

Female

Marked E. Coy

1957-62 cohorts

Mortality by generations - p. 7

Marked bear deceased

Growth & Dev. of Known-age Grizzly Bears

Movement 59-62 p. 13

Induced movement p. 15

Marked grizzlies #'s -1959-62 p. 17
2-140

Marked grizzlies - Family groups 1959-62
#'s 1-37

Marked bears deceased - p. 9-10 - inked references

Ear Tags

APPENDIX

1957 COHORT

A. Two-Year Olds Captured in 1959

Established-Age Bears

<u>Bear No.</u>	<u>Sex</u>	<u>Date</u>	<u>Re-Capture Dates</u>	<u>Dental Casts</u>	<u>Longevity</u>
10	F	7/19/59	8/12/61	No Yes	30 months 55 months
15	F	7/27/59	7/13/61	No Yes	30 months 54 months

B. Three-Year Olds Captured in 1960

Established-Age Bears

35	M	6/26/60		No	41 months
45	F	7/13/60	8/16/61	Yes Yes	42 months 55 months
74	M	9/25/60	7/14/61	No No	44 months 54 months
76	M	9/28/60	7/20/62	No Yes	44 months 54 months

C. Four-Year Olds Captured in 1961

Established-Age Bears

81	F	7/5/61		Yes	54 months
101	F	8/3/61		No	55 months

1958 COHORT

A. Yearlings Captured in 1959

Established-Age Bears

<u>Bear No.</u>	<u>Sex</u>	<u>Date</u>	<u>Re-Capture Dates</u>	<u>Dental Casts</u>	<u>Longevity</u>
5	F	7/4/59		No	18 months
			9/2/60	No	32 months
			9/19/61	Yes	45 months

B. Two-Year Olds Captured in 1960

Established-Age Bears

40	F	7/1/60		No	30 months
			10/24/60	No	33 months
			9/22/61	Yes	44 months
			9/8/62	Yes	53 months
66	F	8/26/60		Yes	31 months

C. Three-Year Olds Captured in 1961

Established-Age Bears

96	F	7/27/61		Yes	42 months
			8/17/62	No	55 months

D. Four-Year Olds Captured in 1962

Established-Age Bears

127	M	7/14/62		No	54 months
			8/2/62	No	55 months
			8/27/62	No	55 months

1959 COHORT

A. Cubs Captured in 1959
Known-Age Bears

<u>Bear No.</u>	<u>Sex</u>	<u>Date</u>	<u>Re-Capture Date</u>	<u>Dental Casts</u>	<u>Longevity</u>
6	F	7/4/59		No	6 months
			7/29/60	No	18 months
			8/19/60	Yes	19 months
			8/ 2/61	Yes	30 months
			7/19/62	Yes	42 months
			8/23/62	No	43 months
26	M	8/21/59		No	7 months
			7/14/60	Yes	18 months
29	F	8/28/59		No	7 months
			7/14/61	Yes	30 months

B. Yearlings Captured in 1960
Established-Age Bears

37	M	6/29/60		No	17 months
			8/22/60	Yes	19 months
			6/27/61	Yes	29 months
			10/4/62	Yes	44 months
38	M	6/29/60		Yes	17 months
			7/11/61	Yes	30 months
			8/ 7/61	No	31 months
51	M	7/29/60		Yes	18 months
56	M	8/4/60		Yes	19 months
			5/28/61	No	28 months
57	M	8/4/60		Yes	19 months

C. Two-Year Olds Captured in 1961
Established-Age Bears

80	M	7/ 2/61		Yes	30 months
			8/ 4/61	No	31 months
			8/15/61	No	31 months
			8/27/61	No	31 months
95	M	7/27/61		Yes	30 months
106	M	8/11/61		Yes	31 months
115	F	8/23/61		Yes	31 months

1960 COHORT

A. Cubs Captured in 1960
Known-Age Bears

<u>Bear No.</u>	<u>Sex</u>	<u>Date</u>	<u>Re-Capture Dates</u>	<u>Dental Casts</u>	<u>Longevity</u>
43	M	7/9/60	8/ 2/61	Yes Yes	6 months 19 months

B. Yearlings Captured in 1961
Established-Age Bears

98	M	7/28/61		Yes	18 months
116	M	8/24/61	7/11/62	Yes Yes	19 months 29 months
121	F	9/19/61	10/17/61 8/ 6/62	Yes Yes Yes	20 months 21 months 30 months

C. Two-Year Olds Captured in 1962
Established-Age Bears

122	M	6/16/62	8/14/62	No No	29 months 30 months
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1961 COHORT

A. Cubs Captured in 1961
Known-Age Bears

<u>Bear No.</u>	<u>Sex</u>	<u>Date</u>	<u>Re-Capture Dates</u>	<u>Dental Casts</u>	<u>Longevity</u>
78	M	6/8/61		No	5 months
			6/16/61	Yes	5 months
			7/ 7/61	No	6 months
			9/29/61	Yes	9 months
			5/13/62	Yes	15 months
82	F	7/5/61		No	6 months
83	M	7/5/61		Yes	6 months
93	F	7/25/61		Yes	6 months
			8/22/61	Yes	7 months
94	M	7/27/61		Yes	6 months
97	M	7/28/61		Yes	6 months
99	F	8/2/61		Yes	7 months
100	M	8/3/61		Yes	7 months
109	F	8/14/61		Yes	7 months
110	F	8/14/61		Yes	7 months
			8/17/62	Yes	19 months
117	F	8/29/61		Yes	7 months

B. Yearlings Captured in 1962
Known-Age Bears

130	M	7/18/62		Yes	18 months
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1962 COHORT

Cubs Captured in 1962
Known-Age Bears

<u>Bear No.</u>	<u>Sex</u>	<u>Date</u>	<u>Re-Capture Dates</u>	<u>Dental Casts</u>	<u>Longevity</u>
124	M	7/5/62		Yes	6 months
132	F	7/27/62		Yes	6 months
133	M	7/27/62		Yes	6 months
135	M	8/8/62		Yes	7 months
136	M	8/8/62		Yes	7 months
137	M	8/20/62		Yes	7 months
138	M	8/20/62		Yes	7 months
139	F	8/28/62		Yes	7 months

MORTALITY BY GENERATIONS
Known or Established-Age Bears

<u>Cohort</u>	<u>Bear No.</u>	<u>Sex</u>	<u>Age</u>	<u>Weight lbs.</u>	<u>Specimens Obtained</u>		<u>Fate</u>
					<u>Skull</u>	<u>Skeleton</u>	
1957 Cohort:	3	F	2	150	X		Killed by NPS as control measure, 7/4/59
	19	M	2	235			Shot near Gardiner, 4/6/60
	47	F	3	190	X		Killed at Shoshone Lake 1960
	32	M	4	310			Shot by hunter, 1961
	50	M	3	270			Shot by hunter, 1961
	68	M	4	225			Shot by hunter, 1961
	9	F	4	?			Not observed for two or more consecutive years
	32	M	4	310			Shot by hunter
	54	F	5	?			Not observed for two or more consecutive years
	55	F	5	?			" " "
	62	F	5	?			" " "
	67	M	5	?			" " "
1958 Cohort:	11	F	1	120	X		Killed by NPS as control measure
	103	F	3	270	X	X	Died from overdose of drug
	61	F	3	185			Shot by hunter
1959 Cohort:	24	M	cub	70	X		Died from overdose of drug
	77	F	1	145	X	X	Died from overdose of drug
	118	F	1	145	X	X	Sacrificed at request of NPS
	25	Unk.	?	?			Not observed for two or more consecutive years

Mortality (cont.)

<u>Cohort</u>	<u>Bear No.</u>	<u>Sex</u>	<u>Age</u>	<u>Weight, lbs.</u>	<u>Specimens</u> <u>Skull</u>	<u>Obtained</u> <u>Skeleton</u>	<u>Fate</u>
1959 cont':	36	M	1	145			Not observed for two or more consecutive years
	86	F	3	?	X		Killed by automobile
	91	F	3	250	X	X	Killed by NPS as control measure
1960 Cohort:							
	53	M	1	90	X	X	Sacrificed for study
	114	M	1	95	X	X	Sacrificed for study
	71	M	cub	85	X	X	Died from overdose of drug
	52	M	1	?			Shot by rancher
	49	F	2	?			Not observed for two or more consecutive years
	70	F	2	?			" " "
	79	F	2	?	X	X	Apparently killed by another bear
1961 Cohort:							
	18A	F	cub	30			Sent to zoo
	92	M	1	140			Shot by hunter
1962 Cohort:							
	134	M	cub	70	X	X	Killed by accident in handling

MARKED BEARS DECEASED, 1959-1962

<u>Bear No.</u>	<u>Sex</u>	<u>Date Marked</u>	<u>Where marked</u>	<u>Date Killed</u>	<u>Where killed</u>	<u>How killed</u>
1	M	6/26/59	Trout Creek	9/2/60	Old Faithful	Drug*
3	F	6/28/59	Trout Creek	7/4/59	Lake	Shot, NPS
4	M	7/2/59	Trout Creek	8/8/60	Trout Creek	Shot, NPS
11	F	7/19/59	Crystal Creek	7/31/59	Fishing Bridge	Shot, NPS
13	M	7/24/59	W. Yellowstone	7/24/59	W. Yellowstone	Drug
<u>18</u>	F	6/8/61	Old Faithful	6/22/61	Not killed; shipped to zoo	
19	M	7/21/59	Gardiner	3/6/60	Gardiner	Shot by resident
22	M	8/7/59	Trout Creek	10/6/59	S.W. of Cooke City	Shot by hunter
<u>23</u>	F	8/10/59	Trout Creek	8/10/59	Trout Creek	Drug
24	M	8/11/59	Trout Creek	8/11/59	Trout Creek	Drug
31	F	6/19/60	Rabbit Creek	6/19/60	Rabbit Creek	Drug*
32	M	6/24/60	Trout Creek	10-/61	S. of Cooke City	Shot by hunter
47	F	7/23/60	Trout Creek	8/6/60	Shoshone Lake	Unknown
50	M	7/28/60	Trout Creek	10-/61	Thorofare	Shot by hunter
52	M	7/30/60	Trout Creek	8/20/61	Moran, Wyo.	Shot by rancher
61	F	8/12/60	W. Yellowstone	10/1/61	Hebgen Lake	Shot by hunter
68	M	8/30/60	Gardiner	10-/61	Slough Creek	Shot by hunter
71	M	9/2/60	Trout Creek	9/2/60	Trout Creek	Drug*
18A	F	6/8/61	Trout Creek	7/25/61	Not killed; shipped to zoo	
103	F	8/9/61	W. Yellowstone	8/9/61	W. Yellowstone	Drug
114	M	8/18/61	Canyon	8/24/61	Trout Creek	Specimen
118	F	8/30/61	Trout Creek	9/2/61	Canyon	Drug* (at request of NPS)

MARKED BEARS DECEASED, (cont.)

<u>Bear No.</u>	<u>Sex</u>	<u>Date Marked</u>	<u>Where marked</u>	<u>Date Killed</u>	<u>Where killed</u>	<u>How killed</u>
53	M	8/2/60	Trout Creek	8/24/61	Trout Creek	Specimen
77	F	9/28/60	Trout Creek	6/10/61	Trout Creek	Drug*
79	F	6/16/61	Trout Creek	approx 6/10/62	Elephant Back	Apparently by another larger bear
131	F	7/26/62	Trout Creek	7/27/62	Trout Creek	Overdose of drugs
134	M	8/6/62	Trout Creek	8/7/62	Trout Creek	Accidentally stranged while being handled
91	F	7/20/61	Rabbit Creek	8/7/62	Rabbit Creek	Shot by NPS
69	M	8/30/60	Gardiner	9/21/62	Hellroaring Buffalo Plateau	Shot by hunter
92	M	7/21/61	Trout Creek	9/15-25/62	South of Cooke City	Shot by hunter
86	F	7/12/61	Trout Creek	9/-/62	Elk Park	Apparently hit by automobile

*Note: Designated for shooting by rangers. In an attempt to save these bears, they were shot with propulsive syringes in or near campgrounds. Because of the danger involved and the hazard to campers should the drug dose prove insufficient, a heavier than normal dose of syccinylcholine chloride was used. Most bears survived the initial dose but succumbed to a second dose. A stress factor may be involved.

GROWTH AND DEVELOPMENT OF KNOWN-AGE GRIZZLY BEAR MALES

<u>Bear No.</u>	<u>Date Captured</u>	<u>Age when Captured*</u>	<u>Weight</u>	<u>Total Length</u>	<u>Ear Length</u>	<u>Nose to Eye</u>
37	June 29, 1960	17 mos.	145	57		
	Aug. 22, 1960	20 mos.	245	59	4 3/4	5 3/4
	June 27, 1961	29 mos.	215	65	4 1/2	6
	Sept. 12, 1961	32 mos.	315	67 1/2	4 3/4	6 7/8
	Oct. 4, 1962	45 mos.	440	73	5	7 1/4
38	June 29, 1960	17 mos.	140	57		5 1/2
	July 11, 1961	29 mos.	185	58	5	6 1/4
	Aug. 7, 1961	30 mos.	205			
51	July 29, 1960	18 mos.	150	50 1/2	4 1/8	5 1/4
	Aug. 7, 1962	42 mos.	275	69 1/2	4 5/8	6 3/4
	Aug. 31, 1962	43 mos.	290	68	4 3/4	6 3/4
52	July 30, 1960	6 mos.	100	42	4	4
	Aug. 22, 1960	7 mos.	120			
	June 22, 1961	17 mos.	140	52	4 1/2	5 1/2
	Aug. 1, 1961	18 mos.	182	52 1/2	4 1/2	5 3/4
43	July 9, 1960	5 mos.	70	41		4 1/2
	Aug 2, 1961	18 mos.	185	54	4 1/2	5 3/8
92	July 21, 1961	6 mos.	55	36	3 1/4	3 5/8
	Aug. 22, 1961	7 mos.	80	42	3 1/2	4 1/8
	Aug. 4, 1962	18 mos.	140	50 1/2	4 1/2	5 1/2
78	June 8, 1961	4 mos.	20	29	2 7/8	3
	Sept. 30, 1961	8 mos.	80	38	3 3/4	4
	May 13, 1962	15 mos.	40	40	4	4 1/2
116	Aug. 24, 1961	19 mos.	205	54 3/4	4 5/8	5 1/4
	July 11, 1962	29 mos.	250	63	5	6 1/4
95	July 27, 1961	30 mos.	278	64	5	5 7/8
	Sept. 20, 1961	32 mos.	360	64 1/4	5	6
26	Aug. 21, 1959	7 mos.	90			
	July 14, 1960	29 mos.	145	55		

*Based on birthdate of Feb. 1.

GROWTH AND DEVELOPMENT OF KNOWN-AGE GRIZZLY BEAR FEMALES

<u>Bear No.</u>	<u>Date Captured</u>	<u>Age When Captured*</u>	<u>Weight</u>	<u>Total Length</u>	<u>Ear Length</u>	<u>Nose to Eye</u>
6	July 4, 1959	5 mos.	45			
	June 29, 1960	17 mos.	105	51 1/2		
	Aug. 19, 1960	19 mos.	160	52	4	5
	Aug. 2, 1961	30 mos.	210	59 1/2	3 7/8	5 3/8
	Sept. 20, 1961	32 mos.	260			
	July 19, 1962	42 mos.	250	65 1/2	4 3/4	5 7/8
	Aug. 23, 1962	43 mos.	295			
29	Aug. 28, 1959	7 mos.	92			
	July 14, 1961	29 mos.	165	57 1/2	4 1/2	5 1/4
	Sept. 8, 1961	31 mos.	252	58 1/4	4 1/2	5 3/4
5	July 4, 1959	17 mos.	110			
	Sept. 2, 1960	31 mos.	240	56		
	Sept. 19, 1961	43 mos.	300	63 1/2	3 1/2	5 3/4
77	Sept. 28, 1960	20 mos.	205	55	4 1/2	5 1/4
	June 10, 1961	28 mos.	145	58 1/2	4 1/2	5 1/2
9	July 9, 1959	29 mos.	160			
	Aug. 16, 1960	42 mos.	280	67 1/2	5	6 1/2
10	July 19, 1959	30 mos.	140			
	Aug. 12, 1961	54 mos.	260	63 1/2	4 1/2	6
15	July 27, 1959	30 mos.	150			
	July 13, 1961	53 mos.	212	66	4 7/8	6 1/2
91	July 20, 1961	30 mos.	150	53	4 1/2	4 3/4
	Aug. 7, 1962	42 mos.	250			
40	July 1, 1960	29 mos.	175	55 1/2		5
	Oct. 24, 1960	33 mos.	230			
	Sept. 22, 1961	44 mos.	300	63	4 3/4	5 3/4
	Sept. 8, 1962	54 mos.	340	64 3/4	5	5 3/4

*Based on birthdate of Feb. 1.

MOVEMENT, 1959 - 1962

<u>Bear No.</u>	<u>Sex</u>	<u>Age when Captured or Observed</u>	<u>Area Marked</u>	<u>Date Marked or Observed</u>	<u>Area Observed</u>	<u>Date Observed</u>	<u>Distance from area where marked or observed (airline miles)</u>
2	M	A	Trout Creek	6/27/59	Rabbit Creek	8/ 3/60 6/23/61	19.5
22	M	A	Trout Creek	8/ 7/59	N. of Cody, Wyo.	10/29/59	50
26	M	1 yr.	Trout Creek	8/21/59	Elk Park Trout Creek	5/ 7/60 6/21/60	14
00	M	A	Rabbit Creek	8/ 6/60	Hawk's Rest, Wyo.	9/--/60	50
65	F	A	Trout Creek	8/22/60	Cascade Lake	10/15/60	11
52	M	cub		7/30/60			
43	M	cub		7/ 9/60			
29	F	1 yr.	Trout Creek	8/28/59	Norris cutoff	10/29/60	7
50	M	A	Trout Creek	7/28/60	Thorofare Range, Wyo.	10/--/60	48
32	M	3-4	Trout Creek	6/24/60	Lamar Valley Pelican Creek Mary Lake 5 mi S. Cooke City	5/ 2/61 7/13/61 7/28/61 10/--/61	24 24 14 54
46	M	A	Trout Creek	7/14/60	Lamar Valley Hayden Valley	5/ 2/61 6/17/61	24 24
67	M	3-4	Gardiner	8/26/60	Lamar Valley Gardiner	5/ 2/61 7/19/61	29 29
68	M	3-4	Gardiner	8/30/60	Lamar Valley Upper Slough Creek	5/ 2/61 10/--/61	29 14

MOVEMENT, 1959 - 1962

<u>Bear No.</u>	<u>Sex</u>	<u>Age when Captured or Observed</u>	<u>Area Marked</u>	<u>Date Marked or Observed</u>	<u>Area Observed</u>	<u>Date Observed</u>	<u>Distance from area where marked or observed (airline miles)</u>
77	F	1 yr.	Trout Creek	9/30/60	Norris Jct.	6/10/61	14
60	M	A	W.Yellowstone	8/10/60	Trout Creek W. Yellowstone	6/22/61 8/14/61	28 28
98	M	1 yr.	Trout Creek	7/28/61	Sylvan Lake	9/ 6/61	19
94	M	cub	Trout Creek	7/27/61	Cascade Lake	10/ 2/61	9
112	F	A	Trout Creek	8/15/61	Cascade Lake	10/18/61	9
61	F	2 yrs.	W.Yellowstone	8/12/60	S.E. Hebgen Lake	10/--/61	8
Scarneck	M	A	Rabbit Creek	Season-'59	E. of Yellowstone River near Sulphur Mtn. Rabbit Creek Trout Creek area	6/9,11,16/61 6/23/61 Season-'62	21 21
92	M	1 yr.	Trout Creek	7/21/61	Cooke City area	8/ 4/62	50
86	F	3 yrs.	Trout Creek	7/12/61	Elk Park	9/28/62	15
69	M	A	Gardiner	8/30/60	Hellroaring-Buffalo Plateau area	9/20/62	30
37	M	3 yrs.	Trout Creek	6/29/60	Rabbit Creek	10/ 4/62	15

INDUCED MOVEMENT AND DISTANCE TRAVELED, 1959 - 1962

<u>Bear No.</u>	<u>Sex</u>	<u>Age When Captured</u>	<u>Area Captured</u>	<u>Area Released</u>	<u>Date Released</u>	<u>Area Observed</u>	<u>Date Observed</u>	<u>Distance Traveled (airline miles)</u>
2	M	A	Thumb	Trout Creek	6/27/59	Thumb	7/ 2/59	15
			Thumb	Carnelian Cr.	7/ 6/59	Trout Creek	7/ 8/59	17
4	M	A	Thumb	Trout Creek	7/ 2/59	Thumb	7/ 5/59	15
			Thumb	Carnelian Cr.	7/11/59	Trout Creek	7/14/59	15
			Pelican Cr.	Trout Creek	7/25/60	Pelican Creek	7/27/60	10
			Pelican Cr.	Rabbit Creek	7/27/60	Pelican Creek	8/ 2/60	18
11	F	1 yr.	Canyon	Crystal Creek	7/19/59	Fishing Bridge	7/28/59	25
12	M	A	Fishing Bridge	Crystal Creek	7/21/59	Trout Creek	7/24/59	21
8	F	A	Thumb	Trout Creek	7/ 8/59	Rabbit Creek	7/24/59	18
9	F	A	Thumb	Trout Creek	7/ 9/59	Thumb	8/16/60	15
47	F	3-4	Thumb	Trout Creek	7/23/60	Shoshone Lake	8/18/60	18
1	M	A	Thumb	Trout Creek	6/26/59	Old Faithful	9/ 1/60	18
43	M	1 yr.	Canyon	Mary Lake	8/ 2/61	Fishing Bridge	8/15/61	14
80	M	2 yrs.	Canyon	Trout Creek	7/ 2/61	Canyon	8/ 4/61	8.5
				Mary Lake	8/ 4/61	Indian Creek	8/15/61	9
				Hayden Valley	8/15/61	Canyon	8/27/61	11
18 & 78	F	A	Old Faithful	Trout Creek	6/ 8/61	Clearwater Sp.	6/12/61	16
	M	cub				Alum Creek	6/14/61	14
						Bridge Bay	6/15/61	11

INDUCED MOVEMENT AND DISTANCE TRAVELED, 1959 - 1962

Bear No.	Sex	Age When Captured	Area Captured	Area Released	Date Released	Area Observed	Date Observed	Distance Traveled (airline miles)
78	M	cub	Bridge Bay	Trout Creek	6/16/61	Sulphur Mtn.	6/18/61	2
			Sulphur Mtn.	Hayden Valley	6/18/61	Grand View	6/24/61	6
			Grand View	Promontory Pt.	6/25/61	Steamboat Pt.	7/ 2/61	27
37	M	2 yr.	Thumb	Trout Creek	6/26/61	Wolf Point	7/ 8/61	26
						Thumb	7/15/61	9
			Thumb	Trout Creek	9/11/61	Thumb	7/28/61	15
52	M	1 yr.	Thumb	Crystal Creek	10/12/61	Crystal Creek old f.		
			Thumb	Trout Creek	9/30/61	Thumb	10/11/61	
			Canyon	Blacktail	6/23/61	Canyon	6/25/61	14
				Deer Creek				
			Canyon	Mary Lake	8/ 1/61	Moran, Wyo.	8/20/61	55
79	F	1 yr.	Gardiner	Trout Creek	6/16/61	Pelican Creek	7/ 3/61	10
			Pelican Cr.	Hayden Valley	7/ 4/61	Pelican Creek	8/21/61	15
38	M	2 yrs.	Pelican Cr.	Trout Creek	7/10/61	Pelican Creek	7/14/61	11
			Pelican Cr.	Promontory Pt.	7/18/61	Pelican Creek	7/21/61	31
			Pelican Cr.	Gardiner	7/24/61	Indian Creek	8/ 6/61	12
107	F	A	Canyon	Trout Creek	8/10/61	Canyon	9/12/61	9
116	M	1 yr.	Fishing Bridge	Trout Creek	8/24/61	Fishing Bridge	8/29/61	9
127	M	3-4 yrs.	Lake	Crystal Creek	8/ 2/62	Fishing Bridge	8/27/62	25

returned to same area {

MARKED GRIZZLIES, 1959 - 1962, LONE INDIVIDUALS

No.	Date	Sex	Age*	Wt.Lbs.	Place Captured	Place Released	Color Marker		Ear Tag	
							R. Ear	L. Ear	R. Ear	L. Ear
2	6/27/59	M	A	300	Thumb	Trout Creek		Yellow	G-15	G-16
9	7/ 9/59	F	2	160	Thumb	Trout Creek	Pink- Purple	Pink- Purple	00-168	00-167
12	7/21/59	M	A	620	Fishing Bridge	Crystal Creek	Purple	Purple	00-200	00-199
14	7/26/59	M	A	520	Trout Creek	Trout Creek	Purple		00-193	
20	8/ 4/59	M	A	280	Gardiner	Gardiner	Purple	Purple	00-195	00-194
30	9/10/59	M	A	710	Trout Creek	Trout Creek	Red- blue	Red- blue	00-289	00-288
33	6/25/60	M	A	425	Trout Creek	Trout Creek	Red- pink	Red- pink	00-281	00-290
41	7/ 5/60	M	A	550	Trout Creek	Trout Creek	Blue- orange	Blue- orange	00-259	00-257
42	7/ 5/60	F	A	250	Trout Creek	Trout Creek	Blue- white	Blue- white	00-260	00-254
44	7/11/60	F	A	300	Trout Creek	Trout Creek	Blue- green	Blue- green	00-218	00-219
45	7/13/60	F	3-4	185	Trout Creek	Trout Creek	White- pink	White- pink	00-270	00-271
46	7/14/60	M	A	355	Trout Creek	Trout Creek	Blue- pink	Blue- pink	00-225	00-224
54	8/ 2/60	F	2(?)	225	Rabbit Creek	Rabbit Creek	Pink- white	Pink- white	H-1553	H-1554
55	8/ 2/60	F	2(?)	200	Rabbit Creek	Rabbit Creek	Pink- green	Pink- green	H-1552	H-1556
60	8/10/60	M	A	600+	W. Yellowstone	W. Yellowstone	Purple- blue	Purple- blue	H-1555	H-1564
62	8/12/60	F	2-3	230	W. Yellowstone	W. Yellowstone	Pink- blue	Pink- blue	H-1567	H-1569

*Age when first marked.

A = "Adult".

YA = "Young Adult".

MARKED GRIZZLIES, 1959 - 1962, LONE INDIVIDUALS

No.	Date	Sex	Age*	Wt. Lbs.	Place Captured	Place Released	Color Marker		Ear Tag	
							R. Ear	L. Ear	R. Ear	L. Ear
63	8/13/60	M	A	560	W. Yellowstone	W. Yellowstone	Purple-pink	Purple-pink	H-1574	H-1528
64	8/17/60	F	A	495	Trout Creek	Trout Creek	Pink-yellow	Pink-yellow	H-1549	H-1531
66	8/26/60	F	2	225	Gardiner	Gardiner	Blue-yellow	Blue-yellow	H-1535	H-1534
67	8/26/60	M	3-4	275	Gardiner	Gardiner	Green-red	Green-red	H-1573	H-1548
74	9/25/60	M	2-3	200	Trout Creek	Trout Creek			H-1512	G-19
75	9/25/60	F	A	350- (est.)	Trout Creek	Trout Creek	White	White	H-1542	H-1543
78	6/ 8/61	M	cub	20	Old Faithful	Trout Creek	Yellow-white H.		00-226	00-269
80	7/ 2/61	M	2	116	Canyon	Hayden Valley				
81	7/ 5/61	F	YA	220	Trout Creek	Trout Creek	Blue-H. redgray	Blue-H. redgray	G-7	G-8
85	7/ 8/61	M	A	465	Trout Creek	Trout Creek			G-6	G-25
87	7/13/61	M	A	450	Trout Creek	Trout Creek				
88	7/18/61	M	A	500	Trout Creek	Trout Creek			G-9	G-12
89	7/19/61	M	A	635	Rabbit Creek	Rabbit Creek			G-14	G-13
90	7/19/61	M	YA	260	Rabbit Creek	Rabbit Creek			00-390	00-329
101	8/ 3/61	F	YA	285	Trout Creek	Trout Creek		Red-H. bluegray	H-1590	H-1578
102	8/ 7/61	F	YA	260 (est.)	Fishing Bridge	Trout Creek		Green-H. bluegray	00-333	H-1589
104	8/10/61	F	A	375 (est.)	W. Yellowstone	W. Yellowstone		White-H. gray	G-17	G-18

73 Searched?

*Age when first marked.

A = "Adult".

YA = "Young Adult".

MARKED GRIZZLIES, 1959 - 1962, LONE INDIVIDUALS

No.	Date	Sex	Age*	Wt.Lbs.	Place Captured	Place Released	Color Marker		Ear Tag	
							R. Ear	L. Ear	R. Ear	L. Ear
105	8/10/61	M	YA	315	W. Yellowstone	W. Yellowstone			H-1579	H-1544
106	8/11/61	M	2	255	W. Yellowstone	W. Yellowstone			G-77	G-76
107	8/10/61	F	A	275- (est.)	Canyon	Trout Creek			rd-red	rd-alum
108	8/12/61	F	A	300	Trout Creek	Trout Creek	Green-H. bluegray	Green-H. bluegray	rd-alum	rd-red
111	8/14/61	M	A	530- (est.)	Trout Creek					G-51
113	8/17/61	M	A	345	Trout Creek	Trout Creek			00-338	G-72
121	9/19/61	F	1(?)	115	Canyon	Trout Creek	Yellow tape	Yellow tape	G-18	00-252
122	6/16/62	M	2	140	Canyon	Trout Creek	None	None	00-263	00-264
126	7/11/62	M	A	310	Trout Creek	Trout Creek	None	None	00-262	00-222
127	7/14/62	M	YA	250	Lake	Trout Creek	None	None	00-346	H-3079
129	7/18/62	F	A	405	Trout Creek	Trout Creek	Pink tape	None	G-57	G-152
140	9/21/62	F	A	375	Trout Creek	Trout Creek	None	None	G-104	G-199

*Age when first marked.

A = "Adult".

YA = "Young Adult".

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
1.	5	<i>Lonesome</i> Sow Yrl.	F F ?	4 A 3	Red tape Unmarked Unmarked	Red tape	00342	00345
2.	a.	6 <i>First cub</i> 7 <i>Green sow</i> 51 115	F F M F	3 A 3 3	Blue-white rope Green tape Green-pink tape Gray-redgray H.	Green-yellow H. Green tape Red-white rope Gray-redgray H.	00177 00190 H 1520 G 78	G 98 00189 H 1519 H 1585
	b.	7	2 '62 cubs	?	cubs	Unmarked		
3.	10 35	Litter mate	F M ?	4 4 4	Blue tape Missing Unmarked	Blue tape Missing	00170 00292	G 74 00291
4.	15	Litter mate	F ?	4 4	Red-green H. Unmarked	Red-green H.	00328	00388
5.	17	1960 cub	F ?	A 2	Green tape Unmarked	Green tape	00186	00185
6.	16	3-1960 cubs	F ?	A 2	Green tape Unmarked	Green tape	00184	00183
7.	8	<i>Green Thumb Sow</i> 3-1960 cubs	F ?	A 2	Green tape Unmarked	Green tape	00180	00181

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
8.	21		F	A	Green tape	Green tape	00274	00275
		2-1960 cubs	?	2	Unmarked			
9.	25	<i>50 lb cub</i>	?	3	Yellow-red tape	Yellow-red tape	00141	00145
		Sow	F	A	Unmarked			
		Litter mate	?	3	Unmarked			
10.	26	<i>90 lb cub</i>	M	3	Missing	Missing	Missing	00215
		Sow	F	A	Unmarked			
	77*		F	3	White rope, w/red flag	White rope, w/red flag	H 1540	H 1541
	95		M	3	Yellow-blk rope, w/red flag	Yellow-blk rope, w/red flag	F 100	H 1598
11.	29	<i>Sucostin kid 1/2 sister</i>	F	3	White-green H.	White-green H.	00389	G 20
	36	<i>Sucostin kid</i>	M	3	White-yellow tape	White-yellow tape	00294	00295
		Sow	F	A	Unmarked			
12.	32*	<i>Collared bear</i>	M	5	None	None	00387	00266
	131	Litter* mate	F	5	Unmarked			
13.	37	<i>Dumpy bear</i>	M	3	Green-redgray H.	None	00178	00326
	38		M	3	Red-yellow H.	None	G 11	G 10
	39		F	A	White-purple tape	White-purple tape	00251	00255

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
14.	40	Litter mate Sow	F	4 or 5	White tape	Yellow tape	00253	00258
			M	4 or 5	Unmarked			
			F	A	Unmarked			
15. a.	43	<i>Paul</i>	M	2	Blue-white rope	Green-gray H.	H 1591	00160
	52		M	2	Yellow-black rope, w/red flag	None	G 3	H 1504
	65		F	A	Blue-white rope, w/white flag	Blue-white rope, w/white flag	H 1533	H 1532
	b. 65		?	cubs	unmarked			
16. a.	48	1 '62 cub	F	A	Green-yellow tape	Green-yellow tape	H 1522	H 1521
	49		F	2	Green-white tape	Green-white tape	H 1523	H 1524
	b. 48		M	cub	None	None	00-104	00-261
17.	53	<i>Cub of ripped nose - now</i>	M	2	Yellow rope, w/red flag	Yellow rope, w/red flag	H 1507	H 1506
	114		M	2	Blue-white rope	Black-yellow rope	00133	00398
			F	A	Unmarked			
18.	56	<i>Tested with chimney radio-copes - put them on at Old Faithful (R. Creek)</i>	M	3	Purple-white tape	Purple-white tape	H 1551	H 1558
	57		M	3	Purple-yellow tape	Purple-yellow tape	H 1560	H 1561
	58		F	A	Red-white rope, w/yellow flag	Red-white rope, w/yellow flag	H 1563	H 1562
19.	59	1960 cub	F	A	Purple-red tape	Purple-red tape	H 1557	H 1559
			?	2	Unmarked			

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
20.	70	<i>White-faced cub</i> <i>White-faced sow</i>	F	2	Yellow rope, w/green flag	Yellow rope, w/green flag	H 1517	H 1518
	72		F	A	Red-white rope, w/green flag	Red-white rope, w/green flag	H 1516	H 1510
21.	82	Litter mate	F	1	None	Red-white H.	G 5	00227
	83		M	1	Yellow-redgray H.	None	00386	G 4
			?	1	Unmarked			
	84		F	A	Blue-white H.	None	G 22	H 1546
22.	34		F	A	Red-yell tape	Red-yellow tape	00298	00297
	92		M	1	Red-white rope, w/red H. flag	Yellow-green H.	00391	00268
	93		F	1	Blue-white rope	Yellow-gray H.	00394	00349
23.	94	Litter Mate Sow	M	1	Red-white rope	Green-white H.	H 1599	00137
			?	1	Unmarked			
			F	A	Unmarked			
24.	96		F	4	Gray-bluegray H.	Gray-bluegray H.	G 99	H 1596
	76		M	4	None	None	H 1538	H 1539
25.	97	Litter mate	M	1	Gray-yellow H.	Yellow rope	H 1594	00330
	100		M	1	White-bluegray H.	White rope	00348	00136
	112		F	A	Blue-gray H.	Red-white rope	H 1588	00399
			?	1	Unmarked			

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
26.	98	Litter	M	2	Yellow-bluegray	H. White rope	00395	H 1576
		mate	?	2	Unmarked			
		Sow	F	A	Unmarked			
27.	99 119		F	1	Redgray H.	Yell-black rope	H 1592	00331
			F	A	None	None	H 1584	00340
		Litter mate	?	1	Unmarked			
28.	91	Litter	F	3	White-redgray H.	White-redgray H.	00392	00393
		mate	?	3	Unmarked			
		Litter	?	3	Unmarked			
		mate						
29.	109 110 130		F	1	Red-yellow H.	Yellow rope	00337	00396
			F	1	Yellow rope	Blue-yellow H.	00400	00335
		Sow	F	A	Unmarked			
			M	1	Yellow rope, green flag	None	00223	H 1581
30.	117		F	1	Blue-white rope, w/yellow flag	Blue-white rope, w/yellow flag	00344	00343
		Sow	F	A	Unmarked			
31.	120		F	A	None	Yellow tape	00339	H 1583
		1961 cub	?	1	Unmarked			
		1961 cub	?	1	Unmarked			

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
32.	116		M	2	White rope, w/red flag	White rope, w/green flag	00341	G 97
		Litter mate	?	2	Unmarked			
		Sow	F	A	Unmarked			
33.	123 137		F	A	Red tape	None	H 3097	00229
			M	cub	None	Blue-white rope w/orange flag	G 205	00231
			M	cub	Blue-white rope, w/orange flag	None	G 425	G 252
34.	125		F	A	Blue tape	None	00-16	00273
		'62 cub	?	cub	Unmarked			
		'62 cub	?	cub	Unmarked			
35.	128		F	A	None	Yellow tape	G 55	G 300
		'62 cub	?	cub	Unmarked			
		'62 cub	?	cub	Unmarked			
36.	132 133		F	cub	White rope, w/blue flag	None	00240	G 201
			M	cub	Orange tape	None	G 101	G 299
		Sow	F	A	Unmarked			
37.	75 135 136		F	A	White tape	White tape		
			M	cub	None	Yellow tape, w/green flag	G 203	G 151
			M	cub	Yellow rope, green flag	None	00232	G 204

MARKED GRIZZLIES, 1959 - 1962, FAMILY GROUPS

Family No.	Marked Bear No.	Unmarked Members	Sex	Age 1962	Color Marker		Ear Tag	
					R. Ear	L. Ear	R. Ear	L. Ear
38.	42		F	A	Blue-white tape	Same	00260	00254
	139		F	cub	Blue-white rope, green flag	None	G 200	G 376
		'62 cub	?	cub	Unmarked			

Frank

marked copy

AN ECOLOGICAL STUDY OF THE GRIZZLY BEAR

Fourth Annual Report
Summary of Work Accomplished
1959-1962

NOT FOR PUBLICATION

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INTRODUCTION

A six year ecological study of the grizzly bear (*Ursus arctos horribilis*) was initiated in 1959 and has been coordinated through the Montana Cooperative Wildlife Research Unit at Montana State University.

Grizzly bears have disappeared from much of their former range in the United States. There is need for detailed ecological studies of this large carnivore if it is to be preserved and intelligently managed. This has been recognized for some time, but formidable obstacles have prevented intensive research. Some of these problems have been:

1. Overcoming the tremendous physical task of gathering data and supplying an operation over thousands of square miles of wilderness grizzly habitat.

2. Locating a grizzly bear population sufficiently large and localized that quantitative data could be obtained.

3. Adapting and improving methods of immobilizing wild bears for detailed inspection and measurement.

4. Developing a method or methods of marking grizzlies so individuals and known-age animals could be observed in the field.

After much fruitless searching in Montana for a suitable study site, Yellowstone National Park was investigated and found to have a relatively large population of grizzlies sufficiently free of artificiality that fundamental biological data could be obtained on a quantitative basis. Advantages of the Yellowstone area are that grizzlies are numerous, readily observed, and can be studied both in the vicinity of man and in the back country--a situation that has yielded basic ecological data as well as information on the interrelations of this large carnivore with man. The National Park Service indicated interest in a proposal for research and offered to cooperate in the study.

During the past four years field work has begun the last of May and terminated in early November. Quarterly and annual reports of the Montana Cooperative Wildlife Research Unit have reported on previous work accomplished. Findings and conclusions will be presented in technical papers as the study progresses. Some results of the investigations from 1959 through 1962 are here summarized for the benefit of financial supporters and the research team. The findings presented are tentative and cannot be considered as final conclusions.

General Objectives:

1. To develop and perfect methods and techniques of capturing, handling, marking, and immobilizing grizzly bears.
2. To study the population dynamics of grizzlies and with the aid of marked animals, determine population size, density, sex and age composition, breeding age, reproductive capacity, growth rate, mortality rate, and population turnover.
3. To study population behavior, family composition and activities, breeding behavior, and relationships between various units in the population.
4. To determine home ranges, daily and seasonal movements, and distances traveled to food, to hibernation sites, and for breeding purposes.
5. To determine carrying capacity and habitat requirements and relate these to existing conditions of food abundance, habitat types and hibernation sites.
6. To collaborate with specialists in conducting physiological hematologic, and pathological studies.
7. To adopt and utilize electronic equipment in obtaining ecological data.

Financial Support:

This project is supported by a five-year grant from the National Science Foundation and from annual grants from the Research and Exploration Committee of the National Geographic Society, the Wildlife Management Institute, the Boone and Crockett Club, and the National Park Service. Funds from the Montana Cooperative Wildlife Research Unit* are annually budgeted for operational expenses and some salaries. The National Park Service and the Yellowstone Park Company have made laboratory facilities and special equipment available. The radio-tracking phase is supported by a three-year grant from the National Science Foundation and by funds allocated by Philco Corporation for development of radio-tracking equipment by engineers of their Western Research and Development Laboratory.

*Contribution from the Montana Cooperative Wildlife Research Unit; U.S. Fish and Wildlife Service, Montana State Fish and Game Department, Montana State University, and Wildlife Management Institute cooperating.

GENERAL RESEARCH METHODS AND TECHNIQUES

CAPTURING AND MARKING

Methods of Capture:

One hundred eighty six grizzlies have been captured in culvert traps and 41 have been shot free-ranging in the field with a CO₂ gun using drug-laden propulsive syringes. Methods of capture for the four years are summarized in Table I.

Trapping Success:

Trapping success (for culvert traps) for all four years is presented in Table II. Trapping operations were carried on only at Trout Creek during the summer of 1962 and trap shyness became evident in the Trout Creek population. This was expected and other methods of capture will be employed to a greater extent in the future. These include the use of offset steel traps and selective shooting and immobilizing of grizzlies with drug-filled propulsive syringes.

Number of Bears Captured:

One hundred and forty one different individuals have been captured and marked since field work began in 1959.

Nineteen new individuals were trapped during the 1962 season, immobilized, individually marked, weighed, measured, and released. Of the 19 bears captured, 11 were males and eight were females. Nine cubs and one yearling were among those captured.

A summary of the number of bears captured and marked since the start of the study is presented in Table III. Table III also shows the number of marked bears known to be dead and those considered dead (or unmarked). Thus, out of 141 marked bears, 101 were theoretically in the population during the summer of 1962, of which 69 were observed one or more times.

TABLE I

SUMMARY, METHOD OF CAPTURE 1959-1962

<u>Year</u>	<u>Total No. Bears Handled (Initial Capture and Recaptures)</u>	<u>Total No. Trapped</u>	<u>Total No. Shot Free-Ranging</u>
1959	33	27	6
1960	64	56	8
1961	95	74	21
1962	<u>35</u>	<u>32</u>	<u>6</u>
Totals	227	186	41

TABLE II

TRAPPING SUCCESS (CULVERT TRAPS) 1959-1962

<u>Year</u>	<u>Trap Nights</u>	<u>Successful Trap Nights</u>	<u>Percent Trapping Success</u>
1959	21	14	76.0
1960	71	51	71.8
1961	77	46	59.6
1962	75	24	32.0

TABLE III

MARKED GRIZZLIES AND THE NUMBER
OF MARKED BEARS THEORETICALLY
IN THE POPULATION IN 1962

<u>Year</u>	<u>No. Marked</u>	<u>No. Known Dead</u>	<u>No. Considered Dead or Unmarked*</u>	<u>No. of Marked Bears Theoret- ically in 1962 Population</u>	<u>No. Observed in 1962</u>	<u>No. Not Observed in 1962</u>
1959	30	10	4	16	11	5
1960	47	11	5	31	16	15
1961	45	8	-	37	25	12
1962	<u>19</u>	<u>2</u>	<u>-</u>	<u>17</u>	<u>17</u>	<u>-</u>
	141	31	9	101	69	32

*Bears that have not been observed or retrapped for two or more years are considered to have lost their markings or to have died.

Marking:

At the inception of the study it was recognized that any single marking technique would not prove entirely effective. Accordingly two separate systems were used with the assumption that where one might fail the other would remain intact and vice versa. This assumption has proved correct and to date practically all bears that have been marked and subsequently observed have been individually identifiable by either colored markers, colored ear tags, or a combination of both.

Varying the placement of the colored aluminum ear tags has proved even more useful than was originally anticipated in identifying bears that have lost all other markers. Retention of these metal tags has been excellent--very few properly placed tags have been lost. Some have been worn by the bears for as long as 40 months.

Polyvinyl tape, the first material used experimentally as a color marker, has been placed on 64 bears. Retention of this material is evaluated in Table IV. Unfortunately, this highly visible tape is not so durable as some other materials.

The use of Herculite, a nylon-impregnated fabric, was discontinued in 1962 after one year of use because this material was not as visible as other materials in use. Durability, however, was reasonably good. Twenty-two bears were marked in one or both ears with 31 Herculite markers in 1961. The 22 bears observed in 1962 still retained 23 Herculite markers, only eight having been lost (Table IV).

Polyethylene braided rope (3/8" size) has proved to be the most durable color-marker material used to date. Since 1960, 29 bears have been lost. Although the observability of this material is not so good as polyvinyl tape, it is sufficiently visible for most field conditions and the relative loss of observability is more than compensated for by its excellent wearing qualities. To improve visibility, one to two inch "flags" of polyvinyl tape were attached to the rope marker. This combination has proved to be the best marking method used to date. Polyethylene rope collars were used experimentally on several bears. These were retained over a year until removed. The collars promised to be more durable and more visible than the ear markers and more of these will be used in the future.

Adult males were not color marked but were marked with metal ear tags and were tattooed.

An evaluation of the durability of the different materials used for marking grizzlies appears in Table IV. This table evaluates only those markers worn by bears observed in the field of those recaptured. The column "Number of Markers" refers only to those markers observed on bears the year after they were marked--it does not include markers on bears that were not observed or recaptured in succeeding years. The possibility exists that some bears lost all their markers and were not identified. It is believed, however, that this possibility is slight.

Table IV shows that 27.7 per cent of the polyvinyl tape markers attached in 1959 had been lost after one year. This figure rose to 52.5 per cent for a similar sample size attached in 1960. After two years, the loss of polyvinyl markers appears quite stable, 54.8 and 53.6 per cent for the 1959 and 1960 samples, respectively. The loss after three years was 66.6 per cent. This loss of color plastic markers did not present a serious problem in making individual field identification of bears. The colored ear tags were retained and by using the alternate system of colored metal ear tags, those that had lost color markers were all readily identified.

To date, none of the polyethylene rope markers have been lost. Eight, or 25.8 per cent, of the 31 Herculite markers were lost after one year.

Tattoo:

Except for a few individuals, all bears were tattooed in the upper lip or behind the foreleg. This permanent mark has proved very helpful in identifying bears that have been shot by hunters and stripped of their markers. Two bears killed by hunters outside the Park, No. 32 in 1961 and No. 69 in 1962, were positively identified by the tattoo alone.

Recaptures:

Table V shows the number of individual bears recaptured and the total number of recaptures from 1959 through 1962. The 86 recaptures have yielded valuable data on growth rates, fat deposition, dentition development, and movement on 59 individual grizzlies. Both the number of individuals recaptured and the total number of recaptures reached a peak in 1961. In 1962 only 13 grizzlies were recaptured; of these, one was marked in 1959, four in 1960, six in 1961, and two in 1962.

TABLE IV
EVALUATION OF DURABILITY OF COLOR-MARKING MATERIALS
FROM OBSERVATIONS OF COLOR-MARKED BEARS, 1959-1962

TYPE OF MARKER AND YEAR ATTACHED	No. BEARS, No. MARKERS, AND MARKER CONDITION AFTER ONE YEAR						No. BEARS, No. MARKERS, AND MARKER CONDITION AFTER TWO YEARS						No. BEARS, No. MARKERS, AND MARKER CONDITION AFTER THREE YEARS					
	No. BEARS	No. OF MARKERS	No. INTACT	No. BROKEN BUT VISIBLE	No. LOST	% LOST	No. BEARS	No. OF MARKERS	No. INTACT	No. BROKEN BUT VISIBLE	No. LOST	% LOST	No. BEARS	No. OF MARKERS	No. INTACT	No. BROKEN BUT VISIBLE	No. LOST	% LOST
POLYVINAL TAPE:																		
1959	25	47	17	17	13	27.7	16	31	8	6	17	54.8	11	21	0	7	14	66.6
1960	36	59	15	13	31	52.5	16	28	11	2	15	53.6						
1961	3	6	6	0	0	00.0												
POLY- ETHYLENE ROPE:																		
1960	5	9	9	0	0	00.0	2	3	3	0	0	00.0						
1961	14	15	15	0	0	00.0												
HERCULITE:																		
1961	22	31	23	0	8	25.8												

TABLE V

SUMMARY OF THE NUMBER OF BEARS RECAPTURED, 1959-1962

<u>Year</u>	<u>No. Individuals Recaptured</u>	<u>Total No. of Recaptures</u>
1959:	3	3
1960:		
Bears marked in 1959	6	7
Bears marked in 1960	7	10
1961:		
Bears marked in 1959	8	10
Bears marked in 1960	12	25
Bears marked in 1961	10	15
1962:		
Bears marked in 1959	1	2
Bears marked in 1960	4	5
Bears marked in 1961	6	6
Bears marked in 1962	2	3
Totals	59	86

IMMOBILIZING AND ANESTHETIZING

The techniques of immobilizing and anesthetizing have gradually been improved and perfected. Briefly, the procedure consists of estimating the bear's weight, computing a dosage of succinylcholine chloride at about 1 mg. (100 mg. per c.c. solution) for every five pounds of body weight (Table VI). The succinylcholine chloride is administered intramuscularly and when the effects have begun to "wear off," pentobarbital sodium is administered by intra-pulmonary injection. The dosage of pentobarbital sodium (250 mg. per c.c. solution) is also calculated on a basis of body weight and averages about 1 c.c. for every 16 pounds of body weight (Table VI). Individuals vary considerably in their reaction to these drugs and tolerance may be affected by age, physical condition, stress and other factors. Table VII compares the dosages of succinylcholine chloride administered to free-ranging bears and those administered to bears captured in culvert traps. Trapped bears have consistently required lighter doses than free-ranging bears. This is believed to be related to stress.

In spite of considerable experience in drugging grizzlies, we have no simple "rule of thumb" procedures. Each operation still requires many judgment decisions and can safely be conducted only by experienced personnel.

Apparent differences in two brands of pentobarbital sodium are worthy of mention. The brand used in previous years and until midway in the 1962 season was manufactured by J. T. Baker Chemical Co., Phillipsburg, New Jersey. When this supply was gone, it was replaced with that made by Penick Chemical Division, New York and Chicago. Since both brands were labeled exactly the same, and both were mixed at the same strength (250 mg/cc. solution), it was assumed their action would be similar. This was not the case. Three bears successfully immobilized with succinylcholine chloride showed very little or no effect at all when administered normal dosages of Penick's pentobarbital. Following these failures, a yearling bear was immobilized with succinylcholine, spread-eagled and secured. Successive doses of the Penick product were administered until anesthesia was effected. Nearly twice the normal dosage was required (1 cc per 9 lbs. body wt.). Similar results were obtained with an adult female processed the same day. Later in the season the original Baker brand of pentobarbital was obtained and effective dosages averaged 1 cc. per 16 lbs. body weight. The differences in these two brands has not yet been satisfactorily explained.

Data concerning average dosages administered to different age classes and the number of individuals handled in each age class for all four years also appear in Table VI.

One death in 1962 was attributed to an overdose of drugs. A stress factor may also have been involved in the death of No. 131, a young adult female. Drug dosages were well within the range of average doses recorded in Table VI.

*Drug dosage
Immobilizing*

TABLE VI

AVERAGE DRUG DOSAGES ADMINISTERED TO
DIFFERENT AGE GRIZZLY BEARS
1959-1962

Age	Succinylcholine Chloride* only		Succinylcholine Chloride Followed by Pent. Sodium**		
	No. Doses Admin.	Avg. Dosages, Mg per lb. body wt.	No. Doses Admin.	Avg. Dosage, Suc., mg per lb. body wt.	Avg. Dosage, Pent., cc per lb. body wt.
Cubs	27	1:4.6	26	1:6.6	1:16.0
Yearlings	14	1:3.9	21	1:5.7	1:15.8
Two yr. olds	17	1:5.5	21	1:6.4	1:16.3
Young adults	20	1:5.5	29	1:6.6	1:16.4
Adults	40	1:5.0	30	1:6.2	1:16.6
	<u>118</u>	<u> </u>	<u>130</u>	<u> </u>	<u> </u>

*Succinylcholine Chloride : 100 mg per cc solution.
**Pentobarbital Sodium : 250 mg per cc solution.

TABLE VII

COMPARISON OF DOSAGES OF SUCCINYLCHOLINE
CHLORIDE ADMINISTERED TO FREE-RANGING BEARS AND
TRAPPED BEARS (ALL AGE CLASSES), 1961 AND 1962.

	<u>Free-Ranging Bears</u>	<u>Trapped Bears</u>
1961:		
No. doses administered	25	85
Ave. dosage, mg per lb. body wt.	1:4.0	1:6.4
1962:		
No. doses administered	6	30
Ave. dosage, mg per lb. body wt.	1:6.1	1:7.0
Totals:		
No. doses administered	31	115
Ave. dosage, mg per lb. body wt.	1:5.1	1:6.7

CONCENTRATION AND DISPERSAL

As in previous years, the number of grizzlies increased gradually at the various concentration sites, then dropped off rather sharply as the bears dispersed in late summer. However, certain aspects of this were different in 1962. Near record precipitation throughout the summer produced exceptionally lush vegetation. An abundance of berries, grass, sedges, and other food plants tended to keep the bears widely dispersed. Many grizzlies visited the refuse sites infrequently and some not at all, at least while the observers were present.

The population at Trout Creek reached a peak in late July. Bear numbers remained relatively high until about August 10, when fewer and fewer bears frequented the Trout Creek area. This dispersal was much earlier than in previous years. In 1961, it occurred between August 20-25, which was earlier than the two preceding years. In 1961, cold temperatures and frequent snow storms in late August, continuing through September and October, probably triggered the dispersal. The fall of 1962, however, was one of the mildest ever recorded and it is believed that food abundance (particularly white-bark pine seed cones) induced the much earlier dispersal. (A bumper crop of pine seeds last occurred in 1959). Examination of feces indicated some bears fed almost entirely on these pine nuts as early as August 20. Use of this food item increased throughout the fall. During October, practically every dropping examined contained pine-cone bracts and seed coats. In many cases it was evident that this food source was being used exclusively.

White-bark pine in the mountain ranges surrounding Yellowstone, as well as within the Park itself, attracted the grizzlies. This was determined by sight records of marked animals and hunter kills outside the Park.

The dispersal of weaned yearlings and two-year olds undoubtedly accounts for some of the decrease (from previous year's count) of these age classes in the population. A weaned yearling, No. 92, marked and released at Trout Creek in 1961, was recaptured near Cooke City, Montana, in the summer of 1962. This yearling had traveled more than 40 miles over extremely rugged terrain to reach the Cooke City area. Returned to Trout Creek and again released there, it was observed ten days later back in the Cooke City region. In September it was killed by a Wyoming hunter, some five miles south of Cooke City. Similar movements for other young bears were recorded during the past season. Information on dispersal of young bears is still very incomplete. Mortality among the yearlings is known to be high, but as yet the degree to which mortality or dispersal is responsible for the sharp drop in numbers observed in this age class is not known and must await further work.

38 Trch
add # 92 in
Range or mortality
chart, prob. latter

ENUMERATION OF THE POPULATION

Various techniques for determining population numbers have been used. Both direct counts and use of ratios of marked to unmarked animals have shown highly consistent results. A minimum population of 170 grizzlies is known to inhabit Yellowstone National Park during the summer months. This population level has remained stable during the four years.

Direct counts at the concentration sites and in other areas of the Park were again used to determine minimum population figures. The Schnabel Method of computing total population corresponded closely to direct count figures for 1959, 1960, and 1961. This method will also be compared to the 1962 direct count and presented in later reports.

The results of direct counts made for the past four years are presented in Table VIII.

CLASSIFIED COUNTS*

Classified counts have been made since the start of the study. Cubs of the year (5-9 months), yearlings (17-21 months), two-year olds (29-33 months), three or four year olds or young adults (41-45 and 53-57 months), and adults (65 months and over) have been recognized in the field. Early in the study, some difficulty was experienced in classifying bears in the middle age classes. During the past two years, however, aging criteria obtained from known-age marked bears have been used to separate the two, three and four year olds.

Age classification for all four years is presented in Table IX. Based on these data the average age stratification is: cubs 20 per cent, yearlings 10 per cent, two-year olds 7 per cent, three, four and five year olds 14 per cent and adults 49 per cent. Age classification at the different count sites for 1961 and 1962 is presented in Table X.

Age and sex of all bears marked since 1959 are presented in Table XI. These data show a sex ratio of 1:1 and an age classification somewhat similar to that obtained from the classified counts of all bears observed (Table IX). The former is believed to be more accurate due to the larger sample involved. A comparison of the age composition of marked bears to that of the average total population is made in Table XII.

Table XIII shows the number of bears in each age class and the per cent of the total population comprised by each age class during the summer of 1962. This is based on a total population of 155, the number of bears actually observed. Theoretically, 101 or 65.3 per cent of the observed population was marked in 1962; of these, 69 or 44.5 per cent were actually observed.

*Age in months is based on an average birth date of January 30. A period of seven months occurs between November 1 and May 30 when bears are not observed due to "hibernation" or the difficulty of making field observation.

TABLE VIII

CENSUS OF GRIZZLY BEARS
1959-1962

Site	1959		1960		1961		1962	
	No. Counts	No. Bears	No. Counts	No. Bears	No. Counts	No. Bears	No. Counts	No. Bears
Trout Creek	17	96	24	98	31	98	31	98
Rabbit Creek	2	22	6	40	7	31	5	29
W. Yellowstone	2	27	3	16	4	19	2	7
Gardiner	2	9	2	9	2	10	2	11
Thumb Area	-	-	2	4	1	4	1	8
Pelican Cr. Area*	-	-	-	2	-	4	0	2
Totals	23	154	37	169	45	166	41	155

* No counts made; bears trapped.

TABLE IX

AGE STRUCTURE OF THE POPULATION THROUGHOUT
YELLOWSTONE NATIONAL PARK, 1959-1962

Age	No. of Indiv. 1959	Percent of Total	No. of Indiv. 1960	Percent of Total	No. of Indiv. 1961	Percent of Total	No. of Indiv. 1962	Percent of Total	Average Percentage for Four-Year Period*
CUBS	26	16.9	35	20.7	30	18.1	39	25.2	19.8
Yearlings	23	14.9	15	8.9	17	10.2	13	8.4	10.2
Two Years	17	11.0	5	2.9	17	10.2	9	5.8	7.2
Young Adults	-	-	12	7.2	23	13.9	35	22.6	13.7
Adults	88	57.2	102	60.3	79	47.6	59	38.0	49.1
	154	100.0	169	100.0	166	100.0	155	100.0	100.0

*Computed from average total population of 167

TABLE X

RESULTS OF CLASSIFICATION COUNTS
BY AREAS
1961-1962

<u>Site</u>	<u>Cubs</u>		<u>1 year</u>		<u>2 years</u>		<u>3, 4, 5 years</u>		<u>Adults</u>		<u>Total</u>	
	<u>'61</u>	<u>'62</u>	<u>'61</u>	<u>'62</u>	<u>'61</u>	<u>'62</u>	<u>'61</u>	<u>'62</u>	<u>'61</u>	<u>'62</u>	<u>'61</u>	<u>'62</u>
Trout Creek	18	25	9	12	11	3	14	19	46	39	98	98
Rabbit Creek	6	8	-	1	3	-	4	7	18	13	31	29
W. Yellowstone	6	-	-	-	3	-	-	4	10	3	19	7
Gardiner	-	3	4	-	-	3	4	2	2	3	10	11
Thumb Area	-	3	2	-	-	2	-	2	2	1	4	8
Pelican Cr. Area	<u>-</u>	<u>-</u>	<u>2</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>1</u>	<u>-</u>	<u>4</u>	<u>2</u>
Totals	30	39	17	13	17	9	23	35	79	59	166	155

TABLE XI

AGE AND SEX DESIGNATION OF MARKED BEAR

1959 - 1962

	1959				1960			1961			1962			4-Year Totals	Percent of Total
	<u>Total</u>	<u>M</u>	<u>F</u>	<u>U**</u>	<u>Total</u>	<u>M</u>	<u>F</u>	<u>Total</u>	<u>M</u>	<u>F</u>	<u>Total</u>	<u>M</u>	<u>F</u>		
Cubs	5	2	2	1	6	4	2	13	6	7	9	7	2	33	23.4
Yearlings	3	0	3	-	5	4	1	5	3	2	1	1	0	14	9.9
2 Years	4	1	3	-	4	2	2	7	3	4	1	1	0	16	11.3
3 or 4 Years*	-	-	-	-	9	4	5	8	2	6	1	1	0	18	12.7
Adults	18	11	7	-	23	10	13	12	6	6	7	1	6	60	42.6
Totals	30	14	15	1	47	24	23	45	20	25	19	11	8	141	100.0

*Not classified in 1959.

**Sex of one individual not determined.

Totals: 141 individuals

67 males

71 females

1 undetermined

TABLE XII

COMPARISON OF AGE COMPOSITION OF ALL MARKED BEARS TO AGE
COMPOSITION OF THE POPULATION, 1959-1962

<u>Age</u>	<u>Marked Bears Only</u>		<u>Total Population</u>	
	<u>No. Bears</u>	<u>Percent of Total Marked Bears</u>	<u>No. of Bears in Population*</u>	<u>Percent of Total Population</u>
Cubs	33	23.4	33	19.8
Yearlings	14	9.9	17	10.2
Two Years	16	11.3	12	7.2
Young Adults	18	12.7	23	13.7
Adults	60	42.6	82	49.1
	141	100.0	167	100.0

*Figures in this column represent average numbers obtained over
a four-year period.

TABLE XIII

POPULATION COMPOSITION AND PERCENT OF
POPULATION MARKED AND OBSERVED, 1962.

<u>Age</u>	<u>Number Bears in Population</u>		<u>No. Marked Bear Theoretically in Population*</u>		<u>Number Marked Bears Actually Observed</u>		
	<u>No. Observed**</u>	<u>Percent of Population</u>	<u>No.</u>	<u>Percent of Population</u>	<u>No.</u>	<u>Percent of Age Class</u>	<u>Percent of Population</u>
Cubs	39	25.2	8	5.2	8	20.5	5.2
Yearlings	13	8.4	13	8.4	8	61.5	5.2
2 Years	9	5.8	6	3.9	5	55.6	3.2
3 Years	7	4.5	13	8.4	6	85.7	3.8
4 & 5 Years	28	18.1	17	11.0	9	32.1	5.8
Adults	<u>59</u>	<u>38.0</u>	<u>44</u>	<u>28.4</u>	<u>33</u>	55.9	<u>21.3</u>
	155	100.0	101	65.3	69		44.5

*Thirty-two bears marked in previous years were not accounted for in 1962 but were considered still marked and still in the population. Only those bears observed, however, are included in population figures.

**Number of bears observed is considered to be the number of bears in the population.

PRODUCTIVITY AND MORTALITY

Data on productivity, mortality and causes of mortality in the population have been gathered over a four-year period. Birth occurs in late winter when the females are in "hibernation" and it has not yet been possible to obtain counts of cubs until late May or early June. Some sows giving birth to cubs late in winter are not seen with their cubs and accounted for until late July. It is presumed that some mortality of cubs occurs during a five to six month period when they are in hibernating dens or before they have begun to move extensively with their mothers.

PRODUCTIVITY

The number of sows with cubs or yearling litters recorded throughout Yellowstone for the past four years are presented in Table XIV. Thirty-nine cubs were produced in 1962 for an average litter size of 2.30. The number of cubs and average litter sizes are also presented for 1959, 1960, and 1961. Data in Table XIV show that 61 sows produced cubs during the four-year period, but only 22 sows were observed with yearlings. This constitutes a 64 per cent differential between sows with cubs and sows with yearlings. This cannot be fully explained by orphaning or weaning alone; it is believed due largely to mortality, either during the winter or early the following spring. The fact that the average litter size for cubs is 2.13 and for yearlings 2.18 suggests mortality or dispersal of entire litters. Observations also appear to confirm this.

The number of females with cub or yearling litters expressed as a percent of the total adult female population appears in Table XV. The number of adult females is considered to be one-half the total adult population--this is based on a 1 to 1 sex ratio (Table XI). The per cent of adult females with cubs of the year has varied only from 31.8 to 39.5 with an average of about 33 per cent, or one-third of the total adult female population. The percentage of sows with yearling litters has also been quite consistent during the four years, averaging 13 per cent of total females.

*1/3 breeding
or producing
at any given
year*

Complete histories have been kept on a number of marked families--age when offspring are weaned, breeding interval of individual females, interval between litters for individual females, age when offspring reach maturity and breed, etc. These studies are contributing materially to an understanding of the population dynamics. While there is sufficient data to establish productivity levels for the Yellowstone population, we believe these data can be much better interpreted when more information is acquired on the marked families and geneology can be traced through several additional years.

MORTALITY

Recorded mortality of both marked and unmarked grizzlies and causes of death appear in Table XVI. Legal shooting of grizzlies by hunters outside the boundaries of Yellowstone accounts for 42.4 per cent of all recorded mortalities. Direct control measures within the Park take a toll of 18.2 per cent. If bears captured and shipped to zoos are included in the control figures, then this percentage rises to 25.8.

The total of 66 known deaths is exactly one-half the total known increment for the four-year period (Table XIV). Since the population has remained remarkably stable during the four years (Table VIII), it appears that mortality or dispersal or both are responsible for holding bear numbers at a level. Table XVII shows there has been a decrease of 64 bears from the age of cub (first year of life) through yearling (second year of life). If we consider this decrease of 64 as mortality, and add this number to the 66 known mortalities among all age classes, we obtain a figure of 130. This exactly equals the total increment for the four years. If the assumption of yearling mortalities is true, then we can account for the stability of the population, as evidenced by the census. Additional data will clarify this assumption.

Tables XVIII and XIX show the observed survival and mortality of 91 grizzly cubs through two years of life. Of the original 91 cubs:

1. Forty-three, or 47.3 per cent, lived through two years, thirty-three observed with their mother during their second year, four of 12 orphans survived their second year, six weaned yearlings survived their second year.
2. Thirteen, or 14.3 per cent, were known to have died. five were killed as cubs, eight were killed as yearlings.
3. Thirty-five, or 38.4 per cent, were not observed or accounted for after their first year of life, and this is evidence that some of these represent mortalities.
4. It is highly probable that the eight orphans unaccounted for also died. This would result in 21 deaths, or 23.1 per cent of the total, and 27, or 29.6 per cent, unaccounted for and probably dead.

Final conclusions concerning mortality of the younger age classes, as well as overall mortality within the population, are reserved until more data is available and until all factors can be more completely evaluated. From the foregoing data, however, it does appear that many young bears do not live two years, and that this may be the most important factor in keeping population numbers stable.

TABLE XV

NUMBER OF FEMALES WITH CUBS OR YEARLINGS EXPRESSED AS
PERCENT OF TOTAL ADULT FEMALE POPULATION
1959-1962

	Computed Adult Female Pop.*	Number Females With Cubs	Percent of Adult Female Pop. With Cubs	No. Females With Yearlings	Percent of Adult Female Pop. with Yearlings
1959	44	14	31.8	7	15.9
1960	51	17	33.3	6	11.8
1961	39	13	33.3	5	12.8
1962	43	17	39.5	5	11.6

*Based on sex ratio of 1 : 1

TABLE XVI

GRIZZLY BEAR MORTALITY, 1959-1962

Yr.	Hunters Outside Yellowstone		NPS, as Control Measure		Drug Overdose		Sacrificed for Study		Misc. Causes Inc. Bears Shipped to zoos		Total	Pct. of Tot. Pop.
	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked	Marked	Unmarked		
'59	1	3	2	2	3	-	-	-	-	1	12	7.6
'60	1	10	1	2	3	1	-	-	1	-	19	11.4
'61	5	3	-	1	2	-	3	-	2	4	20	11.8
'62	2	3	1	4	1	-	-	-	3	1	15	9.7
Tot.	9	19	4	9	9	1	3	0	6	6	66	
Grand Total	28		13		10		3		12		66	

TABLE XVII

CUB AND YEARLING COUNTS, 1959-1962

	1959	1960	1961	1962	Total
Cubs	26	35	30	39	130
Yearlings	23	13	17	13	66

Mortality

TABLE XVIII

OBSERVED SURVIVAL AND MORTALITY OF 91 GRIZZLY CUBS THROUGH TWO YEARS OF LIFE

YEAR	No. OF SOWS WITH CUBS	No. OF CUBS	No. OF CUBS KILLED	No. OF CUBS ORPHANED	No. OF CUBS THEORETICALLY IN POP. AS YEARLINGS THE FOLLOWING YEAR	No. OF YRL. WITH SOWS FOLLOWING YEAR	No. OF ORPHANS KNOWN TO SURVIVE	No. OF YRL. KNOWN WEANED	No. OF YRL. KNOWN KILLED	No. OF YRL. NOT OBSERVED OR ACCOUNTED FOR	PER CENT YRL. NOT OBSERVED OR ACCOUNTED FOR
1959	14	26	1	2	25	10	1	2	2	10	40.0
1960	17	35	2	7	33	10	3	4	3	13	39.4
1961	13	30	2	3	28	13	1*	3**	3**	12	42.9
TOTAL	44	91	5	12	86	33	5	9	8	35	40.8

* RECAPTURED EARLY FOLLOWING SPRING, NOT OBSERVED LATER IN SEASON, NOT CONSIDERED IN FINAL TALLY.

** ALSO ACCOUNTED FOR UNDER ANOTHER HEADING.

TABLE XIX

FATE OF 91 GRIZZLY CUBS

TOTAL No. OF CUBS	No. KNOWN LIVING THROUGH TWO YEARS	PER CENT OF TOTAL	No. KNOWN TO HAVE DIED	PER CENT OF TOTAL	No. NOT OBSERVED OR ACCOUNTED FOR AFTER FIRST YEAR OF LIFE	PER CENT OF TOTAL
91	43	47.3	13	14.3	35	38.4

BREEDING AGE AND BEHAVIOR

Breeding Age

During the summer of 1962 known-age females were recorded breeding for the first time since the study began. Number 6, a three-year-old female marked as a cub in 1959, bred in 1962. Number 29, another three-year-old female marked as a cub, and Number 86, also three years old, attracted a number of males, but were not actually observed copulating. No known-age males have yet been recorded breeding, although several of established age have displayed interest in females. Testicular biopsies were performed on established-age males and will be taken from known-age males in the future. It is expected that much information concerning breeding age of both males and females will be obtained in the next two years. A number of known-age animals are now marked and will be reaching maturity.

Breeding Behavior

Reproductive behavior of both males and females was reported in detail in a thesis prepared as a requirement for the M.S. degree. These studies, carried on for three years, found that females in estrus attracted, and were receptive to, practically all adult males. There appeared to be some variation in the length of the estrus period in individual females. Some were observed to breed a number of times over a rather extended period, while others were observed breeding but a single time. Some females copulated with as many as four different males in a single evening. The breeding season extended from about June 10 to July 10, reaching its highest intensity in late June. Sexually stimulated males were more aggressive than at other seasons of the year and dominance was most vigorously asserted during the breeding season. Males ranking high in the dominance structure were extremely intolerant of all others, except females in breeding condition. During a three-year period, only two males attempted to defend a single female. Other males often appeared with a female at the concentration areas and left with the same female, but made no attempt to keep other males from her while in the concentration area.

SOCIAL BEHAVIOR

Studies carried on for three years and reported on in an M.S. thesis revealed definite stratification of members of the grizzly population. Five distinct dominance classes were recognized. These were, in descending order of dominance, the Dominant Class, Aggressive Class, Defensive Class, Cautious Class, and Subordinate Class. A sixth, the Sub-Dominant Class, was added in 1961. Dominance was asserted most actively by those individuals near the top of the dominance structure.

Criteria used to classify adult males included aggressiveness, size, age and in some cases a combination of all. Aggressiveness was considered to be the major factor determining dominance classes. Aggressiveness and

Breeding Age
86
Hierarchy

reproductive condition appeared to govern females' behavior toward adult males, while aggressiveness, age, and size determined their social rank in relation to other members of the population. Sex was not a factor in the social status of younger bears, and they were classified mainly by age and size.

The same male actively assumed the dominant position in all three years. Four other males vied for this position with varying degrees of aggressiveness.

Females with offspring, particularly those with cubs of the year, exhibited excessive hostility toward adult males. The behavior of individual females toward adult males was noticeably different each year. This behavior was associated with the particular female's reproductive status.

Females with offspring and weaned two-year old litter-mates running together functioned somewhat as an individual in the social structure. That is, these families tended to "stick together" in disputes with other bears. Young bears still with the female appeared to be influenced by the behavior of their mothers--aggressive females usually had aggressive offspring. Aggressive offspring weaned at two years of age retained this behavior but aggressive offspring weaned as yearlings became timid and apprehensive of other bears and appeared to retain these traits. Two-year olds running with litter-mates showed more aggressiveness toward other bears than did lone individuals of the same age.

ACTIVITY AND MOVEMENT

Seasoned movements of the population and dispersal of certain individuals have been discussed under Concentration and Dispersal. The activity and movement recorded for individuals and family groups has formed the basis for the conclusions concerning the population. In addition, many sight records of individually marked animals has yielded information on daily and weekly movements in search of food, movements as related to age, and the movements of individuals and family groups.

In general, movements can be classified in the following categories: daily movements, weekly movements, seasonal movements, induced movements, and movements involving a period of a year or more. Similarly, movements can be associated with such activities as breeding, food getting, and seeking hibernating sites. This information has not yet been fully tabulated.

Marked individuals in the population for the past four years have shown conclusively that Yellowstone grizzlies make seasonal migrations to areas of food abundance. The four major refuse sites in and on the borders of the Park attract grizzlies from as far as 60 to 75 miles.

During June and July, new individuals and family groups arrive at the refuse sites, the population peaking around August 1; dispersal from these sites usually begins the last week in August. The concentrating of bears at the refuse sites develops gradually, and in years of food abundance this migration is delayed, some of the bears spending the early summer in areas where one or more food items are plentiful, while other bears ignore the refuse sites entirely.

Sight records on marked animals indicate grizzlies return in the fall to areas where they were observed in early spring. This suggests two separate ranges for the Yellowstone grizzlies; summer ranges and spring and fall ranges. Both appear to be largely determined by the availability of food. We do not know if grizzlies in Yellowstone hibernate in the same "dens" each year, but we have considerable evidence that they return to the same general area to spend the winter.

We have obtained sight records on 25 different individuals in at least two widely separated areas in or near the borders of Yellowstone. An example is the movement of No. 32, a young adult male. This bear was sighted in May, 1961, in the Lamar river valley in the north-east section of the Park. In August, this bear was recaptured at Pelican Creek, near Yellowstone Lake, and was released at Mary Lake, in upper Hayden Valley. It was killed by a hunter in October, 1961, south of Cooke City, Montana, some distance outside the Park. These movements represent air line distances of 25 to 60 miles over mountainous terrain. Movements similar to this have been recorded for a number of other marked grizzlies.

Induced movements have been recorded from 19 different bears trapped in one area and released in another. Almost invariably these bears exhibited strong homing tendencies, returning to the area where originally trapped. Some traveled as far as 35 miles over extremely rugged terrain in less than two days.

32
movement & mortality

GROWTH AND DEVELOPMENT

Records of growth and development have been kept on 19 known-age bears recaptured one or more times during the four-year period. Bears recaptured in succeeding years have supplied information on changes in weight, body measurements, seasonal differences in pelage, as well as the effects of the age of weaning on growth of dentition and overall development of the younger bears. Table XX shows that ten known-age males have been captured a total of 29 times, nine known-age females, 27 times. Five different records have been obtained in three successive years for an individual male, seven in four successive years for an individual female.

Tables XXI and XXII show the seasonal and yearly changes in weight and total length of 46 male and 36 female grizzlies of known and established age. Tables XXI and XXII include the 56 sets of data reported in Table XX plus data from 26 individuals captured a single time. All weights and measurements recorded before August 1 were considered "Spring" data, those after August 1, "Fall" data. Spring weights tend to be a more accurate measurement of growth since the animals are not obese at this season of the year. Increases in weight and total length are consistent from spring to fall and from year to year. One exception is the total length of three-year-old females--this figure is greater in the spring than in the fall. Only three individuals were measured, however, and it is believed that this will change with the accumulation of more information. It is believed that the small sample size is also responsible for the inconsistencies, between males and females, in the annual per cent increase in weight and total length. Increases in growth from cub through yearling age appears to be constant for both males and females--the weight increases about 150 per cent and the total length approximately 40 per cent. Data obtained from marked known-age animals in the future should eliminate inconsistencies occurring in the two and three year old classes.

Some variability in the rate of growth of individual males and females has been noted. Several different factors may be responsible for this--genetic traits, food habits and preferences, age when weaned, etc. Final conclusions must await the time when we can isolate and evaluate these factors more specifically. With the number of known-age grizzlies now marked in the population, our records should be strengthened considerably in the future.

Average total length and seasonal weights of adult grizzlies are presented in Table XXIII. Forty-seven different individuals, 26 females and 21 males, were weighed and measured; however, during the four-year period, additional weights were obtained on five of the females. On the other hand, total length measurements were not obtained on some animals due to the lack of time or other circumstances existing with drugged bears. It will be noted in Table XXIII that weights of both males and females are greater during the "Fall" period, while total length measurements, as would be expected, remain constant. Maximum and minimum weights and total length measurements for adult bears are presented in Table XXIV.

*Growth & Development
Increase in Wt.*

TABLE XX

SUMMARY OF RECAPTURES OF KNOWN-AGE GRIZZLY BEARS
1959-1962

	<u>Number Individuals</u>	<u>Total No. Times Bears Weighed and Measured</u>	<u>Max. No. Successive Years Records Obtained on One Individual</u>	<u>Max. No. Times Records Obtained on One Individual</u>	<u>Max. Age Recorded, in Months</u>
Males	10	29	3	5	45
Females	<u>9</u>	<u>27</u>	4	7	<u>54</u>
Totals	19	56			99

AGING TECHNIQUES

Sixty-six known-age and established-age bears have been individually marked in the past four years. These include 33 cubs, 14 yearlings, and 16 two-year olds. From the majority of these, impressions have been made of the dentition and fore paws. Casts made from the impressions have proved invaluable in establishing the age of other bears from the age of six to 45 months. A total of 97 dental casts and 45 foot casts have been made since 1960. Several bears have been captured in successive years and casts made of their dentition and fore feet. One bear, No. 6, has been recaptured for three successive years and casts obtained; others have been captured and casts taken in two successive years. Still others have been captured in alternate years. These casts not only show annual growth changes in individuals but, collectively, show striking growth changes among the different age classes. These casts are now being systematically measured and the data will be analyzed and reported on later.

In arriving at reliable aging criteria, weights and measurements of all known-age bears have been carefully considered. While a correlation does exist between age and weight, it is not considered reliable. A number of factors determine bear weights. These include: genetic differences governing size, rate of fat deposition in individuals, age at which bears are weaned, degree of parasitism, food habits and preferences, and season of year when the bear is weighed. The growth and development of the teeth and jaws are also affected by some of the above factors, but there appears to be a significant correlation between tooth development and age and between foot size and age up to three and four years of age.

TABLE XXI

AVERAGE SEASONAL AND YEARLY WEIGHTS AND MEASUREMENTS OF 46 KNOWN AND ESTABLISHED AGE MALE GRIZZLIES¹

AGE CLASS	TOTAL NUMBER DIFFERENT INDIVIDUALS WEIGHED AND MEASURED	SPRING					FALL				
		No. BEARS ²	Wt., LBS.	PERCENT INCREASE FROM PREVIOUS YEAR	TOTAL LENGTH, INCHES	PERCENT INCREASE FROM PREVIOUS YEAR	No. BEARS ²	Wt., LBS.	PERCENT INCREASE FROM PREVIOUS YEAR	TOTAL LENGTH, INCHES	PERCENT INCREASE FROM PREVIOUS YEAR
CUBS	20	10	53.9	- -	37.6	- -	10	81.8	- -	42.1	- -
YEARLINGS	16	8	132.2	145.3	52.6	39.9	8	181.0	121.3	53.3	26.6
TWO YEARS	8	4	214.6	62.3	61.0	16.0	6	293.3	62.0	66.0	23.9
THREE YEARS	2	0	- -	- -	- -	- -	3	335.0	14.2	71.3	8.0
	<u>46</u>	<u>22</u>					<u>27</u>				

¹ INCLUDES FIVE ESTABLISHED-AGE BEARS; THE 41 OTHERS ARE OF KNOWN AGE.² A NUMBER OF DIFFERENT INDIVIDUALS WERE WEIGHED AND MEASURED MORE THAN ONE TIME.

TABLE XXII

AVERAGE SEASONAL AND YEARLY WEIGHTS AND MEASUREMENTS OF 36 KNOWN AND ESTABLISHED AGE FEMALE GRIZZLIES¹

AGE CLASS	TOTAL NUMBER DIFFERENT INDIVIDUALS WEIGHED AND MEASURED	SPRING					FALL				
		No. BEARS*	WT., LBS.	PERCENT INCREASE FROM PREVIOUS YEAR	TOTAL LENGTH, INCHES	PERCENT INCREASE FROM PREVIOUS YEAR	No. BEARS*	WT., LBS.	PERCENT INCREASE FROM PREVIOUS YEAR	TOTAL LENGTH, INCHES	PERCENT INCREASE FROM PREVIOUS YEAR
CUBS	13	6	45.8	--	35.6	--	7	79.6	--	40.0	--
YEARLINGS	7	4	113.0	146.7	50.3	41.3	3	183.0	130.1	54.5	36.3
TWO YEARS	13	5	153.3	35.7	55.7	10.7	9	236.7	29.3	57.8	6.1
THREE YEARS	3	4	256.3	67.2	65.5	17.6	3	293.3	23.9	64.7	11.9
	<u>36</u>	<u>19</u>					<u>22</u>				

¹ INCLUDES EIGHT ESTABLISHED-AGE BEARS; THE 28 OTHERS ARE OF KNOWN AGE.

* SEVERAL DIFFERENT INDIVIDUALS WERE WEIGHED AND MEASURED MORE THAN ONE TIME.

TABLE XXIII

AVERAGE TOTAL LENGTH AND SEASONAL* WEIGHTS OF 47
DIFFERENT ADULT GRIZZLIES

SPRING					FALL				
No. Diff.	No. of	Ave. Total Length	Ave. Total		No. Diff.	No. of	Ave. Total Length	Ave. Total	
Bears	Weighed & Measured	Wt., Lbs.	Measurements Obtained	Length, in Inches	Bears	Weighed & Measured	Wt., Lbs.	Measurements Obtained	Length, in Inches
Females:									
14	18	309	8	71	12	13	387	10	70
Males:									
12	12	499	9	78	9	9	567	7	78

*Weights and measurements obtained before August 1 were considered "Spring" data; those obtained after August 1, "Fall" data.

TABLE XXIV

MAXIMUM AND MINIMUM WEIGHTS AND TOTAL LENGTH MEASUREMENTS
AMONG DATA OBTAINED FROM 47 ADULT GRIZZLIES

	SPRING*				FALL*			
	Max. Wt.	Min. Wt.	Max. Total Length	Min. Total Length	Max. Wt.	Min. Wt.	Max. Total Length	Min. Total Length
Females	435	225	78	67	495	300	74.5	66
Males	645	310	91	69	780	345	85	73

*"Spring"---period before August 1
"Fall" ---period after August 1

PHYSIOLOGY, PATHOLOGY, AND HEMATOLOGY

PATHOLOGY

Dr. Morgan Berthrong, pathologist, Penrose Hospital, Colorado Springs, again spent several days at the field laboratory in Yellowstone. Complete autopsies were performed on two grizzlies and two black bears, bringing the total for the past two years to four autopsies for each species. Organs, tissues, and internal parasites were collected and preserved for future study. The circulatory system received major attention, particularly the coronary and great arteries.

Data obtained in 1961 is presented to show the type of information being obtained. The results of the 1962 autopsies have not yet been fully analyzed.

Gross Autopsies:

1. Two fat adult black bears and two young and rather thin yearling grizzlies shows a remarkable absence of arteriosclerosis. The ascending aortas of all were peculiarly thick-walled in relation to humans. This thickness tapered rapidly to an effected aortic wall in the arch and remainder of the aorta.
2. Coronary arteries were absolutely free of arteriosclerosis.
3. The livers, gall bladders and bile ducts were normal as were the pancreases and spleens.
4. Other than the striking lobulation of the kidneys, the urinary tracts were normal.
5. The adrenal weights were small for the size of the animals. A 100-200 lb. man would have about 12-16 grams of adrenals. These animals had about 6-8 grams of adrenals.
6. Intestines - 49 feet from anus to duodenum in grizzly No. 53.
7. The rugal folds of the stomach and the villi of the small intestine were extremely prominent as compared to man. In addition, the mucosal folds in the entire small intestine had a general pattern resembling the gastric mucosal rugal rather than the transverse folds seen in man.
8. Thyroid - very small and thin. These weighed from 5 to 10 grams. (Adult human thyroid glands weigh 30-40 grams. Very old humans may have 10 gram thyroids.)
9. Testes, skeletal muscle, veins, diaphragm, pleura, peritoneum, mediastinum, retroperitoneal space, lymphnodes, bones and bone marrow appeared normal and no parasites were seen.
10. Fat was pale yellow compared to man. In human infants and children the fat is pale yellow but adult man usually shows an orange-yellow colored fat.
11. The eyes are small; two-thirds the size of man.

Physiology &
Hematology

Microscopic Studies: (all observations are in comparison to tissues of man.)

1. Large, medium, and small arteries were totally free of intimal or medial arteriosclerosis.

2. The peculiar thickening of the ascending aorta seems to be the consequence of medial fibrous tissue which lies between the elastica in large bundles causing a loss of the usual regularity of the medial elastica. Smooth muscle is present also in these bundles. In the descending aorta, these fibrous and smooth muscle masses are much less evident and the aortic media more closely resembles man's. Perhaps this ascending aortic wall is related to cardiac output, blood pressure, etc., but whatever, is so striking a change as to warrant study.

3. The myocardium is normal as are the valves, epicardium and endocardium.

4. The livers of two bears, 53 and 114, contain small granulomas of unknown etiology. These granulomata are tiny, contain clefts which may represent fatty material, and probably are of not pathologic significance in these animals. One section of gall bladder is different from man's in the presence of accumulations of lymphocytes in the mucosa. No infiltrations of the muscularis are present. The pancreases show very prominent zymogen granules in the acini--suggestive of vigorous secretion of enzymes. The islets of Langerhans cells show hydropic change in one animal, 114. Perhaps stress. The spleens show remarkably prominent trabeculae, which appear very muscular; perhaps the bear spleen does act as a very significant reservoir for blood--not the case in man--definitely the case in dogs.

5. The multilobular kidneys were histologically normal except for a peculiar projection of the renal papillae into the calyces further than that in man. This suggests an ability to concentrate urine by greater water reabsorption in long loops of Henle. (Desert animals have extraordinarily long renal papillae projecting long ways into the calyces and pelves.)

6. The adrenals are quite different from man's. The zona glomerulosa is very broad and cellular. This zone is thought to produce the salt (Na^+ , Cl^- , K^+) regulating hormone. The zona fasciculata is cellular and the cells are large without much lipoid content. (Perhaps this has been lost during the 24 hours in the trap.) The medulla is huge in relation to the cortex--the medulla produces epinephrine and norepinephrine.

7. The stomachs show tremendously thick mucosa in which the parietal cells are especially prominent (HCL). The whole small intestine show extremely long and numerous villi. These are concerned with absorption of food in man. In malabsorption syndromes in man, the villi are absent or are blunted. Bears must have an absolutely fantastic absorption capacity as far as the gut mucosa is concerned.

8. The microscopic appearances of the thyroids are completely normal. There is no evidence of scarring, epithelial atrophy, or hyperplasia or of thyroiditis.

9. The testicles of 53 and 114 (yearlings) are clearly pre-pubertal as far as spermatogenesis is concerned. However the Leydig cells seem numerous and active. The mature tubules of the black bear were not producing sperm but the Leydig cells were foamy and abnormal.

No worms or cysts were found in the skeletal muscle but one granuloma in the skeletal muscle of 114 may be the residuum of a trichina cyst. One lymphnode was full of plasma cells. (These are related to gamma globulin in man.)

10. The fat is histologically normal.

11. The eyes show a rather thick layer of conjunctival cells over the cornea, and a retinal layer that extends far anterior and (lateral vision) seems rather thin.

HEMATOLOGY AND CHEMICAL STUDIES

In 1961, blood samples were taken from one black bear and three grizzlies and the chemical analysis compared with human normals (Table XXV). During 1962, specimens of blood were collected from 19 grizzlies and two black bears, were centrifuged at the field laboratory, and the serum frozen and shipped to Dr. Berthrong. A total of 50 such blood specimens have now been collected and the specimens are currently being analyzed. Although not yet complete, a cursory examination indicates the results support the 1961 results (Table XXV).

TABLE XXV

CHEMICAL STUDIES: BEARS, 1961

<u>Test</u>	<u>Black Bear</u>	<u>Grizzly 53</u>	<u>Grizzly 114</u>	<u>Grizzly 116</u>	<u>(in our lab.) Human Normals</u>
Amylase	--	42	67	86	20-150 units
Sodium	143	148	141	140	135-145 mEq/L
Potassium	5.3	5.1	5.1	5.0	3.5-5.0 mEq/L
Chloride	99	104	103	95	95-105 mEq/L
Blood urea nitrogen	11.1	13.2	14.6	13.3	8-25 Mgm%
P.B.I. (protein bound iodine)	2.3	3.3	2.9	2.6	3.5-8Mcg%
Prothrombin time	--	--	12.7 sec	16 sec	12.5-13.5 secs
Acid phosphatase	--	1.8	1.4	1.9	0-4 KA units
Cholesterol	313	299	220	273	150-280 Mgm%
Cholesterol esters	65%	35%	55%	63%	50-65%
Uric Acid	2.2	1.1	1.0	1.1	3-6 Mgm%

Serum levels of:

mEq/L - Milliequivalents per liter

Mgm% - Milligram %

Mcg% - Microgram %

MANAGEMENT

The grizzly population in Yellowstone National Park has remained quite stable for the past four years, indicating the annual increment and the annual mortality are in balance. The population stability also indicates that mortality within the population is not excessive. One-half of the apparent mortality for the past four years, 66 bears, has been specifically accounted for. Of these 66 mortalities, 28 or 42.4 per cent, were killed by sport hunters outside Park boundaries (Table XIV). This constitutes an important factor to be considered in any future manipulation of the Yellowstone grizzly population. Grizzlies are protected in Idaho, but are hunted during the fall big game season in Montana. Wyoming allows both spring and fall hunting of grizzlies, and baiting is also legal. Changing hunting regulations to increase or decrease the sport hunting harvest of grizzlies in the states surrounding Yellowstone should have a pronounced effect on the population. Full cooperation between the Fish and Game Departments of Idaho, Montana, and Wyoming and the National Park Service will be required to manage the Yellowstone grizzly population intelligently in the future. Specific recommendations for managing this population will be made in future reports.

Some techniques for managing grizzlies have been applied within the Park. Most of these methods have been aimed at moving or enticing problem bears away from areas where human use is heavy, thus minimizing the chance of bear-man conflicts. Techniques for obtaining censuses in remote areas have been tested and found to be feasible. These techniques will be reported in detail when the pilot programs have been more fully evaluated. Management of the grizzly in Yellowstone must be coordinated with management of the black bear as some ecological relationships are strongly inter-specific.

RADIOTRACKING

During the summer and fall of 1962 the entire wildlife radio-tracking system was tested and put into operation. It consisted of a base station, field station, mobile unit, portable tracking units, improved pulsed transmitters, and a voice communication system.

A comparison of the performance of the tracking system with the original requirements as postulated reveals that the system, as perfected to date, either fulfills or in most cases exceeds the requirements. Ranges as determined through tests and actual tracking were: fixed stations operational range 8-10 miles and 20 miles under favorable conditions; mobile unit operational range of 6-8 miles and up to 20; portable units 3-5 miles and up to 6.

Philco's redesigned transmitters could be identified by the difference in pulse rate and had an expected life with the battery pack used of from 60 to 105 days.

Three grizzlies were instrumented, two with improvements in methods over 1961. Actual tracking was conducted for $2\frac{1}{2}$ months. One grizzly was continuously tracked for 36 hours and was located, tracked, and observed over a two-week period. Animals were located through triangulation and tracked from a distance using a combination of directional receivers. Portable receivers made close approach and observation possible. Careful and extended observations were made of instrumented grizzlies with no indication that they were disturbed by the collar. Ecological data were gathered through tracking and observation, but emphasis was still placed on perfecting the radio tracking system and technique as a data gathering tool. Some idea of the potential of the system is revealed by the figures computed in searching for lost instrumented grizzlies. In two days it was estimated that 1500 square miles of country was monitored. A four mile signal range was used as the basis for computing this area. Both electronic and ecological problems were encountered in the course of the season, with the latter proving more difficult of remedy. The tracking system has a potential for securing a wide range of hitherto unavailable information on the grizzly bear. The application of the system in the study of other big game should prove to be a valuable tool in both research and management. Major technical problems have been overcome and it is expected that data gathering can now take precedence over development in techniques. Early instrumenting and tracking of grizzlies is planned for 1963 and work is under way and contemplated for improving the system, experimenting with a command system and providing for the telemetering of environmental data. Some progress was made in this direction in 1962.

mobility