

TABLE
RADIO-TAGGED GRIZZLIES
1961-1967 1968

Bear No.	Sex	Age (Years)	Tracking Dates	Animal Tracking Days	Remarks
6	F	5	1964 7/10-8/5	19	First cub captured and marked. Daughter of No. 7. Radio removed on 8/5 after 27 days
7	F	Adult	1963 7/26-8/12	18	Grizzly removed loose fitting collar. Recovered collar August 10.
			9/2-9/27	26 <u>44</u>	Tracked to fall range, last signal weak.
14	M	Adult	1964 9/5-10/15	41	Large boar weighing 890 lbs. Would go 1000 lbs. by hibernation time. Transmitter functioning on last date but tracking discontinued.
34	F	Adult	1964 7/23-8/25	34	Sow with 2 yearlings. Left summer range for fall range with transmitter still functioning.
37	M	Immature	1961 9/30-9/31	1	Bear moved beyond range of receivers, collar missing when retrapped.
			1962 10/4-10/18	15 <u>16</u>	Transmitter functioning, bear lost journeying to hibernation area. Shot by hunter in spring of 1963.
40	F	3	1961 9/22-10/22	32	Transmitter still functioning, receiver range inadequate. Bear hibernated.
		4	1962 9/8-9/17	10	Transmitter no longer functioning, but still on bear. Removed by bear during hibernation.
		5	1963 8/7-9/4	29	Transmitter no longer functioning but still on bear at time of hibernation.
		6	1964 9/4-11/9	67	Tracked to hibernation den with cub, transmitter still functioning. Bear's first litter.
		7	1965 6/28-9/6	71	Removed 1964 collar and reinstrumented with a temperature sensitive transmitter.
			10/13-11/16	35	Reinstrumented and tracked to den, transmitter functioning after 11/16.
		8	1966 9/1-10/29	59	Removed 1965 collar and reinstrumented.
			10/30-11/15	17	Signal failed. Reinstrumented, tracked to den with cubs. Transmitter still functioning after 11/15.
		9	1967 9-11-9/26	16	Transmitter failed 9/26. Collar not recovered.
		10	1968 7/25-9/4	333 42	Reinstrumented on 9/4, collar still functioning. Second collar still working on 11/7 when saw cubs tracked to their den.
			9/5-11/7	64 442	
75	F	Old Adult	1963 8/16-9/28	44	Bear immobilized and transmitter removed. Still functioning well. Sow with two yearlings.
76	M	Young Adult	1963 8/26-9/22	28	Lost signal, bear traveling, transmitter functioning.

Bear No.	Sex	Age (Years)	Tracking Dates	Animal Tracking Days	Remarks
96	F	Young Adult	1962 8/17-8/19	2	Lost Signal, bear traveled to distant portion of park. No mobile tracking units. Sow with cubs. Transmitter battery pack shorted by water.
			1963 7/12-7/17	<u>6</u> 8	
101	F	10	1967 9/6-9/28	23	Reinstrumented when first transmitter failed. No radio operating from 9/29 to 10/18. Tracked to first den on 11/2. Located second den on 11/13. Grizzily removed collar on 8/29
			10/19-11/13	26	
			1968 8/24-8/29	<u>49</u> 55	
120	F	very old	1966 10/25-10/29	5	Lost signal after 10/29.
150	F	Adult	1963 10/6-11/3	29	Sow with cubs. Transmitter still functioning. Bear hibernated, lost during hibernation trek. Sow with yearlings. Trouble instrumenting at night, bear lost collar.
			1964 8/11-8/14	<u>4</u> 33	
158	M	Yearling	1964 10/11-11/9	30	Yearling with sow and two yearling littermates. Tracked to hibernation den, transmitter still functioning. Lost signal after 9/9.
		3	1966 8/20-9/9	<u>21</u> 51	
164	F	Adult	1963 10/26-11/5	11	Transmitter still functioning, bear hibernated, den located.
170	F	Adult	1964 7/3-7/13	11	Sow with two cubs tracked in release and homing experiment. Transmitter removed after 11 days.
187	F	4	1967 9/4-11/7	65	Pregnant female. Tracked to den on 11/1. Transmitter failed on 11/7. Saw may be pregnant. Tracked to denning area on 9/5. Transmitter failed on 9/29.
			1968 8/28-9/29	<u>33</u> 98	
188	M	Weaned Yearling	1965 10/2-10/20	19	Bear lost while moving to hibernation area. Transmitter still functioning. Checked for signal over 40-day period. Reinstrumented when first transmitter failed. Antenna connection broken. No radio operating from 8/27-9/4. Believe No. 188 moved out of area where signal could not be received. Also did this in 1965.
		3	1967 8/22-8/26	5	
			9/5-9/14	<u>10</u> 34	
183	M	4	1968 9/4-9/6	3	Signal was lost after 9/6. Transmitter failed or grizzily moved out of range of the tracking units.

Bear No.	Sex	Age (Years)	Tracking Dates	Animal Tracking Days	Remarks
194	M	Orphan Yearling 2	1964 10/16-10/18 1965 9/16-10/15	3 21 30 24 33	Lost track of animal while following others. Transmitter recovered in spring. Dropped collar was located and retrieved.
202	M	Weaned Yearling 2	1965 9/17-9/24 10/5-11/21 1966 6/24-7/16 8/13-9/10 9/10-11/15 9/11	8 47 48 22 23 28 29 56 66 161 174	Tracked to hibernation den. Transmitter functioning when monitoring was stopped. Grizzly removed collar. Reinstrumented Reinstrumented, tracked to den, transmitter still functioning.
206	M	Large Adult	1965 8/2-8/5	4	Bear lost collar. Transmitter retrieved 8/17.
210	M	Large Adult	1965 8/26-9/24	30	Bear moved far and fast to fall range. Unable to continue tracking.
216	M	Cub	1966 10/30-10/30	1	133 lb. male removed transmitter on first day.

23
 22 Different Grizzlies
 48
 43 Instrumentings

Total---~~1,507~~ 1,059 Tracking Days
 1,219

GRIZZLIES RADIO TRACKED TWO OR MORE YEARS
1961 - 1968

Bear No.	Sex	Age (Years)	Tracking Dates	Animal Tracking Days	Remarks
37	M	Immature	1961 9/30-9/31	1	Bear moved beyond range of receivers, collar missing when retrapped. Transmitter functioning, bear lost journeying to hibernation area. Shot by hunter in spring of 1963.
			1962 10/4-10/18	<u>15</u> 16	
40	F	3	1961 9/22-10/22	32	Transmitter still functioning, receiver range inadequate. Bear hibernated.
		4	1962 9/8-9/17	10	Transmitter no longer functioning, but still on bear. Removed by bear during hibernation.
		5	1963 8/7-9/4	29	Transmitter no longer functioning, but still on bear at time of hibernation.
		6	1964 9/4-11/9	67	Tracked to hibernation den with cub, transmitter still functioning. Bear's first litter.
		7	1965 6/28-9/6	71	Removed 1964 collar and reinstrumented with a temperature sensitive transmitter.
			10/13-11/16	35	Reinstrumented and tracked to den, transmitter functioning after 11/16.
		8	1966 9/1-10/29	59	Removed 1965 collar and reinstrumented.
			10/30-11/15	17	Signal failed. Reinstrumented, tracked to den with cubs. Transmitter still functioning after 11/15.
		9	1967 9/11-9/26	16	Transmitter failed 9/26. Collar not recovered.
		10	1968 7/25-9/4	64	Reinstrumented on 9/4, collar still functioning.
			9/4-11/7	<u>42</u> 442	Second collar still working on 11/7 when sow and cubs were tracked to their den.
96	F	Young Adult	1962 8/17-8/19	2	Lost signal, bear traveled to distant portion of park. No mobile tracking units.
			1963 7/12-7/17	<u>6</u> 8	Sow with cubs. Transmitter battery pack shorted by water.
101	F	11	1967 9/6-9/28	23	Reinstrumented when first transmitter failed.
			10/17-11/13	26	No radio operating from 9/29 to 10/18. Tracked to first den on 11/2. Located second den on 11/13.
			1968 9/24-8/29	<u>6</u> 55	Grizzly removed collar on 8/29.

Bear No.	Sex	Age (Years)	Tracking Dates	Animal Tracking Days	Remarks
150	F	Adult	1963 10/6-11/3	29	Sow with cubs. Transmitter still functioning, bear hibernated, lost during hibernation trek.
			1964 8/11-8/14	<u>4</u> 33	Sow with yearlings. Trouble instrumenting at night, bear lost collar.
158	M	Yearling	1964 10/11-11/9	30	Yearling with sow and two yearling littermates. Tracked to hibernation den, transmitter still functioning.
		3	1966 8/20-9/9	<u>21</u> 51	Lost signal after 9/9.
187	F	5	1967 9/4-11/7	65	Tracked to den on 11/1; transmitter failed on 11/7.
			1968 8/29-9/29	<u>33</u> 98	Sow may be pregnant. Tracked to denning area on 9/25; transmitter failed on 9/29.
188	M	1	1965 10/2-10/20	19	Weaned yearling. Bear lost while moving to hibernation area. Transmitter still functioning. Checked for signal over 40-day period.
		3	1967 8/22-8/26 9/5-9/14	5 <u>10</u> 34	Reinstrumented when first transmitter failed. Antenna connection broken. No radio operating from 8/27 through 9/4. Believe No. 188 moved out of area where signal could not be received. Also did this in 1965.
194	M	Orphan Yearling	1964 10/16-10/18	3	Lost track of animal while following others.
		2	1965 9/16-10/15	<u>31</u> 34 ^{→30} 34-33	Transmitter recovered in spring. Dropped collar was located and retrieved.
202	M	Weaned Yearling	1965 9/17-9/24	8	Tracked to hibernation den. Transmitter functioning when monitoring was stopped.
		2	1966 10/5-11/21	<u>47</u> ⁴⁸ 22 ²³	Grizzly removed collar.
			6/24-7/16	22	Reinstrumented.
			8/13-9/10	28	Reinstrumented, tracked to den, transmitter still functioning.
			9/10-11/15	<u>56</u> ⁶⁵ 161 ¹⁷²	
			9/11-		

Total ----- 932 -- Tracking days

942

10 different grizzlies

34 instrumentings

Note: 9 grizzlies tracked two years
1 grizzly tracked eight years.

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6	F	5	1964 7/10-8/5	19	First cub captured and marked. Daughter of No. 7. Radio removed on 8/5 after 27 days.
7	F	Adult	1963 7/26-8/12 9/2-9/27	18 <u>26</u> 44	Grizzly removed loose fitting collar. Recovered collar August 10. Tracked to fall range, last signal weak.
14	M	Adult	1964 9/5-10/15	41	Large boar weighing 890 lbs. Would go 1000 lbs. by hibernation time. Transmitter functioning on last date but tracking discontinued.
34	F	Adult	1964 7/23-8/25	34	Sow with 2 yearlings. Left summer range for fall range with transmitter still functioning.
37	M	Immature	1961 9/30-9/31 1962 10/4-10/18	1 <u>15</u> 16	Bear moved beyond range of receivers, collar missing when retrapped. Transmitter functioning, bear lost journeying to hibernation area. Shot by hunter in spring of 1963.
40	F	3	1961 9/22-10/22	32	Transmitter still functioning, receiver range inadequate. Bear hibernated. Transmitter no longer functioning, but still on bear. Removed by bear during hibernation. Transmitter no longer functioning but still on bear at time of hibernation. Tracked to hibernation den with cub, transmitter still functioning. Bear's first litter.
		4	1962 9/8-9/17	10	
		5	1963 8/7-9/4	29	
		6	1964 9/4-11/9	67	

40 Cont.	F	7	1965 6/28-9/6	71	Removed 1964 collar and reinstrumented with a temperature sensitive transmitter Reinstrumented and tracked to den, transmitter functioning after 11/16. Removed 1965 collar and reinstrumented. Signal failed. Reinstrumented, tracked to den with cubs. Transmitter still functioning after 11/15
			10/13-11/16	35	
		8	1966 9/1-10/29	59	
			10/30-11/15	<u>17</u> 320	
75	F	Old Adult	1963 8/16-9/28	44	Bear immobilized and transmitter removed, Still functioning well. Sow with two yearlings.
76	M	Young Adult	1963 8/26-9/22	28	Lost signal, bear traveling, transmitter functioning.
96	F	Young Adult	1962 8/17-8/19	2	Lost signal, bear traveled to distant portion of park. No mobile tracking units. Sow with cubs. Transmitter battery pack shorted by water.
			1963 7/12-7/17	<u>6</u> 8	
120	F	very old	1966 10/25-10/29	<u>5</u> 4	Lost signal after 10/29
150	F	Adult	1963 10/6-11/3	29	Sow with cubs. Transmitter still functioning bear hibernated, lost during hibernation trek. Sow with yearlings. Trouble instrumenting at night, bear lost collar
			1964 8/11-8/14	<u>4</u> 33	
158	M	Yearling	1964 10/11-11/9	30	Yearling with sow and two yearling littermates. Tracked to hibernation den, transmitter still functioning. Lost signal after 9/8.
		3	1966 8/20-9/8	<u>21</u> 20 <u>50</u> 51	

164	F	Adult	1963	10/26-11/5	11	Transmitter still functioning, bear hibernated, den located.
170	F	Adult	1964	7/3-7/13	11	Sow with two cubs tracked in release and homing experiment. Transmitter removed after 11 days.
188	M	Weaned Yearling	1965	10/2-10/20	19	Bear lost while moving to hibernation area. Transmitter still functioning. Checked for signal over 40-day period.
194	M	Orphan Yearling	1964	10/16-10/18	3	Lost track of animal while following others. Transmitter recovered in spring.
		2	1965	9/16-10/15	<u>31</u> 34	Dropped collar was located and retrieved.
202	M	Weaned Yearling	1965	9/17-9/24	8	Tracked to hibernation den. Transmitter functioning when monitoring was stopped.
		2		10/5-11/21	47	Grizzly removed collar
			1966	6/24-7/16	22	Reinstrumented,
				8/13-9/10	28	Reinstrumented, tracked to den, transmitter still functioning
				9/10-11/15	<u>56</u> 161	
206	M	Large Adult	1965	8/2-8/5	4	Bear lost collar. Transmitter retrieved 8/17.
210	M	Large Adult	1965	8/26-9/24	30	Bear moved far and fast to fall range. Unable to continue tracking.
216	M	Cub	1966	10/30-10/30	1	The 133 lb. male removed transmitter on first day.

Total --- ⁹¹⁴
~~912~~ Tracking Days

20 Different Grizzlies

37 Instrumentings

Radio-Tagged Grizzlies - 1967

<u>Bear No.</u>	<u>Sex and Age</u>	<u>Tracking Dates</u>	<u>Animal Tracking Days</u>	<u>No. Days Located or Sighted</u>	<u>Remarks</u>
40	Female 9 years old	9/11 - 9/26	16	13	Transmitter failed 9/26. Collar recovered.
101	Female 10 years old	9/6 - 9/28 10/19 - 11/13	23 <u>26</u> 49	36	Reinstrumented when first transmitter failed. No radio operating 9/29 to 10/18. Tracked to first den on 11/2. Located second den on 11/13.
187	Female 4 years old	9/4 - 11/7	65	54	Pregnant female. Tracked to den on 11/1. Transmitter failed on 11/7.
188	Male 3 years old	8/22 - 8/26 9/5 - 9/14	5 <u>10</u> 15	13	Reinstrumented when first transmitter failed. Antenna connection broken. No. radio operating from 8/27 through 9/4. Believe No. 188 moved out of area where signal could not be received. Also did this in 1965.
Total			<u>145</u>	<u>116</u>	

GRIZZLIES RADIO TRACKED ONE YEAR
1961 - 1967 1968

Bear No.	Sex	Age (Yrs.)	Tracking Dates	Animal Tracking Days	Remarks
6	F	5	1964 7/10-8/5	19	First cub captured and marked. Daughter of No. 7. Radio removed on 8/5 after 27 days.
7	F	Adult	1963 7/26-8/12 9/2-9/27	18 <u>26</u> 44	Grizzly removed loose fitting collar. Recovered collar August 10. Tracked to Fall range, last signal weak
14	M	Adult	1964 9/5-10/15	41	Large boar weighing 890 lbs. Would go 1000 lbs. by hibernation time. Transmitter functioning on last date but tracking discontinued.
34	F	Adult	1964 7/23-8/25	34	Sow with 2 yearlings. Left summer range for fall range with transmitter still functioning.
75	F	Old Adult	1963 8/16-9/28	44	Bear immobilized and transmitter removed, still functioning well. Sow with 2 yearlings.
76	M	Young Adult	1963 8/26-9/22	28	Lost signal, bear traveling, transmitter functioning.
101	F	10	1967 9/6-9/28 10/17-11/13	23 <u>26</u> 49	Reinstrumented when first transmitter failed. No radio operating from 9/29 to 10/18. Tracked to first den on 11/2. Located 2nd den on 11/13.
<i>see grizzlies radio Tracked Two or More Years</i>					
120	F	Very Old	1966 10/25-10/29	5	Lost signal after 10/29.
164	F	Adult	1963 10/26-11/5	11	Transmitter still functioning, bear hibernated, den located.
170	F	Adult	1964 7/3-7/13	11	Sow with two cubs tracked in release and homing experiment. Transmitter removed after 11 days.
187	F	4	1967 9/4-11/7	65	Pregnant female. Tracked to den on 11/1. Transmitter failed on 11/7.
<i>See grizzlies radio tracked two or more years.</i>					
183	M	4	1968 9/4-9/6	3	Signal was lost after 9/6. Transmitter failed or possibly moved out of the range of the tracking units.

Bear No.	Sex	Age (Yrs.)	Tracking Dates	Animal Tracking Days	Remarks
206	M	Large Adult	1965 8/2-8/5	4	Bear Lost collar. Transmitter retrieved 8/17.
210	M	Large Adult	1965 8/26-9/24	30	Bear moved far and fast to fall range. Unable to continue tracking.
216	M	Cub	1966 10/30-10/30	1	The 133 lb. male removed transmitter on first day.
Total -----				386 ²⁷⁵	-- Tracking days

~~14~~ ¹³ Different Grizzlies

~~16~~ ¹⁴ Instrumentings

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RADIO-TAGGED GRIZZLIES
1961-1965

Bear No.	Sex and age	Tracking Dates	Animal Tracking Days	Remarks
6	5-year old female	1964 7/10-8/5	18	First cub captured and marked. Daughter of #7. Radio removed after 18 days.
7	Adult female	1963 7/26-8/12 9/2-9/27	18 <u>26</u> 44	Grizzly removed loose fitting collar. Recovered collar August 10. Tracked to fall range, last signal weak.
14	Adult male	1964 9/5-10/15	41	Large bear weighing 890 lbs. Would go 1000 lbs. by hibernation time. Transmitter functioning on last date but tracking discontinued.
34	Adult female	1964 7/23-8/25	34	Sow with 2 yearlings. Left summer range for fall range with transmitter still functioning.
37	Immature male	1961 9/30-9/31 1962 10/4-10/18	1 <u>15</u> 16	Bear moved beyond range of receivers, collar missing when retrapped. Transmitter functioning, bear lost journeying to hibernation area. Shot by hunter in spring of '63.
40	3-year old female	1961 9/22-10/22	32	Transmitter still functioning, receiver range inadequate. Bear hibernated.
	4-year old	1962 9/8-9/17	10	Transmitter no longer functioning, but still on bear. Removed by bear during hibernation.
	5-year old	1963 8/7-9/4	29	Transmitter no longer functioning but still on bear at time of hibernation.
	6-year old	1964 9/4-11/9	67	Tracked to hibernation den with cub, transmitter still functioning. Bear's first litter.
	7-year old female	1965 6/28-9/6 10/13-11/16	71 <u>35</u> 244	Removed 1964 collar and reinstrumented with a temperature sensitive transmitter. Reinstrumented and tracked to den, transmitter functioning after 11/16.
75	Old Adult female	1963 8/16-9/28	44	Bear immobilized and transmitter removed, still functioning well.
76	Young adult male	1963 8/26-9/22	28	Sow with two yearlings. Lost signal, bear traveling, transmitter functioning.
96	Young adult female	1962 8/17-8/19 1963 7/12-7/17	2 <u>6</u> 8	Lost signal, bear traveled to distant portion of park. No mobile tracking units. Sow with cubs. Transmitter battery pack shorted by water.
150	Adult female	1963 10/6-11/3 1964 8/11-11/4	29 <u>4</u> 33	Sow with cubs. Transmitter still functioning, bear hibernated, lost during hibernation trek. Sow with yearlings. Trouble instrumenting at night, bear lost collar.
158	Male yearling	1964 10/11-11/9	30	Yearling with sow and 2 yearling littermates. Tracked to hibernation den, transmitter still functioning.
164		1963 10/26-11/5	11	Transmitter still functioning, bear hibernated, den located.
170	Adult female	1964 7/3-7/13	11	Sow with two cubs tracked in release and homing experiment. Transmitter removed after 11 days.
188	Weaned male yearling	1965 10/2-10/20	19	Bear lost while moving to hibernation area. Transmitter still functioning. Checked for signal over 40 day period.
194	Orphan yearling male	1964 10/16-10/18 1965 9/16-10/15	3 <u>31</u> 34	Lost track of animal while following others. Transmitter recovered in spring. Dropped collar was located & retrieved.
202	Weaned male yearling	1965 9/17-9/24 10/5-11/21	8 <u>47</u> 55	Tracked to hibernation den. Transmitter functioning when monitoring was stopped.
206	Large adult male	1965 8/2-8/5	4	Bear lost collar. Transmitter retrieved 8/17
210	Large adult male	1965 8/26-9/24	30	Bear moved far and fast to fall range. Unable to continue tracking.

Total - 733 Tracking days

18 different grizzlies
29 instrumentings

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7	Adult female	1963 7/26-8/12 9/2-9/27	18 <u>26</u> 44	Grizzly removed loose fitting collar. Recovered collar August 10. Tracked to fall range, last signal weak.
14	Adult male	1964 9/5-10/15	41	Large bear weighing 890 lbs. Would go 1000 lbs. by hibernation time. Transmitter functioning on last date but tracking discontinued.
34	Adult female	1964 7/23-8/25	34	Sow with 2 yearlings. Left summer range for fall range with transmitter still functioning.
37	Immature male	1961 9/30-9/31 1962 10/4-10/18	1 <u>15</u> 16	Bear moved beyond range of receivers, collar missing when retrapped. Transmitter functioning, bear lost journeying to hibernation area. Shot by hunter in spring of '63.
40	3-year old female	1961 9/22-10/22	32	Transmitter still functioning, receiver range inadequate. Bear hibernated.
	4-year old	1962 9/8-9/17	10	Transmitter no longer functioning, but still on bear. Removed by bear during hibernation.
	5-year old	1963 8/7-9/4	29	Transmitter no longer functioning but still on bear at time of hibernation.
	6-year old	1964 9/4-11/9	67	Tracked to hibernation den with cub, transmitter still functioning. Bear's first litter.
	7-year old female	1965 6/28-9/6 10/13-11/16	71 <u>35</u> 244	Removed 1964 collar and reinstrumented with a temperature sensitive transmitter. Reinstrumented and tracked to den, transmitter functioning after 11/16.
75	Old Adult female	1963 8/16-9/28	44	Bear immobilized and transmitter removed, still functioning well.
76	Young adult male	1963 8/26-9/22	28	Sow with two yearlings. Lost signal, bear traveling, transmitter functioning.
96	Young adult female	1962 8/17-8/19 1963 7/12-7/17	2 <u>6</u> 8	Lost signal, bear traveled to distant portion of park. No mobile tracking units. Sow with cubs. Transmitter battery pack shorted by water.
150	Adult female	1963 10/6-11/3 1964 8/11-11/4	29 <u>4</u> 33	Sow with cubs. Transmitter still functioning, bear hibernated, lost during hibernation trek. Sow with yearlings. Trouble instrumenting at night, bear lost collar.
158	Male yearling	1964 10/11-11/9	30	Yearling with sow and 2 yearling littermates. Tracked to hibernation den, transmitter still functioning.
164		1963 10/26-11/5	11	Transmitter still functioning, bear hibernated, den located.
170	Adult female	1964 7/3-7/13	11	Sow with two cubs tracked in release and homing experiment. Transmitter removed after 11 days.
188	Weaned male yearling	1965 10/2-10/20	19	Bear lost while moving to hibernation area. Transmitter still functioning. Checked for signal over 40 day period.
194	Orphan yearling male	1964 10/16-10/18 1965 9/16-10/15	3 <u>31</u> 34	Lost track of animal while following others. Transmitter recovered in spring. Dropped collar was located & retrieved.
202	Weaned male yearling	1965 9/17-9/24 10/5-11/21	8 <u>47</u> 55	Tracked to hibernation den. Transmitter functioning when monitoring was stopped.
206	Large adult male	1965 8/2-8/5	4	Bear lost collar. Transmitter retrieved 8/17
210	Large adult male	1965 8/26-9/24	30	Bear moved far and fast to fall range. Unable to continue tracking.

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29 instrumentings

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14	Adult male	1964 9/5-10/15	41	Large boar weighing 890 lbs. Would go 1000 lbs. by hibernation time. Transmitter functioning on last date but tracking discontinued.
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	6-year old	1964 9/4-11/9	67	Tracked to hibernation den with cub, transmitter still functioning. Bear's first litter.
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194	Orphan yearling male	1964 10/16-10/18 1965 9/16-10/15	3 <u>31</u> 34	Lost track of animal while following others. Transmitter recovered in spring. Dropped collar was located & retrieved.
202	Weaned male yearling	1965 9/17-9/24 10/5-11/21	8 <u>47</u> 55	Tracked to hibernation den. Transmitter functioning when monitoring was stopped.
206	Large adult male	1965 8/2-8/5	4	Bear lost collar. Transmitter retrieved 8/17
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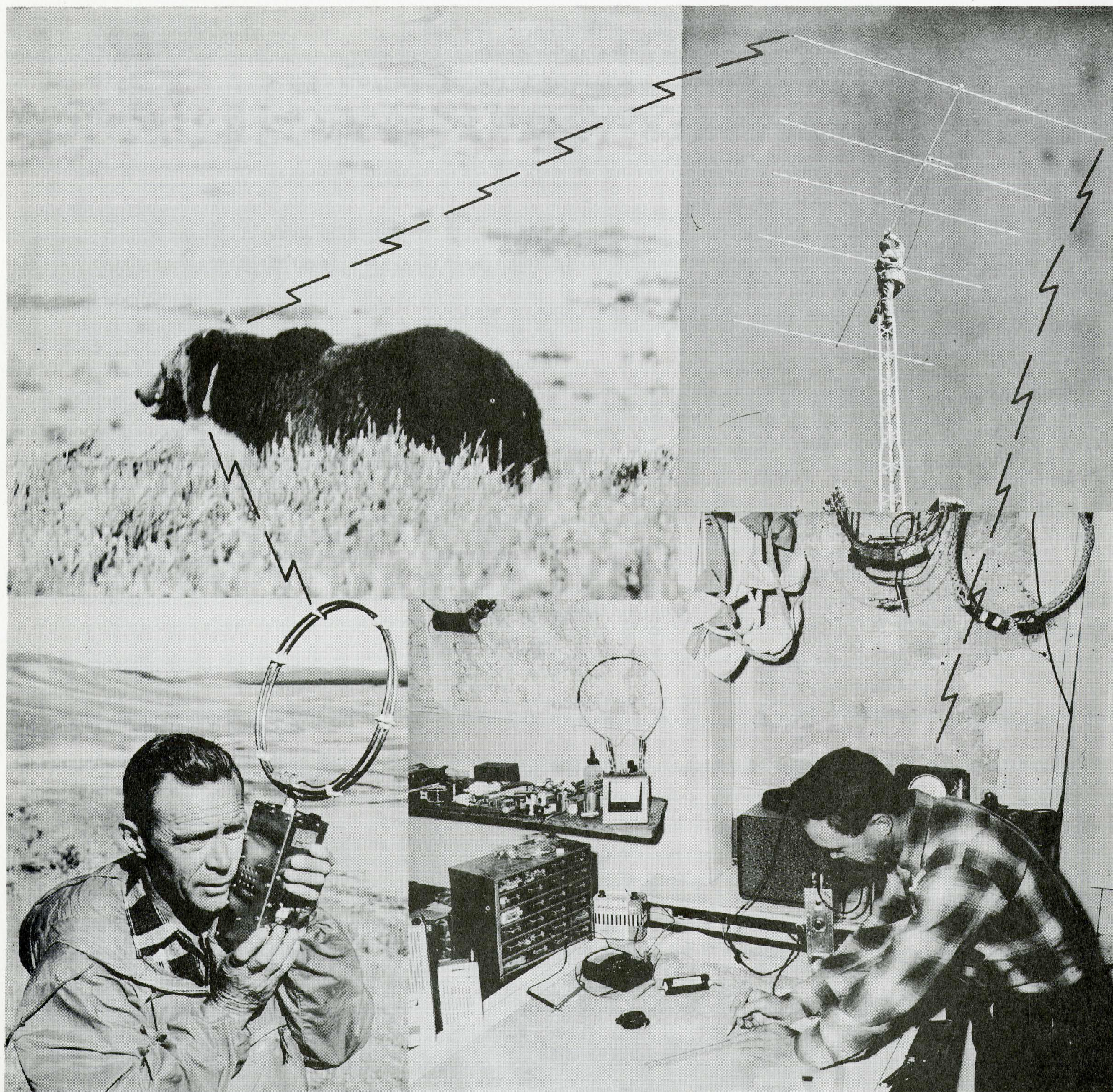
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BIO-TELEMETRY

Radiotracking
of Grizzly Bears

TRACKING GRIZZLY BEARS • Frank C. Craighead, Jr. and John J. Craighead

Since reporting on the progress of our initial radiotracking work during the summer of 1961 to the Bio-Telemetry Conference in New York (1) we have continued our instrumentation of grizzly bears (*Ursus arctos horribilis*) as part of a comprehensive ecological study of that animal. Two animals were instrumented in 1961, three, in 1962, and eight, during the summer of 1963. Some of these bears were under radio surveillance for a month or longer and others — due to a loss of collar or mechanical failure — were tracked for shorter periods of time.

In November, 1963, we successfully tracked a grizzly to its hibernation den in Yellowstone National Park — the first hibernation den we have managed to locate as the grizzly actually entered it. We picked up the signal from grizzly No. 164 after she crossed the divide between the Old Faithful area and upper Trout Creek in Hayden Valley. The signal was received at Base Station and a fix plotted 12 miles away. We moved in on foot during the day of November 5, guided by a portable receiver. We were able to approach to within 20 feet of the den with the grizzly inside. The tracking took place during a snow storm which continued through-

out the night and into the next day. We were indeed fortunate in our timing, since all of the grizzlies in the area hibernated at this same time, moving into their dens during the storm.

Another accomplishment in 1963 was the simultaneous monitoring of four instrumented grizzlies from our Yellowstone bioelectronic laboratory (Fig. 1). We were able to pick up the distinctive signal from any of these four bears, 24 hours a day, at distances of 10 to 12 miles. Each animal was wearing a 1.8 oz "Philco" transmitter pulsed at a different rate (50, 62, 74, and 92 pulses per minute were used). Power output from the different transmitters varied from 90 to 200 milliwatts, and the pulse rates were separately distinguished and bearings obtained despite some difficulty in

making fixes when all four animals were in the same general direction or when one or more of the signals was weak due to distance or shielding effect.

An instrumented bear is located by obtaining compass bearings from the base, field, and mobile stations. We then move in toward the point of intersection with portable direction finders, designed and built for us by the Philco Corporation. Our present tracking system has the demonstrated capability of locating instrumented animals at distances of 15 to 20 miles as well as a "closing-in" ability that, on occasion, has enabled us to approach to within 40 feet of a bear before being detected.

In the course of studying the grizzly bear, we have captured and ear-tagged

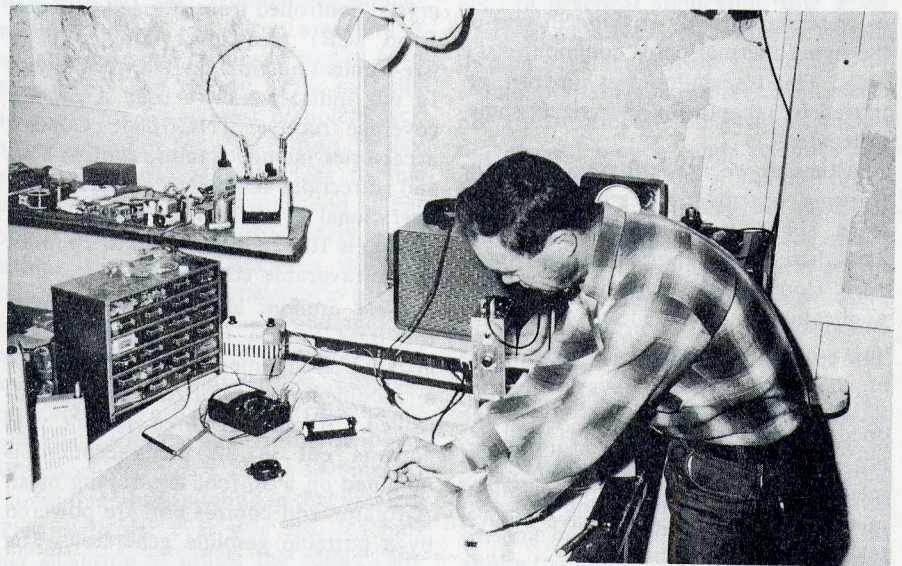


FIG. 1. Receiving equipment and plotting table in the Bioelectronic Laboratory at Yellowstone National Park. From this base station, operated by the Montana Cooperative Wildlife Research Unit and the Environmental Research Institute, grizzlies were monitored day and night.

Presented for the research team: Frank C. Craighead, Jr., Environmental Research Institute; John J. Craighead, Montana Cooperative Wildlife Research Unit; Joel Varney, Philco Corporation; Maurice Hornocker, Montana Cooperative Wildlife Research Unit; Hoke Franciscus (W3ELV), Carlisle, Pa. Cooperating and supporting agencies include the National Geographic Society, National Science Foundation (G-17502), Philco Corporation, U.S. Fish and Wildlife Service, National Park Service, Boone and Crockett Club, New York Zoological Society, Wildlife Management Institute, Yellowstone Park Company, and the Environmental Research Institute.

164 different animals. Each of these marked grizzlies is given a number, and I will refer to these numbers in naming or identifying instrumented individuals. Bear No. 40, which we tracked and monitored for a month last season, has been instrumented and tracked for 3 consecutive years. Bear No. 7 has been instrumented twice in the same year while two other animals, No. 37 and No. 96, have been instrumented and tracked for 2 consecutive years. The career of No. 37 as a "radio bear" terminated when he was shot by a hunter just outside the south boundary of Yellowstone Park. Grizzly No. 96 wore a transmitter collar for almost a year's time and produced two cubs while instrumented. She hibernated with the collar on and then came out of hibernation still wearing it. Soon after leaving her den, she traveled from the northeast portion of Yellowstone Park to Hayden Valley, where we made a recapture by shooting her with a propulsive syringe dart containing an immobilizing drug (Fig. 2). While she was anesthetized, we removed the transmitter. Although the batteries in the transmitter-collar were dead, the transmitter was still in working condition. We placed another radio collar on the bear, but, unfortunately, the battery pack in the new collar became shorted after a week of operation. The bear immersed in water, apparently soaking in one of the many thermal pools common in the area. This transmitter was, in turn, removed by recapturing the grizzly sometime later.

Although we are still developing the tracking system and yet have much to learn about its potentialities, we now have had 3 years of tracking experience from which to evaluate possible applications and future use.

The tracking system

The tracking system we have developed, tested, and put into operation has not only fulfilled our original requirements but has exceeded our expectations in many respects, and we have not yet taxed its capabilities.

Some idea of the potential of the system is revealed by the figures computed in searching for instrumented grizzlies at the close of the season in 1962. In two days we monitored approximately 1500 square miles of Yellowstone country using a mobile tracking unit. A 4-mile signal range was used as a basis for computing the area cov-



FIG. 2. Grizzly No. 96 was immobilized in the early summer of 1961, using a dart gun. The old transmitter-collar, which she wore during hibernation, has just been removed and a new one slipped on.

ered. From the top of Mt. Washburn approximately 1200 square miles were theoretically covered at a single monitoring with the possibility of good signal reception from many localities within this coverage.

Our present tracking system consists of the following:

Base Station consists of a modified crystal-controlled transistorized Citizens' Band (CB) transceiver coupled to a five-element antenna on a 40-foot tower. In our initial work we used a general coverage receiver (NC-188). Control accessories include rotator, control box, and direction indicator. Under most operational conditions the range or reception is 10-12 miles and up to 20 miles under favorable conditions.

Field Station, located 8 miles from the Base Station in the heart of the grizzly bear summer range, consisting of a modified transistorized crystal-controlled CB unit. A three-element yagi antenna cut to 32 mc reception is mounted on a 30-foot telescoping mast. A rotator and control box are powered by a portable gasoline generator. The operational range is approximately 8-10 miles and up to 15 miles under favorable conditions.

Mobile Units include trucks, pickups, or panel wagons with seatings for accommodating a telescoping mast and a three-element antenna. Antenna coaxial cable connects with a general coverage receiver or with the crystal-controlled

transistorized CB units, modified by Philco. General coverage receivers were used in 1962, but better results are now being obtained with the modified CB walkie-talkies. The range of the Mobile Units is similar to that of the Field Station.

Portable Direction Finders or *Portable Directional Receivers* complete the receiving equipment. These are the same modified CB transceivers already mentioned. Readily removable loop antennas are attached to the top of these receivers and a whip-type sense antenna enables the operator to determine the direction of the signal source. Antennas from all other tracking stations (Base, Field, and Mobile) can be connected to the portable receiving units. Various modifications and improved models have been field-tested over the past 3 years. Present models weigh 3 lbs, are ruggedly constructed, and have an operational range of 2-4 miles when battery-powered as portable units.

The transmitters are crystal-controlled, transistorized, are 1 x 1 x 2 inches in size, weigh 1.8 oz, vary in output from 90 to 200 mw pulses, and have undergone several changes in design. The antenna is a resonant metal loop that, when reinforced and padded, serves as a collar for attachment. The transmitter frequency is 32.02 mc. Seven Mallory mercury cells, type 1450, power the transmitter 60 or more days.

A *citizens' band, voice communication system* is employed with the tracking system. It consists of a base, three mobile, and five portable units — all stock items.

Grizzly insights

At the present time we cannot submit detailed ecological results from our radiotracking, as the field work is still in progress and the data have not yet been fully analyzed. I would like, however, to mention briefly a few interesting things we are learning about grizzly bears.

1) We have found that grizzly No. 40, one that has been instrumented three times in 3 years, has spent most if not all of these years within a very limited area. Roughly this area or home range is about 5 miles long by 3 miles wide. Within this range sow No. 40 has, for weeks at a time, confined her activities to an even more restricted area of a few square miles. She has spent

most of the daylight hours resting and sleeping, and these daytime retreats have been in the same location for 3 years. Daytime beds of this as well as of other bears tracked consist of shallow excavations. They are scooped from the earth usually in heavy timber or dense windfall.

2) In a 10-day period grizzly No. 7 and her two yearlings traveled over a range about 14 by 4 miles, and this range increased considerably in size as the season progressed. In the first 10 days she crossed the Yellowstone River three times and climbed high on the slopes of Mt. Washburn. She traveled and foraged during daylight hours as well as at night. At times she approached close to concentrations of park visitors but was seen by neither visitors, rangers, nor ourselves on these occasions. The radio-tracking has shown that grizzlies can approach and perhaps frequently are close to humans without being detected. Information obtained from this and other instrumented grizzlies may suggest how encounters between park visitors and grizzlies might be avoided.

3) Both grizzly No. 75 and grizzly No. 7 had yearlings that traveled with them. Although in each case we were tracking a single animal, we were actually obtaining information about a family unit of three. By following bears No. 7 and No. 75 to their daytime retreats, we found that the yearlings normally bedded down close to the sows during the daytime. At our approach, No. 75, an old and belligerent grizzly, gave a warning "woof" to her yearlings when we were 125 feet away and they took off at a run. Copious saliva around the edge of her bed revealed that she had been as nervous at our near presence as we had been at hers. Possibly a decision to attack or flee had hung precariously in the balance.

4) When bedded down during the day, all bears tracked have, at one time or another, been approached closely and by-passed at less than 100 yards without being disturbed. They apparently have a reluctance to leave their daytime retreats unless pressed to do so. Even in dense woods and windfall difficult for a man to traverse, they can move so quietly that they cannot be detected by ear. Some grizzlies have circled us, keeping just out of sight.

5) On another occasion we tracked a boar, No. 76, into a thick stand of

lodgepole. Soon after entering the dense timber, we "jumped" a large unmarked grizzly we had passed by and then startled still another grizzly, No. 75, and her yearlings. In addition, we heard other bears and found ourselves literally surrounded by grizzlies. Numerous beds and feces indicated that this was an area where the animals concentrated to rest and sleep during the day.

6) Radiotracking grizzlies has provided considerable direct as well as indirect information about their diets and can furnish much more in the future. It is also supplying data on habitat preferences and the relation of these preferences to food supply, seasonal conditions, and cover requirements. In following the instrumented bears, we have observed numerous excavations where all of them have unearthed the nests and tunnels of field mice (*Microtus spp.*), and we have frequently watched them catch mice. These small rodents have attained high population levels in the Park this year, and the grizzlies have been preying on them. Northern pocket gophers (*Thomomys talpoides*), likewise, are more numerous than they have been over the last five years. These, too, are being consumed by the bears in considerable numbers. Our observations obtained through radiotracking indicate that both sows No. 7 and No. 75 are feeding on rodents to a greater extent than sow No. 40. Number 40 supplements her diet at a refuse area and is largely dependent on this source of food during July and August. This partially accounts for her almost complete lack of movement or foraging during the day and her regular nightly visits to this source of food. The nature and extent of human influences on the grizzly populations, though significant, is still not fully known. Such information is needed for informed management and may be essential for future preservation of the species. In the vicinity of No. 75's daytime retreat we found numerous lodgepole pines with the bark freshly stripped. We concluded that she was seeking the cambium and the pitchy sap that exuded. This particular bear was also teaching her offspring to utilize the edible cambium.

7) Information obtained to date indicates that a decided difference exists in the foraging ranges and in the activity patterns between males, barren females, sows with cubs, and sows with yearlings. For example, continuous changes

in signal strength reveal the greater activity of a mother with energetic and hungry cubs. This has been repeatedly verified by visual observation of instrumented animals. Boars may tend to travel more and cover greater distances than barren sows or sows with offspring. One young adult boar has been radio-tracked in a circular trek of 50 or more airline miles.

In addition to the tracking briefly described, we have built and experimented with sensing devices or transducers for telemetering environmental data. During fall or in winter we plan to instrument a grizzly with a transmitter employing a thermistor to control the pulse rate of the transmitter. Changes in pulse rate due to changes in temperature can be converted to temperature readings of the collar under prehibernating and hibernating conditions. We have also experimented with audio amplifiers coupled to small transmitters that enable us to receive distant animal sounds and interpret them in relation to animal behavior.

Advantages of biotelemetry

I have given a brief sketch of the types of data we are gathering. Perhaps this is a good time to point out that the primary function of our biotelemetry or big game tracking system is to extend the range of man's observational powers. In practical application this is accomplished in two ways. First, a variety of data is gathered from a distance with a minimum of time, effort, and manpower. Information on position, animal movement, ranges, and activities acquired from afar has a unique value. The presence of the observer does not influence the actions or behavior of the subject. The instrumented animals can be monitored continuously — at night as well as during the daylight hours. Information on periods of activity and speed of travel hitherto impossible to obtain by more conventional methods can and is being recorded. Physiological parameters can also be telemetered from free roaming animals and we are embarking on this phase at present. This ability to obtain a variety of information continuously and from afar has evident advantages. However, I would like to emphasize that an even greater asset of a tracking system is its capability of putting a scientific observer in a predetermined position where he can observe a particular instrumented animal and

reason about and interpret what he observes on the spot. In some 3000 square miles of grizzly bear habitat, 85% heavily wooded, man and grizzly can arrange to meet with the man alone aware of the grizzly's presence and location. He can observe undetected. This ability to locate, move in, or follow and then observe is in itself a tangible research reward.

At the present time we can instrument a grizzly bear, monitor its signal 24-hours a day for a month or two, and plot its movements during this time from a distance. From minor but detectable signal changes we can deduct certain activities. At almost any time within this 2-month period we can fix the bear's position through the intersection of two or more bearings and then move in and make visual observations in rough and heavily timbered country. We can approach sufficiently close to observe feeding activities and breeding and social behavior of the instrumented bear, to hear its departure if unobserved, or to continue tracking it when it moves off before being sighted.

Though there is a widespread, growing, and keen interest in the application of electronics to ecological research and to the management of wildlife, there are still some who doubt its usefulness and practicality. Our results indicate it has a tremendous research potential and that, in planning comprehensive field studies of the future, biotelemetry will be given ever more serious consideration as a method of gathering data. Within

Yellowstone National Park. Conventional plastic, color-coded neck markers are being used. The information gathered by observing marked animals is delineating the general pattern of elk migration in spring and fall. Such data will not provide a continuous pattern of movement. This can be obtained only a few years we foresee that many universities offering advanced degrees in ecology or in resource management will provide interdisciplinary courses emphasizing biotelemetry. We feel certain that a majority of State Fish and Game Departments will eventually establish research and management programs employing biotelemetry systems and methods. Some have already made a start and many are expressing interest. Practical applications for Federal agencies are numerous and there is little doubt that land managing agencies will become increasingly involved in the use of electronics for studying wildlife, gathering data for management, telemetering environmental information such as temperature, light intensity, moisture conditions or telemetering physiological conditions from free-roving animals. Some agencies will even telemeter physiological information from humans for other than purely medical objectives.

A big game radiotracking system has many applications and at least a few of these are worth mentioning at this time as examples of the many possibilities.

Currently, we are conducting a study of the migration of elk (*Cervus canadensis*) for the National Park Service in

by daily monitoring instrumented elk within the herd. The migration and movement data that can be collected in this way will have direct application in the management of the elk herds. There is both a research and a management application in the use of radio tracking to "keep tab" on exotic game species introduced into a new environment or to follow and study native species that have been transplanted. Biotelemetry also has unexplored possibilities in education, specifically, the interpretive services of National Parks. Interpretation of Park attractions and values is an important aspect of National Park management and administration. It would be quite feasible to devise and set up electronic systems in visitor centers or field museums that could visually and audibly portray location and movements of instrumented wild animals. This information could then be related to the big game and range management procedures and problems of a specific national park such as Yellowstone, where the need to reduce the number of elk to within the carrying capacity of the winter range poses a problem in public education and must be explained to the visiting public and to sportsmen's groups.

REFERENCE

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