YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

ANNUAL REPORT OF THE INTERAGENCY STUDY TEAM

1982

National Park Service
U.S. Forest Service
Montana Fish and Game Department
U.S. Fish and Wildlife Service
Idaho Fish and Game Department
Wyoming Game and Fish Department

YELLOWSTONE GRIZZLY BEAR INVESTIGATIONS

Report of the Interagency Study Team

1982

National Park Service

Wyoming Game and Fish Department

U. S. Fish and Wildlife Service

Montana Fish, Wildlife and Parks Department

U. S. Forest Service

Idaho Fish and Game Department

This research is funded by public money and carried out by Federal and State employees; the results may be cited in context without permission

Written by: *Richard R. Knight*
Bonnie M. Blanchard

Reviewed by: *Gary Brown*
Kenneth C. Greer
Lloyd E. Oldenburg
Larry J. Roop

Cover drawing by: *Bart O. Schleyer*

U. S. Department of the Interior
National Park Service

July 1983

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The Interagency Grizzly Bear Study Team, initiated in 1973, is a cooperative effort of the National Park Service, Fish and Wildlife Service, Forest Service, and since 1974 the States of Wyoming, Montana, and Idaho. This research provides immediate and long range information needed by various management agencies on the grizzly bears *(Ursus arctos horribilis)* that inhabit the Yellowstone system. With increasing demands on most resources in the area, it is apparent that current quantitative data on grizzly bears is urgently required for management decisions.

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 Park Service since 1967 - mainly the closing of open pit garbage dumps - have markedly changed some habitat and population parameters (Meagher and Phillips 1980). Thus, current research efforts are needed to define and evaluate grizzly bear population dynamics. 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.

Distribution of grizzly bears within the study area, movement patterns, and habitat use have been largely determined and are now being studied on a monitoring and updating level. Efforts are being concentrated on gathering population data, determining behavior patterns, and assessing the effects of land use practices adjacent to the park boundary.

Movement data conclusively indicates 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. Population trend indices appear to be more meaningful and measurable than a number estimate.

Major objectives for 1982 were as follows:

1. Finish community analysis mapping of areas for discriminate function analysis of habitat preference.

2. Obtain additional data on early spring and late fall food habits and habitat use.

3. Trap and instrument bears to increase sample size for population parameters.

An annotated list of major and minor objectives is given in the 1982 Work Plan (Appendix A).

This study is funded by the National Park Service, the U.S. Fish and Wildlife Service, and the State of Wyoming. Cooperating agencies include Yellowstone National Park, the U.S. Forest Service, and the State wildlife

departments of Idaho and Montana. The assistance of many Interagency Grizzly Bear Study (IGBS) seasonal technicians and pilots, Dave and Roger Stradley, is gratefully acknowledged, as are the Forest Service district personnel and Yellowstone Park in providing field facilities.

MOVEMENTS AND OBSERVATIONS

PROCEDURES

Grizzly bear movements were determined by radio telemetry techniques. Bears were trapped in culvert traps, fitted with radio transmitters, and released. Telonics transmitters were attached to neck collars which were constructed with two-ply conveyor belting and uralane plastic. Collars were fitted to the adult bears using a decomposable cotton strip and an elastic strip to connect the belting ends. Collars on subadult bears were connected with elastic shock cords (Knight et al. 1980).

Radio-tracking flights were made approximately twice a week. Types of antennas and tracking techniques were described by Knight et al. (1978). Aerial locations of radio-collared bears were plotted on U.S. Geological Survey topographical maps to within a 100-m^2 plot using the Universal Transverse Mercator system.

Observations of unmarked bears were obtained during aerial flights, ground reconnaissance, and from verified reports.

Previous evaluation of several methods traditionally used to determine home range sizes indicated that the minimum area method (Stickel 1954) gave the best representation of a grizzly bear's range size, shape, and habitat preferences (Knight et al. 1978).

Study area boundaries were adjusted to include movements of instrumented grizzly bears and to facilitate computerized data analysis. The study area is bounded by Universal Transverse Mercator grids 4500-6500 East and 48150-50500 North.

RESULTS

Movements

Since 1975, 95 grizzly bears have been fitted with radio collars and monitored for varying lengths of time. Of these bears, 37 were known or suspected to be dead at the end of the 1982 field season (Table 1); 84% of these deaths were man-caused. Only 38 of the total 95 bears were known to be alive at the end of 1982.

During 1982, 30 different grizzlies were captured 52 times, including 13 adults, 13 subadults, and 4 cubs (Table 2). Seven were adult females and three were weaned subadult females. Twenty-seven of the 52 captures were for research purposes only. The other 25 resulted from interagency management control actions by Yellowstone National Park and the States of Idaho, Montana, and Wyoming. Grizzlies were captured at 23 trap locations throughout the study area (Fig. 1).

Forty-six bears were monitored during 1982 (Table 3). Twenty-two of these bears ceased providing data during the year. Six were killed or otherwise

Table 1. Status of instrumented grizzly bears, 1975-1982 (N = 95)

Known dead			Suspected dead			
Man-caused	Natural	Unknown	Man-caused	Natural	Off air	Active
3	12	77	7	54	2	1
4	56		24	55	11	10
5	65	1 total	31		13*	15
6			32	2 total	16	38
8	3 total		75		19	43
9					20*	50
14			5 total		21**	51
17					23	59
18					33	60
22					34*	61
25					35*	67
26					36*	70
27					37	78
28					40**	87
29					41*	88
30					42*	89
39					44	91
46					45	92
47					48*	93
49					57*	94
58					64**	95
62					68*	96
63					71**	97
69					72**	98
81					73**	
90					74**	24 total
					76**	
26 total					79**	
					80**	
					82**	
					83**	
					84**	
					85**	
					86**	
					34 total	

* Last known alive in 1981.
** Last known alive in 1982.

Table 2. Grizzly bears trapped -- 1982

Bear	Sex	Age	Wt[1/]	Date trapped[2/]	Trap location	Release site	Trapper
5	M	14	425*	07-30 (D)	Cooke City, MT	Control kill	MT
8	F	16	275*	08-01 (L)	Cooke City, MT	British Columbia	MT
10	F	11	400	08-28 (RIL)	Cooke City, MT	Fan Cr, YNP	MT
15	M	11	490*	08-12 (I)	Richards Ponds, YNP	On site	IGBT
			608*	09-25 (RTL)	Madison Fk ranch, MT	Blacktail, YNP	MT
			635	10-15 (RTL)	Madison Fk ranch, MT	Blacktail, YNP	MT
38	F	11	345*	08-17 (I)	Richards Ponds, YNP	On site	IGBT
43	F	5	275	08-03 (RI)	Cap & Ball Pk, WY	On site	IGBT
			315*	09-24 (RI)	Cap & Ball Pk, WY	On site	IGBT
60	F	5	260	08-26 (RIL)	Cooke City, MT	Fan Cr, YNP	MT
67	F	1	65*	06-30 (RIL)	Eagle Cr, WY	Mt Norris, YNP	IGBT/YNP
69	F	2	175	07-29 (L)	Tom Miner, MT	British Columbia	MT
70	M	4	350*	09-03 (RI)	Two Ocean, YNP	On site	IGBT
				09-04,05(RT)	Two Ocean, YNP	On site	IGBT
71	M	4	200	07-09 (L)	Sawtell Estates, ID	Glen Cr, YNP	ID
78	M	3	375	09-20 (RIL)	Trestle Ranch, MT	Crooked Cr, YNP	MT
			400	10-16 (RT)	Cap & Ball Pk, WY	On site	IGBT
81	M	4	342*	09-03 (L)	Bridge Bay, YNP	Blacktail, YNP	YNP
			390*	09-20 (L)	Indian Pond, YNP	The Promontory, YNP	YNP
			400	10-15 (L)	Lake, YNP	Control kill	YNP
84	M	14	475	05-28 (I)	Nez Perce Cr, YNP	On site	IGBT
85	M	6	450	07-02 (I)	Antelope Cr, YNP	On site	IGBT
86	F	12	225	07-05 (I)	Antelope Cr, YNP	On site	IGBT
87	M	2	178*	07-17 (I)	Lodgepole Cr, WY	On site	IGBT
88	M	5	225	07-19 (IL)	Fishing Bridge, YNP	The Crags, YNP	YNP
				08-06 (RIL)	Fishing Bridge, YNP	Crooked Cr, YNP	YNP

Table 2. Grizzly bears trapped -- 1982
(continued)

Bear	Sex	Age	Wt[1/]	Date trapped[2/]	Trap location	Release site	Trapper
89	M	1	135*	07-28 (IL)	Brook Lk Lodge, WY	Trail Cr, WY	WY
90 (G-12)	M	2	265*	08-06 (IL)	Bakers Hole, MT	Crooked Cr, YNP	MT
				08-30 (RTL)	Grebe Lk pit, YNP	British Columbia	YNP
91	F	1	125*	08-06 (I)	South Crandall, WY	On site	IGBT
92 (G-7)	M	3	265*	08-13 (I)	Grayling Cr, YNP	On site	IGBT
				08-15, 09/08 & 09-12(RT)	Richards Ponds, YNP	On site	IGBT
93 (G-14)	F	Cub	50	08-28 (IL)	Cooke City, MT	Fan Cr, YNP	MT
94 (G-13)	M	Cub	40	08-28 (IL)	Cooke City, MT	Fan Cr, YNP	MT
95 (G-15)	M	Cub	40	08-28 (IL)	Cooke City, MT	Fan Cr, YNP	MT
96	M	SAd	300	08-31 (I)	Grebe Lk pit, YNP	On site	YNP
97	F	5	260	09-09 (I)	Richards Ponds, YNP	On site	IGBT
				09-13 (RT)	Richards Ponds, YNP	On site	IGBT
98	M	SAd	235*	09-29 (I)	Cap & Ball Pk, WY	On site	IGBT
G-13	M	Cub	45*	07-19,30(NI)	Woody Cr, MT	On site	IGBT
				08-02 (NI)	Cooke City, MT	On site	IGBT/MT
G-14	F	Cub	53*	07-19,30(NI)	Woody Cr, MT	On site	IGBT
G-15	M	Cub	38*	07-15,17(NI)	Woody Cr, MT	On site	IGBT
				08-02 (NI)	Cooke City, MT	On site	IGBT/MT
G-16	F	Cub	58*	08-17 (NI)	Richards Ponds, YNP	On site	IGBT
--	M	Ad	501*	11-03 (NI)	Shoshone Lodge, WY	Dispatched	WY/IGBT

Table 2. Grizzly bears trapped -- 1982
(continued)

1/ Weight in pounds; * indicates scale weight.

2/ D = Dispatched
I = Instrumented with transmitter
NI = Not instrumented
RI = Reinstrumented
RT = Retrapped; not reinstrumented
L = Transplanted

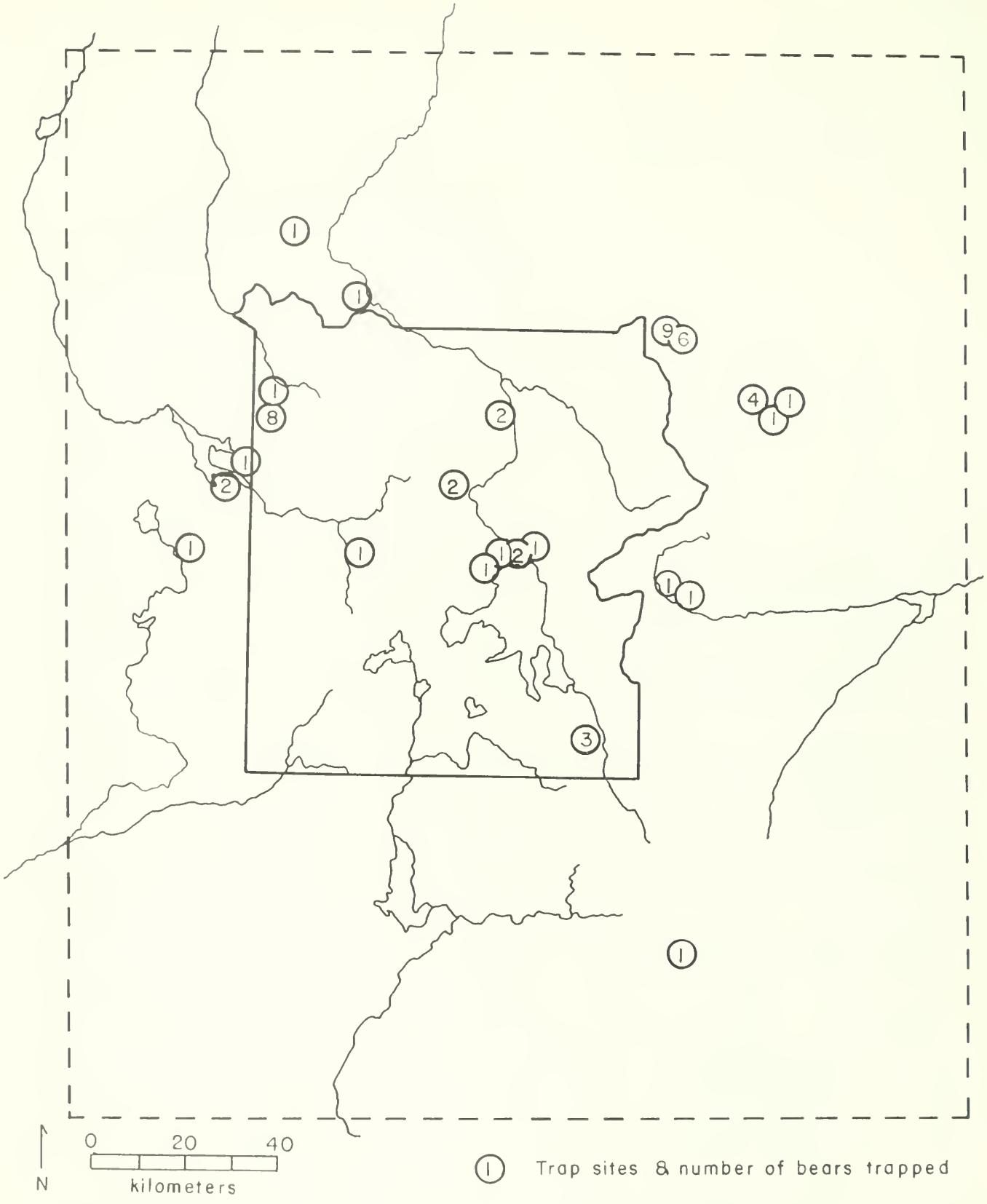


Fig. 1. Study area boundaries and 1982 trap sites.

Table 3. Grizzly bears monitored during 1982 (N = 46)

Bear	Sex	Age	No. locations	Interval (days)	Bear	Sex	Age	No. locations	Interval (days)
1	M	18	13	264	74	M	1	1	-
8	F	16	15	209	76	F	2	24	279
10	F	11	25	126	78	M	3	22	206
15	M	11	25	142	79	F	8	1	-
21	F	9	1	121	80	M	2	1	-
38	F	11	20	137	81	M	4	17	141
40	M	7	2	118	82	F	6	4	172
43	F	5	14	365	83	F	14	31	261
50	F	Ad	25	202	84	M	14	4	29
51	M	15	11	250	85	M	6	8	104
59	F	4	31	365	86	F	12	18	76
60	F	5	38	365	87	M	2	13	168
61	M	6	13	365	88	M	5	13	166
63	M	4	7	209	89	M	1	12	157
64	F	4	6	163	90	M	2	9	10
65	M	4	8	154	91	F	1	11	148
67	F	1	27	365	92	M	3	20	141
68	F	13	4	-	93)	F	Cub	27	126
69	F	2	1	-	94)	M	Cub	28	126
70	M	4	11	365	95)	M	Cub	28	126
71	M	4	6	9	96	M	SAd	10	123
72	F	Ad	7	163	97	F	5	9	114
73	M	3	2	145	98	M	SAd	3	94

removed from the population, 11 cast their transmitters, and five transmitters apparently failed.

Aerial radio-tracking during 1982 was not designed to gather data for determining annual home ranges of instrumented bears. Therefore, ranges could not be calculated for the majority of monitored grizzlies. Free-ranging movements were further complicated by frequent long distance transplants. Figures 2 and 3 illustrate the 1982 home ranges of bears for which data was available.

Observations

The 1982 distribution of observations of unmarked grizzly bears is shown in Fig. 4. Three unusual verified observations during 1982 included sightings of a female with two cubs near Henry's Lake and the Centennial Mountains on the west-central side of the study area during July; one sighting of a "medium-sized" grizzly near Barrier Lake on the Custer National Forest in August; and a large adult grizzly observed in the Payette River drainage near Boise, Idaho, during July.

In the study area, 90 verified observations of 139 unmarked grizzly bears were recorded; 23 unverified observations of 37 grizzlies were recorded outside Yellowstone Park. (Unverified observations within Yellowstone Park are recorded in Yellowstone Park files.)

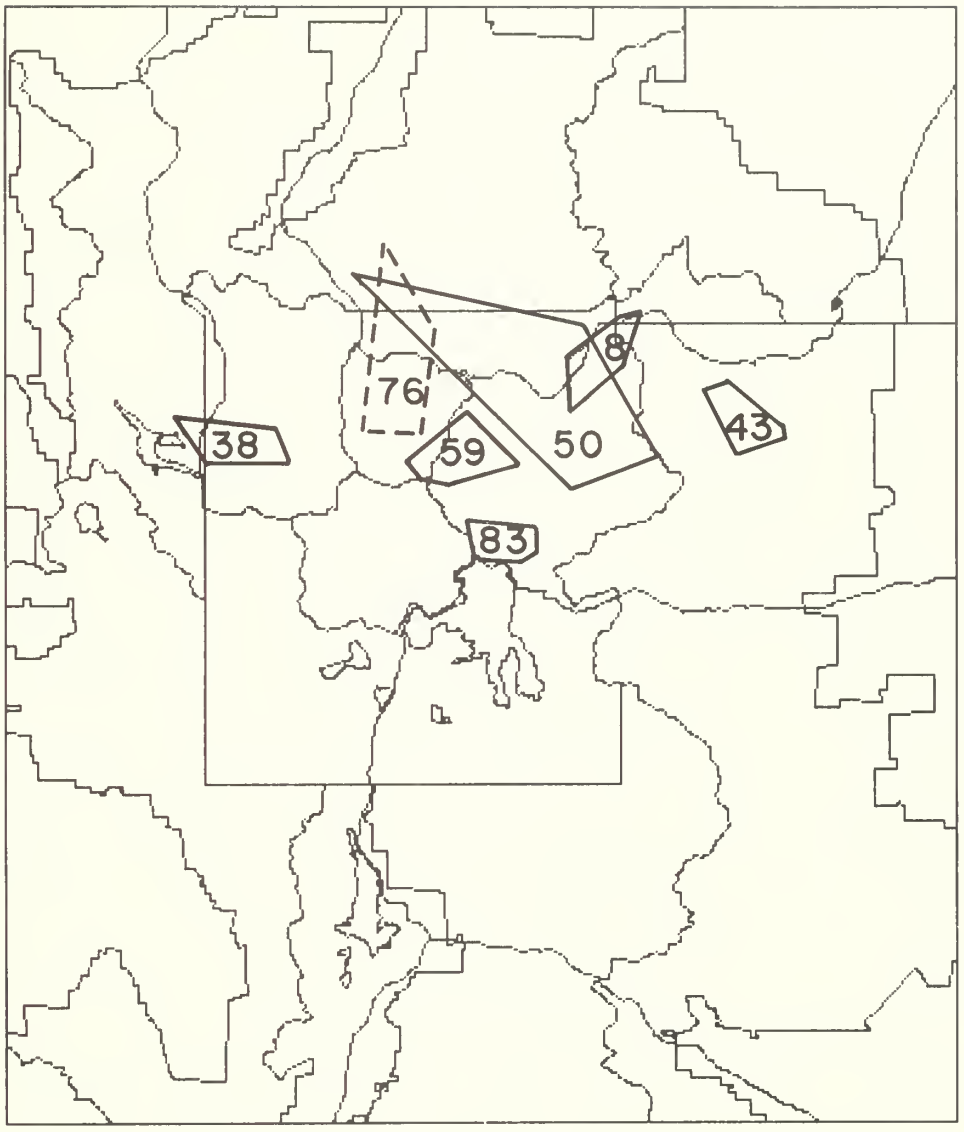


Fig. 2. Annual home ranges of seven female grizzly bears during 1982.

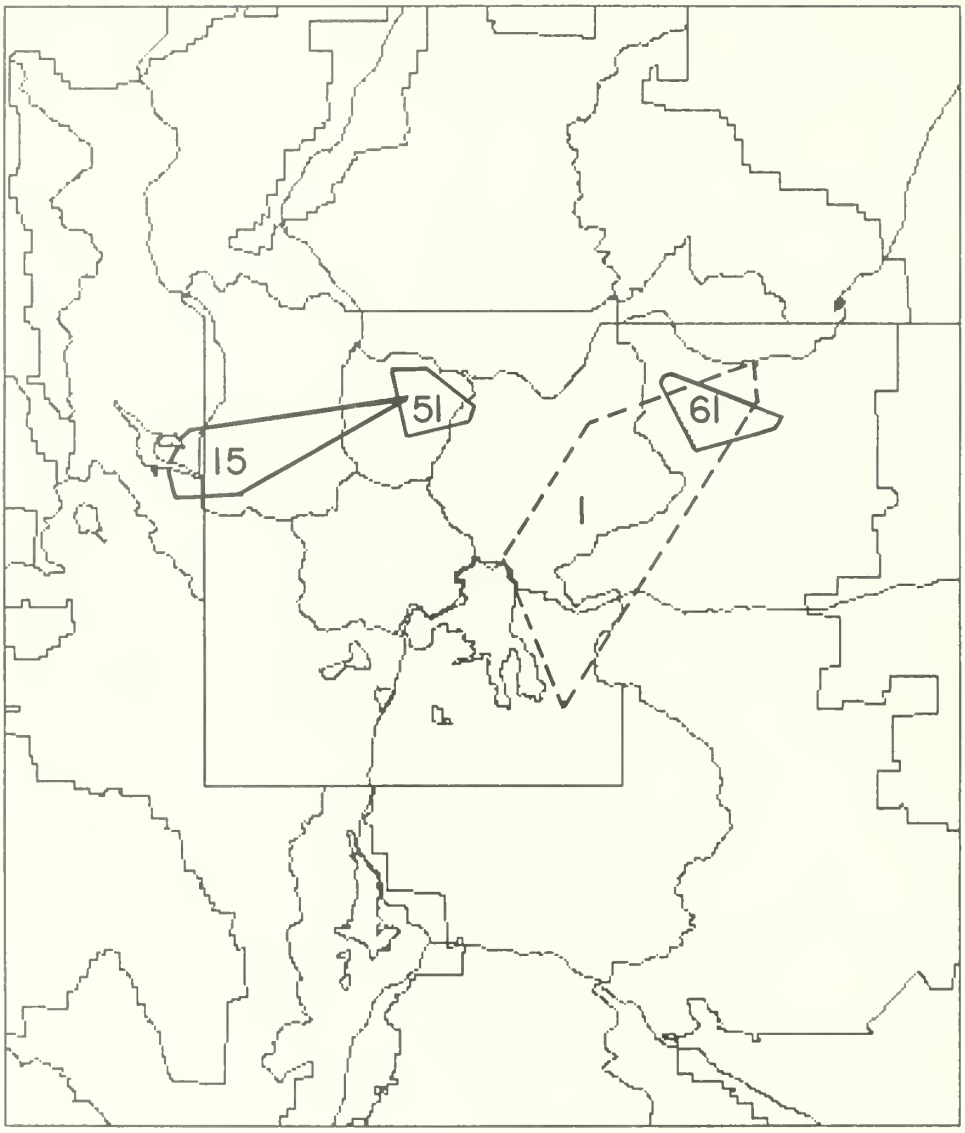


Fig. 3. Annual home ranges of four male grizzly bears during 1982.

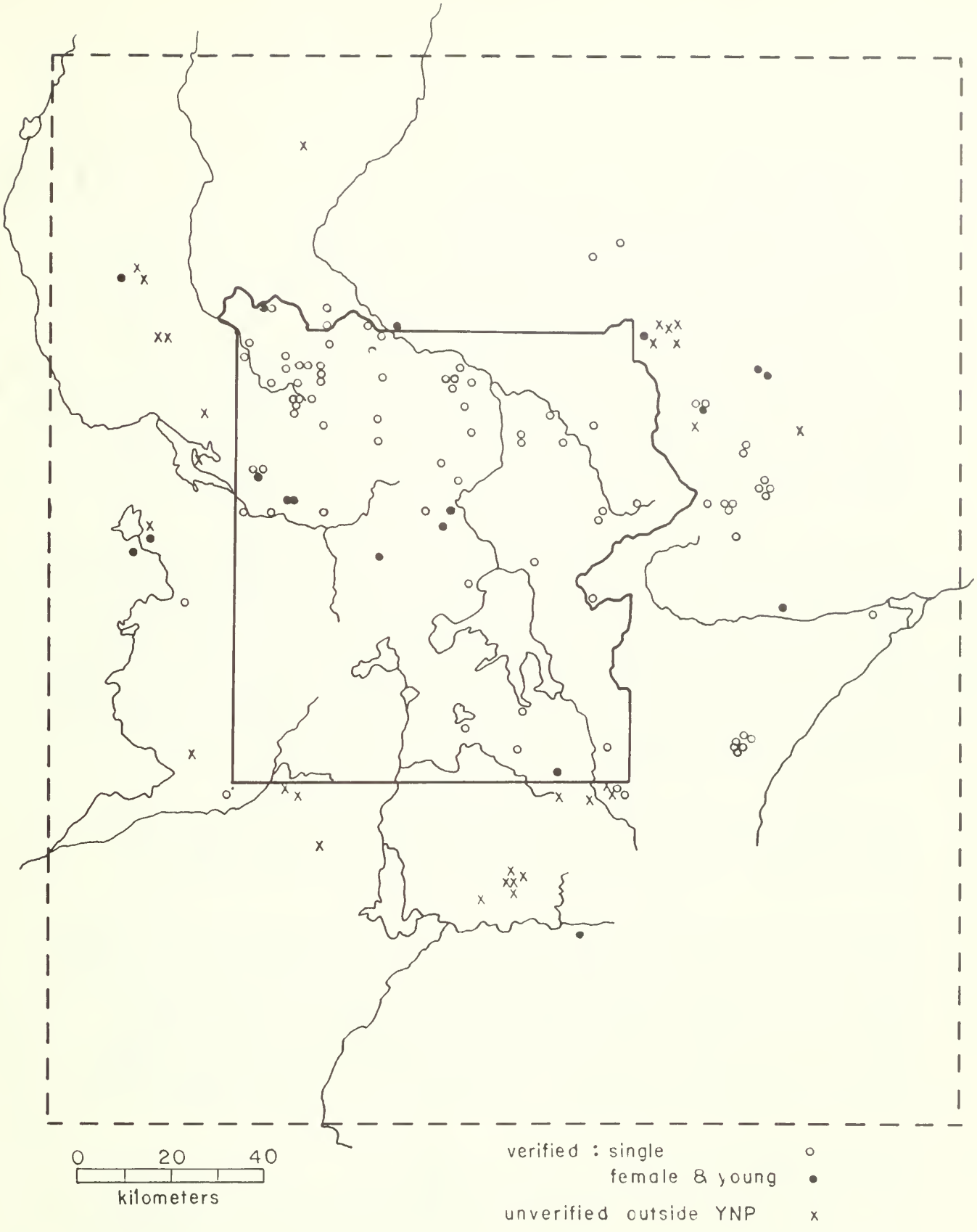


Fig. 4. Observations of unmarked grizzly bears during 1982.

FOOD HABITS

PROCEDURES

Yellowstone grizzly bear food habits were determined from scat analysis and ground investigation of feeding sites. Scats were collected whenever encountered during investigations of aerial relocations (relocation sites) of instrumented bears. The contents were assumed to be representative of the food habits of the bears in the study area.

All bear scats collected (grizzly, black, and species unknown) were included in the analysis.[1/] Dried scats were soaked in water to soften them and washed through two screens. Coarse material was retained in the large screen (holes 0.125 in.) and fine material, including seeds, was collected in the small screen (holes 0.0328 in.). All items were identified to species when possible, and the percent volume of each item was visually estimated.

Procedures used in the ground investigation of feeding sites are described by Blanchard (1980) and Knight and Blanchard (in prep.). Because feeding activities produce evidence of varying observability and longevity, site examinations were not used alone to determine food habits. Site examinations provide data on habitat use and preference; these examinations also provide data on feeding behavior which produces long lasting sign. Easily digestible food items which are rarely revealed through scat analysis (such as mushrooms) are often evident at the feeding site. The more digestible items are probably under-represented in scat contents and, therefore, in the food habits analysis.

Food item preference was determined using the comparison of usage and availability method described by Johnson (1980). The volume of items in scats indicated usage, and the frequency of items in scats indicated availability.

Whitebark pine *(Pinus albicaulis)* cone production was monitored to determine annual variation in the amount of pine nuts available to bears. Nine 90-m transects were established in whitebark pine stands in the study area (Fig. 5). Ten whitebark pine trees were selected along each transect and marked with a blaze and an aluminum identification tag. The crown of selected trees could be viewed from the ground from at least two angles. Cones were counted in July and early August when they had reached mature size, but few had been harvested by squirrels. All trunks joined at the base were considered one tree.

[1/] Hair samples were collected from all day beds (N = 100) encountered during 1979. Analysis of the samples (Picton and Knight 1980) revealed 70% were from grizzly bear and 17% were from black bear. The remaining 12% were not from bear.

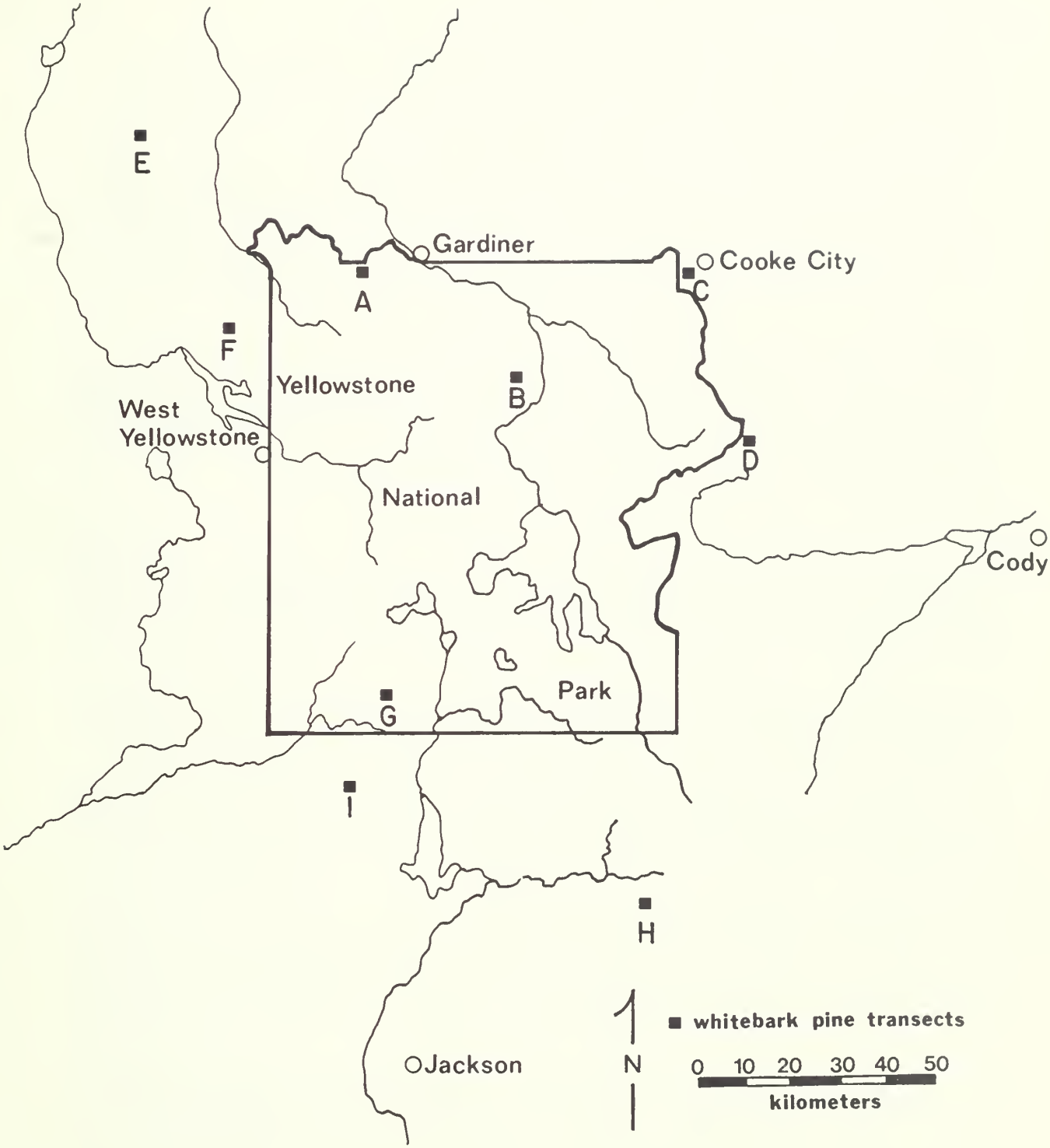


Fig. 5. Locations of whitebark pine cone production transects.

RESULTS

Scat Analysis

In 1982, 149 scats were collected and analyzed for content (Table 4). Of the scats collected, 67% were deposited in summer (June-August) and 31% were deposited in fall (September-October). Only two spring scats were collected.

During the summer, graminoids were consumed most frequently (69.7%) and in the greatest volume (27.3%) (Table 5). The most frequently utilized forbs were dandelions (34.3%) and claytonia (10.1%). Ants were consumed frequently (36.4%) but in small volumes (2.5%). Food items with the highest composition per scat were *Rubus* spp. (95%), pine nuts (92%), *Heuchera cylindrica* (84%), and *Cirsium scariosum* (80%).

Yampa tubers were the most frequently consumed food item during fall (39.1%) and also constituted the greatest scat volume (31.7%). Graminoids (26.1%), ants (19.6%), and mushrooms (10.9%) were also frequently consumed. Food items with the highest composition per scat were *Trifolium* spp. (100%), *Penstemon wilcoxii* (100%), elk (100%), *Microtus* spp. (100%), *Cirsium scariosum* (90%), yampa (82.9%), and garbage (82.5%).

Whitebark Pine Production

Whitebark pine cones were counted at nine locations from August 6-13, 1982 (Table 6). Mean cone production per tree was significantly lower in 1982 than in 1980 ($\underline{P} = 0.025$, t-test) but was not significantly different from 1981.

While the mean cone production for the entire study area was poor, some stands of whitebark pine produced well above the average. Three transects were not statistically different in cone production during 1982 compared to 1980, a "good" nut year. These three were located in Republic Creek (C), Sunlight Creek (D), and Hominy Peak (I) (Fig. 5). Good crops were also noted in the Beartooth Mountains. These locally good producing stands made 1982 a better nut crop year than 1981 but still not as productive as 1980.

Food Availability and Movements of Grizzly Bears

The number of grizzly bears observed aerially outside Yellowstone Park varies annually and seasonally (Fig. 6). This variation can be largely explained by food availability, primarily elk and whitebark pine nuts.

From 1975 through 1982, marked and unmarked grizzlies were most frequently observed from the air outside the park in 1977 and 1981. These were the only 2 years grizzly bears were observed outside the park from April through June. During 1977 there were virtually no elk or pine nuts available to grizzlies from spring through fall, forcing many bears to search for food outside the park. The percent of bears observed outside

Table 4 . Bear scat content analysis, 1982 (N = 149)

Food item	No. scats	% Frequency occurrence	% Diet volume	% Scat composition
Trees				
Pinus albicaulis (pine nuts)	12	8.1	7.2	89.9
Shrubs				
Arctostaphylos spp.	1	0.7	0.1	10.0
Betula spp.	1	0.7	0.4	60.0
Shepherdia canadensis	2	1.3	0.3	18.5
Vaccinium globulare	5	3.4	2.6	77.0
Vaccinium scoparium	7	4.7	1.7	36.4
Total	15	10.1	5.7	56.1
Sporophytes				
Equisetum spp.	18	12.1	3.6	30.2
Equisetum fluviatile	2	1.3	0.4	30.0
Mushrooms	6	4.0	0.7	18.3
Total	26	17.5	4.8	27.4
Graminoids				
Bromus spp.	11	7.4	1.7	23.6
Calamagrostis spp.	2	1.3	0.5	35.0
Carex spp.	4	2.7	0.5	19.5
Grass/sedge	60	40.3	17.0	42.1
Juncus spp.	1	0.7	0.1	10.0
Phleum alpinum	2	1.3	0.4	27.0
Poa spp.	18	12.1	2.8	23.3
Total	84	56.4	23.0	40.7
Forbs				
Angelica spp.	1	0.7	0.1	15.0
Arabis spp.	2	1.3	0.4	32.5
Cirsium scariosum	10	6.7	3.8	56.5
Claytonia spp.	2	1.3	0.1	9.5
Claytonia lanceolata	10	6.7	2.4	35.5
Epilobium spp.	3	2.0	0.2	11.0
Epilobium angustifolium	2	1.3	0.1	5.0
Forbs	7	4.7	0.7	15.0
Fragaria spp.	3	2.0	0.5	25.0
Heuchera cylindrica	1	0.7	0.6	84.0
Lomatium spp.	3	2.0	0.9	43.3
Lomatium triternatum	3	2.0	1.0	48.3
Mertensia spp.	2	1.3	0.5	37.5
Penstemon wilcoxii	1	0.7	0.7	100.0
Perideridia gairdneri	18	12.1	9.8	81.1
Polygonum spp.	8	5.4	1.4	25.8
Polygonum bistortoides	2	1.3	0.4	30.5
Ranunculus spp.	2	1.3	0.3	25.0

Table 4 . Bear scat content analysis, 1982 (N = 149)
(continued)

Food item	No. scats	% Frequency occurrence	% Diet volume	% Scat composition
Forbs (continued)				
Taraxacum spp.	35	23.5	8.0	34.1
Taraxacum officinale	1	0.7	0.5	75.0
Trifolium spp.	6	4.0	1.4	35.0
Umbelliferae/Apiaceae	3	2.0	0.3	16.7
Total	84	56.4	34.1	60.5
Mammals				
Large mammal (unidentified)	5	3.4	1.5	44.8
Deer	5	3.4	0.9	25.2
Elk	9	6.0	3.7	61.7
Grizzly bear	2	1.3	0.6	47.5
Microtus spp.	2	1.3	0.7	52.5
Total	23	15.4	7.4	48.0
Insects				
Unknown insects	1	0.7	0.1	20.0
Ants	47	31.5	2.5	7.8
Bees	1	0.7	0.1	20.0
Coleoptera spp.	2	1.3	<0.1	1.0
Grasshoppers	1	0.7	<0.1	1.0
Total	49	32.9	2.7	8.4
Fish				
Unknown fish	2	1.3	<0.1	3.0
Cutthroat trout	3	2.0	0.2	8.0
Total	5	3.4	0.2	6.0
Miscellaneous				
Debris	46	30.9	5.5	17.8
Dirt	29	19.5	5.0	25.8
Garbage	12	8.1	3.9	47.8
Needles	1	0.7	0.1	10.0
Trap bait	3	2.0	0.4	20.0
Wood	1	0.7	0.1	9.0

Table 5. Seasonal bear scat content analysis by major food categories, 1982

	Spring[1]			Summer[2]			Fall[3]		
	No. scats	% freq.	% vol.	No. scats	% freq.	% vol.	No. scats	% freq.	% vol.
Trees	1	50.0	50.0	3	10.1	9.3	1	2.2	1.3
Shrubs	0	-	-	13	13.1	8.1	2	4.4	1.0
Grass/Sedge	1	50.0	37.5	47	69.7	27.3	12	26.1	12.8
Forbs	1	50.0	10.0	60	60.6	31.5	23	50.0	42.2
Mammals	0	-	-	12	12.1	4.2	9	19.6	13.2
Insects	1	50.0	2.5	37	37.4	2.7	10	21.7	3.0
	2	(<1%)		99	(67%)		46	(31%)	

1/ Spring = March, April, May
2/ Summer = June, July, August
3/ Fall = September, October

Table 6. Number of cones in 10 whitebark pine trees at nine locations, 1980-1982

Transect	Tree 1	2	3	4	5	6	7	8	9	10	Mean cones/tree	Avg
A	0[1]	10	47	2	7	4	14	38	25	80	23	
	12[2]	36	11	1	6	0	24	23	27	138	28	22
	11[3]	12	22	4	3	D[4]	1	17	41	30	16	
B	20	25	10	34	35	26	31	6	20	28	24	
	17	0	2	27	10	16	0	7	8	0	9	26
	192	45	10	49	39	14	27	12	20	55	46	
C	7	8	23	6	23	20	0	8	4	40	14	
	4	0	13	3	5	6	4	11	2	6	5	12
	28	6	36	25	6	15	4	11	7	18	16	
D	18	19	19	5	12	6	19	8	6	32	14	
	12	10	14	6	15	11	5	5	4	7	9	12
	10	5	7	17	8	15	17	12	10	34	14	
E	32	26	21	16	28	14	6	18	16	14	19	
	0	0	0	2	0	0	3	0	3	0	1	7
	0	0	0	0	0	0	0	0	0	0	0	
F	25	11	51	50	51	169	20	60	65	60	56	
	0	0	5	0	0	0	5	3	1	0	1	19
	0	0	0	0	0	0	0	0	0	0	0	
G	35	8	50	52	12	90	53	5	28	18	35	
	3	1	5	50	18	20	22	3	22	0	14	19
	1	0	5	28	D	8	3	15	8	0	8	
H	30	25	9	24	30	13	18	28	47	24	25	
	45	24	18	99	36	50	60	45	100	12	49	38
	14	4	38	2	20	17	57	100	110	34	40	
I	42	11	0	18	12	26	14	11	65	16	22	
	4	1	0	2	0	0	1	5	15	0	3	12
	9	2	0	D	8	D	D	25	21	19	12	
Total											26	
											13	
											15	

1/ 1980
2/ 1981
3/ 1982
4/ D = dead

Fig. 6. Percent of marked and unmarked grizzly bears observed aerially outside Yellowstone National Park.

Yellowstone Park was greatest during late summer as bears searched for food to increase fat deposits in preparation for denning. As bears ranged more widely in search of food, fatal encounters with humans were more numerous in 1977 (Table 7).

During 1981 the availability of elk in the spring and pine nuts in the spring and fall was low (Figs. 7 and 8), and the percent of bears observed outside the park was nearly as high as during 1977. Again, mortalities were higher in 1981 than the mean annual known death rate of 8 from 1974 through 1982.

Virtually no grizzlies were observed outside Yellowstone Park during 1980. That spring the availability of elk to bears was the highest recorded from 1977 through 1982. Elk were consumed at lower levels during summer and again at high levels during fall. Whitebark pine nuts were also available that fall. Over 50% of the scats collected during the fall of 1980 contained pine nuts, with over 40% containing elk remains.

During 1982 neither elk nor whitebark pine nuts were readily available to bears, yet grizzlies were not observed outside the park in high numbers. However, exceptional crops of yampa and mushrooms were available to bears inside the park during late summer and fall of 1982. Extensive digging for yampa and tubers began the first of September and continued until denning. Mushrooms were abundant from early September through early October. Yampa has never occurred in such high volume or frequency in scat contents during this study as it did during 1982 (Tables 8 and 9).

Table 7. Grizzly bear mortalities, 1970-1982

Year	Known	Probable	Possible	Total
1982	17	0	0	17
1981	9	4	2	15
1980	7	0	0	7
1979	3	6	2	11
1978	5	2	3	10
1977	13	1	1	15
1976	5	1	0	6
1975	2	1	0	3
1974	15	0	1	16
1973	10	5	3	18
1972	24	0	0	24
1971	39	3	2	44
1970	43	0	1	44
	192	23	15	230

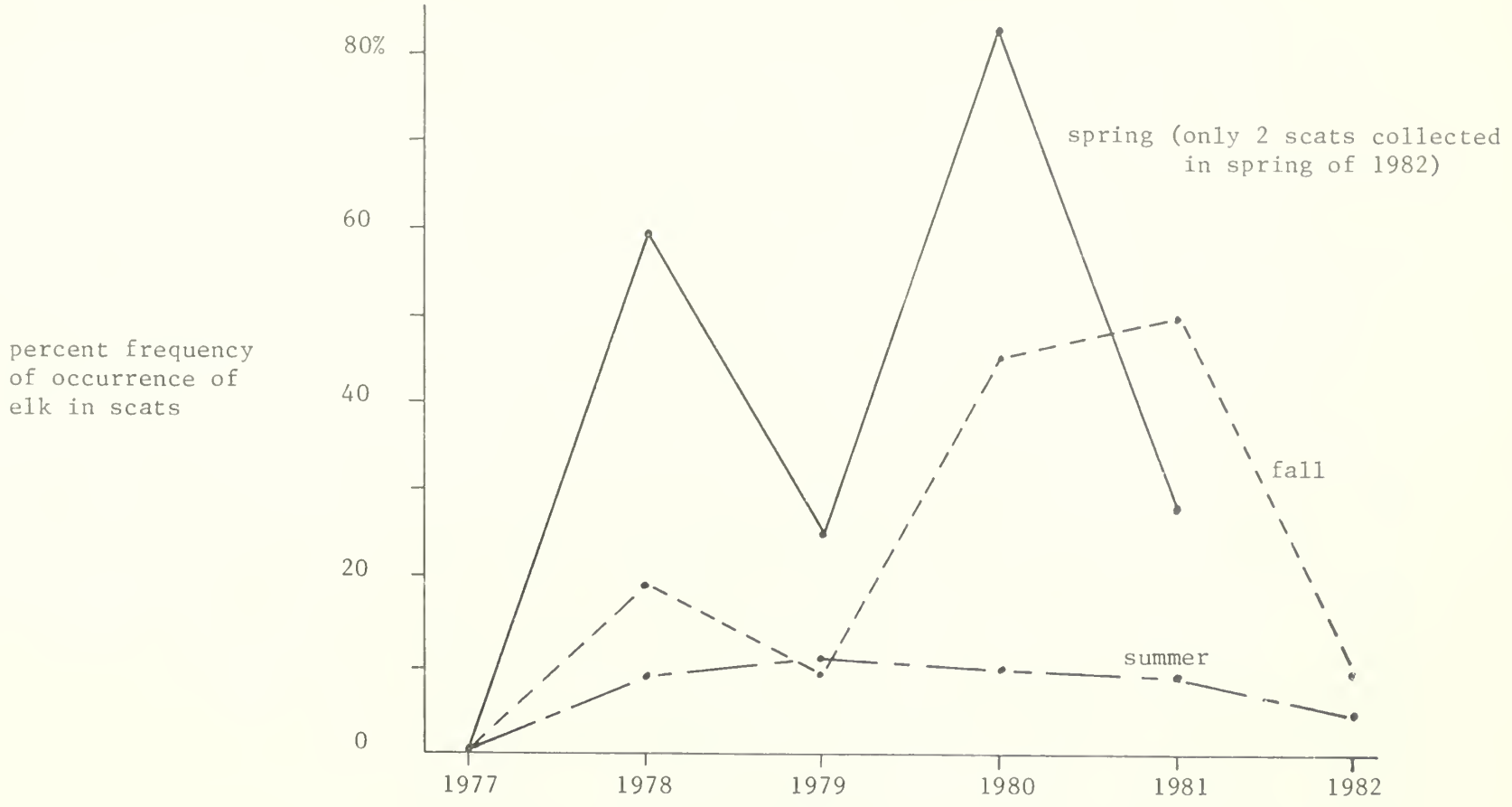


Fig. 7. Seasonal availability of elk to Yellowstone grizzly bears.

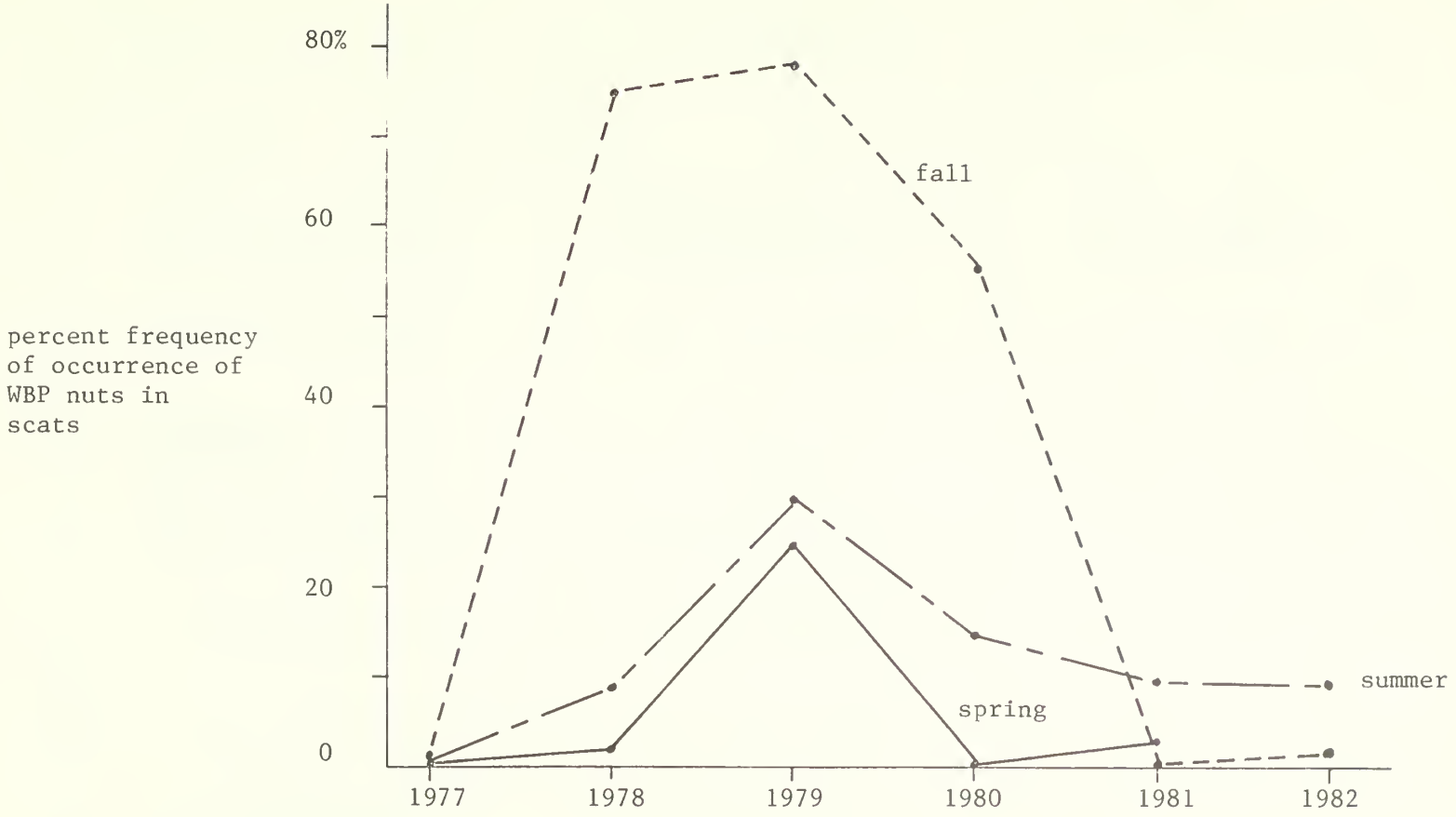


Fig. 8. Seasonal availability of whitebark pine nuts to Yellowstone grizzly bears. (only 2 scats collected in spring of 1982)

Table 8. Major food items occurring in scats by year and by percent of diet volume (use)

	1982		1981		1980	
1	Grass/sedge	(41)	Grass/sedge	(37)	Grass/sedge	(23)
2	Yampa	(10)	Dandelion	(10)	Elk	(17)
3	Dandelion	(9)	Clover	(8)	Pine nuts	(14)
4	Pine nuts	(7)	Horsetail	(6)	Dandelion	(4)
5	Thistle	(4)	Pine nuts	(6)	Ants	(4)
6	Elk	(4)	Ants	(4)	Yampa	(3)
7	Horsetail	(4)	Thistle	(4)	Claytonia	(2)
8	Huckleberry	(3)	Elk	(2)	Clover	(2)
9	Ants	(3)	Fireweed	(2)	Horsetail	(2)
10	Claytonia	(2)	Montia	(1)	Grouseberry	(2)
Total natural items	54		59		88	

	1979		1978		1977	
1	Pine nuts	(40)	Grass/sedge	(26)	Grass/sedge	(22)
2	Grass/sedge	(19)	Pine nuts	(9)	Ants	(15)
3	Horsetail	(3)	Dandelion	(9)	Horsetail	(7)
4	Yampa	(3)	Claytonia	(4)	Biscuitroot	(6)
5	Dandelion	(3)	Biscuitroot	(4)	Yampa	(6)
6	Elk	(3)	Thistle	(4)	Elk	(5)
7	Clover	(2)	Ants	(4)	Thistle	(5)
8	Claytonia	(2)	Yampa	(3)	Bison	(3)
9	Thistle	(2)	Elk	(3)	Knotweed	(2)
10	Buckthorn	(1)	Huckleberry	(2)	Pine nuts	(2)
Total natural items	106		93		108	

	1976		1975		1974-3	
1	Pine nuts	(45)	Grass/sedge	(31)	Grass/sedge	(36)
2	Grass/sedge	(29)	Trout	(10)	Claytonia	(12)
3	Ants	(10)	Biscuitroot	(7)	Thistle	(8)
4	Domestic stock	(4)	Thistle	(7)	Clover	(6)
5	Thistle	(1)	Ants	(7)	Elk	(4)
6	Trout	(1)	Horsetail	(4)	Onion grass	(4)
7	Horsetail	(1)	Pine nuts	(4)	Pine nuts	(3)
8			Onion grass	(2)	Horsetail	(3)
9			Angelica	(2)	Grouseberry	(3)
10			Claytonia	(1)	Yampa	(2)
Total natural items	11		27		-	

Table 9 . Major food items occurring in scats by year and by percent frequency of occurrence (availability)

	1982		1981		1980	
1	Grass/sedge	(56)	Grass/sedge	(78)	Grass/sedge	(48)
2	Ants	(32)	Ants	(31)	Ants	(26)
3	Dandelion	(24)	Dandelion	(30)	Elk	(20)
4	Horsetail	(12)	Clover	(20)	Pine nuts	(19)
5	Yampa	(12)	Horsetail	(13)	Dandelion	(13)
6	Pine nuts	(8)	Pine nuts	(10)	Clover	(8)
7	Thistle	(7)	Thistle	(8)	Yampa	(6)
8	Claytonia	(7)	Fireweed	(6)	Claytonia	(6)
9	Knotweed	(7)	Elk	(4)	Thistle	(5)
10	Elk	(6)	Buffaloberry	(3)	Horsetail	(5)
Total natural items	54		59		88	

	1979		1978		1977	
1	Grass/sedge	(53)	Grass/sedge	(78)	Grass/sedge	(57)
2	Pine nuts	(47)	Ants	(29)	Ants	(38)
3	Ants	(13)	Dandelion	(19)	Biscuitroot	(18)
4	Horsetail	(11)	Pine nuts	(13)	Horsetail	(17)
5	Dandelion	(9)	Thistle	(12)	Thistle	(17)
6	Claytonia	(8)	Biscuitroot	(11)	Yampa	(11)
7	Yampa	(7)	Claytonia	(11)	Knotweed	(8)
8	Thistle	(6)	Horsetail	(8)	Clover	(8)
9	Elk	(6)	Clover	(7)	Fireweed	(7)
10	Clover	(5)	Yampa	(6)	Elk	(6)
Total natural items	106		93		108	

	1976		1975		1974-3	
1	Grass/sedge	(85)	Grass/sedge	(96)	Grass/sedge	(65)
2	Pine nuts	(69)	Trout	(34)	Thistle	(16)
3	Ants	(22)	Ants	(28)	Claytonia	(15)
4	Thistle	(9)	Thistle	(18)	Clover	(11)
5	Claytonia	(4)	Horsetail	(13)	Trout	(9)
6	Horsetail	(4)	Biscuitroot	(12)	Elk	(7)
7	Biscuitroot	(4)	Pine nuts	(9)	Pocket gopher	(6)
8	Bees	(4)	Claytonia	(7)	Onion grass	(6)
9	Trout	(4)	Buttercup	(4)	Horsetail	(6)
10	Domestic stock	(4)	Elk	(3)	Yampa	(5)
Total natural items	11		27		-	

POPULATION PARAMETERS

PRODUCTION

During 1982 the IGBS monitored 11 unduplicated female grizzly bears with 21 cubs (Table 10).

The female reproductive rate is the number of young produced per breeding female per year. A mean for the population can be obtained by dividing the number of cubs produced by total reproductive years or dividing cubs produced each litter by number of years to the next litter and averaging. On an annual basis, reproductive rate can be estimated by dividing mean litter size by the mean reproductive cycle. Given an adequate sample, the results from all these methods should be the same.

By 1982 we had a sample of 12 reproductive cycles for 11 females to calculate a reproductive rate of 0.676. Mean cycle length was 3.08 years and mean litter size was 1.85 cubs. Sample sizes are still too small to make confident estimates of the population reproductive rate.

MORTALITY

Categories of grizzly bear mortalities included known, probable, and possible deaths. A mortality involving a retrieved carcass, or parts of a carcass, was a known mortality. Reports of a death by a reliable source (as determined by the Team Leader) with no carcass retrieved were counted as probable mortalities. Persistent and repeated rumors of a death were recorded as possible mortalities. Grizzly bear mortality rates were probably underestimated due to the difficulty involved in obtaining volunteer information concerning illegal deaths of a Federally "protected" species. Mortalities were frequently not reported until several years after the death occurred.

Mortalities from 1970 through 1982 are summarized in Table 7. Known mortalities in 1982 were the highest recorded since 1972. More grizzlies died in 1982 than during 1973 and 1974 when hunting was legal in Wyoming. Of the 17 deaths in 1982, three were natural and 14 were man-caused (Table 11). Six female grizzlies died in 1982, the highest number recorded during this study (Fig. 9).

SURVIVORSHIP

Survivorship by age class is illustrated in Table 12. Two-year-old grizzly bears in the Yellowstone area have only a 55% chance of surviving to 3 years of age. Survival of prime age (5-16 years) females is 89%.

Sample sizes were still not large enough to break all age classes into sex classes.

Table 10. Grizzly bear females with cubs, 1974-82

Year	Females	Cubs	Ratio	
1974	21	36	1.7	cumulative
	15	26	1.7	unduplicated
1975	5	8	1.6	
	4	6	1.5	
1976	36	69	1.9	
	17	35	2.0	
1977	24	43	1.8	
	13	25	1.9	
1978	15	31	2.1	
	10	19	1.9	
1979	21	39	1.9	
	13	26	2.0	
1980	13	26	2.0	
	9	19	2.1	
1981	17	32	1.9	
	13	22	1.7	
1982	17	30	1.8	
	11	21	1.9	
AVERAGE	11.67	22.11	1.89	

Table 11. Grizzly bear mortalities, 1982

	Location	Total
KNOWN		
Natural		
Cub, female	N. Fork Shoshone River, WY	
Subadult, male, #65	Mt Washburn, YNP	
Cub, unknown, of #50	Lamar River country, YNP	3
Man-caused		
Adult, female	Sunlight Creek, WY	
Adult, male	N. Fork Shoshone River, WY	
Adult, male	N. Fork Shoshone River, WY	
Subadult, male, #63	Sunlight Creek, WY	
Adult, male, #5	Cooke City, MT	
Adult, female, #8	Cooke City, MT	
Subadult, female, #69	Tom Miner, MT	
Adult, female	Gardner River, YNP	
Subadult, male, #90	Canyon, YNP	
Adult, male	Lava Creek, WY	
Adult, female	Cave Falls, WY	
Subadult, male, #81	Lake, YNP	
Adult, male	Sunlight Creek, WY	13
Unknown		
Subadult, unknown	Moss Lake, WY	1
PROBABLE		0
POSSIBLE		0
		17

Adult female	4
Subadult female	2
Total female	6
Adult male	5
Subadult male	4
Total male	9
Unknown sex	2

Natural	3
Management control action	5
Hunter/outfitter	7
Research/accidental	2
	17

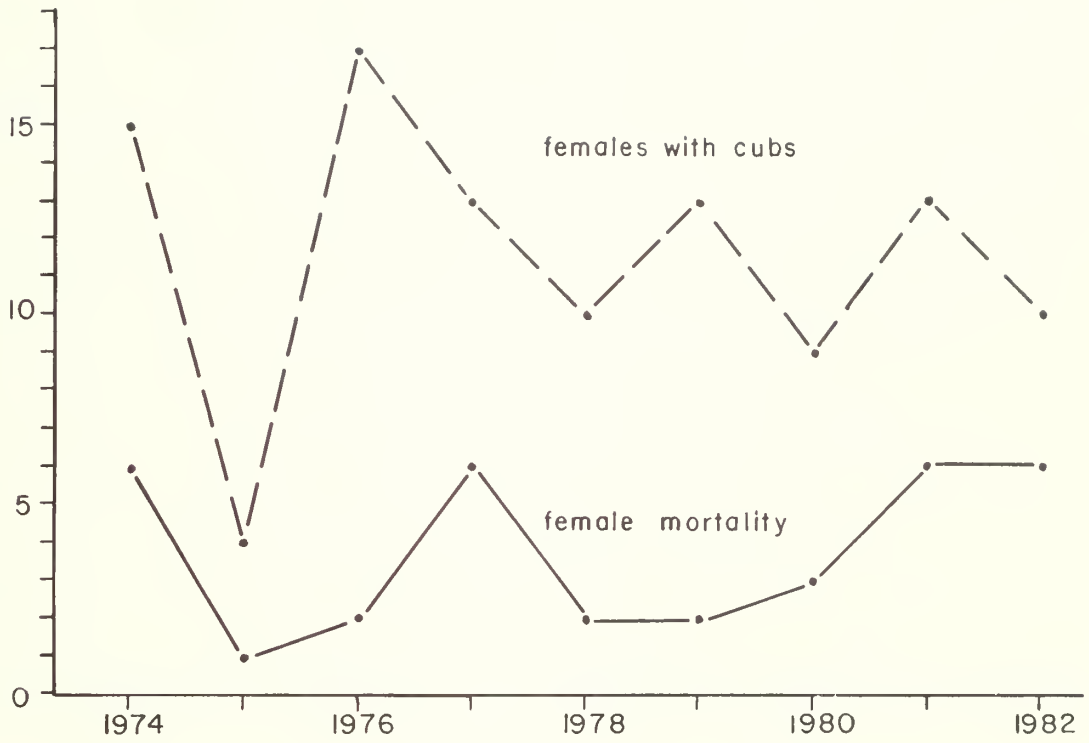


Fig. 9. Annual unduplicated observations and mortalities of female grizzly bears.

Table 12. Grizzly bear survivorship by age class during 1982

Age	% Surviving to next year class	Sample size
Cub	89	53
1	74	34
2	55	20
3	76	17
4	82	17
5	81	16
6	100	12
7	100	12
8	91	11
9	82	11
10	100	10
11	100	9
12	83	6
13	100	5
14+	61 (Avg)	33

SEX AND AGE STRUCTURE

Since 1975 we have radio-instrumented 95 different grizzly bears. An additional nine have been trapped, ear-tagged, and released; and 29 cubs and yearlings have been associated with trapped females but not tagged. Of these bears, 43 were known to be alive at some time during 1982 (38 instrumented, five cubs of instrumented females). Survivorship rates were applied to 48 bears not encountered during 1982 and not believed to be dead: 22 radio-instrumented bears, 3 tagged but nonradio-instrumented bears, and 23 untagged young of radio-instrumented females. From these grizzly bears we have constructed an age structure as illustrated in Fig. 10. This age structure indicates 49% of the population is less than 5 years old (if the sample used to calculate the age structure is representative of the population).

Data from tagged bears give an adult sex ratio of 51M:49F ($\underline{N}$ = 37, age = 5+ years) and a subadult sex ratio of 63M:37F ($\underline{N}$ = 63; age = cub to 4 years). The sex ratio for cubs of known litter composition was 67M:33F ($\underline{N}$ = 24 cubs in 10 litters).

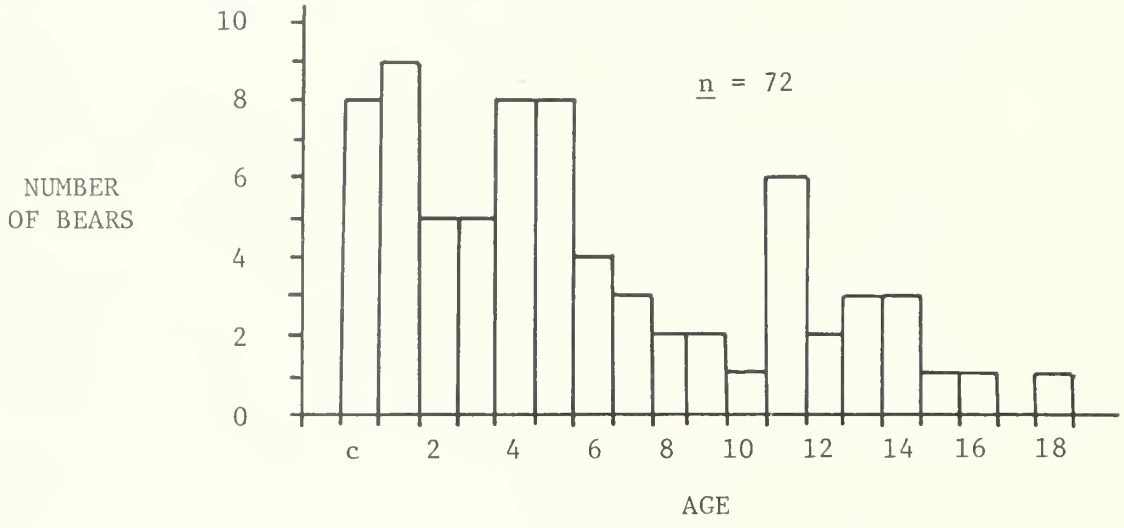


Fig. 10. Age structure of the Yellowstone grizzly bear population during 1982.

GRIZZLY BEAR BEDS

METHODS

Identification of grizzly bear bed characteristics was conducted as a part of habitat requirement and utilization investigations. Bed data were recorded from 1977 through 1981 while teams investigated randomly selected sites where grizzly bears had been aerially located.

Beds found at the sites were measured for length, width, and depth; and elevation, aspect, slope, topography, and vegetative characteristics of the site were recorded. Vegetative cover class designations follow those of Pfister et al. (1977). Characteristics of each bed were described including lining material, vegetation providing cover at the bed, and approximate date of use. The age of a bed was determined with the aid of telemetry and by subjectively estimating the age of associated bear sign such as tracks and scats. Ground crews also recorded beds located in the course of other field work.

During 1980 and 1981, visibility of a bear in the bed was estimated from four compass points, each 90° apart. The distance was estimated and recorded at which 10% of the animal's body became visible to a human approaching on foot. The distance to an opening at least 100 m^2 was recorded for beds in the timber, and the distance to timber with a canopy cover over 5% was recorded for beds in the open. This distance is referred to as the distance to timber/opening edge.

Hair samples were collected from beds beginning in 1979 to determine the proportion of grizzly bear to black bear beds encountered. Bear species was determined for each sample using the methods described by Picton and Knight (1980). Seasons were delineated as spring (March-May), summer (June-August), and fall (September-November). Statistical procedure and notation follow Steele and Torrie (1960).

RESULTS

A total of 295 beds were recorded from 1977 through 1981; 149 beds were known to be used by grizzly bears, 128 by bears of unknown species, and 18 by black bears. The 128 beds for which species identification was not made were either beds recorded prior to 1979 or beds from which adequate hair samples could not be obtained.

Bed Characteristics

An average grizzly bear bed was a shallow depression 88 cm long, 70 cm wide, and 16 cm deep (Table 13). Nine of the 149 grizzly bear beds were 30 cm or more in depth, with nine dug into mineral soil, two dug into snow during the spring, and one in a squirrel midden. Comparison of measurements of known grizzly bear beds with those of beds used by bears of unknown species indicated there was no significant difference between the

Table 13. Bed dimensions

		$\bar{x}$ (cm)	S_x (cm)	$S_{\bar{x}}$ (cm)	Range (cm)	n
LENGTH	Grizzly bear	88	25.9	2.1	33-195	148
	Unknown	82	28.1	2.5	25-180	127
	Black bear	90	24.7	5.8	66-120	18
WIDTH	Grizzly bear	70	20.4	1.7	30-182	
	Unknown	68	21.2	1.9	17-144	
	Black bear	70	18.7	4.4	33-112	
DEPTH	Grizzly bear	16	9.7	0.8	0-55	
	Unknown	16	10.8	1.0	0-60	
	Black bear	15	11.1	2.6	8-47	

two groups (depth: $t = 0.12$, $df = 270$; width: $t = 0.91$, $df = 273$; length: $t = 1.75$, $df = 273$). There was also no significant difference between the measurements of grizzly bear beds and black bear beds (depth: $t = 0.31$, $df = 85$; width: $t = 0.35$, $df = 85$; length: $t = 0.40$, $df = 85$).

Beds were usually scraped into duff or mineral soil and not lined (Table 14). Only 15 of the 149 grizzly beds were lined with substances other than the base substrate, 11 with grass and/or forbs, and four with tree boughs. The mean depth of lined beds was 24 cm. Lining materials were obtained from vegetation immediately surrounding the bed.

Eighty-three percent of the 149 grizzly beds and 84% of the unidentified beds were less than 1 m from a tree. Of these beds, 49 grizzly and 57 unidentified beds were touching a tree. Only two beds were more than 5 m from a tree (7 and 10.8 m). Both beds were used during July and both were dug deeply into the ground (25 and 29 cm).

Site Characteristics

Only one of the 149 grizzly bear beds was located in untimbered habitat (Table 15). This bed was constructed in a recent burn, used snags and charred downfall as cover, and was 10 m to live timber. Thirty-nine percent of the grizzly bear beds were in subalpine fir habitat types. Subalpine fir habitats were most frequently used during summer (67%). The next most frequently used habitats were lodgepole pine (21%) and Douglas-fir (15%). Both these habitats were used mainly during spring and summer. Only five grizzly beds were located in whitebark pine habitat types, and these were all during the spring.

Immediate cover at beds was usually the tree under which they were dug (79% of 149 beds). Trees providing immediate cover at beds (less than 1 m

Table 14. Linings of beds used by grizzly bears and bears of unknown species during 1977-1981

Season	Lined		Unlined				No record	Total
	Grass/ forbs	Tree boughs	Dirt/ duff	Squirrel midden	Rotten logs	Snow		
Mar-May	2/1*	3/0	31/29	3/0	3/0	2/0	0/0	74
Jun-Aug	7/5	1/0	45/42	17/0	7/1	0/0	1/5	131
Sep-Nov	2/1	0/0	17/25	1/5	3/1	0/0	0/1	56
Unknown	0/0	0/1	3/10	0/0	1/1	0/0	0/0	16
Total	11/7	4/1	96/106	21/5	14/3	2/0	1/6	277

* Number of grizzly bear beds/number of unknown species beds.

Table 15. Seasonal occurrence of grizzly bear beds within habitat series[1/] recorded, 1977-1981

	Open	Ecotone	Pial	Abla	Pico	Psme	Pifl	Pien	Unk	Total
Spring	0/0[2/]	1/1	5/3	10/8	14/9	10/10	0/0	0/0	3/1	43/32
Summer	1/0	7/3	0/3	39/16	12/17	13/6	2/0	4/0	0/8	78/53
Fall	0/0	2/1	0/6	8/7	4/7	0/3	0/0	0/1	10/6	24/31
Unknown	0/0	1/2	0/0	1/1	2/3	0/2	0/0	0/0	0/4	4/12
Total	1/0	11/7	5/12	58/32	32/36	23/21	2/0	4/1	13/19	149/128

[1/] Timber habitat series classes, as described by Pfister et al.

[2/] Number of grizzly bear beds/number of unidentified beds.

from bed) occurred in the same order as their availability in the study area, except during spring. Using the method of Johnson (1980) where rankings of use are subtracted from comparable rankings of availability to give an indication of preference, spruce and subalpine fir were evidently preferred as bed cover during spring. Only 8 of the 149 grizzly bear beds had no immediate cover. These beds had a mean depth of 15 cm and were an average of 1.9 m to the nearest tree. Other types of cover at beds included deadfall and snags (20), large rocks (1), shrubs (1), and the porch of a backcountry cabin (1).

Grizzly bear beds located in the timber were an average of 107 m to a timber/opening edge and ranged from 0 to 1,000 m. There was no significant difference in the distance from bed site to a timber/opening edge for grizzly bears and black bears ($t = 0.30$, $df = 162$) or for grizzly bears and unidentified bears ($t = 0.95$, $df = 270$).

Grizzly bears generally constructed beds at sites with good concealment. A human approaching a bear in an average bed would not be able to see a minimum of 10% of the bear's body until he was 18 m from the bear ($n = 34$ grizzly bear beds; avg = 20 m for $n = 42$ unidentified beds).

Grizzlies bedded most frequently on hillsides (113 of 149 beds), using mostly mid to lower portions of slopes during spring, all portions during summer, and upper portions during fall. Beds were generally located on gentle slopes with 75% of the 149 grizzly beds recorded on slopes of 10° or less. During spring 48% of the beds were on south exposures ($n = 44$) while during summer 46% were on north exposures ($n = 79$). The majority of fall beds were on flat sites (48% of 23 beds).

DISCUSSION

It is clear that grizzly bears prefer bed sites with timber cover. The species of tree is not as important as the quality of concealment provided. Tree species and habitats selected as bed sites are probably a reflection of seasonal foraging and movement patterns. Brown bears in Norway were also found to prefer timbered sites for beds (Mysterud 1980).

LITERATURE CITED

Blanchard, B. 1980. Grizzly bear - timber relationships in the Yellowstone area. Proc. 5th Int. Conf. on Bear Res. and Manage., Madison, Wis. (In press)

Craighead, J. J., J. R. Varney, and F. C. Craighead. 1974. A population analysis of the Yellowstone grizzly bears. Montana For. and Conserv. Exp. Sta. Bull. 40. Univ. of Montana, Missoula. 20pp.

Johnson, D. H. 1980. The comparison of usage and availability measurements for evaluating resource preference. Ecol. 61(1):65-71.

Knight, R., J. Basile, K. Greer, S. Judd, L. Oldenburg, and L. Roop. 1978. Yellowstone grizzly bear investigations. Annual report of the Interagency Study Team, 1977. U.S. Dep. Inter. Natl. Park Serv. 107pp.

Knight, R., B. Blanchard, K. Kendall, and L. Oldenburg, eds. 1980. Yellowstone grizzly bear investigations. Report of the Interagency Study Team, 1978-1979. U.S. Dep. Inter. Natl. Park Serv. 91pp.

Knight, R., and B. Blanchard. Techniques used in the study of grizzly bears. (In prep.)

Meagher, M., and J. Phillips. 1980. Restoration of natural populations of grizzly and black bears in Yellowstone National Park. Proc. 5th Int. Conf. on Bear Res. and Manage., Madison, Wis. (In press)

Mysterud, I. 1980. Bedding behavior in the European Brown Bear. Proc. 5th Int. Conf. on Bear Res. and Manage., Madison, Wis. (In press)

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. Forest habitat types of Montana. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-34. 174pp.

Picton, H., and R. Knight. 1980. Age and sex-related characteristics of grizzly bear *(Ursus arctos horribilis)* hair. Presented at Northwest Sect. Meet. of Natl. Wildl. Society, Banff, Alberta, 1980. 19pp.

Steele, R.G.D., and J. H. Torrie. 1960. Principles and procedures of statistics. McGraw-Hill Book Co., New York. 481pp.

Stickel, L. F. 1954. A comparison of certain methods of measuring ranges of small mammals. J. Mammal. 35(1):1-15.

1982 WORK PLAN

The attached general work plan for the period 1981-88 was approved by the Steering Committee on 13 March 1981. This specific work plan for the 1982 field season follows the priorities approved by the Steering Committee. During 1982 there will be four field crews and one graduate student working on bear use of microhabitats. All work in the following work plan will be accomplished by the four field crews and the Montana Fish, Wildlife, and Parks wildlife laboratory.

Major objectives for 1982 are as follows:

I. Finish community analysis mapping of areas for discriminate function analysis of habitat preference.

II. Obtain additional data on early spring and late fall food habits and habitat use.

III. Trap and instrument bears to increase sample size for population parameters.

A. Sex and age structure
B. Population size
C. Reproductive rate
D. Recruitment rates
E. Mortality
F. Dispersal

Community analysis mapping will be done in areas known to be familiar to instrumented bears. This data is recorded in the same manner as habitat use data and will be compared with the habitat use data using discriminate function analysis to determine habitat preferences. One specialized field crew will concentrate on mapping with the other crews participating as time, opportunity, and expertise permit.

Spring and fall habitat use and food habits will be investigated by field examination of sites where instrumented bears are located by aerial tracking. Using this procedure, a community analysis is made at the site noting plant communities, topography, and items that attracted bears. Scats are collected as encountered. Sites used by bears that are encountered while traveling to and from use sites of instrumented bears are also examined.

Capture and instrumentation of bears will be accomplished with culvert traps in place, as follows:

Woody Creek	- 1
Crandall	- 2
Crystal Creek	- 1

Nez Perce Creek - 1
Mesa Road - 1
Fir Ridge - 2
Two Ocean Plateau - 1
Gardner River - 1

Traps at Fir Ridge and Crystal Creek, and one at Crandall, will be relocated during the summer along with one new trap. One of each of these will be flown to the Gardner River and Two Ocean Plateau so that there will be two traps in each of those areas. Traps in backcountry sites that must be monitored by horseback or on foot are most efficient when placed in pairs close enough that both can be checked each day.

Four traps will be placed in pairs by helicopter; two will be placed on the eastern side of the study area and two on the western side. Priorities for placing traps are as follows:

East
1. Eagle Creek (wilderness, Shoshone National Forest)
2. Parker Peak (Yellowstone Park)
3. Cache Creek (Yellowstone Park)

West
1. Winegar Hole (Targhee National Forest)
2. Cabin Creek (Gallatin National Forest)
3. Fan Creek (Yellowstone Park)

Routine radio-tracking flights will continue. As time and funds permit, observation flights will be made to obtain ratios of marked-to-unmarked animals for purposes of population estimation.

Effort toward other objectives for 1982 will be on an opportunistic basis. This does not necessarily mean that they are less important than major objectives, only that resources are not available for more intensive effort at this time, more background data is needed before they can justify more effort, or sufficient data has been gathered toward the objective so that only minimal further effort is required.

IV. Effects of fire.

V. Behavior

A. Aggression
B. Long and short term stress
C. Aversive conditioning

VI. Modeling and monitoring.

Effects of old wildfires have been estimated by comparing wildfire histories in Yellowstone Park with known habitat use patterns of instrumented bears. Instrumented bears who have recent wildfires within their home ranges will be monitored as time permits to determine their extent of use of these areas.

Data on aggression and behavior will be gathered during trapping and as time and opportunity permit during the summer.

The procedure for determining short term stress is the same as physiological measurement of aggressive tendency. This has been done for 2 years and will continue. Measurement of long term stresses will require an additional laboratory procedure and will be done as money permits.

The Taser gun that has been acquired for personal protection while studying aggression has been tested and shown to be effective in instantly immobilizing a bear. This same weapon may have some application to conditioning bears to avoid developed areas as an alternative to trapping and transplanting. Further testing will require some carefully chosen conditions and will be accomplished as opportunity permits.

All data will be applied to modeling efforts as analyzed. Data that shows promise of being applicable to monitoring systems will be tested for sensitivity and simplicity of acquisition.

* * * * * *

Attachment 1: GENERAL WORK PLAN, 1981-1988

At the 1979 meeting of the Steering Committee, it was agreed that future work plans should largely reflect research needs called for in the recovery plan. Although the recovery plan is well underway, it will probably not be completed until late summer. The following work plan reflects the needs of the recovery plan, as we now understand it, and the recommendations of the Peer Review Committee commissioned by the Steering Committee.

I. Major Objectives

A. Population parameters

1. Population estimation - 1984-85
2. Reproductive rates - ongoing

3. Recruitment (cub and yearling survival rates) - ongoing
4. Mortality - ongoing
5. Dispersal - ongoing

Techniques and procedures will involve instrumenting bears with radio transmitters. New developments in radio-telemetry will allow us to instrument cubs and yearlings. Fewer radio-tracking flights will be required since movements of instrumented bears will be studied mainly on a monitoring level. More emphasis will be placed on observation flights to obtain population parameter data. Population estimation will be accomplished by Peterson index after intensive trapping efforts in 1983-84. Saturation trapping during 1983 and 1984 will be necessary to determine true sex ratios in the population

B. Habitat use

1. Early spring and late fall use - 1981-83
2. Effects of wildfire - 1982
3. Habitat preferences - 1981-83
4. Daily habitat use patterns - 1981-83
5. Habitat $\begin{matrix}(\text{modification})\\(\text{manipulation})\end{matrix}$ (bug-killed trees and wildfire) - 1982

We now have nearly adequate data on general habitat use and food habits of Yellowstone grizzly bears. Additional data is needed for early spring and late fall.

Effects of wildfire will be analyzed using known home range data and historical fire data from Yellowstone Park.

Habitat preference and selection will be investigated through comparison of the plant community composition of areas with differing intensities of bear use.

C. Develop monitoring indices from modeling - ongoing
D. Data analysis, modeling - ongoing

II. Minor objectives

A. Distribution - monitoring
B. Movements - monitoring
C. Food habits and summer habitat use - monitoring status

1. Spring ungulate use
2. Riparian habitat classification
3. Community analysis of use sites (summer feed sites)
4. Scat collection and analysis
5. Ant species collection and identification
6. Plant food collection and succulence determination
7. Whitebark pine production - monitoring

D. Aggression

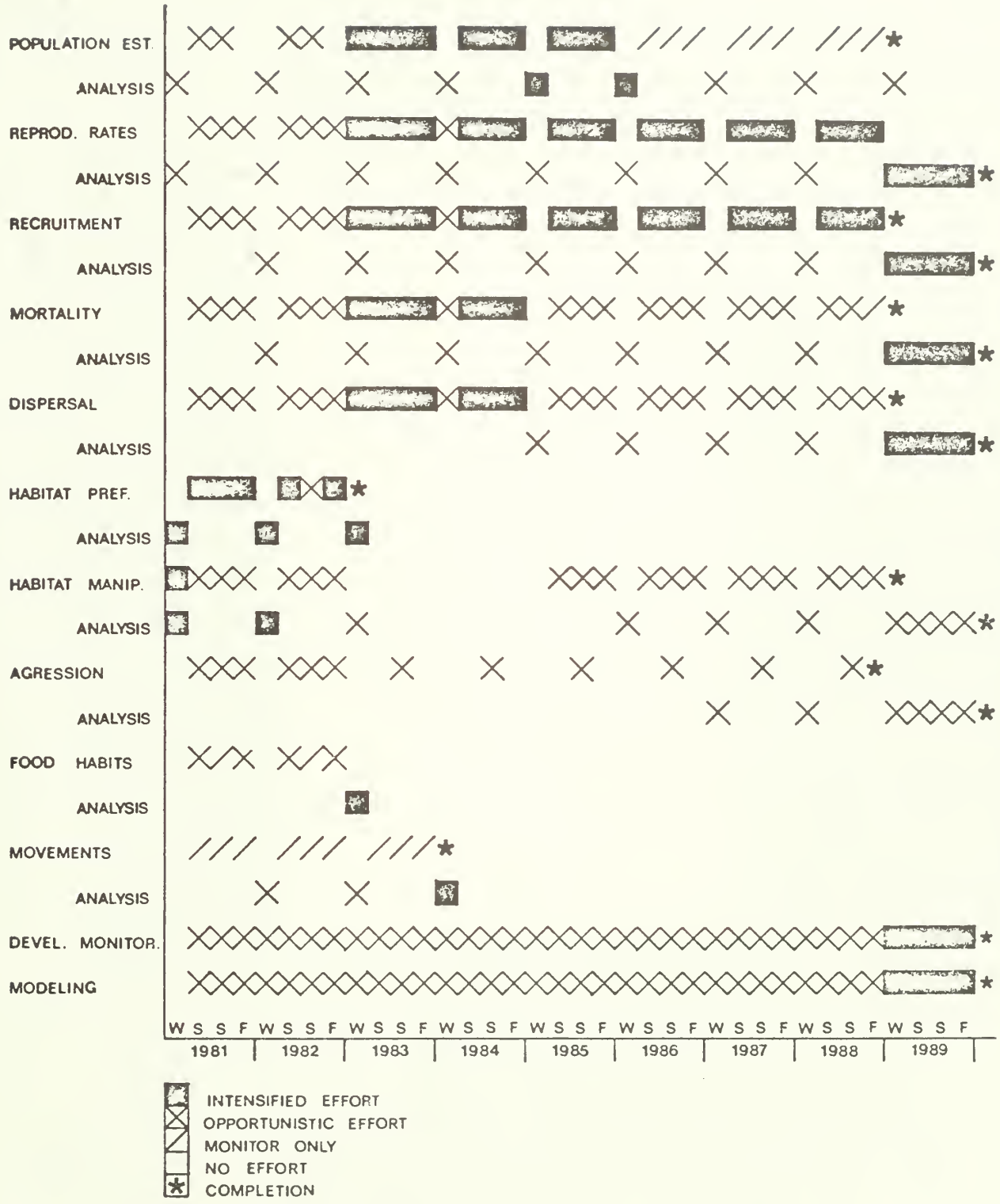
Aggression of grizzlies toward humans will be studied by determining flight distance for individual grizzlies, both marked and unmarked; and by determining adrenaline level differences of individual trapped animals from urine catecholamine levels. Possible relations among flight distances, adrenaline levels, and coat color will be investigated.

Several aspects of food habits and habitat use will be studied to supplement areas in which data is insufficient. Emphasis will be placed on obtaining spring and fall information, including spring use of ungulates as a food source.

A graduate student will be working on a riparian habitat classification.

Scats will be collected throughout the year and analyzed. Ant species utilized as food will be collected and identified. Plant parts eaten will be sampled and analyzed for moisture content. Whitebark pine cone production throughout the study area will be monitored. Plant community analysis of bear use sites will be conducted at randomly selected bear locations, with emphasis on spring and fall seasons.

The 1981-88 General Work Plan was approved by the Steering Committee on 13 March 1981.



Interagency Grizzly Bear Study Team schedule of activities, 1981-1988.

☆U.S GOVERNMENT PRINTING OFFICE: 1984-0-777-762/9147