was removed from the population. In late April, a subadult male bear (#326) was captured at a residence in the Wood River west of Meeteetse after getting food rewards and damaging property. The bear was relocated to an area west of Cody. The bear remained in the area for a brief period then made a large movement due south and was last located just west of Dubois. The carcass of bear #326 was found in a daybed near Dubois in August. We were unable to determine cause of death but there was no reason to suspect human involvement. In mid-May, subadult female bear #334 was captured at a residence west of Cody after killing 3 lambs in a corral near a home. In less than 2 months she had returned to an area near her original capture site, but remained in the backcountry and was not known to have been involved in any additional conflicts with humans. In late June, adult male grizzly bear #339 was captured and relocated to northern YNP after being involved in a cattle depredation on private land west of Cody. Throughout the remainder of the summer bear #339's movements were to the southeast where he eventually denned just outside the southeast corner of YNP in the Teton Wilderness.

In early July, subadult male bear #312 was captured on private land west of Cody after damaging beehives. The bear was relocated north of Dubois but in less than 1 month, had moved to the northeast primarily on national forest lands. The bear remained in the area the remainder of the fall and was not known to have been involved in any additional conflicts. In mid-July, adult male grizzly bear #269 was captured and euthanized after being involved in a series of cattle depredation on BTNF lands north of Pinedale. There

was evidence that bear #269 had been involved in all or part of 6 cattle losses in a 5-day period. Chronic losses on this allotment in the past prompted the decision to remove #269 from the population. In late August, grizzly bear #270 and her 2 yearling cubs were captured after a series of cattle depredations on the Bacon Creek grazing allotment on the BTNF. The bear and her offspring were relocated to an area on the SNF west of Cody. After her release she was located near the release site, and then moved into YNP for a brief period, returned to an area near the release site, then moved north and denned in Montana. In early September, subadult male bear #347 was captured after involvement in sheep depredations on the TNF. The bear was relocated to northeastern YNP and remained in the northern portion of YNP the remainder of the non-denning season. In early September adult male bear #348 was captured after killing a calf on a State owned land parcel west of Cody. The bear was relocated to JDR north of Jackson. Bear #348 remained in the area for just over a month then moved southeast into the Teton Wilderness. The bear then moved northeast and denned north of where it was originally captured.

In addition to the 10 bears captured after coming into conflict with humans or their property, 3 bears were captured and relocated to prevent conflicts with people or livestock depredations. In late April, adult female grizzly bear #327 was captured and moved to a location on the SNF after frequenting a calving pasture on private lands and using areas close to a residential area. The bear quickly moved back near its original capture location and was located in the area the remainder of the non-denning period but was not known to have caused any conflicts. In mid-August adult male bear #345 was captured on a grazing allotment on the BTNF and relocated to northern YNP after a series of cattle depredations in the area near where he was captured. Bear #345 was not known to have been involved in the depredations, but he was moved as a precautionary attempt to prevent involvement in cattle losses. The bear used areas near its release site then moved north into Montana outside of YNP and remained there for the rest of the non-denning period. In late August, adult male grizzly bear #185 was captured on private ranch lands near Dubois and relocated a short distance away on the SNF. The bear was frequenting areas occupied by cattle and had been feeding on a carcass of a calf that died from undetermined causes. The bear used areas near its original capture site for the rest of the season but was not known or suspected of being involved in any conflicts with humans or livestock losses.

A list of major conflicts including location, conflict type, conflict summary, and recommended management actions are presented in Table 41.

Table 41. Major conflict areas and recommended management actions in the Wyoming portion of the Greater Yellowstone Ecosystem, 1999.

Location	Conflict type	Summary	Recommended action
Targhee National Forest (Badger & Leigh Creeks)	Livestock damage	Bears kill and injure sheep on public land livestock allotments managed by USFS.	Continue to investigate livestock damage. Reimburse owners for confirmed losses. Relocate or remove bears when necessary. Attempt to find alternative grazing allotments. Experiment with deterrent devices.
Bridger-Teton National Forest (Lime Creek area)	Livestock damage	Bears kill and injure sheep on public land livestock allotments managed by USFS.	Continue to investigate livestock damage. Reimburse owners for confirmed losses. Relocate or remove bears when necessary. Attempt to find alternative grazing allotments. Experiment with deterrent devices.
Bridger-Teton National Forest (Upper Green River drainage and Union Pass area)	Livestock damage	Bears kill and injure cattle on public land livestock allotments managed by USFS.	Continue to investigate livestock damage. Reimburse owners for confirmed losses. Relocate or remove bears when necessary.
Dubois Area (public and private)	Livestock damage	Bears kill and injure cattle on private lands and public land livestock allotments.	Continue to investigate livestock damage. Reimburse owners for confirmed losses. Relocate or remove bears when necessary.
Cody Area (public and private)	Livestock damage	Bears kill and injure cattle on private lands and public land livestock allotments.	Continue to investigate livestock damage. Reimburse owners for confirmed losses. Relocate or remove bears when necessary.

Yellowstone National Park

There were 3 incidents where grizzly bears obtained anthropogenic foods, 7 incidents where grizzly bears damaged property, and 2 grizzly bear-inflicted human injuries in YNP in 1999. Due to the conflicts that occurred, 2 grizzly bears were captured in management actions. One of these was translocated and the other removed and sent to a zoo.

Anthropogenic Foods.--On 1 July 1999, a park visitor threw potato chips to a subadult grizzly bear that had been grazing in a clover patch next to the road just south of Lake Butte Junction. Park Rangers patrolled the area for several weeks after the incident and hazed the bear away whenever it was observed within 50 yards of the road.

On 8 July 1999 at 2050 hours, a subadult grizzly bear entered the Superintendent's Campground just south of the Indian Creek Campground while a wedding reception was in progress. As the bear walked into the site the people entered their vehicles for safety, leaving their food on the tables. The bear began sniffing around, picked up an empty pop can, sniffed some food items, knocked over a lawn chair, and then found a partially eaten plate of food and consumed the contents. The bear then headed off through the woods towards Indian Creek Campground where it was monitored by park rangers for about 45 minutes. At dark the bear left the area and did not return for the remainder of that evening.

On 31 August 1999, a subadult grizzly bear was observed by a park visitor eating garbage out of the bucket of a contractor's front-end loader that was parked next to the road 5 miles west of the East Entrance. The visitor reported the incident to rangers at the East Entrance. When rangers arrived at the front-end loader the bear was gone. The contractor, who was working on the reconstruction of the East Entrance Road, was given a warning concerning improper garbage storage in YNP. The contractor had been given a "Living and Working in Bear Country" orientation session prior to beginning work in the park.

Property Damage.--On 9 April 1999, at approximately 11:30 p.m., 2 park concession employees were driving the road between Mud Volcano and Fishing Bridge Junction when they noticed animal tracks in the road. Shortly after noticing the tracks, they saw a bear in their headlights approximately 100 feet ahead. The bear stopped and turned toward the vehicle, stood up on 2 legs, then went back down to all 4 legs and began running down the left hand side of the road approximately 30 feet ahead of the vehicle. The vehicle was driving slowly because it was pulling a large camper trailer. The people in the vehicle began video taping the grizzly bear as it ran in front of them. At one point the vehicle slowed down almost to a stop in an attempt to let the bear get off the road. Instead of leaving the road, the bear ran across in front of the truck. Because of snow on the road and pulling the large camper trailer, the truck could not stop in time and "bumped" the bear. After being "bumped" by the vehicle, the bear turned and bit the bumper of the truck, breaking a tooth off in the plastic molding. The plastic molding was

also broken where the bear bit into it. The broken-off piece of tooth was turned in to park rangers when the incident was reported.

29 June 1999 - At approximately 0500 hours, a subadult grizzly bear entered site #70 and pawed the tent set up in the site, tearing the tent pole sleeve and breaking a tent pole. The bear did not obtain any human food and no one was injured in the incident. At 0530 hours a photographer observed a subadult male grizzly bear (based on observing it urinate) leaving the campground. After leaving the campground, the bear walked over to an out-of-bounds-camper and investigated the vehicle. The bear then walked back through the Indian Creek Campground, and left the area. Bear warning signs were posted at the entrance to the campground and at all water spigots and pit toilets as well as at the campground information board. Bear Management Office personnel set and baited 2 traps in the area, 1 on either side of the Indian Creek Campground. After 3 days when no bear was caught, the traps and bait were removed so as not to lure other non-target bears to the area.

9 July 1999 - At approximately 0545 hours, a subadult grizzly bear entered Indian Creek Campground. The bear stuck its head into the screen door of an occupied tent in site #41. The people yelled "get out of here" and the bear walked away without causing any damage. The bear then entered site #40 where it leaned on an occupied tent, bending an aluminum pole beyond repair. The people in the tent shook the sides of the tent and yelled causing the bear to leave. Bear foot prints consisting of fire-pit ash on the tent suggest that the bear had been digging through the campground campfire pits for food scraps. The bear then proceeded to the upper loop of the campground where several people observed it. It was described as a small grizzly bear, copper and light brown in color. The bear entered site #21 where it stepped on another occupied tent tearing the rain fly and bending the poles. The people said they could see the shadow of the bear through the tent material. There was no evidence that the bear obtained any human foods other than food scraps it may have obtained from the fire pits. After this incident, additional bear warning signs that specifically described the incidents (damage to tents) that had been occurring in the campground were posted throughout the campground. Bear Management Office personnel re-initiated trapping operations, this time for 5 days. On 13 July, a potential suspect bear, subadult female grizzly bear #325, was captured, radio collared, and relocated out of the area. Bear #325 was later exonerated of any involvement in the incidents when more tents were damaged prior to her returning to the area. DNA evidence also proved the she was not the bear responsible for damaging the tents. Bear #325 has since returned to the Indian Creek/Swan Lake area and reoccupied her former home range.

18 July 1999 - At approximately 1915 hours, 2 subadult grizzly bears entered the Indian Creek Campground. People in the campground began banging pots and honking car horns but this did not alter the behavior of the bears. One of the bears stayed in the trees on the edge of the campground while the other walked into campsite #11. Two campers sitting at the picnic table in the site, got into their vehicle and watched the bear sniff their campsite, then bounce on their tent breaking the poles, ripping the tent fabric, and

crushing the tent to the ground. At approximately 1920 hours, a man and his son were hiking along Panther Creek next to the Indian Creek Campground when they encountered 2 grizzly bears. They proceeded to their campsite, #8; 1 of the bears followed them to their campsite. They stated that the bears seemed curious but not aggressive. The bears did not obtain a food reward. Traps were again set, for a period of 7 days, but the bears, apparently having left the area, were not caught and Bear Management Office personnel terminated the trapping effort. At that time, tent camping was prohibited and the Indian Creek Campground was temporarily designated for hard-sided camping units only. There were no further incidents in the Indian Creek Campground after requiring hard-sided camping units.

26 July 1999 – A backpacker left his camp around 1730 hours for a short hike. When he returned to his backcountry campsite 3L2, he noticed that his tent had been torn open by a bear. He hiked out that night and reported the incident to a park ranger. There was no food in the tent at the time it was damaged by the bear. The tent was set up over 100 yards from the campfire ring and food storage pole. The ranger that investigated the site found adult size grizzly bear tracks next to the tent. The ranger noticed that the tent water-proofing had a very strong odor, which may have attracted the bear. The campsite was temporarily closed and bear warnings were placed on adjacent campsites 3L1 and 3L3. This incident was not considered to be related to the incidents of damaged tents at the Indian Creek Campground due the difference in track size as well as the distance (30 miles) between the incident sites.

17 August 1999 - At 2130 hours, a group of people from France heard a bear in the trees next to their backcountry campsite #1G3. They gathered near their fire as the bear entered the campsite and began sniffing and pawing their tent, bending and damaging the poles. The camping party spent the night around the campfire and left the next day. They thought the bear might have been a black bear but were unsure as they did not get a good look due to darkness. However, the incident was similar to the incidents that had occurred at the Indian Creek Campground and another incident later that same night at campsite 1G4 one-half mile away, and probably involved the same grizzly bear. Backcountry campsite 1G3 is approximately 7 miles northwest of the Indian Creek Campground. At approximately 2200 hours on 17 August, a single camper at backcountry campsite 1G4 was awakened by the sound of his rain fly zipper moving. He shined a flashlight towards the tent door, saw a bear outside, then yelled for the bear to go away. The bear bumped the tent then left. Twenty minutes later, thinking it might be a grizzly, the camper decided to climb a tree. Ten to 20 minutes after climbing the tree, the bear returned and jumped on the tent breaking the poles and tearing holes in the tent and ground tarp. The bear also bit the backpacker's tripod and sandals. There was no food in the tent. The man spent a cold night in the tree, and hiked out the next day. Due to darkness, the man could not determine the species of bear. Backcountry campsite 1G4 is less than ½ mile from campsite 1G3 and approximatley 7½ miles from the Indian Creek Campground. This incident was very similar in nature to the incidents that occurred at Indian Creek. Bear Management Office personnel collected bear hair from the torn tent and broken poles for DNA analysis. Initial macroscopic analysis of the hair indicated

that it was a grizzly bear. This was confirmed by DNA microsatellite analysis a few days later. The individual genotype of the bear was also determined from the collected hair so that if a suspect bear was captured its involvment in the tent incidents could be confirmed or refuted. After this incident, all backcountry campsites in the area were temporarily closed and the next day (18 August), a bear trap was flown into campsite 1G4. When the bear was not caught after 3 days, the trap was shut down and flown out.

27 August 1999 – Sometime between 1800 hours and midnight a subadult grizzly bear (as estimated by track size), bit and tore the vinyl spare tire cover off of a GMC Jimmy 4x4 parked in the driveway next to the Stephens Creek residence.

Bear Inflicted Human Injuries--27 August 1999, a female from New York (age 39) and a male from Switzerland (age 28) were day hiking on the Black Butte Trail towards Bighorn Peak. Approximately 3.5 miles from the trailhead (WK2) they had a surprise encounter with an adult female grizzly and 2 yearlings. The 2 hikers had been chatting but not making as they described "enough noise". They suddenly heard what they described as a drawn out moan. Unsure what it was, they took another step or 2 and then to their left, up slope, saw a bear less than 10 yards away. The woman did not initially see the cubs and instantly, while saying "it's a bear" stepped 1 or 2 steps off the trail to the right, away from the bear and dropped into a ball. The bear charged to her. The woman could feel the bears breath on her ear and back when the bear huffed a couple of times. The bear did not touch her. At the same time the male hiker stepped off the trail to the up-hill side as the sow ran past at the woman. He was then approached by 2 yearling cubs that did not touch him. The male hiker deployed his pepper spray at the yearling cubs but was unsure if he actually hit them. At this time the adult female bear turned away from the woman and charged toward him. He continued to spray and fell backwards onto his back. The bear did not make contact, he fell as he stepped or was startled. Initially, there was no reaction from the bear, the male hiker put 1 leg up thinking the bear was going to attack him. The adult bear swatted his leg inflicting 2 gashes and 2 shallower scratches (injuries probably came from the bear's claws). The adult bear sniffed at the cloud of pepper spray, ran off, then returned again. Both hikers remained on the ground very still. By this time the male hiker had depleted the can of bear pepper spray and all 3 bears then left the area. The hikers returned to the trailhead and were given hydrogen peroxide to wash the wound by some people in an RV. They then drove themselves to Bozeman, Montana, and received medical attention. The wounds, although not serious, were monitored for infection, no stitches were made so the wounds could drain properly. The incident was reported to YNP a couple of days later. Bear warnings were posted on the Black Butte Trail.

22 September 1999 – At approximately 1530 hours, a male backpacker, hiking alone, encountered an adult female grizzly bear and 2 yearlings on the Black Butte Trail, approximately 4.1 miles from the trailhead. The hiker heard a branch snap on the uphill side of the trail, looked up, and observed a grizzly bear running through the trees in his direction. He also observed 2 other bears nearby, probably yearlings, on the downhill side of the trail. The man dropped to the ground in an effort to protect against injury. The

bear, a suspected adult female grizzly, ran straight to his head and bit him at least twice before moving down to his unprotected lower right side. She bit him again, causing a deep laceration on his side. At first the man attempted to "play dead", but after the bear had his head in her mouth he stated that he changed strategies and fought back. At this time the backpacker tried to deploy his pepper spray but was unable to get the safety off of the spray. As the attack continued the can of bear spray was knocked from his grasp. At one point during the struggle the man's backpack was torn away from him. The bear left on 2 occasions but when the man stood up the bear returned and attacked again. After the attack ended and the bear left, the man hiked out to the trailhead and flagged down a passing motorist. Park rangers responded and treated the man's injuries and then had him flown by helicopter to Eastern Idaho Regional Medical Center where he was treated for several days. Bear Management Office and ranger personnel flew all trails in the area by helicopter to evacuate all other hikers and post closure signs on all nearby trails as well as to retrieve the man's backpack and personal belongings. Whitebark pine middens as well as bear scats containing whitebark pine seeds were found at the incident site. Further investigation the next day indicated that the bears had been feeding on whitebark pine seeds from numerous squirrel middens in the area where the encounter occurred. The Black Butte trail as well as adjacent trails were closed for several weeks following the incident. These trails were not reopened until late in the fall.

Management Captures.--On 13 July 1999 subadult female grizzly bear #325 was captured next to the Indian Creek Campground. Although not a prime suspect in the incidents involving damage to tents at Indian Creek Campground, bear #325 was a potential suspect due to her home range encompassing the area around Indian Creek. Bear #325 was fitted with a new radio collar and translocated to Otter Creek (29 km straight line distance from capture site) in an effort to sort out which bear was damaging tents at the Indian Creek Campground. Bear #325 was later exonerated of any involvement in the Indian Creek Campground incidents when more tents were damaged prior to her returning to the area following relocation. Bear #325 was later exonerated by DNA evidence as well. Bear #325 has since returned to the Indian Creek/Swan Lake area and reoccupied her former home range.

22 August 1999 - grizzly bear #G-64, a subadult male that had damaged 6 tents in the park was captured adjacent to the Indian Creek Campground. Bear Management Office personnel baited the trap with one-half can of blueberries and an arificial cantelope lure. A burlap sack soaked in anise oil was hung from a nearby tree as a call bait. A decoy tent (Walrus brand) was set up approximately 10 yards from the culvert trap. On 22 August, a 180-pound, subadult male grizzly bear (given #G-64) was caught in the trap. The bear stepped on, tore, and crushed the decoy tent then entered the trap and was caught.

DNA extracted from hair collected from the captured bear matched the DNA extracted from hair collected from the tent damaged at backcountry campsite 1G4. DNA laboratory work was done at the University of Idaho, by Dr. Lisette Waits. Dr. Waits calculated that the chance of a match to any other grizzly bear in YNP was approximately 1 in 20,597. This was considered a very low probability since the total grizzly bear

popualtion in the Yellowstone ecosytem is estimated at a maximum of only 610 bears. The probability was calculated from a genetic fingerprint from 5 independent microsatellite loci (5 pieces of highly variable DNA). Even if bear #G-64 had a full sibling in the population, the chance of a match at these 5 genetic loci is 1 in 36.

Grizzly bear #G-64 was deemed a danger to public safety as per Grizzly Bear Special Rule (50 CFR 17.40) and was not considered suitable for release back into the wild. The U.S. Fish and Wildlife Service Grizzly Bear Recovery Coordinator concurred with that decision. Under a special permit from the U.S. Fish and Wildlife Service, bear #G-64 was held in a holding facility at the Grizzly Discovery Center in West Yellowstone, MT until the YNP Bear Management Office could find a suitable public zoological institution to house the bear on a long-term basis. On 27 September, grizzly bear #G-64 was shipped to the Wildlife Way-Station in Sylmar, California, adjacent to the Angeles National Forest. The Wildlife Way-Station is a private, non-profit sanctuary for injured, neglected, and homeless wild animals. Following removal of #G-64 from the wild in YNP, there were no more incidents of tents being crushed by grizzly bears in the park for the remainder of the year.

Strong public education and sanitation programs have kept the number of bear-human conflicts and human-caused grizzly bear mortalities in YNP relatively low in recent years. Continuation of these programs is essential to further reducing and preventing bear-human conflicts within the park. Management of human habituated (non-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 1999, park staff responded to 72 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 have learned to live in close proximity to people while being involved in relatively few conflicts with humans. 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 the reduction in the number of bears removed in management actions and by gaining access to previously unavailable 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 to reduce the potential for bear-human conflicts with, and human-caused mortality of, habituated grizzly bears that frequent road corridors in YNP.

As the grizzly bear population increases and recovery goals are met, the problem of habituated bears foraging for natural foods along roadsides is likely to increase and expand to other areas outside of YNP throughout the Yellowstone Ecosystem. Within the last few years, habituated bears have started to appear along the North Fork highway east of the park. New innovative strategies for managing people and habituated bears along

roadside corridors would also benefit bears outside of the park on national forest lands and help ensure the continued survival of grizzly bears throughout the Yellowstone Ecosystem.

DISCUSSION

In 1999, there was an average to above average abundance of most high-quality bear foods in the Yellowstone Ecosystem. Numbers of all types of grizzly bear-human conflicts except for livestock depredations were average to below average (Table 42, Appendix G). Livestock depredations were above average in 1999 (Table 42), the third consecutive year that livestock depredations were higher than the long-term average. Human-caused grizzly bear mortality has been correlated to the availability of whitebark pine (Mattson et al. 1992). Our data indicates that the number of incidents of grizzly bear-human conflict involving anthropogenic foods, property damage, gardens, orchards, and bee hives is also related to the abundance of bear foods in the ecosystem, especially fall foods. When the abundance of bear foods is below average, the number of incidents of grizzly bears obtaining anthropogenic foods, and damaging property, bee hives, gardens, and orchards is generally high (Table 43). When bear foods are abundant or of average abundance, the number of these types of incidents are generally low (Table 43). In contrast, livestock depredations occur independent of the abundance of bear foods (Table 43).

Table 42. Number of incidents of different types of grizzly bear-human conflicts in 1999 and average number of conflicts recorded from 1992-98 in the Yellowstone Ecosystem.

	Time period	
Type of conflict	1992-98 Average	1999
Human injury	4	2
Property damage	13	13
Anthropogenic foods	34	19
Gardens/Orchards	5	3
Beehives	3	4
Livestock depredations	45	72
Total conflicts	104	113

Table 43. Qualitative assessment of spring, summer, and fall bear foods and the number of different types of grizzly bear-human conflicts recorded in the Yellowstone Ecosystem, 1992-99.

	Availability of important bear foods			Number of incidents of grizzly bear-human conflicts					
Year	Spring	Summer	Fall	Anthropogenic foods	Property damage	Gardens/ orchards	Bee hives	Human injury	Livestock depredations
1992	Average	Average	Average	6	7	0	0	3	8
1993	Average	Average	Average	19	14	7	0	0	50
1994	Below average[a]	Below average[b]	Below average[c]	93	31	5	5	9	20
1995	Above average[d]	Average	Below average[c]	56	20	9	14	3	42
1996	Above average[d]	Average	Above average[e]	16	6	0	1	2	49
1997	Above average[d]	Above average[f]	Below average[g]	21	8	6	0	8	73
1998	Average	Average	Average	30	3	6	3	4	71
1999	Above average[d]	Average	Above average[e]	19	13	3	4	2	72

[a] Based on below average abundance of winter-killed ungulate carcasses.
[b] Based on below average abundance of spawning cutthroat trout and below average precipitation (hot, dry summer) causing vegetation to desiccate early.
[c] Based on below average abundance of army cutworm moths and whitebark pine seeds.
[d] Based on above average abundance of winter-killed ungulate carcasses.
[e] Based on above average abundance of whitebark pine seeds.
[f] Based on presence of over-wintered whitebark pine seeds left over from the previous fall and above average precipitation keeping vegetation succulent.
[g] Based on below average abundance of the current season's crop of whitebark pine seeds.

Army cutworm moths and whitebark pine seeds were abundant in 1999 and provided bears with good foraging opportunities during the late summer/fall period of hyperphagia. Hyperphagia is the period of intensive search for high-energy foods as bears prepare for hibernation (Nelson et al. 1983). Bear foods were abundant enough in 1999 to keep most bears from seeking anthropogenic foods in association with human activities at lower elevations. This resulted in an average to below average number of property damages, incidents of bears obtaining anthropogenic foods, and human-caused grizzly bear mortalities.

Most of the grizzly bear-human conflicts in 1999 occurred in 7 distinct geographic areas of the ecosystem (Figure 16). Many of the conflicts in these 7 areas were caused by just a few individual grizzly bears. The 7 areas where most conflicts occurred included the South Badger Creek area where bears killed sheep; the upper Green River area where bears killed cattle; the Wood River area where bears obtained bird feed, grain, and garbage; the North and South Forks of the Shoshone River where bears killed cattle and sheep, damaged apiaries, and obtained garbage; the area around Tom Miner Basin where bears killed chickens and turkeys, and obtained dog food; the area around the Indian Creek Campground where bears damaged tents; and the area around Gardiner where bears obtained apples from orchards and dog food, bird seed, and damaged vehicles around residences. The Badger Creek, Green River, and Shoshone River areas have consistently had more conflicts than other areas of the ecosystem each of the last 3 years (1997-99). Future management and public education efforts should be directed at reducing conflicts in these 3 geographic areas.

The majority of conflicts in 1999 occurred outside of the Recovery Zone. The most prevalent types of conflicts that occurred outside of the Recovery Zone boundary were livestock depredations, incidents of grizzly bears obtaining human foods, and property damages. Incidents of grizzly bears obtaining human foods and damaging property in search of human foods are likely to increase outside of the Recovery Zone as bear numbers increase beyond the Recovery Zone boundary. Now that grizzly bears are becoming more common in areas beyond the Recovery Zone boundary, sanitation and public education programs designed to reduce bear-human conflicts should be expanded into these areas.

The number of reported livestock depredations by grizzly bears has increased from 8 in 1992 to over 70/year each of the last 3 years (1997-99). Over the last 3 years, livestock depredations have comprised 62% of all grizzly bear-human conflicts reported in the Yellowstone Ecosystem, a significant increase from 28% during the 3-year period 1992-94. The increase in the number of livestock depredations has occurred primarily outside of the Recovery Zone boundary. During the 3-year period 1992-94, 26% of all reported grizzly bear livestock depredations occurred outside of the Recovery Zone boundary, in contrast to 76% of depredations during the most recent 3-year period 1997-99. Although every effort is made to prevent bears involved in livestock depredations from further depredations, most grizzly bears that persistently prey on livestock are eventually removed in management actions. Four grizzly bears (#s 209, 269, 286, and 301) involved

in livestock depredations have been captured and euthanized over the last 8 years (1992-99), an average of 1 livestock-related removal every 2 years. During the same 8-year period, there were 23 incidents where grizzly bears involved in livestock depredations or associated with livestock grazing or calving areas were captured and translocated to areas further away from livestock. At present, highly selective control of livestock-depredating grizzly bears has resulted in only the most chronic depredators being removed from the Yellowstone population. Depredation on livestock will likely continue to increase as grizzly bear activity outside of the designated Recovery Zone increases. At some point the level of human tolerance of grizzly bear depredations on livestock will likely be exceeded, especially in areas far from the Recovery Zone boundary. At that point, predator control actions against depredating grizzly bears will likely increase as well. The interface areas between occupied grizzly bear habitat and livestock producing agricultural areas are likely to be a continual challenge to grizzly bear managers in the Yellowstone region. Future management should address both the overall increasing trend in grizzly depredations on livestock as well as the increasing trend for livestock depredations to occur outside of the existing Recovery Zone.

Over the last 8 years there have been 62 human-caused grizzly bear mortalities in the Yellowstone Ecosystem. The most prevalent causes of human-caused grizzly bear mortality were the killing of bears in self-defense (39%, $n = 24$) and management removal (35%, $n = 22$) of bears involved in bear-human conflicts. Other sources of human-caused grizzly bear mortality included incidents of poaching (13%, $n = 8$), bears being electrocuted by downed power-lines (5%, $n = 3$), mistaken identification by black bear hunters (5%, $n = 3$), and being hit and killed by vehicles (3%, $n = 2$).

Self-defense kills of grizzly bears have been the highest source of human-caused grizzly bear mortality over the last 8 years. Self-defense kills included incidents with hunters ($n = 22$) and incidents at private homes and cabins ($n = 2$). Increased hunter education efforts and promotion of the use of bear pepper spray during confrontations with bears have been emphasized over the last few years in an effort to reduce the number of self defense kills of grizzly bears by hunters. Bear pepper sprays containing capsicum appear to be potentially useful in deterring aggressive bears in a variety of field situations (Herrero and Higgins 1998). Over the last 2 years (1998-99), there were only 3 grizzly bears killed by hunters in self-defense, suggesting that hunter education efforts might have been effective.

Management removal of nuisance grizzly bears, especially food-conditioned bears, has been the second highest source of human-caused bear mortality in the ecosystem. Management related mortalities included removal of grizzly bears that were conditioned to human foods ($n = 11$) as well as those involved in property damages ($n = 4$), livestock depredations ($n = 4$), management handling accidents ($n = 2$), and human injuries ($n = 1$). Living in Bear Country workshops, backcountry camping information, trailhead and campground signs, press releases, information handouts and mailings, and personal contacts have been used to inform the public on methods of reducing bear-human conflicts while living, working, hiking, or camping in bear country. Continuation and

expansion of these programs is necessary to further reduce and/or prevent grizzly bear-human conflicts, especially during years with shortages of natural bear foods.

Incidents of poaching have been the third highest source of human-caused grizzly bear mortality during the last 8 years. These incidents included malicious killings, radio collars found cut off of bears, and bears killed and left in the field unreported.

LITERATURE CITED

Barber, K., and D. Ouren. 1999. Monitoring effects of human activities on grizzly bear habitat. Pages 51-57 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1998. U.S. Geological Survey, Bozeman, Montana.

Bartmann, R.M., G.C. White, L.H. Carpenter, and R.A. Garrott. 1987. Aerial mark-recapture estimates of confined mule deer in pinyon-juniper woodland. Journal of Wildlife Management 51:41-46.

Basile, J. 1982. Grizzly bear distribution in the Yellowstone area, 1973-79. U.S. Forest Service Research Note INT-321. 11pp.

Blanchard, B. 1985. Field techniques used in the study of grizzly bears. National Park Service, Interagency Grizzly Bear Study Team report. 24pp.

Blanchard, B. 1987. Size and growth patterns of the Yellowstone grizzly bear. International Conference on Bear Research and Management 7:99-108.

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

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

Blanchard, B.M., and R.R. Knight. 1996. Effects of wildfire on grizzly bear movements and foraging strategies. Proceedings - Second Biennial Scientific Conference. In press.

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

Bolten, A., K. Bjorndahl, H. Martins, T. Dellinger, M. Biscotio, S. Encalada, and J.R. Spotila. 1997. Loggerhead transatlantic developmental migrations demonstrated by mtDNA sequence analysis. Proceedings - Sea Turtle Biology and Conservation Workshop.

Bunnell, F. L., and D. E. N. Tait. 1981. Population dynamics of bears – implications. Pages 75-98 *in* C.W. Fowler and F.D. Smith, editors. Dynamics of large mammal populations. John Wiley and Sons, New York, New York.

Burton, R.L., J.K. Starks, and D.C. Peters. 1980. The army cutworm. Bulletin B-749, Agricultural Experimental Station, Oklahoma State University. 35pp.

Byers, J.R. 1978. Biosystematics of the genus *Euxoa* (Lepidoptera: Noctuidae) X. Incidence and level of mutiple mating in natural and laboratory populations. Can. Ent. 110:193-200.

Carroll, P., D. Everson, and H. Malcom. 1996. Introduction to GPS for Field Biologists. National Conservation Training Center, Branch of Technical Training, Route 2, Box 49, Kearneyville, West Virginia 25430.

Chapman, D.G. 1951. Some properties of the hypergeometric distribution with applications to zoological sample censuses. University of California Publication in Statistics 1:131-160.

Chapman, J.A., J.I. Romer, and J. Stark. 1955. Ladybird beetle and army cutworm adults as food for grizzly bears in Montana. Ecology 36:156-158.

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

Craighead, J.J., J. Varney, and F.C. Craighead. 1974. A population analysis of the Yellowstone grizzly bears. Montana Forest and Conservation Experiment Station Bulletin 40. School of Forestry, University of Montana, Missoula, Montana. 20pp.

Craighead, J.J., J.S. Sumner, and G.B. Scaggs. 1982. Definitive system for analysis of grizzly bear habitat and other wilderness resources. Wildlife-Wildlands Institute Monograph No.1.

Craighead, J.J., K.R. Greer, R.R. Knight, and H.I. Pac. 1988. Grizzly bear mortalities in the Yellowstone Ecosystem, 1959-87. Report of the Montana Department of Fish, Wildlife and Parks; Craighead Wildl.-Wildlands Institute; Interagency Grizzly Bear Study Team; and National Fish and Wildlife Foundation. 104pp.

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

Craighead, F.L., and E.R. Vyse. 1996. Brown/grizzly bear metapopulations. Pages 325-351 *in* D. McCullough, editor. Metapopulations and wildlife conservation. Island Press, Washington, D.C.

Domino, R.P., W.B. Showers, S.E. Taylor, and R.H. Shaw. 1983. Spring weather pattern associated with suspected black cutworm moth (Lepidoptera: Noctuidae) introduction to Iowa. Environ. Entomol. 12:1863-1872.

Eberhardt, L.L. 1990. Survival rates required to sustain bear populations. J. of Wildl. Manage. 54:587-590.

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

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

Estoup, A., L. Garnery, M. Solignac, and J. Cornuet. 1995. Microsatellite variation in honey bee (*Apis Mellifera* L.) populations: hierarchical genetic structure and test of the infinite allele and stepwise mutation models. Genetics 140:679-695.

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

Farnes, P., C. Heydon, and K. Hansen. 1999. Snowpack distribution across Yellowstone National Park. Montana State University, Department of Earth Sciences, Bozeman. 58pp.

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

Garcìa-Moreno, J., M.D. Matocq, M.S. Roy, E. Geffen, and R.K. Wayne. 1996. Relationships and genetic purity of the endangered Mexican wolf based on analysis of microsatellite loci. Conservation Biology (10)2:376-389.

Green, G.I. 1994. Use of spring carrion by bears in Yellowstone National Park. M.S. Thesis, University of Idaho, Moscow, Idaho. 161 pp.

Gunther, K.A., M.J. Biel, H. Corrigan, D. Ireland, H.L. Robison, and H.N. Zachary. 2000. Bear management office administrative annual report for calendar year 1999. U.S. Department of the Interior, National Park Service, Bear Management Office, Yellowstone National Park, Wyoming.

Gunther, K.A., and M.J. Biel. 1999. Reducing human-caused black and grizzly bear mortality along roadside corridors in Yellowstone National Park. Pages 25-27 *in* Proceedings of the International Conference on Wildlife Ecology and Transportation. FL-ER-73-99.

Gunther, K.A., K. Aune, S. Cain, T. Chu, and C.M. Gillin. 1993. Grizzly bear-human conflicts in the Yellowstone Ecosystem 1992. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee report. U.S. Department of the Interior, National Park Service, Yellowstone National Park, Wyoming.

Gunther, K.A., M. Bruscino, S. Cain, T. Chu, K. Frey, and R.R. Knight. 1994. Grizzly bear-human conflicts, confrontations, and management actions in the Yellowstone Ecosystem, 1993. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee Report. U.S. Department of the Interior, National Park Service, Yellowstone National Park, Wyoming.

Gunther, K.A., M. Bruscino, S. Cain, T. Chu, K. Frey, and R.R. Knight. 1995. Grizzly bear-human conflicts, confrontations, and management actions in the Yellowstone Ecosystem, 1994. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee Report. U.S. Department of the Interior, National Park Service, Yellowstone National Park, Wyoming.

Gunther, K.A., M. Bruscino, S. Cain, T. Chu, K. Frey, and R.R. Knight. 1996. Grizzly bear-human conflicts, confrontations, and management actions in the Yellowstone Ecosystem, 1995. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee Report. U.S. Department of the Interior, National Park Service, Yellowstone National Park. Wyoming.

Gunther, K.A., M. Bruscino, S. Cain, T. Chu, K. Frey, and R.R. Knight. 1997. Grizzly bear-human conflicts, confrontations, and management actions in the Yellowstone Ecosystem, 1996. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee Report. U.S. Department of the Interior, National Park Service, Yellowstone National Park, Wyoming.

Gunther, K.A., M.T. Bruscino, S. Cain, J.T. Chu, K. Frey, M.A. Haroldson, and C.C. Schwartz. 1998. Grizzly bear-human conflicts, confrontations, and management actions in the Yellowstone Ecosystem, 1997. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee Report. U.S. Department of the Interior, National Park Service, Yellowstone National Park, Wyoming.

Gunther, K.A., M.T. Bruscino, S. Cain, J. Copeland, K. Frey, M.A. Haroldson, and C.C. Schwartz. 1999. Grizzly bear-human conflicts, confrontations, and management actions in the Yellowstone Ecosystem, 1998. Interagency Grizzly Bear Committee, Yellowstone Ecosystem Subcommittee Report. U.S. Department of the Interior, National Park Service, Yellowstone National Park, Wyoming.

Gunther, K.A., and R.R. Renkin. 1990. Grizzly bear predation on elk calves and other fauna of Yellowstone National Park. International Conference on Bear Research and Management 8:329-334.

Haroldson, M.A., M. Ternent, G. Holm, R.A. Swalley, S. Podruzny, D. Moody, and C.C. Schwartz. 1998. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1997. U.S. Geological Survey, Biological Resources Division, Bozeman, Montana. 54pp.

Haroldson, M., D. Reinhart, K. Gunther, and L. Waitts. 1999. Spawning cutthroat trout numbers on tributary streams to Yellowstone Lake and grizzly bear use of spawning trout. Pages 33-40 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1998. U.S. Geological Survey, Bozeman, Montana.

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

Herrero, S., and A. Higgins. 1998. Field use of capsicum spray as bear deterrent. Ursus 10:533-537.

Hoskins, W.P. 1975. Yellowstone Lake tributary study. Interagency Grizzly Bear Study Team, Bozeman, Montana. Unpublished report. 31pp.

Houston, D.B. 1982. The northern Yellowstone Elk. Macmillan Publishing Company, New York, New York. 474pp.

Klaver, R.W., J.J. Claar, D.B. Rockwell, H.R. Mays, and C.F. Acevedo. 1986. Grizzly bears, insects and people: bear management in the McDonald Peak Region, Montana. Pages 204-211 *in* G.P. Contreras and K.E. Evans, editors. Proceedings - grizzly bear habitat symposium. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah. General Technical Report INT-207.

Knight, R.R., B.M. Blanchard, and M.A. Haroldson. 1997. Yellowstone grizzly bear investigations 1996. Annual report of the Interagency Study Team. U.S. Department of the Interior, U.S. Geological Survey, Bozeman, Montana.

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

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

Knight, R.R., D.J. Mattson, and B.M. Blanchard. 1984. Movements and habitat use of the Yellowstone grizzly bear. National Park Service, Interagency Grizzly Bear Study Team report. 177pp.

Lebo, J.A., W.L. Cranor, and J.D. Petty. 2000. Screening of army cutworm moth samples for organochlorine pesticides and other unknown contaminates. U.S. Geological Survey, Columbia Environmental Research Center, Columbia, Missouri. 22pp.

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

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

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

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

Mattson, D.J., and C. Jonkel. 1990. Stone pines and bears. Pages 223-236 *in* W.C. Schmidt and K. J. McDonald, compilers. Proceedings-symposium on whitebark pine ecosystems: ecology and management of a high-mountain resource. U.S. Forest Service General Technical Report INT-270.

Mattson, D.J., and R.R. Knight. 1992. Spring bear use of ungulates in the Firehole River Drainage of Yellowstone National Park. Pages 5-93 - 5-120 *in* J.D. Varley and W.G. Brewster, editors. Wolves for Yellowstone? a report to the United States Congress, Volume IV Research and Analysis. National Park Service, Yellowstone National Park, Wyoming.

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

McIntyre, J.D. 1996. Review and assessment of possibilities for protecting the cutthroat trout of Yellowstone Lake from introduced lake trout. Pages 28-33 *in* J.D. Varley and P. Schullery, editors. The Yellowstone Lake crisis: confronting a lake trout invasion. National Park Service Report. Yellowstone National Park, Wyoming.

McLellan, B.N. 1994. Density-dependent population regulation of brown bears. Density-dependent population regulation in black, brown, and polar bears. International Conference on Bear Research and Management. Monograph 3:15-24.

Mealey, S.P. 1975. The natural food habits of free-ranging grizzly bears in Yellowstone National Park, 1973-1974. M.S. Thesis, Montana State University, Bozeman, Montana. 158 pp.

Mealey, S.P. 1980. The natural food habits of grizzly bears in Yellowstone National Park. International Conference on Bear Research and Management 3:281-292.

Miller, S.D., E.F. Becker, and W.H. Ballard. 1987. Black and brown bear density estimates using modified capture-recapture techniques in Alaska. International Conference on Bear Research and Management 7:23-35.

Miller, S.D., G.C. White, R.A. Sellers, H.V. Reynolds, J.W. Schoen, K. Titus, V. Barnes, Jr., R.B. Smith, R.R. Nelson, W.B. Ballard, and C.C. Schwartz. 1997. Brown and black bear density estimation in Alaska using radiotelemetry and replicated mark-resighting techniques. Wildlife Monograph 133. 53pp.

Moen, R., J. Pastor, Y. Cohen, and C.C. Schwartz. 1996. Effects of moose movement and habitat use on GPS collar performance. Journal of Wildlife Management 60(3):659-668.

Moen, R., J. Pastor, and Y. Cohen. 1997. Accuracy of GPS telemetry collar locations with differential correction. Journal of Wildlife Management 61(2):530-539.

Neal, A.K., G.C. White, R.B. Gill, and D.F. Reed, and J.H. Olterman. 1993. Evaluation of mark-resight model assumptions for estimating mountain sheep numbers. Journal of Wildlife Management 57:436-450.

Nelson, R.A., G.E. Folk, E.W. Pfeifer, J.J. Craighead, C.J. Jonkel, and D.L. Steiger. 1983. Behavior, biochemistry, and hibernation in black, grizzly and polar bears. International Conference on Bear Research and Management 5:284-290.

O'Brien, S.L., and F.G. Lindzey. 1994. Grizzly bear use of moth aggregation sites and summer ecology of army cutworm moths in the Absaroka Mountains, Wyoming. Final Report to the Wyoming Game and Fish Department, Wyoming Cooperative Fish and Wildlife Research Unit, University of Wyoming, Department of Zoology-Physiology, Laramie, Wyoming. 279pp. [plus 15 pages of preface including cover]

O'Brien, S.L., and F.G. Lindzey. 1998. Aerial sightability and classification of grizzly bears at moth aggregation sites in the Absaroka Mountains, Wyoming. Ursus 10:427-435.

Palsboll, P.J., J. Allen, M. Bèrubè, P.J. Clapham, T.P. Feddersen, P.S. Hammond, R.R. Hudson, H. Jorgensen, S. Katona, A.H. Larsen, F. Larsen, J. Lien, D.K. Mattila, J. Sigurjònsson, R. Sears, T. Smith, R. Sponer, P. Stevick, and N. Olen. 1997. Genetic tagging of humpback whales. Nature 388:767-769.

Pritchard, G.T., and C.T. Robbins. 1990. Digestive and metabolic efficiencies of grizzly and black bears. Canadian Journal of Zoology 69:1645-1651.

Pruess, K.P. 1967. Migration of the army cutworm, *Chorizagrotis auxiliaris* (Lepidoptera: Noctuidae). I. evidence for a migration. Annals of the Entomological Society of America 60(5):910-920.

Queller, D.C., J.E. Strassmann, and C.R. Hughes. 1993. Microsattelites and kinship. TREE (8)8:285-288.

Rankin-Baransky, K., C.J. Williams, B.W. Bowen, S.E. Encalada, and J.R. Spotila. 1997. Origin of loggerhead sea turtles in the Western N. Atlantic as determined by mtDNA sequence analysis. Proceedings - Sea Turtle Biology and Conservation Workshop.

Reinhart, D.P. 1990. Grizzly bear use of cutthroat trout spawning streams in tributaries of Yellowstone Lake. M.S. Thesis, Montana State University, Bozeman, Montana. 128pp.

Reinhart, D.P., S.T. Olliff, and K.A. Gunther. In press. Managing bears and developments on cutthroat spawning streams in Yellowstone Park. Greater Yellowstone Predators: Proceedings of the Third Biennial Scientific Conference on the greater Yellowstone Ecosystem.

Rempel, R.S., A.R. Rodgers, K.F. Abraham. 1995. Performance of a GPS animal location system under boreal forest canopy. Journal of Wildlife Management 59(3):543-551.

Rempel, R.S., A.R. Rodgers. 1997. Effects of differential correction on accuracy of a GPS animal location system. Journal of Wildlife Management 61(2):525-530.

Robison, H. 1999. Moth project summary and description of fieldwork for summer and fall 1999. Unpublished summary submitted to the Interagency Grizzly Bear Study Team. U.S. Geological Survey, Bozeman, Montana. 2pp.

Rogers, L.L. 1987. Effects of food supply and kinship on social behavior, movements, and population growth of black bears in northeastern Minnesota. Wildlife Monograph No. 97.

Schullery, P., and J.D. Varley. 1996. Cutthroat trout and the Yellowstone Ecosystem. Pages 12-21 *in* J.D. Varley and P. Schullery, editors. The Yellowstone Lake crisis: confronting a lake trout invasion. National Park Service report Yellowstone National Park, Wyoming.

Schwartz, C.C. 1999. Evaluation of a Capture-Mark-Recapture estimator to determine grizzly bear numbers and density in the Greater Yellowstone Area. Pages 13-20 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1998. U.S. Geological Survey, Bozeman, Montana.

Servheen, C.W. 1983. Grizzly bear food habits, movements, and habitat selection in the Mission Mountains, Montana. Journal of Wildlife Management 47(4):1026-1035.

Showers, W. B.F. Whitford, R.B. Smelser, A.J. Keaster, J.F. Robinson, J.D. Lopez, and S.E. Taylor. 1989. Direct evidence for meteorologically driven long-range dispersal of an economically important moth. Ecology 70(4):987-992.

Strickland, E.H. 1916. The army cutworm (*Euxoa* [*Chorizagrotis*] *auxiliaris* Grote). Canadian Department of Agriculture, Entomology Branch Bull. 13. 31pp.

Stringham, S.F. 1990. Grizzly bear reproductive rate relative to body size. International Conference on Bear Research and Management 8:433-443.

Ternent, M., and M. Haroldson. 1999. Grizzly bear use of insect aggregation sites documented from aerial telemetry and observations. Pages 40-44 *in* C.C. Schwartz and M.A. Haroldson, editors. Yellowstone grizzly bear investigations: annual report of the Interagency Grizzly Bear Study Team, 1998. U.S. Geological Survey, Bozeman, Montana.

U.S. Fish and Wildlife Service. 1993. Grizzly bear recovery plan. Missoula, Montana. 181pp.

White, G.C. 1996. NOREMARK: population estimation from mark-resighting surveys. Wildlife Society Bull.

White, G.C., and R.A. Garrott. 1990. Analysis of wildlife radio-tracking data. Academic Press, New York, New York. 383pp.

Appendix A. Number of different incidents of grizzly bear inflicted human injury and total number of people injured by grizzly bears in the Yellowstone Ecosystem, 1992-99.

Year	Number of incidents of bear-inflicted human injury	Number of people injured
1992	3	4
1993	0	0
1994	9	9
1995	3	3
1996	2	3
1997	8	9
1998	4	4
1999	2	2

Appendix B. Number of incidents where livestock were killed, number where livestock were injured, and total number of incidents of livestock depredation recorded in the Yellowstone Ecosystem, 1992-99.

Year	Killed livestock	Injured livestock	Total livestock depredations
1992	8	0	8
1993	46	4	50
1994	19	1	20
1995	40	2	42
1996	48	1	49
1997	72	1	73
1998	68	3	71
1999	71	1	72

Appendix C. Grizzly bear-human conflicts reported in the Yellowstone Ecosystem, 1999.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of conflict	Resolution	Source
GTNP: 2								
07/22/99	n/a	GTNP	Elk Ranch	540600 E, 4851400 N	Unk	Cattle Depredation/1 calf killed, 1 calf inj.	Investigated/No action taken	GTNP
07/28/99	n/a	GTNP	Elk Ranch	539600 E, 4851800 N	Unk	Cattle Depredation-1 calf killed	Investigated/No action taken	GTNP
IFG:2								
07/12/99	12	ID-State	North of Henry's Lake	468000 E, 4947000 N	Unk	Cattle Depredation-Killed 1 calf	Attempt trap-Unsuccessful	IFG
07/12/99	12	TNF	Centennial Range	453000 E, 4929000 N	Unk	Sheep Depredation-Killed several sheep	Attempt trap-Unsuccessful	IFG
MFWP:15								
05/07/99	2	MT-private	Gardiner, 3 mile marker	518100 E, 4991300 N	Unk	Anthropogenic Foods–Bird feeder	Bird Feeder Removed	MFWP
05/17/99	2	MT-private	Rock Creek	504300 E, 5006300 N	Unk 3 Bears	Livestock Depredation-Chickens	Investigated	MFWP
05/18/99	2	MT-private	Rock Creek	504300 E, 5006300 N	Unk 3 Bears	Anthropogenic Foods-Dog food/blood fertilizer	Investigated/Clean-up	MFWP
05/18/99	5	MT-private	Cooke City	584200 E, 4985400 N	Unk	Anthropogenic Foods-Bird Feed	Investigated	MFWP
08/02/99	2	MT-private	Mol Heron Creek	510500 E, 4989100 N	Unk	Anthropogenic Foods-Dog Food/Damaged car	Investigated	MFWP
08/03/99	2	MT-private	Tom Miner Basin	505800 E, 5002800 N	Unk	Livestock Depredation-Chickens	Attempt trap-Unsuccessful	MFWP
08/05/99	2	MT-private	Tom Miner Basin	506800 E, 5004100 N	Unk	Livestock Depredation-Chickens	Attempt trap-Unsuccessful	MFWP
08/06/99	2	MT-private	Tom Miner Basin	507600 E, 5004000 N	Unk	Livestock Depredation-Turkeys,geese,chickens	Attempt trap-Unsuccessful	MFWP
08/09/99	11	MT-private	South Fork Madison	481400 E, 4953100 N	Unk	Property Damage-Float Tube and tire	Investigated/Area patrolled	MFWP
08/16/99	11	MT-private	Watkins Creek	478600 E, 4961200 N	Unk	Anthropogenic Foods-Garbage	Attempt trap-Unsuccessful	MFWP
08/18/99	3	GNF	Iron Mountain	551000 E, 5002500 N	Unk	Sheep Depredation-Killed 19 sheep	Sheep moved	MFWP
08/19/99	11	MT-private	Kirkwood Creek/Hebgen Lake	476600 E, 4965000 N	Unk	Anthropogenic Foods-Garbage	Attempt trap-Unsuccessful	MFWP
09/08/99	11	MT-private	Buttermilk/Denny Creek	481700 E, 4947400 N	Unk	Anthropogenic Foods-Grain	Investigated	MFWP
09/15/99	3	GNF	Slough Creek	566000 E, 4990100 N	Unk	Anthropogenic Foods-Camp foods	Investigated	MFWP
09/20/99	3	GNF	Cat Creek	554100 E, 4993900 N	#298 + 2 COY	Property Damage-Wall tent	Investigated	MFWP
WGF:79								
04/24/99	24	WY-private	Wood River	656800 E, 4871100 N	#326, SAd-M	Anthropogenic Foods-Bird seed/suet	Attempt trap	WGF
04/25/99	24	WY-private	Wood River	656800 E, 4871100 N	SAd-M, #326	Anthropogenic Foods-Grain/garbage	Trap/Translocate-Elks Fork	WGF
05/14/99	24	WY-private	South Fork Shoshone	637600 E, 4921100 N	Unk	Beehives-Bear damaged 2 hives	Investigated	WGF
05/16/99	24	WY-private	South Fork Shoshone	635100 E, 4917100 N	Unk	Property Damage-Chicken coop	Investigated	WGF
05/16/99	24	WY-private	South Fork Shoshone	637606 E, 4918922 N	Unk	Anthropogenic Foods-Garbage	Investigated	WGF
05/17/99	n/a	WY-private	South Fork Shoshone	642701 E, 4918753 N	SAd-F, #334	Sheep Depredation-Killed 3 lambs/inj. 1 lamb	Trap/Translocate/Antelope Creek	WGF
05/17/99	24	WY-private	South Fork Shoshone	637606 E, 4918922 N	Unk	Anthropogenic Foods-Garbage	Attempt trap-Unsuccessful	WGF
05/17/99	24	WY-private	Sheep Creek	638082 E, 4916913 N	Unk	Beehives-Bear Damaged 4 beehives	Fixed electric fence	WGF
06/16/99	24	WY-private	Jordan Creek	625420 E, 4914161 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
06/21/99	24	WY-private	South Fork Shoshone	626881 E, 4916185 N	SAd-M, #339	Cattle Depredation-Killed 1 calf	Trap/Translocate-Oxbow Creek	WGF
06/28/99	16	SNF	West Fork Dunoir	539200 E, 4841100 N	Unk	Cattle Depredation-Injured cow	Investigated	WGF
07/05/99	24	SNF	North Fork Shoshone	591743 E, 4923251 N	Unk	Property Damage-Raft	Attempt trap	WGF
07/05/99	24	SNF	North Fork Shoshone	591740 E, 4923251 N	Unk	Property Damage-Life vest	Attempt trap-Unsuccessful	WGF
07/07/99	24	WY-private	Sheep Creek	638082 E, 4916913 N	SAd-M, #312	Beehives-Bear Knocked over 5 hives	Fixed electric fence	WGF
07/08/99	n/a	BTNF	Crow Creek	583300 E, 4803800 N	Unk	Cattle Depredation-Killed 1 calf	Attempt trap	WGF
07/08/99	n/a	BTNF	Crow Creek	585000 E, 4803800 N	Unk	Cattle Depredation-Killed 1 calf	Attempt trap	WGF
07/08/99	24	WY-private	Sheep Creek	638082 E, 4916913 N	SAd-M, #312	Beehives-Bear knocked over 2 hives	Trap/Translocate-Parque Creek	WGF
07/09/99	24	SNF	Whitt Creek	621000 E, 4918500 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/11/99	n/a	BTNF	Crow Creek	583300 E, 4803900 N	Unk	Cattle Depredation-Killed 1 calf	Attempt trap	WGF

Appendix C. Continued.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of conflict	Resolution	Source
07/11/99	n/a	BTNF	Crow Creek	583350 E, 4803950 N	Unk	Cattle Depredation-Killed 1 yearling	Attempt trap	WGF
07/11/99	n/a	BTNF	Crow Creek	582809 E, 4804105 N	Unk	Cattle Depredation-Killed 1 calf	Attempt trap	WGF
07/11/99	n/a	WY-private	Wood River	657900 E, 4872500 N	Unk	Anthropogenic Foods-Garbage/Damaged barn	Attempt trap-Unsuccessful	WGF
07/12/99	n/a	BTNF	Crow Creek	583200 E, 4803700 N	Ad-M, #269	Cattle Depredation-Killed 1 calf	Trap/Remove-Euthanize	WGF
07/12/99	n/a	WY-private	Wood River	657900 E, 4872500 N	Unk	Anthropogenic Foods-Bird feed	Investigated	WGF
07/12/99	n/a	WY-private	Wood River	653700 E, 4868000 N	Unk	Anthropogenic Foods-Bird feed	Investigated	WGF
07/15/99	n/a	BTNF	Mud Lake	585290 E, 4803090 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/16/99	n/a	BTNF	Green River	582400 E, 4804300 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/19/99	24	WY-private	East Twin Creek	623310 E, 4914460 N	Unk	Cattle Depredation-Killed 1 cow	Investigated	WGF
07/20/99	n/a	BTNF	Mud Lake	585200 E, 4803000 N	Unk	Cattle Depredation	Investigated	WGF
07/20/99	24	WY-private	West Twin Creek	621900 E, 4913500 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/21/99	24	WY-private	West Twin Creek	621800 E, 4913100 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/21/99	24	SNF	Whitt Creek	620800 E, 4915400 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/26/99	n/a	BTNF	Gypsum Creek	585700 E, 4795100 N	Unk	Cattle Depredation-Killed 1 calf	Attempt trap	WGF
07/26/99	n/a	BTNF	Gypsum Creek	585100 E, 4794700 N	Unk	Cattle Depredation-Killed 1 calf	Attempt Trap	WGF
07/27/99	n/a	BTNF	Crow Creek	588100 E, 4803700 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/30/99	n/a	BTNF	Mud Lake	585220 E, 4803040 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
07/30/99	24	WY-private	East Twin Creek	623255 E, 4914628 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
08/04/99	n/a	BTNF	TOSI Creek	567500 E, 4797500 N	Unk	Sheep Depredation-Killed 1 ewe	Report Taken	WGF
08/04/99	25	WY-private	Dunoir River	597100 E, 4832350 N	Ad-F + 2 COY	Anthropogenic Foods-Livestock feed	Attempt trap	WGF
08/05/99	n/a	BTNF	TOSI Creek	567550 E, 4797550 N	Unk	Sheep Depredation-Killed 1 lamb	Report Taken	WGF
08/07/99	n/a	BTNF	TOSI Creek	567600 E, 4797600 N	Unk	Sheep Depredation-Killed 1 ewe	Report Taken	WGF
08/07/99	n/a	BTNF	Wagon Creek	579190 E, 4807990 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
08/07/99	n/a	BTNF	Strawberry Creek	583100 E, 4810700 N	Unk	Cattle Depredation-killed 1 calf	Investigated	WGF
08/07/99	25	WY-private	Dunoir River	596770 E, 4837040 N	Ad-F + 2 COY	Property Damage-Boat seats/upholstery	Investigated	WGF
08/07/99	25	WY-private	Dunoir River	594300 E, 4835950 N	Unk	Cattle Depredation-Yearling cow	Attempt trap	WGF
08/07/99	n/a	BTNF	Park Creek	575367 E, 4814471 N	Unk	Cattle Depredation-4 yr old Black Angus	Attempt trap	WGF
08/07/99	n/a	BTNF	Park Creek	574815 E, 4813595 N	Unk	Cattle Depredation-1 Black Angus bull calf	Attempt trap	WGF
08/08/99	n/a	BTNF	Park Creek	574530 E, 4814251 N	Unk	Cattle Depredation-1 Black Angus Heifer calf	Attempt trap	WGF
08/09/99	n/a	BTNF	Park Creek	574621 E, 4814977 N	Unk	Cattle Depredation-Killed 1 commercial steer	Attempt trap	WGF
08/09/99	n/a	BTNF	Park Creek	574564 E, 4814008 N	Unk	Cattle Depredation-1 Black Angus bull calf	Attempt trap	WGF
08/10/99	n/a	BTNF	Park Creek	575879 E, 4814085 N	Unk	Cattle Depredation-1 Black Angus Heifer calf	Attempt trap	WGF
08/12/99	n/a	BTNF	Park Creek	575793 E, 4810629 N	Unk	Cattle Depredation-Black Angus Bull calf	Attempt trap	WGF
08/12/99	n/a	BTNF	Strawberry Creek	582500 E, 4811050 N	Unk	Cattle Depredation-Killed 1 calf	Investigated	WGF
08/16/99	18	TNF	South Badger Creek	501136 E, 4858118 N	Ad-F + 1 COY	Sheep Depredation-Killed 4 ewes	Investigated	WGF
08/17/99	n/a	BTNF	Leeds Creek	583667 E, 4817424 N	Unk	Cattle Depredation-1 Black Angus Heifer calf	Attempt trap	WGF
08/20/99	18	TNF	South Badger Creek	501236 E, 4858108 N	Ad-F + 1 COY	Sheep Depredation-Killed 2 ewes	Attempt trap	WGF
08/21/99	18	TNF	South Badger Creek	501216 E, 4858148 n	Ad-F + 1 COY	Sheep Depredation-Killed 1 lamb	Attempt trap	WGF
08/22/99	n/a	BTNF	Leeds Creek	582300 E, 4820500 N	Unk	Cattle Depredation-1 registered bull calf	Attempt trap	WGF
08/23/99	18	TNF	South Badger Creek	501215 E, 4858141 n	Ad-F + 1 COY	Sheep Depredation-Killed 1 Ewe	Attempt trap	WGF
08/24/99	n/a	BTNF	Bull Moose Creek	584136 E, 4819386 N	Ad-F + 2 yrls	Cattle Depredation-1 Black Angus Heifer calf	Attempt trap	WGF
08/24/99	n/a	BTNF	Wagon Creek	579100 E, 4807900 N	Unk	Cattle Depredation-killed 1 calf	Investigated	WGF
08/26/99	n/a	BTNF	Bull Moose Creek	584183 E, 4818572 N	#270 + 2 yrls	Cattle Depredation-Killed 1 steer, 2 calves	Trap/Translocate-Sunlight Creek	WGF
08/27/99	18	TNF	South Badger Creek	501255 E, 4858041 N	Ad-F + 1 COY	Sheep Depredation-Killed 1 ewe	Attempt trap	WGF
08/28/99	18	TNF	South Badger Creek	501285 E, 4858081 N	Ad-F + 1 COY	Sheep depredation-Killed 1 ewe	Attempt trap	WGF
08/30/99	18	TNF	South Badger Creek	501025 E, 4856375 N	Ad-M, #347	Sheep Depredation-Killed 2 ewes, 1 lamb	Trap/Translocate-Mirror Plateau	WGF

Appendix C. Continued.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of conflict	Resolution	Source
09/05/99	18	TNF	South Badger Creek	501045 E, 4856371 N	Unk	Sheep Depredation-Killed 1 ewe	Investigated	WGF
09/05/99	n/a	BTNF	Leeds Creek	583033 E, 4816398 N	Unk	Cattle Depredation-1 Registered Black Angus heifer calf	Investigated	WGF
09/05/99	24	WY-State	Bull Creek	639200 E, 4907200 N	Ad-M, #348	Cattle Depredation-killed 1 heifer calf	Trap/Translocate-Grassy Lake Rd	WGF
09/06/99	18	TNF	South Badger Creek	501049 E, 4856376 N	Unk	Sheep Depredation-Killed 4 ewes	Investigated	WGF
09/08/99	n/a	BTNF	Bull Moose Creek	582850 E, 4817850 N	Unk	Cattle Depredation-1 Black Angus bull calf	Investigated	WGF
09/08/99	n/a	BTNF	Bull Moose Creek	582800 E, 4817800 N	Unk	Cattle Depredation-Registered Black Angus heifer calf	Investigated	WGF
09/10/99	18	TNF	South Badger Creek	501045 E, 4856379 N	Unk	Sheep Depredation-Killed 1 ewe	Investigated	WGF
09/18/99	n/a	BTNF	TOSI Creek	567650 E, 4797650 N	Unk	Sheep Depredation-Killed 1 ewe	Report Taken	WGF
09/12/99	n/a	BTNF	Leeds Creek	582800 E, 4816900 N	Unk	Cattle Depredation-1 Commercial heifer calf	Investigated	WGF
09/13/99	18	TNF	South Badger Creek	501041 E, 4856371 N	Unk	Sheep Depredation-Killed 1 ewe	Investigated	WGF
09/23/99	26	BTNF	Leeds Creek	582100 E, 4821700 N	Unk	Cattle Depredation-1 Registered Black Angus bull calf	Investigated	WGF
09/30/99	n/a	BTNF	South Fork Fish Creek	580900 E, 4816800 N	Unk	Cattle Depredation-1 Registered Black Angus calf	Investigated	WGF
10/15/99	n/a	BTNF	Wagon Creek	579150 E, 4807950 N	Unk	Cattle Depredation-Killed 1 Yearling	Investigated	WGF
11/07/99	26	BTNF	Devils Basin Creek	577400 E, 4824900 N	Unk	Cattle Depredation-1 Black Angus bull calf	Investigated	WGF
YNP: 15								
04/09/99	10	YNP	South of Mud Volcano	548600 E, 4938000 N	Unm	Property Damage-Vehicle, plastic molding	Report Taken	YNP
06/29/99	2	YNP	Indian Creek Campground	520960 E, 4970120 N	G64, SAd-M	Property Damage-1 Tent	Attempt trap	YNP
07/01/99	8	YNP	Jct. Lake Butte Drive	558610 E, 4927980 N	Unm, SAd	Anthropogenic foods-Potato chips	Management Hazing	YNP
07/08/99	2	YNP	Superintendents Campground	520600 E, 4969400 N	G64, SAd-M	Anthropogenic foods-Picnic foods	Attempt trap	YNP
07/09/99	2	YNP	Indian Creek Campground	520750 E, 4970000 N	G64, SAd-M	Property Damage-2 Tents	Attempt trap-Caught #325	YNP
07/18/99	2	YNP	Indian Creek Campground	520800 E, 4970100 N	G64, SAd-M	Property Damage-1 Tent	Attempt trap	YNP
07/26/99	5	YNP	Backcountry campsite 3L2	567100 E, 4964000 N	Ad, Sex Unk	Property Damage-1 Tent	Campsite Temporarily Closed	YNP
08/17/99	2	YNP	Backcountry camps 1G3, 1G4	514940 E, 4979930 N	G64, SAd-M	Property damage-2 tents	Trap/Remove-To Zoo	YNP
08/26/99	2	YNP	Stephens Creek	518550 E, 4987200 N	Unm, SAd	Apple orchard	Report Taken	YNP
08/27/99	2	YNP	Stephens Creek	518520 E, 4987170 N	Unm, SAd	Property damage-Vehicle, tire cover	Report Taken	YNP
08/27/99	2	YNP	3.5 miles up Black Butte Tr.	494810 E, 4989000 N	Sow + 2 yrl	Bear inflicted human injury	Bear Warnings Posted	YNP
08/31/99	8	YNP	5 miles west of East Ent.	572000 E, 4923800 N	Unm, SAd	Anthropogenic foods-Garbage	Investigation	YNP
09/06/99	2	YNP	Stephens Creek	518560 E, 4987200 N	Unm, SAd	Apple orchard	All Apples Picked Up	YNP
09/18/99	2	YNP	Stephens Creek	518550 E, 4987200 N	Unm, SAd	Apple orchard-Climbed tree to get apples	All Apples Picked From Tree	YNP
09/22/99	2	YNP	Black Butte Trail	495330 E, 4989540 N	Sow + 2 yrl	Bear inflicted human injury	Trail Temporarily Closed	YNP

Appendix D. Grizzly bear-human confrontations reported in the Yellowstone Ecosystem, 1999.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of confrontation	Resolution	Source
GTNP:0								
IFG:0								
MFWP:38								
04/21/99	29	MT-private	Pine Creek	537000 E, 5038800 N	Unm, Ad-M	Bear in Development-Near Residence	Investigated	MFWP
04/25/99	29	MT-private	Pine Creek	536900 E, 5037000 N	Unm, Ad-M	Aggressive Encounter-Bluff Charge	Investigated	MFWP
05/06/99	5	MT-private	Silver Gate	579600 E, 4984100 N	Unk	Bear In Development-Motel/Cabins	Investigated	MFWP
05/08/99	5	MT-private	Silver Gate	579600 E, 4984100 N	Unk	Bear In Development-Motel/Cabins	Attempt trap-Unsuccessful	MFWP
06/08/99	11	GNF	Beaver Creek	470000 E, 4966900 N	Unm, Ad-M	Bear In Development-Campground	Bear hazed out of Campground	MFWP
06/12/99	2	MT-private	Tom Miner Basin	497100 E, 4997000 N	Unk	Aggressive Encounter-Bluff Charge	Investigated	MFWP
06/18/99	11	GNF	Taylors Fork	475600 E, 4990700 N	Sow + 2 COY	Bear In Development-Near Residence	Bear hazed out of area	MFWP
06/25/99	1	GNF	Sentinel Creek	470300 E, 4978500 N	Sow + 1 COY	Aggressive Encounter	Investigated	MFWP
06/26/99	n/a	GNF	Wheeler Mountain	492900 E, 5039000 N	Sow + 2 COY	Aggressive Encounter–Bluff Charge	Investigated	MFWP
06/29/99	20	GNF	Dudley Creek	478300 E, 5014900 N	Unk	Bear In Backcountry Camp	Investigated	MFWP
07/04/99	4	GNF	Upper South Boulder River	559600 E, 5006200 N	Unm, Ad	Bear In Backcountry Camp	Investigated	MFWP
07/09/99	21	GNF	Upper South Boulder River	560000 E, 5021000 N	Unm, Ad	Bear In Backcountry Camp	Investigated	MFWP
07/13/99	11	GNF	Beaver Creek	470000 E, 4966900 N	Unm, Ad	Bear In Development-Campground	Bear hazed out of campground	MFWP
08/02/99	19	GNF	Mile Creek	465000 E, 4954200 N	Unk	Aggressive Encounter-Carcass on trail	Trail temp. closed	MFWP
08/02/99	3	MT-private	Cedar Creek	518200 E, 5000100 N	Unk, #325?	Bear In Development-Near Residence	Investigated	MFWP
08/02/99	n/a	GNF	Spanish creek	469700 E, 5031000 N	Unk	Aggressive Encounter	Investigated	MFWP
08/05/99	20	MT-private	Rock Creek	504300 E, 5006300 N	Unk	Bear In Development-Residential Yard	Investigated	MFWP
08/06/99	11	GNF	Cabin Creek	473100 E, 4968300 N	Unm, Male	Bear In Development-Campground	Investigated	MFWP
08/07/99	11	GNF	Campfire Lodge	470800 E, 4966400 N	Unm, Male	Bear In Development-Campground	Bear hazed out of campground	MFWP
08/24/99	11	MT-private	Duck Creek/Hebgen lake	488700 E, 4958500 N	Unm, 5 Bears	Bears In Development-Residence	Hazed hazed away all night	MFWP
08/25/99	11	GNF	Campfire Lodge	470800 E, 4966400 N	Unm, Male	Bear In Development-Campground	Bear hazed out of campground	MFWP
09/05/99	1	GNF	Buck Creek	469400 E, 5002800 N	Unk	Aggressive Encounter-Bluff Charge	Investigated	MFWP
09/13/99	3	GNF	Specimen Creek	539900 E, 4989500 N	Unk	Bear In Camp	Investigated	MFWP
09/15/99	3	GNF	Bull Mountain	561200 E, 4995500 N	Unk -Large	Aggressive Encounter-bluff Charge	Investigated	MFWP
09/16/99	2	GNF	Porcupine Creek	488500 E, 5005900 N	Female+2 yrl.	Aggressive Encounter-Charge	Investigated	MFWP
09/16/99	3	GNF	Telephone Basin	556500 E, 4993700 N	Sow + 2 COY	Aggressive Encounter-Bluff Charge	Investigated	MFWP
09/17/99	1	GNF	Shedhorn Mountain	466100 E, 4993700 N	Unm, Male	Aggressive Encounter	Investigated	MFWP
09/21/99	1	GNF	Taylors Fork	471200 E, 4984400 N	Unk	Aggressive Encounter-Defense of hunter carcass	Investigated	MFWP
09/27/99	1	GNF	Wapiti Creek	476500 E, 4986800 N	Unk	Aggressive Encounter	Investigated-Inform public	MTFWP
10/04/99	11	MT-private	Cream Creek	484200 E, 4946800 N	Unm, SAd	Bear In Development-Residence	Bear hazed away	MTFWP
10/05/99	2	GNF	Packsaddle Peak	496700 E, 5002700 N	Sow + 2 COY	Aggressive Encounter-Charge	Sprayed with pepper spray	MTFWP
10/14/99	n/a	GNF	East Baldy Basin	544700 E, 5047100 N	Sow + 2 COY	Aggressive Encounter	Investigated	MTFWP
10/24/99	n/a	GNF	Little Bear/Squaw	493600 E, 5033700 N	Female + 1 COY	Aggressive Encounter-Charge	Investigated	MTFWP
10/24/99	1	GNF	Shedhorn Mountain/Indian Creek	467400 E, 4994500 N	Ad Male-Large	Aggressive Encounter-Bluff Charge	Investigated	MTFWP
11/12/99	11	GNF	Cub Creek	476900 E, 4974800 N	Ad Male-Large	Bear In Backcountry Camp	Investigated	MTFWP
11/20/99	1	GNF	Taylors Fork	478500 E, 4982700 N	2 Subadults	Aggressive Encounter-Treed hunter	Fired shots, bears ran off	MTFWP
11/20/99	11	GNF	Upper Cub Creek	477500 E, 4975600 N	Sow + 3 COY	Aggressive Encounter	Investigated	MTFWP
11/20/99	11	GNF	Cub/Cabin Creeks	477100 E, 4975900 N	Sow + 3 yrls.	Aggressive Encounter	Investigated	MTFWP

Appendix D. Continued.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of confrontation	Resolution	Source
WGF:4								
04/29/99	24	WY-private	South Fork Shoshone	638380 E, 4916600 N	Ad-F, #327	On Ranch near Apiary & Calving Area	Trap/Translocate-Sweetwater Cr.	WGF
08/04/99	25	SNF	Long Creek	591000 E, 4835000 N	Unk	Aggressive Encounter-Charge	Report Taken	WGF
08/21/99	25	WY-private	Dunoir River	594220 E, 4838990 N	Ad-M, #185	Bear on Ranch Lands	Trap/Translocate-Parque Creek	WGF
09/01/99	17	BTNF	South Fork Buffalo Creek	586650 E, 4857810 N	SAd-M, #324	Bear In Camp-Hunters Camp	Bear Shot and Killed by Hunters	WGF
09/02/99	14	BTNF	Snake River	556560 E, 4885446 N	Unk	Bear In Camp	Bear shot and injured not killed	WGF
10/02/99	7	SNF	Crow Creek	574126 E, 4929847 N	Ad-F + 2 COY	Aggressive Encounter-Charge	Hunter Shot/Killed Sow	WGF
YNP: 52								
05/10/99	8	YNP	East Entrance Housing Area	579400 E, 4926700 N	Unk	Bear In Development	Report Taken	YNP
05/14/99	9	YNP	Tower Fall Campground	548300 E, 4970400 E	Unm, Ad	Bear In Development	Bear Monitored By Campground Host	YNP
05/18/99	8	YNP	East Entrance Housing Area	579200 E, 4926600 E	Sow + 2 COY	Bear In Developed Area	Bear Monitored By Ranger	YNP
05/28/99	10	YNP	Lake Horse Corrals	547490 E, 4934140 N	2 SAd's	Bear In Developed Area	Bear Hazed out of Area	YNP
05/31/99	2	YNP	Near Black Butte/Lava Butte	492000 E, 4987000 N	Unm, Ad	Aggressive Encounter-Bluff Charge	Bear Warnings Posted on Trail	YNP
05/31/99	2	YNP	Near Black Butte/Lava Butte	492300 E, 4987200 N	Sow + 2 COY	Aggressive Encounter-Bluff Charge	Bear Warnings Posted on Trail	YNP
06/03/99	9	YNP	Canyon Village Residential Area	538900 E, 4953800 N	Unm, Ad	Bear In Development	Report Taken	YNP
06/09/99	8	YNP	East Entrance Road/Teton Overlook	559180 E, 4928220 N	Unm, SAd	Aggressive Encounter-Bluff Charge	Bear Hazed out of Area	YNP
06/11/99	2	YNP	Backcountry Campsite 1C2	518500 E, 4964400 N	Unm, Ad	Bear In Camp	Bear Warnings Posted on Campsite	YNP
06/15/99	8	YNP	Wapiti Lake Trail	544500 E, 4951600 N	Sow + 3 COY	Aggressive Encounter-Bluff Charge	Bear Warnings Posted on Trail	YNP
06/19/99	10	YNP	Lake Horse Corrals	548100 E, 4934100 N	Unm, Ad	Bear In Development	Rangers Monitored Bear	YNP
06/20/99	10	YNP	Bridge Bay Campground	545240 E, 4931680 N	Unk	Bear In Development	Report Taken	YNP
06/24/99	14	YNP	Grant Village Campground	534760 E, 4919790 N	Unm, SAd	Bear In Development	Bear Hazed Out of Campground	YNP
06/26/99	10	YNP	Lake Hotel Employee Housing Area	548000 E, 4933100 N	Unm, SAd	Bear In Development	Report Taken	YNP
06/28/99	2	YNP	Indian Creek Campground	520920 E, 4970200 N	Unm, SAd	Bear In Development	Bear Warnings Posted	YNP
06/29/99	14	YNP	Grant Village Campground	534800 E, 4915680 N	Unk	Bear In Development	Report Taken	YNP
06/29/99	2	YNP	Indian Creek Campground	520920 E, 4970200 N	Unm, SAd	Bear In Development	Bear Warnings Posted	YNP
07/01/99	4	YNP	Slough Creek Campground	554900 E, 4977300 N	Unm, SAd	Bear In Development	Report Taken	YNP
07/04/99	9	YNP	Sulphur Creek/7 Miles Hole	547200 E, 4955700 N	Unm, Ad	Bear Approached Hikers	Trail Temporarily Closed	YNP
07/08/99	2	YNP	Superintendents Campground	520370 E, 4969190 N	Unm, SAd	Bear In Development	Campground Temporarily Closed	YNP
07/08/99	14	YNP	Heart Lake BC Campsite 8H2	539700 E, 4901500 N	Unk	Bear In Backcountry Camp	Bear Warnings Posted	YNP
07/09/99	2	YNP	Indian Creek Campground	520750 E, 4970000 N	Unm, SAd	Bear In Development	Bear Warnings Posted/Traps Set	YNP
07/10/99	14	YNP	Grant Village Campground	535000 E, 4915400 N	Unm, SAd	Bear In Development	Report Taken	YNP
07/11/99	14	YNP	Grant Residential Area	535780 E, 4914620 N	Unm, Ad	Bear In Development	Bear Hazed Out of Area	YNP
07/12/99	14	YNP	Grant Contractors Camp	536350 E, 4914800 N	Unm, Ad	Bear In Development	Bear Hazed Out of Area	YNP
07/16/99	14	YNP	Grant Village Campground	534300 E, 4916000 N	Unm, Ad	Bear In Development	Report Taken	YNP
07/18/99	2	YNP	Indian Creek Campground	520800 E, 4970100 N	Unm, SAd	Bear In Development	Bear Warnings Posted/Traps Set	YNP
07/18/99	14	YNP	Grant Village Hamilton Dorm Area	535000 E, 4915300 N	Unm, SAd	Bear In Development	Investigated	YNP
07/19/99	14	YNP	Grant Village Hamilton Dorm Area	534800 E, 4915600 N	Unk	Bear In Development	Investigated	YNP
07/20/99	8	YNP	Pelican Valley	552000 E, 4936000 N	Unm, Ad	Aggressive Encounter-Bluff Charge	Bear Warnings Posted on trail	YNP
07/20/99	5	YNP	Cache Creek	569000 E, 4964200 N	Unm, SAd	Aggressive Encounter-Bluff Charge	Report Taken	YNP
07/23/99	2	YNP	Stephens Creek	518560 E, 4987200 N	Unm, SAd	Bear In Development	Report Taken	YNP
07/24/99	2	YNP	Backcountry Campsite WC2	498920 E, 4979670 N	Unm, SAd	Bear In Backcountry Camp	Report Taken	YNP
07/26/99	5	YNP	Backcountry Campsite 3L2	567100 E, 4964000 N	Unk	Bear In Backcountry Camp	Campsite Temporarily Closed	YNP
07/29/99	5	YNP	On Trail between camps 3L1 & 3L4	567500 E, 4963000 N	Unm, Ad	Aggressive Encounter-Bluff Charge	Report Taken	YNP
08/03/99	8	YNP	Backcountry Campsite 5E8	556600 E, 4919000 N	Sow+2 2yr old	Bears In Backcountry Camp	Report Taken	YNP
08/13/99	4	YNP	Slough Creek/First Meadow	557300 E, 4977700 N	Sow + 2 COY	Bear Approached Hikers	Report Taken	YNP
08/14/99	2	YNP	Indian Creek Campground	520800 E, 4970100 N	Unm, SAd	Bear In Developed Area	Bear Warnings Already Posted	YNP

Appendix D. Continued.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of confrontation	Resolution	Source
08/17/99	2	YNP	Backcountry Campsite 1G3 & 1G4	514940 E, 4979930 N	G64, SAd-M	Bear In Occupied Backcountry Camp	Campsite Temp. Closed/Traps Set	YNP
08/19/99	8	YNP	Pelican Cone Trail	563000 E, 4940800 N	Sow + 2 COY	Aggressive Encounter-Bluff Charge	Report Taken	YNP
08/24/99	2	YNP	Stephens Creek	518550 E, 4987200 N	Unm, SAd	Bear In Development-Yard	Report Taken	YNP
08/26/99	9	YNP	7 Mile Hole Trail	544200 E, 4956000 N	Unm, Ad	Bear Approached Hikers	Trail Temporarily Closed	YNP
08/26/99	2	YNP	Stephens Creek	518550 E, 4987200 N	Unm, SAd	Bear In Development-Yard	Report Taken	YNP
08/27/99	2	YNP	Stephens Creek	518520 E, 4987170 N	Unm, SAd	Bear In Development-Yard	Report Taken	YNP
09/06/99	2	YNP	Stephens Creek	518560 E, 4987200 N	Unm, SAd	Bear In Development-Yard	Report Taken	YNP
09/12/99	2	YNP	Mt. Holmes Trail	510800 E, 4961800 N	Unm, Ad	Bear Approached Hikers	Report Taken	YNP
09/18/99	2	YNP	Stephens Creek	518550 E, 4987200 N	Unm, SAd	Bear In Development-Yard	Report Taken	YNP
09/22/99	14	YNP	Grant Village Campground	533500 E, 4917900 N	Unm, Ad	Bear In Development-Campground	Investigated	YNP
09/26/99	14	YNP	Grant Village-Grayling Dorm	534700 E, 4915600 N	Unm, Ad	Bear In Development	Investigated	YNP
10/13/99	10	YNP	Elephant Back Trail	547200 E, 4934300 N	Unm, Ad	Bear Approached-2 Hikers	Report Taken	YNP
10/11/99	14	YNP	Grant Village Developed Area	534700 E, 4915700 N	Unm, Ad	Bear In Development	Report Taken	YNP
10/21/99	10	YNP	Lake Horse Corrals	547900 E, 4933900 N	Unm, Ad	Bear In Development-Horse Corral	Monitored by Rangers	YNP

Appendix E. Grizzly bear management captures in the Yellowstone Ecosystem, 1999.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Type of conflict	Resolution	Source
GTNP:0								
IFG:0								
MFWP:0								
WGF:11								
04/27/99	29	WY-private	Wood River	657420 E, 4872200 N	SAd-M, #326	Anthropogenic Foods-Bird Feeders	Capture/Translocate-Elks Fork	WGF
04/29/99	24	WY-private	South Fork Shoshone	638380 E, 4916600 N	Ad-F, #327	On Ranch Near Apiary & Calving Area	Capture/Translocate-Sweetwater Cr.	WGF
05/18/99	29	WY-private	South Fork Shoshone	642701 E, 4918753 N	SAd-F, #334	Sheep Depredation	Capture/Translocate-Antelope Creek	WGF
06/23/99	24	WY-private	South Fork Shoshone	626909 E, 4916154 N	Ad-M, #339	Cattle Depredation	Capture/Translocate-Oxbow Creek	WGF
07/09/99	24	WY-private	Sheep Creek	638082 E, 4916913 N	SAd-M, #312	Damaged Bee Hives	Capture/Translocate-Parque Creek	WGF
07/12/99	29	BTNF	Crow Creek	585000 E, 4803800 N	Ad-M, #269	Cattle Depredations	Capture/Remove-Euthanize	WGF
08/20/99	n/a	BTNF	North Pinion Ridge	584500 E, 4811700 N	Ad-M, #345	Near area where cattle depredations occurred	Capture/Translocate-Oxbow Creek	WGF
08/27/99	29	BTNF	Bull Moose Creek	584183 E, 4818572 N	#270,G65,G66	Cattle Depredations	Capture/Translocate-Sunlight Creek	WGF
08/31/99	25	WY-private	Dunoir River	594220 E, 4838990 N	Ad-M, #185	On ranch near area where cattle depredations occurred, also wolf in area	Capture/Translocate-Parque Creek	WGF
09/01/99	18	TNF	Dry Ridge	501250 E, 4856370 N	SAd-M, #347	Sheep Depredation	Capture/Translocate-Mirror Plateau	WGF
09/06/99	24	WY-State	Bull Creek	639200 E, 4907200 N	Ad-M, #348	Cattle Depredation	Capture/Translocate-Grassy Lake Rd.	WGF
YNP:2								
07/13/99	2	YNP	Indian Creek Campground	520000 E, 4971100 N	#325, SAd-F	Trapped due to Tent Damage at Indian Creek Campground.	Capture/Translocate-Bear #325, Bear #325 Later Exonerated of Involvement in Tent Incidents.	YNP
08/22/99	2	YNP	Indian Creek Campground	520370 E, 4969190 N	G64, SAd-M	Damaging Tents	Captured/Removed-Sent To Zoo DNA Confirmed Bear #G64 Involvement in Tent Incidents	YNP

Appendix F. Known human-caused grizzly bear mortalities in the Yellowstone Ecosystem, 1999.

Date	BMU	Ownership	Location description	UTM location	Bear ID	Cause	Source
GTNP:0							
IFG:0							
MFWP:0							
WGF:5							
05/06/99	17	BTNF	Buffalo Fork	550523 E, 4852139 N	Ad-M, #277	Illegal-Poaching, Under Investigation	WGF
07/13/99	n/a	BTNF	Crow Creek	585000 E, 4803800 N	Ad-M, #269	Management Removal-Cattle Killer	WGF
09/01/99	17	BTNF	South Fork Buffalo Creek	586650 E, 4857810 N	SAd-M, #324	Hunter Self Defense-Bear Entered Hunter Camp	WGF
10/02/99	7	SNF	Crow Creek	574126 E, 4929847 N	Ad-F + 2 COY	Hunter Self Defense-Sow Charged, Hunter Shot/Killed Sow	WGF
10/19/99	16	SNF	Dunoir River	597572 E, 4843122 N	SAd-M	Illegal-Poaching, Under Investigation	WGF
YNP: 1							
08/22/99	2	YNP	Indian Creek Campground	520460 E, 4969170 N	G64, SAd-M	Management Removal-Sent To Zoo, Crushing Tents in Indian Creek Campground and Backcountry Campsites	YNP

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Appendix G. Known incidents of grizzly bear-human conflicts in the Yellowstone Ecosystem, 1992-98

Year	Total conflicts	Human injuries	Property damages	Anthropogenic foods	Gardens/orchards	Bee hives	Livestock depredations
1992	24	3	7	6	0	0	8
1993	90	0	14	19	7	0	50
1994	163	9	31	93	5	5	20
1995	144	3	20	56	9	14	42
1996	74	2	6	16	0	1	49
1997	116	8	8	21	6	0	73
1998	117	4	3	30	6	3	71
Total	728	29	89	241	33	23	313
Ave./yr	104 (±46 SD)	4 (±3 SD)	13 (±10 SD)	34 (±30 SD)	5 (±4)	3 (±5)	45 (±24)