Yellowstone Grizzly Bear Investigations 1995

Annual Report of the Interagency Grizzly Bear Study Team

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Report of the Interagency Grizzly Bear Study Team

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INTRODUCTION

The Interagency Grizzly Bear Study Team (IGBST) was initiated in 1973 and is a cooperative effort of the National Biological Service, National Park Service, Forest Service, and since 1974 the States of Idaho, Montana, and Wyoming. The IGBST conducts research that provides information needed by various agencies for immediate and long-term management of grizzly bears (*Ursus arctos horribilis*) inhabiting the Yellowstone area. With increasing demands on most resources in the area, current quantitative data on grizzly bears are required for formulation of management decisions that will insure survival of the population. IGBST annual reports are intended to facilitate the timely transfer of research results and perspectives to management of the population.

Objectives of the study are to determine the status and trend of the grizzly bear population, the use of habitats and food items by the bears, and the effects of land management practices on the bear population. Earlier research on grizzlies within Yellowstone National Park provided data for the period 1959-67 (Craighead et al. 1974). However, changes in management operations by the National Park Service since 1967 - mainly the closing of open pit garbage dumps - have markedly changed some food habits (Mattson et al. 1991), population parameters (Knight and Eberhardt 1985), and growth patterns (Blanchard 1987).

Distribution of grizzly bears within the study area (Basile 1982, Blanchard et al. 1992), movement patterns (Blanchard and Knight 1991), food habits (Mattson et al. 1991), habitat use (Knight et al. 1984), and population dynamics (Knight and Eberhardt 1985, Eberhardt et al. 1994) have been largely determined and are now being studied on a monitoring and updating level. Efforts are being concentrated on developing a GIS-based Cumulative Effects Model and assessing the effects of land use practices.

Movement data conclusively indicate that the existence of semi-autonomous population segments is unlikely and that the determination of population size will be difficult due to the average home range sizes of individual bears (cf. Blanchard and Knight 1991). Population trend indices appear to be more meaningful and measurable than a number estimate (Eberhardt et al. 1986). Research is ongoing in the attempt to document a sensitive and reliable trend index.

Data analyses and summaries presented in this report supersede all previously published data. Study methods are reported by Blanchard (1985) and Mattson et al. (1991). The study area has been described in detail by Blanchard and Knight (1991) and Mattson et al. (1991).

RESULTS AND DISCUSSION

Monitoring/Population Trend

Marked Animals

Thirty-nine individual grizzly bears were captured and marked during 1995 (Table 1), including 19 females (12 adult) and 20 males (12 adult). Twenty-three of the 39 had not been marked previously. Twenty-six captures were a result of research efforts and the bears were released on-site. Twenty-eight captures resulted from management actions involving conflicts on private land (14), campground-trailhead conflicts (2), livestock depredation (2), and conflict in a development (10); and 22 were transported to release sites within the Yellowstone ecosystem.

A total of 71 grizzly bears were monitored for varying intervals during 1995, including 28 adult females. A maximum of 23 adult females were monitored consecutively during October and 21 were wearing active transmitters at denning.

Since 1975, 262 grizzly bears have been radio-marked (Table 3).

Unduplicated Females

One method of monitoring population trend is recording the number of unduplicated females with cubs-of-the-year (COY) each year. A summary of procedures used to determine whether or not observations are duplicates were reported by and Knight et al. (1995).

Seventeen unduplicated females with 37 COY were observed in 9 Bear Management Units (BMUs) within the Recovery Zone during 1995 (Fig. 1). The current running 6-year average (1990-95) for the entire study area is 21 females per year with an average litter size of 2.19 cubs (Table 4). This 6-year average has steadily increased from 12 females per year with 1.85 cubs per litter during the period of 1973-78.

Table 1. Grizzly bears captured during 1995.

Bear	Sex	Age	Date	Location[a]	Release site[a]	Trapper
243	M	4	05/24	Mormon Cr, SNF	on site	IGBST
244	M	9	05/25	Mormon Cr, SNF	on site	IGBST
G55 (257)	M	2	05/24 09/14	SE of Cody, WY (private, mgt) Gardiner, MT (private, mgt)	Blacktail, YNP Eldridge Cr, GNF	WY MT
G56 (259)	M	2	05/24 09/23 10/05	SE of Cody, WY (private, mgt) Gardiner, MT (private, mgt) Wapiti, WY (private, mgt)	Blacktail, YNP Sunlight Cr, SNF mgt removal	WY MT WY
245	M	4	06/07	Gas Cr, SNF	on site	IGBST
246	F	7	06/10	Kitty Cr, SNF	on site	IGBST
188	F	7	06/11	Trail Cr, SNF	on site	IGBST
240	F	SAd	06/29 09/07	Grant, YNP (mgt) Gardiner, MT (mgt)	Bacon Rind, YNP to zoo	YNP MT
151	M	Ad	06/30	Beam Gulch, SNF	on site	IGBST
215	M	Ad	07/10	Flat Mountain Arm, YNP	on site	IGBST
179	F	6	07/15	Spread Cr, BTNF	on site	WY
G57	F	4	07/16	N Fork Shoshone, SNF (mgt)	to zoo	WY
247	F	6	07/22	Baldy Mountain, BTNF	on site	WY
248	F	2	07/22 08/30	Game Cr, BTNF Game Cr, BTNF	on site on site	WY WY
249	F	7	07/23 08/31	S Fk Shoshone, WY (private, mgt) S Fk Shoshone, WY (private, mgt)	Grassy Lake Rd, JDRMP Hominy Peak, TNF	WY WY
191	M	18	08/01 08/22	Taylor's Fork, MT (private, mgt) Black Butte, MT (private, mgt)	Eldridge Cr, GNF mgt removal	MT MT
211	M	5	08/05 10/11	Grebe Lake Road, YNP Norris, YNP	on site on site	IGBST IGBST
203	M	Ad	08/03	N Fork Spread Cr, BTNF	on site	WY
250	M	5	08/07	Grebe Lake Road, YNP	on site	IGBST
251	M	7	08/16	Split Rock Cr, BTNF	on site	WY
174	M	9	08/23 08/27	E Squaw Basin, BTNF E Squaw Basin, BTNF	on site on site	WY WY
252	M	6	08/04	Game Cr, BTNF	on site	WY
253	M	4	08/27	Squaw Basin, BTNF	on site	WY

Table 1. Continued.

Bear	Sex	Age	Date	Location[a]	Release site[a]	Trapper
254	F	6	09/02	Beaver Cr, GNF (mgt)	E Fk Crooked Cr, YNP	MT
189	F	14	09/07	Frozen Lake Cr, SNF (mgt)	Blacktail, YNP	WY
163	F	11	09/08 09/19	Mormon Cr, SNF (mgt) Covered Wagon, MT (private, mgt)	Bacon Rind Cr, YNP to zoo	WY MT
255	F	cub	09/08 09/19	Mormon Cr, SNF (mgt) Covered Wagon, MT (private, mgt)	Bacon Rind Cr, YNP to zoo	WY MT
256	M	cub	09/08 09/19	Mormon Cr, SNF (mgt) Covered Wagon, MT (private, mgt)	Bacon Rind Cr, YNP to zoo	WY MT
258	F	8	09/16	Boulder River, GNF (nontarget mgt)	Trapper Cr, GNF	MT
209	M	8	09/08	Elk Ranch, GTNP	Lamar, YNP	WY
260	M	4	09/25	Antelope Cr, YNP	on site	IGBST
106	F	19	09/23	N Fork Shoshone, SNF (mgt)	Grassy Lake, TNF	WY
261	F	Ad	09/20	N Fork Shoshone, SNF (mgt)	Parque Cr, SNF	WY
262	M	2	09/22	N Fork Shoshone, SNF (mgt)	Grassy Lake, JDRMP	WY
263	M	7	09/29	Brown Cr, Wood R, WY (private, mgt)	Swan Lake Flat, YNP	WY
125	F	12	10/13	Antelope Cr, YNP	on site	IGBST
264	F	4	10/14	Indian Cr, YNP	on site	IGBST
265	F	7	10/16	Dore residence, MT (private, mgt)	Natural Bridge Rd, YNP	MT
79	F	21	10/14	Dore residence, MT (private, mgt)	Otter Cr, YNP	MT
241	F	1	10/15	N Fork Shoshone, SNF	Black Butte, MT	WY

	Females	Males
Adults	12	12
Subadults	7	8

	Females		Males	
	Ad	SAd	Ad	SAd
Research	5	4	13	4
Management	11	5	3	9

New bears: 23
Total individual bears: 39
Total captures: 56

[a] BTNF = Bridger-Teton National Forest, GNF = Gallatin National Forest, GTNP = Grand Teton National Park, JDRMP = John D. Rockefeller, Jr. Memorial Parkway, SNF = Shoshone National Forest, YNP = Yellowstone National Park, (mgt = management action).

Table 2. Grizzly bears monitored, captured, and transported, 1980-95.

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

Table 3. Status of radio-marked grizzly bears, December 1995. (Age when died or age in 1995).

Known dead								Suspected dead			
Human-caused				Natural		Unknown		Human-caused		Natural or unknown	
3	(7)	90	(2)	1	(28[a])	77	(9)	7	(5)	13	(25[a])
4	(5)	93	(2)	12	(25[a])	108	(4)	11	(7)	16	(27[a])
5	(14)	94	(1)	56	(1)			24	(2)	19	(25[a])
6	(8)	95	(11)	65	(3)			32	(4)	36	(25[a])
8	(17)	97	(16)	145	(2)			75	(1)	51	(26[a])
9	(17)	105	(Ad)	161	(20)			102	(2)	54	(1)
10	(12)	110	(5)	187	(5)			147	(10)	55	(1)
14	(12)	113	(2)	180	(5)					68	(25[a])
15	(12)	120	(3)	200	(11)					84	(31[a])
17	(2)	121	(6)							86	(25[a])
18	(3)	122	(3)							109	(7)
20	(14)	127	(1)								
22	(9)	134	(8)								
25	(5)	150	(5)								
26	(22)	154	(4)								
27	(2)	158	(7)								
28	(16)	160	(5)								
29	(1)	163	(11)								
30	(2)	176	(5)								
31	(cub)	177	(12)								
34	(22)	181	(18)								
38	(13)	183	(4)								
39	(3)	186	(4)								
45	(6)	191	(18)								
46	(5)	198	(Ad)								
47	(2)	202	(4)								
49	(3)	223	(2)								
58	(2)	226	(12)								
59	(8)	230	(SAd)								
60	(6)	231	(2)								
62	(3)	235	(4)								
63	(4)	236	(14)								
67	(4)	240	(SAd)								
69	(3)	244	(9)								
76	(6)	250	(5)								
81	(4)	255	(cub)								
83	(19)	256	(cub)								
87	(15)	257	(SAd)								
88	(7)	259	(SAd)								
78 Total				9 Total		2 Total		7 Total		11 Total	

[a] Suspected died of old age.
[b] Known alive in 1991.
[c] Known alive in 1992.
[d] Known alive in 1993.
[e] Known alive in 1994.
[f] Known alive in 1995.

Table 3. Continued.

Off air								Active			
2	(24)	115	(19)	172	(8)			79	(21)	261	(Ad)
21	(22)	116	(21)	173[b]	(Ad)			106	(19)	262	(2)
23	(19)	117[b]	(12)	175[b]	(Ad)			124	(15)	263	(Ad)
33	(20)	118	(12)	178[b]	(9)			125	(12)	264	(Ad)
35	(20)	119	(14)	181[b]	(6)			136	(12)	265	(7)
37	(17)	123	(11)	184[d]	(14)			151	(15)		
40	(20)	126	(23)	185[c]	(9)			166	(12)		
41	(17)	128[f]	(10)	190	(10)			174	(9)		
42	(24)	129	(14)	192	(8)			179	(6)		
43	(18)	130	(13)	193	(9)			182	(6)		
44	(unk)	131	(14)	194	(19)			188	(7)		
48	(17)	132	(12)	195[c]	(8)			189	(14)		
50	(21)	133	(14)	196[e]	(10)			201	(5)		
57	(24)	135	(14)	197[d]	(11)			203	(Ad)		
61	(19)	137	(15)	199[e]	(6)			207	(14)		
64	(17)	138	(17)	204[e]	(5)			209	(8)		
70	(17)	139	(16)	205[f]	(11)			210	(12)		
71	(17)	140[f]	(16)	206[f]	(21)			211	(5)		
72	(18)	141[b]	(9)	208[f]	(8)			214	(3)		
73	(16)	142[c]	(14)	212[f]	(4)			215	(Ad)		
74	(14)	143	(16)	213[e]	(3)			221	(3)		
78	(16)	144	(9)	216[e]	(9)			222	(3)		
80	(15)	146	(15)	217[f]	(11)			227	(3)		
82	(19)	148[f]	(12)	218[f]	(6)			232	(2)		
85	(19)	149	(Ad)	219[e]	(5)			233	(2)		
89	(14)	152[d]	(22)	220[f]	(12)			237	(12)		
91	(14)	153	(15)	224[f]	(7)			241	(1)		
92	(16)	155[d]	(9)	225[e]	(2)			242	(14)		
96	(unk)	156	(13)	228[e]	(5)			243	(4)		
98	(unk)	157	(Ad)	229[f]	(12)			246	(7)		
99	(14)	159	(Ad)	234[f]	(10)			247	(6)		
100	(12)	162	(21)	238[f]	(2)			248	(2)		
101[f]	(13)	164[b]	(11)	239[f]	(Ad)			249	(Ad)		
103	(21)	165[b]	(17)	245[f]	(4)			251	(7)		
104[f]	(13)	167	(20)					252	(6)		
107	(16)	168[d]	(9)					253	(4)		
111	(12)	169[c]	(9)					254	(6)		
112[f]	(22)	170	(14)					258	(8)		
114	(13)	171	(14)					260	(Ad)		
112 Total								44 Total			

Table 4. Annual unduplicated female grizzly bears with cubs-of-the-year and adult female deaths, 1973-95.

Year	Females	Cubs	Mean litter size	Adult female deaths (known and probable)
1973	14	26	1.86	4
1974	15	26	1.73	4
1975	4	6	1.50	1
1976	16	30	1.88	1
1977	13	25	1.92	6
1978	9	18	2.00	1
1979	13	29	2.23	2
1980	12	23	1.92	1
1981	13	24	1.85	5
1982	11	20	1.82	4
1983	13	22	1.69	2
1984	17	30	1.76	2
1985	9	16	1.78	2
1986	25	48	1.92	2
1987	13	29	2.23	2
1988	19	40	2.11	2
1989	16	30	1.88	0
1990	24	57	2.38	4
1991	24	43[a]	1.87	0
1992	23	56	2.43	0
1993	20	41	2.05	3
1994	20	47	2.35	3
1995	17	37	2.18	3
Total	360	723		54
Mean	15.65	31.43	2.01	2.35

[a] Number of cubs for 23 females; litter size for 1 female unknown.

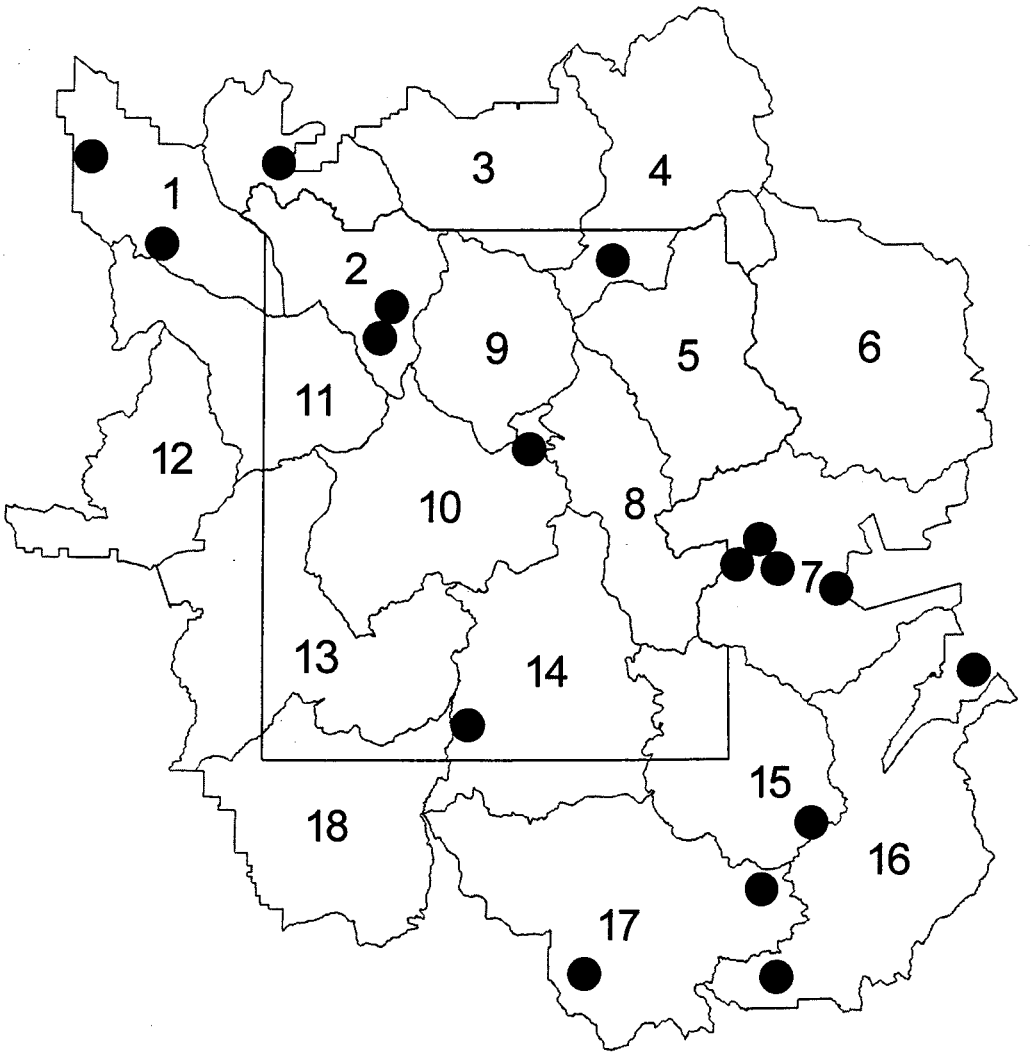

Fig. 1. Locations of initial observations of 17 unduplicated females with cubs-of-the-year within Bear Management Units inside the Recovery Zone during 1995.

Observation Flights

During 1995, 12% of the unduplicated females with COY were seen on IGBST observation flights (Table 5). Observation flights accounted for an average 40% of the unduplicated observations during 1986-95 when methodology was similar; 11% were recorded incidentally on observation flights made by other researchers over the study area, 35% from ground sightings, and 14% from IGBST trapping efforts and radio-tracking flights only.

Table 5. Annual unduplicated female grizzly bears with the cubs-of-the-year by prioritized method of observation, 1986-95.

	Observation flights		Ground	Radio	
Year	IGBST	Other	sightings	flights/trap	Total
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

The 18 BMUs were flown at least once between 14 June and 13 September for an average 2.17 hours each. Grizzly bear observation rate was 1.07 bears/hour on 30 observation flights (Table 6) compared to 0.18 unmarked bears/hour on 75 radio-tracking flights. Females with COY were seen an average of 0.077/hour on observation flights and 0.005/hour on radio-tracking flights. Radio-marked bears were seen 4% of the time on radio-tracking flights (0.16 bears/hour).

Table 6. Unmarked grizzly bears observed during observation flights, 1973-95.

Year	Number flights	Number hours	Total bears	Bears/hour	Unduplicated females with COY/hour
1973	24	75.90	59	0.78	0.03
1974	47	146.30	128	0.87	0.06
1975	24	47.20	20	0.42	0.02
1976	5	18.50	30	1.62	0.05
1977	0				
1978	0				
1979	7	23.00	14	0.61	0.13
1980	6	22.30	27	1.21	0.18
1981	4	16.00	13	0.81	0.25
1982	6	23.70	23	0.97	0.13
1983	41	124.30	36	0.29	0.03
1984	11	29.00	27	0.93	0.24
1985	16	30.50	21	0.69	0.07
1986	24	52.00	29	0.56	0.17
1987	20	47.20	35	0.74	0.11
1988	17	33.87	62	0.66	0.21
1989	37	88.71	87	0.98	0.08
1990	39	86.01	81	0.94	0.09
1991	46	99.24	257	2.59	0.17
1992	31	68.73	204	2.97	0.15
1993	29	58.42	43	0.74	0.05
1994	32	64.46	112	1.75	0.19
1995	30	65.20	70	1.07	0.08

Mortalities

Eighteen known mortalities were recorded during 1995 (Table 7). Seventeen were human-caused and the cause of 1 was unknown, although suspected to be an illegal mortality due to the characteristics of the site where the carcass was located. The carcass was 50 yards from an established trail in a meadow, an unlikely site for a natural mortality.

Table 7. Grizzly bear mortalities recorded during 1995.

Bear	Sex	Age	Date	Type	Location[a]	Cause
244	M	9	06/01	Known	Sam Berry Meadows, SNF	Human-caused, collar found cut off
G57	F	4	07/16	Known	N Fork Shoshone, SNF	Human-caused, mgt removal to zoo
250	M	5	08/15	Known	Hayden Valley, YNP	Human-caused, electrocuted by power line
unm	M	Ad	08/19	Known	Hayden Valley, YNP	Human-caused, electrocuted by power line
unm	M	SAd	08/10	Known	Hayden Valley, YNP	Human-caused, electrocuted by power line
191	M	18	08/22	Known	Black Butte Ranch, MT (private)	Human-caused, mgt removal
240	F	SAd	09/07	Known	Gardiner, MT	Human-caused, 3rd mgt capture, to zoo
87	M	15	09/16	Known	Sage Cr, GNF	Human-caused, moose hunter
257	M	2	09/17	Known	Lightening Cr, GNF	Human-caused, shot
163	F	11	09/19	Known	Covered Wagon Ranch, MT	Human-caused, 3rd mgt capture, to zoo
255	F	cub	09/19	Known	Covered Wagon Ranch, MT	Human-caused, to zoo
256	M	cub	09/19	Known	Covered Wagon Ranch, MT	Human-caused, to zoo
unm	F	Ad	09/19	Known	head Slough Cr, GNF	Human-caused, self-defense by elk hunter, had yearling
unm	F	SAd	09/21	Known	Rodent Cr, BTNF	Human-caused, self defense by hunter
259	M	SAd	10/05	Known	Wapiti, WY	Human-caused, 3rd mgt captured, mgt removal
unm	M	3	10/12	Known	Table Mountain, SNF	Human-caused, shot by hunter, in camp
unm	F	Ad	10/17	Known	Bliss Cr Meadows, SNF	Human-caused, shot by hunter, had 2 COY
unm	unk	Ad	10/01	Known	Houlihan Cr, SNF	Unknown
unm	?	1	July	Possible	Open Creek/Trident, SNF	Unknown, report of carcass, female and yearling nearby

[a] BTNF = Bridger-Teton National Forest, GNF = Gallatin National Forest, SNF = Shoshone National Forest, YNP = Yellowstone National Park.

Grizzly bear mortalities from 1973-95 are depicted in Table 8. These deaths include known and probable mortalities as defined by Craighead et al. (1988).

Table 8. Known and probable grizzly bear deaths, 1973-95

	All bears		All adult females	
Year	Human-caused	Other[a]	Human-caused	Other
1973	14	3	4	0
1974	15	1	4	0
1975	3	0	1	0
1976	6	1	1	0
1977	16	1	6	0
1978	7	0	1	0
1979	8	0	1	0
1980	6	4	1	0
1981	10	3	3	2
1982	14	3	4	0
1983	6	1	2	0
1984	9	2	2	0
1985	6	7	2	0
1986	9	2	2	0
1987	3	0	2	0
1988	5	8	0	2
1989	2	1	0	0
1990	9	0	4	0
1991	0	0	0	0
1992	4	4	0	0
1993	3	2	2	1
1994	10	1	3	0
1995	17	1	4	0

[a] Includes deaths from natural and unknown causes.

Population Trend

The following is an excerpt from "How Many Grizzlies in Yellowstone?" by L. L. Eberhardt and R. R. Knight. 1996. Journal of Wildlife Management 60(2):416-421.

When faced with uncertainty about a species, the first question administrators and the public ask is "How many are there?" This appears to be an entirely reasonable inquiry, but is usually the wrong question. The crucial questions are "Is the population increasing or decreasing?" and "Which parameters are responsible for the observed trend?"

Trend data indicate that the Yellowstone grizzly bear population has been increasing in recent years, after a decline induced by closure of open garbage dumps in 1970-71. The initial results of our study indicated a slow rate of decrease through 1980, roughly 2% per year (Knight and Eberhardt 1985). Current analyses (Eberhardt et al. 1994, Knight and Blanchard 1995, Knight et al. 1995) show a positive annual rate of change (roughly 2 to 5%). The turning point appeared to occur in the mid-1980s, when the policy of preventing adult female mortalities whenever feasible began to be widely observed. This policy has not been without costs in time, human resources, and public relations to the agencies, and has required continued cooperation and extra efforts.

A population estimate with 90% confidence limits of 280-610 bears was made using Peterson estimates and bootstrapping techniques.

Although the grizzly population may be increasing, so has human use of its range, with continuing potential for human-bear conflicts. Relaxation of concerns about population size and trend probably will lead to an increase in bear mortalities, because it is much easier to destroy a bear than to manage sources of bear-human conflicts.

Because bear-human conflict situations continue to increase, and often result in death of bears (Blanchard and Knight 1995), we believe alternate use of some bears is worthwhile.

Food Habits

Scat Analysis

Food habits represented by fecal analysis often do not accurately reflect relative proportions of ingested items because different diet items are digested at varying rates and to different degrees. More easily digested items such as meat and berries are under-represented in fecal analysis while vegetal items are over-represented. A more complete understanding of food habits should involve analysis of feeding activities recorded at sites where bears were located visually and by radio-telemetry.

Scats were primarily composed of graminoid and forb foliage during all 3 seasons (Table 9). Volume of these food items was greater than the 1977-87 average (Fig. 2). Dandelions (*Taraxacum*) and clover (*Trifolium*) were the predominant forbs consumed.

Table 9. Seasonal grizzly bear scat contents during 1995.

	Spring (*n* = 50)		Summer (*n* = 54)		Fall (*n* = 7)		Total (*n* = 116)	
	% freq.	% vol.	% freq.	% vol.	% freq.	% vol.	% freq.	% vol.
Whitebark pine seeds	4.00	1.70					1.72	0.73
Berries								
Shepherdia canadensis			1.85	0.04			0.86	0.02
Vaccinium			3.70	1.36			3.45	2.25
Sporophytes								
Equisetum	2.00	0.50	11.11	3.80			6.03	1.98
mushrooms			1.85	0.09	28.57	18.57	2.59	1.16
Foliage								
Graminoids	86.00	70.04	74.07	35.94	57.14	25.00	77.39	50.16
Forbs	32.00	18.00	79.63	45.83	71.43	56.43	56.89	33.36
Cirsium	2.00	0.30	9.26	7.89	14.29	10.71	6.90	4.84
Epilobium	8.00	5.50	7.41	4.26			6.90	4.35
Taraxacum	18.00	8.80	37.04	15.56			25.86	11.51
Trifolium	8.00	3.40	33.33	15.31	28.57	17.14	20.69	9.63
Roots	2.00	2.00						
Lomatium			5.56	5.37			2.59	2.50
Melica	2.00	2.00						
Mammals	20.00	5.74	16.67	5.35			16.38	4.97
Elk	8.00	0.64	5.56	2.17			6.03	1.28
Bison	8.00	4.70	9.26	3.06			7.76	3.45
Insects	4.00	0.12	14.81	0.67			9.48	0.38
Ants	2.00	0.02	9.26	0.20			6.03	0.12
Debris	16.00	1.90	11.11	1.48			12.93	1.59

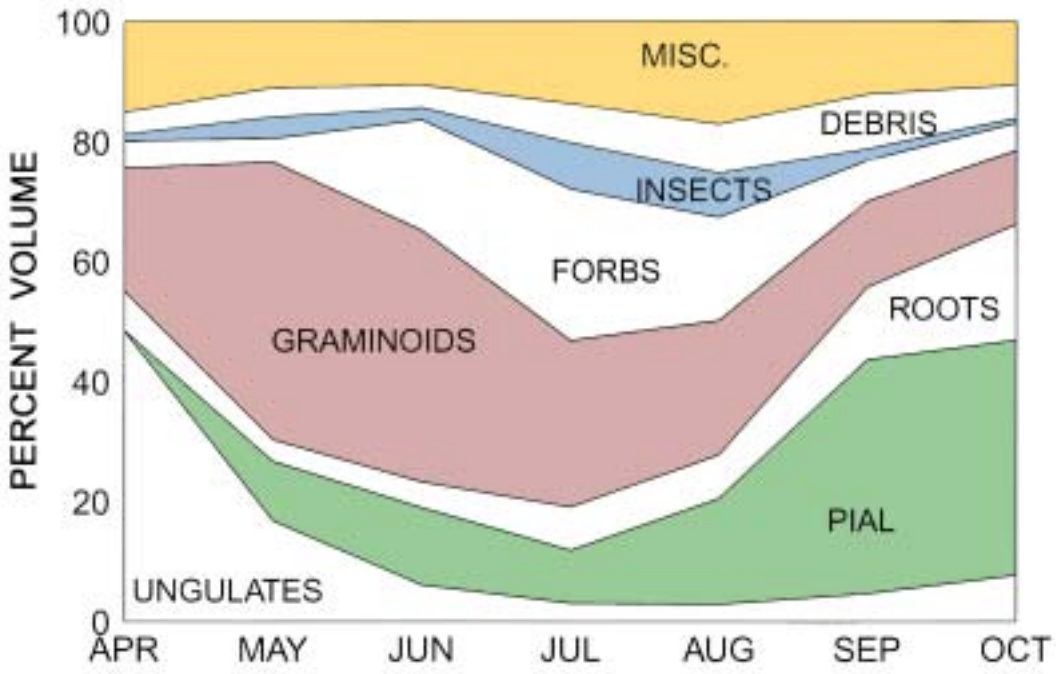

Fig. 2. Percent volume of food items in scats collected 1977-87.

Whitebark Pine Cone Production

Grizzly bears generally consume the seeds of whitebark pine (*Pinus albicaulis*) to the near exclusion of other food items when available in sufficient quantities. These seeds are largely unavailable to bears until cone production approaches 20 cones/tree (Blanchard 1990). Widespread use by bears generally occurs when production exceeds 22 cones/tree (Mattson et al. 1992). Cone production during 1995 averaged <2 cones/tree for the 19 transects in the Yellowstone ecosystem (Table 10, Fig. 3). Only 1 transect in the southeast corner of the study area produced >20 cones/tree (Figure 4). Five transects in the southeast quarter produced an average 9 cones/tree compared to <1 cone/tree for the rest of the area.

Table 10. Mean annual whitebark pine cone production on study transects, 1980-95.

Year	Total cones	Total trees	Total transects	Mean cones per tree	Mean cones per transect	Cones/transect/year SD	Min	Max	Mean Julian date read each year
1980	2,312	90	9	25.69	256.89	122.99	139	562	212
1981	1,191	90	9	13.23	132.33	148.69	8	489	204
1982	1,443	85	9	16.98	160.33	154.18	0	463	229
1983	1,531	88	9	17.40	170.11	88.78	78	372	211
1984	360	56	6	6.43	60.00	41.41	14	124	220
1985	2,312	85	9	27.20	256.89	192.27	17	625	214
1986	103	75	8	1.37	12.88	13.18	0	38	207
1987	394	155	16	2.54	24.63	37.49	0	118	217
1988	406	169	17	2.40	23.88	44.32	0	148	208
1989	10,199	209	21	48.80	485.67	384.27	7	1,473	206
1990	319	207	21	1.54	15.19	51.52	0	243	212
1991	2,744	177	18	15.50	152.44	107.99	7	366	215
1992	2,876	187	19	15.38	151.37	81.67	19	294	209
1993	1,926	189	19	10.19	101.37	114.97	0	456	217
1994	361	178	19	2.03	19.00	54.25	0	244	207
1995	514	188	19	2.73	27.05	61.41	0	277	215

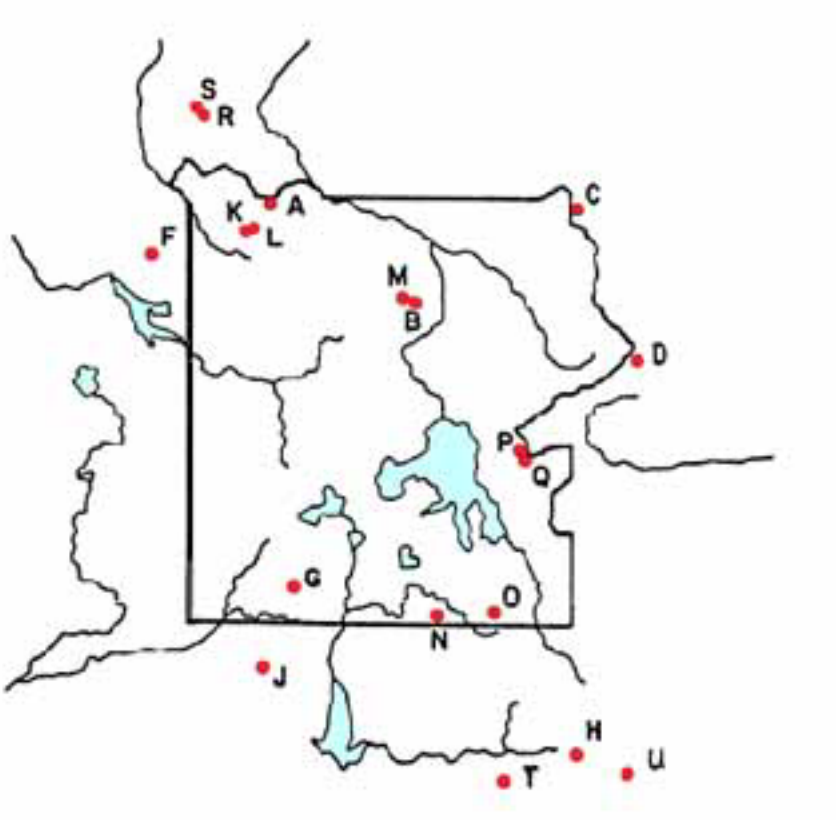

Fig. 3. Locations of whitebark pine cone transects within the study area.

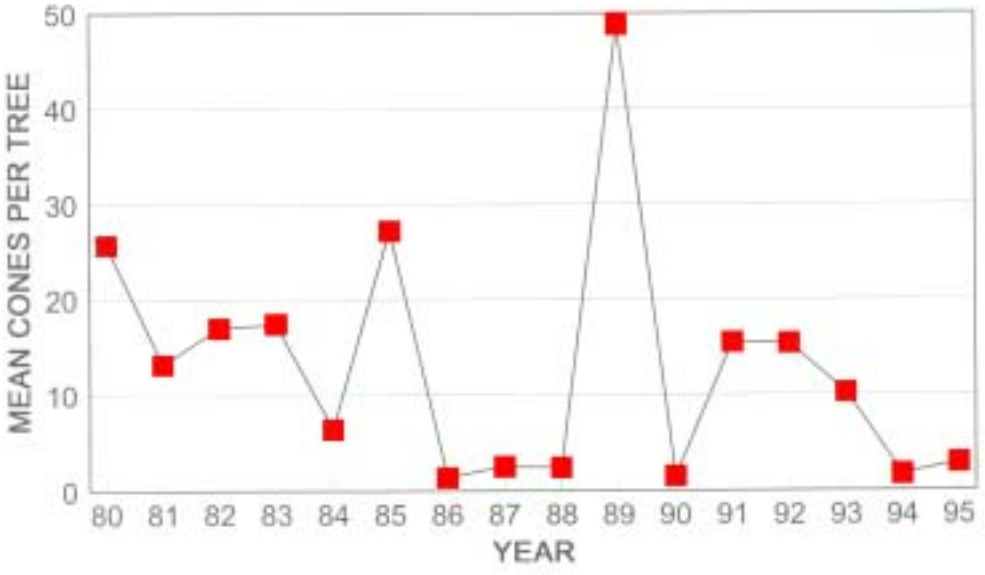

Fig. 4. Whitebark pine cone production on study area transects during 1995.

Low cone production can be attributed to a late killing frost during the spring of 1993 (Diana Tombeck, personal communication). Terminal reproductive organs were killed, affecting cone production for 3 years. We would hope to see better production in 1996.

During years of low whitebark pine seed availability, grizzly bears often seek alternate foods in association with human activities and the number of management actions and mortalities both increase during fall. During August-November, grizzly bears were captured 38 times, 23 of which resulted in transport of the bears away from conflict situations at lower elevations.

Feed Sites

Ground investigations at 62 aerial locations of radio-marked and unmarked grizzly bears from May-October revealed evidence of feeding activity at 19% of the sites. Evidence of activity other than feeding was recorded at an additional 14 sites, and no sign of bear activity was evident at the remaining 36 sites.

Grizzly bear activity was recorded at an additional 40 sites not associated with an aerial location of bear (29 with feeding activity and 11 with other sign recorded). Activities are summarized in Table 11 for those 41 sites with evidence of feeding.

Table 11. Seasonal frequencies of 49 activities at 41 feeding sites during 1995.

Feeding activity	Spring[a] (n = 29)	Summer[b] (n = 18)	Fall[c] (n = 2)	Total (n = 49)
Whitebark pine seeds	0.04	0	0	0.02
Grazing	0.24	0.11	0	0.18
Digging roots	0.04	0.61	0	0.25
Digging rodents/caches	0.28	0.17	0	0.23
Large mammals	0.35	0	0	0.20
Searching for insects	0.07	0.06	0.50	0.08
Mushrooms	0	0.06	0.50	0.04

[a] Spring = May-June.
[b] Summer = July-August.
[c] Fall = September-October.

Predation on ungulates (elk and bison) was the most frequently recorded spring feeding activity. Digging for pocket gophers (*Thomomys talpoides*) and their root caches and grazing were also common feeding activities in spring. During summer, digging for biscuitroot (*Lomatium cous*) and yampa (*Perideridia gairdneri*) were the most frequently observed feeding activity. Sample sizes were too small during fall to determine feeding activities, although bears probably engaged in a variety of activities in the absence of whitebark pine seeds. When conditions were similar in the fall of 1994, grizzly bears dug for roots and pocket gophers, and searched for ants and mushrooms. Some also looked for alternate foods in association with human activity.

MOVEMENTS AND FEEDING STRATEGIES

Annual range sizes and seasonal rates of movement were not significantly different from the cohort means recorded 1975-87 (Tables 12 and 13), although extreme variation among individuals was apparent. Spring and summer rates of movement were generally lower than the 13-year mean due to average to above average availability of native foods. When native foods are abundant, bears are not forced to range widely in search of alternate foods. Winter-killed and weakened ungulates were abundant during spring because an ice crust formed in February prevented many ungulates from digging through to forage (Gunther et al. 1996). Elk calves were abundant during late spring and early summer. Average to above average precipitation during spring and summer resulted in abundant succulent vegetation and root crops. However, during fall virtually no whitebark pine seeds and few cutworm moths were available. These 2 high-fat content foods are preferred late summer and fall foods when available. Alternate food sources primarily included succulent foliage, roots, mushrooms, and foods associated with human activity. Grizzly bear-human conflicts (144), confrontations (49), and management actions (23) occurred within the Yellowstone Ecosystem in 1995 resulting in the transport of 18 and removal of 7 nuisance grizzlies (Gunther et al. 1996).

Table 12. Annual range sizes (km^2) of grizzly bears located ≥12 times and during all 3 seasons of 1995.

Cohort	Number of locations	MCP[a]	1975-87 cohort mean MCP	(SD)
Females				
With yearlings	19	181	338	(244)
	19	132		
Lone adults	14	215	236	(114)
	20	64		
	13	173		
	35	413		
	22	126		
	16	1,880		
Subadults	15	81	365	(191)
	24	579		
	25	168		
Males				
Subadults	14	399	698	(598)
	22	765		
	21	263		
	10	1,937		
Adults	19	2,534	874	(630)
	18	2421		
	12	332		

[a] Minimum Convex Polygon.

Table 13. Seasonal rates of movement for radio-marked grizzly bears during 1993, 1994, and 1995.

		Mean km/day/animal				
					1975-87	
Season	Cohort	1993	1994	1995	mean	(SD)
Spring	Adult females with COY	1.6	0.4	0.4	0.7	(0.3)
	Females with yearling	0.6	1.8	0.4	1.1	(0.7)
	Lone adult females	1.1	0.8	0.6	1.0	(0.6)
	Subadult females		0.9	0.8		
	Subadult males	1.0	0.8	0.4	1.1	(0.6)
	Adult males	0.2	0.9	0.6	1.3	(0.8)
Summer	Adult females with COY	1.3	0.6	0.5	1.3	(1.0)
	Females with yearling	0.9	1.7	0.9	1.7	(0.9)
	Lone adult females	0.5	1.1	0.9	1.3	(0.7)
	Subadult females		1.2	0.5		
	Subadult males	0.9	0.9	0.7	1.1	(0.9)
	Adult males	0.5	1.6	1.3	1.9	(1.1)
Fall	Adult females with COY	0.9	0.6		1.2	(1.0)
	Females with yearling	0.7	1.4	1.0	1.6	(0.9)
	Lone adult females	0.7	1.0	0.7	1.0	(0.7)
	Subadult females		0.7	0.5		
	Subadult males	0.8	0.9	1.1	1.1	(0.8)
	Adult males	0.4	1.3	1.7	1.4	(0.8)

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Appendix A

Appendix A. Seasonal scat contents, 1994.

	Spring[a] (*n* = 64)		Summer[b] (*n* = 119)		Fall[c] (*n* = 32)		Total (*n* = 220)	
	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.	% Freq.	% Vol.
Whitebark pine seeds					3.13	1.72	0.45	0.25
Berries								
Vaccinium	3.12	1.32			3.13	3.13	1.36	0.84
others[d]	1.56	0.02	0.84	0.01	3.13	1.88	0.91	0.28
Sporophytes								
Equisetum	9.38	4.86	6.72	2.48	3.13	1.41	7.27	3.30
mushrooms	4.69	1.16	10.92	6.55	43.75	31.72	13.64	8.49
Foliage								
Graminoids	68.75	34.25	52.10	8.99	31.25	7.34	54.55	16.71
Forbs	68.76	40.00	73.11	63.71	37.50	29.85	68.64	53.07
Agoseris	3.13	1.41	4.20	2.06	3.13	2.50	4.09	1.94
Cirsium	6.25	2.89	5.88	2.10	12.50	5.47	6.81	2.75
Epilobium	3.13	1.55	0.84	0.17			1.36	0.54
Fragaria	1.56	0.08	2.52	1.69			1.82	0.94
Lomatium			1.68	1.25			0.90	0.68
Taraxacum	32.81	21.86	28.57	15.37	15.63	6.56	27.27	15.31
Trifolium	45.31	12.22	57.98	41.87	15.63	15.31	48.18	28.97
Roots								
Lomatium	1.56	1.33	4.20	2.99	3.13	2.34	3.18	2.34
Perideridia			1.68	0.88			0.90	0.48
Potamogeton	1.56	1.09					0.45	0.32
Mammals	28.13	10.22	16.81	8.50	21.88	14.06	20.45	9.62
Bison	14.06	5.02	10.08	5.46	9.38	4.22	10.91	5.03
Elk	7.81	2.98	1.68	0.64			3.18	1.21
Moose			0.84	0.80			0.45	0.43
Small mammals	4.69	0.94	3.36	1.60	9.38	0.81	4.54	1.25
Insects			6.72	2.35			5.45	1.71
Ants	3.13	1.41	5.88	2.18	3.13	0.16	4.55	1.61
Grouse	1.56	0.16					0.45	0.05
Cambium							0.45	0.05
Debris	29.69	5.89	24.37	2.91	56.25	6.41	29.10	3.78

[a] March, April, May, and June.
[b] July and August.
[c] September and October.
[d] *Rosa* spp., *Shepherdia canadensis*, *Berberis repens*.