

D-461
IN
STORAGE

MANAGEMENT INVOLVING GRIZZLY BEARS AND HUMANS
IN YELLOWSTONE NATIONAL PARK, 1970-73--AN INTERIM REPORT

Glen F. Cole
Supervisory Research Biologist
Yellowstone National Park, Wyoming

U. S. Department of the Interior

National Park Service

PLEASE RETURN TO:

TECHNICAL INFORMATION CENTER
DENVER SERVICE CENTER
NATIONAL PARK SERVICE

October 31, 1973

ON MICROFILM

MANAGEMENT INVOLVING GRIZZLY BEARS AND HUMANS
IN YELLOWSTONE NATIONAL PARK, 1970-73--AN INTERIM REPORT

Glen F. Cole¹

INTRODUCTION

This report evaluates the results of a management program that has been carried out in Yellowstone National Park since 1970. Program objectives were to maintain the park grizzly population under natural conditions and reduce bear injuries to humans.

The different procedures employed have been described in previous reports (Cole 1970a, 1971, 1973). In summary, these involved actions to eliminate sources of unnatural food (garbage and camp groceries) that had altered bear habits and been the basic cause of most injuries from 1930-69 (Cole 1970b). Also, hiking and camping were regulated to reduce the opportunities for bear injuries to humans and certain bears were captured, transplanted, or destroyed when this was considered necessary to protect humans.

The procedures used to collect data and evaluate the results of management also have been described in the above cited reports. Evaluations mainly involved testing hypotheses that could be rejected by inconsistent data or appropriate statistical tests. These hypotheses

¹ Supervisory Research Biologist, National Park Service, U. S. Department of the Interior, Yellowstone National Park, Wyoming.

were that the management actions to eliminate unnatural food sources and the bear control procedures applied in the 1970s will:

1. Reduce the number of grizzly injuries to humans in park developments from 1963-69 levels (4.4 average; 2-8 range).
2. Restore a more natural grizzly population than existed in the 1960s as evidenced by scattered distributions in summer, fewer bears using developed areas, and progressive reductions in the numbers of bears being controlled and destroyed.
3. Not prevent the grizzly population from maintaining or rapidly reestablishing its numbers at natural carrying capacity levels.

MANAGEMENT RESULTS

Injuries to Humans

The data in Table 1 show that grizzlies caused fewer injuries per year during the 1970s than the 1960s. The 1970-73 mean of about 0.7 injuries per year in developed areas was significantly different ($P = 0.05$) from the 1963-69 mean of 4.4 (2-8 range) per year by the sum test of Wilcoxon and Wilcox (1964). Injuries in backcountry areas did not increase despite a 300% increase in the numbers of backcountry campers and hikers from 1970-73.

Grizzly Distributions

From 1968-73 the number of grizzlies seen in park developments or in the wild (Table 2) varied with different natural food and other

environmental conditions. The animals were most observable in the wild when they were digging for rodents or preying and scavenging on large ungulates at low elevations (Cole 1972). Sightings in developed areas were inflated by increased night patrols during the 1970s and other data from bear control operations (Table 3) more accurately reflect the downward trends in bear use. In the spring of 1973 an absence of a crust on snow appeared to initially hold grizzlies near their hibernation sites, and to subsequently allow bears to obtain food at high elevations where they were less observable. Marked declines in pocket gopher (Thomomys talpoides) numbers at low elevations also appeared to contribute to grizzlies using high elevations to a greater extent during 1973.

As presented, the yearly totals in Table 2 show the general trends from 1970-73 were toward fewer sightings of grizzlies in developed areas. Variable numbers of grizzlies were seen in the wild each year, but the observed distributions on natural foods in summer contrasted with previous years when large numbers concentrated at garbage dumps.

Bear Control

Table 3 shows that the numbers of bear control actions in park developments, numbers of different animals handled, and numbers of bears intentionally removed from the population declined from 1970-73. Thirteen unintentional deaths that resulted from drug effects, bears

charging personnel, animals coming out of drugs during handling or injuring themselves in traps are included in the yearly totals. In comparison with the 1968-69 period and the beginning of the park program in 1970, the success rate for transplants increased.

Two large open-pit garbage dumps that were used by grizzlies were in the park during 1968 and 1969. Separated "edible" garbage was hauled to one of these dumps, as recommended by Craighead and Craighead (1967). As scheduled in the park management program, one dump was closed during 1970. Garbage was not hauled to the remaining dump in 1971 or during subsequent years because, as shown in Table 3, the need to control bears in park developments progressively declined.

Removals

By the use of information from various sources, a grizzly population of at least 250 animals was estimated to occur within Yellowstone's 3400 miles² in 1970 (Cole 1971). Reviews of state records (Cole 1973) tentatively suggested that at least 100 additional grizzlies would have had to occur in a 2000 mile² area bordering Yellowstone Park. Table 4 shows that the known removals from this combined park and outside area population amounted to 41 in 1970, 38 in 1971, 21 in 1972, and 4 in 1973 (reports not complete for 1973).

The removals from the park population alone were calculated as 25 in 1970 and 1971, 12 in 1972, and 2 in 1973. These figures may be slightly

inflated because I had to assume all of the removals due to the park's control program and a similar Montana program outside park boundaries were from the park's population. Some bears made seasonal migrations into the park to use dumps or developed areas (Hornocker 1963, Craighead and Craighead 1967). Ratios of 60% marked to 40% unmarked bears inside the park and 13% marked to 87% unmarked bears in kills in the adjoining states (Table 4), with allowances for emigrations or transplant effects, suggested that 10-15% of the 46 grizzlies killed in these states were from the park population.

EFFECTS ON BEAR POPULATION

The effects of management to eliminate unnatural foods and the removals shown in Table 4 were inferred from data on female reproduction and calculations of probable population numbers and trends.

Reproduction

Table 5 shows the numbers and ratios of female grizzlies and young seen within and adjacent to Yellowstone Park before and after garbage dumps were closed. Repeated observations on sample areas indicated that under free-ranging conditions only a portion of the females with young present were seen or identified as a particular family group. Thus, the tabulations of individuals represent minimum figures.

The differences between cub and yearling ratios during the 1959-66 period show the first year mortality of cubs was 39% in population

segments that used garbage dumps. Mundy (1963) reported a 35% cub mortality rate in a population segment that used dumps in a Canadian park. These rates contrast with the 5 and 7 percent cub mortality figures reported for populations that used natural foods (Troyer 1962, Martinka 1969).

My tentative interpretation of the data in Table 5 is that in population segments that used garbage dumps the production of cubs was mainly by older dominant females. Litter size was high, but survival to yearling age was low. Under free-ranging conditions, less dominant younger females that either produce one young (Couturier 1954, as cited in Mundy and Flook 1973) or smaller litters also contributed to population reproduction. Cub survival to yearling age increased. The 25% difference between the 1972 cub and 1973 yearling ratios in the individual animal samples may have been partly due to younger females only being able to raise one young to yearling age, partly due to greater numbers of these females producing cubs than previously, and finally, some females with one cub not being observed until their young reached yearling age.

Population Numbers

Table 6 shows the different population sizes (N) that could occur with different numbers of females with young, a mean 3 year reproductive cycle for adult females, a known adult male to female ratio, and mortality and emigrations that were equal to the yearly production of cubs.

The 1973 sightings of 13 different females with cubs and 15 different females with yearlings (Table 5), with track records (Knight unpub. data) that indicated that at least four other females with cubs or yearlings were present, suggested that Column II in Table 6 provided the best estimate of the park grizzly population. The calculated 250-290 population size is surprisingly close to earlier published estimates that were obtained by different methods (Cole 1970b and 1973).

Two of the 13 females with cubs shown in Table 5 were outside Yellowstone Park, but these were in such close proximity (within 1 mile) as to suggest their home ranges overlapped park boundaries. If five additional females with cubs and proportionate numbers of other classes occurred in the 2000 mile² area bordering Yellowstone, the combined park and outside area population would approximate 320-360 animals, as shown in Column III in Table 6. Craighead and Craighead (1971) estimated a minimum population of 175 for the park and adjacent 2000 mile² area, but this estimate was mainly derived from averages of yearly counts of bears that used garbage dumps.

Population Trends

General trends in population numbers since 1970 were inferred from the differences between the known yearly removals (Table 4) and the mortality and emigrations (36 individuals) that would maintain a population of 250-290 grizzlies (Table 6).

Because proportionally greater numbers of adult males were removed than of either adult females or younger bears, rates of population increase would have been slightly higher than those shown in Column II of this table. Emigrations of young adults from the park were probably reduced as a result of lowered adult densities.

The differences between the known yearly removals from the park population and the 36 that would have to die or emigrate in order to maintain stable population numbers were a plus 11 animals in 1970 and in 1971, 24 in 1972, and 34 in 1973. If additional deaths from natural causes were equal to one-quarter to one-half of the yearly increments of young (9-18 bears), population numbers were either slightly depressed or stable during 1970 and 1971. The removals of 5% or less of population numbers in 1972 and 1973 were probably not of sufficient magnitude to prevent the park population from either increasing or reestablishing its numbers at natural carrying capacity levels.

DISCUSSIONS AND CONCLUSIONS

The hypotheses that the management actions to eliminate unnatural foods and bear control procedures applied in the 1970s will (1) reduce injuries in developed areas, (2) restore a more natural grizzly population and (3) not prevent the population from either maintaining or reestablishing its numbers at natural carrying capacity (K) could not be rejected on the basis of the collected data. Evidence of the population

reaching K will require that emigrations of significant numbers of socially subordinate bears (Martinka 1971) from the park be detected.

Grizzly injuries to backcountry hikers and campers were probably reduced from what they would have otherwise been if the locations of many females with young had not been known, and backcountry users had not been appropriately warned or controlled.

My conclusions are that during the 1970-73 period the park management program significantly reduced grizzly injuries to humans and made measurable progress toward accomplishing the objective of maintaining the bear population under natural conditions. The declining removals from the park population shown in Table 4 probably temporarily reduced the need for young bears to emigrate outside the park to find a vacant home range, but these have not been of sufficient magnitude to prevent this population from replenishing its numbers by its yearly production of young.

LITERATURE CITED

- Cole, G. F. 1970a. Grizzly bear management in Yellowstone Park, 1970. 2nd. Int. Conf. on Bear Research and Management, U. of Calgary, Alberta.
- _____. 1970b. Preservation and management of grizzly bears in Yellowstone National Park. 2nd Int. Conf. on Bear Research and Management, U. of Calgary, Alberta.
- _____. 1971. Progress in restoring a natural grizzly bear population in Yellowstone National Park. BioScience. 21(16):858-864.
- _____. 1972. Grizzly bear-elk relationships in Yellowstone National Park. J. Wildl. Manage. 36(2):556-561.
- _____. 1973. Management involving grizzly bears in Yellowstone National Park 1970-72. U. S. Dept. of Interior, Nat. Park Serv. Natur. Res. Rpt. No. 7. 10 p.
- Craighead, J. J. and F. C. Craighead, Jr. 1967. Management of bears in Yellowstone National Park. Environ. Res. Inst. and Mont. Coop. Wildl. Res. Unit Rep., 113 p. (multi.)
- _____. 1971. Preservation and management of grizzly bears in Yellowstone National Park. BioScience. 21(16):858-864.
- Hornocker, M. G. 1962. Population characteristics and social and reproductive behavior of the grizzly bear in Yellowstone National Park. M.S. Thesis, Montana State Univ., Missoula. 94 p.
- Martinka, C. J. 1969. Grizzly ecology studies, Glacier National Park. Nat. Park Serv. Prog. Rep. 43 p. (mimeo.)

- _____. 1971. Population characteristics of grizzly bears in Glacier National Park, Montana. Research in National Parks. AAAS Symposium. Unpub.
- Mundy, K. R. D. 1963. Ecology of the grizzly bear (Ursus arctos) in Glacier National Park, British Columbia. Unpub. M.S. Thesis, Univ. of Alberta, Edmonton. 103 p.
- Mundy, K. R. D. and D. R. Flook. 1973. Background for managing grizzly bears in the national parks of Canada. Canadian Wildl. Serv. Rpt. Ser. No. 22. 35 p.
- Troyer, Willard A. 1962. Size, distribution, structure and harvest of a Kodiak bear population. Unpubl. M.S. Thesis, Univ. of Montana, Missoula. 49 p.
- Wilcoxon, F. and Roberta Wilcox. 1964. Some rapid approximate statistical procedures. Lederle Laboratories, Pearl River, New York. 59 p.

Table 1. Numbers of injuries to humans from grizzly bears by periods and years, Yellowstone National Park, 1930-73.

Years	<u>No. grizzly-caused injuries per year</u> ¹		No. of visitors per injury
	Developments	Backcountry	
1930's	0.6 (0-3)	0	800,000
1940's	1.2 (0-7)	0	600,000
1950's	0.6 (0-2)	0	2,700,000
1960's	3.6 (1-8)	0.3 (0-2)	500,000
1970	2	1	700,000
1971	0	0	0
1972	1	1	1,000,000
1973	0	0	0

¹ Averages of known and probable injuries due to grizzlies by decades from Cole (1970b). The one injury in a development in 1972 was also a probable case.

Table 2. Total number of grizzly bears observed on a daily basis in developments and in the wild within Yellowstone National Park, 1968-73.

Locations:	1968	1969	1970	1971	1972	1973
No. in developments	293	99	178	146	105	54
No. in wild	414	315	614	320	349	348

Table 3. Records of grizzly bear control actions in developed areas, Yellowstone National Park, 1968-73.

Developed areas:	Control actions ^a					
	1968	1969	1970	1971	1972	1973
Old Faithful	1 ^b	0 ^b	22	1	0	0
Canyon	14	16	9	11	10	3
Lake Outlet	16	25	11	20	13	4
Grant Village	20	5	15	5	0	0
Bridge Bay	8	9	0	1	3	3
Eleven other units . .	0	2	13	1	0	0
Total control actions	59	57	70	39	26	10
No. different bears ^c	?	?	50	33	21	7
Pct. successful						
transplants . . .	33 ^d		60	80	74	70
No. bears destroyed ^e	5(3)	10(5)	12(6)	6(2)	6(4)	0
No. bears to zoos .	0	0	8	0	1	0

^a Number of times a bear was captured for transplanting, shipped to a zoo, or destroyed.

^b Grizzlies present until Rabbit Creek dump opened each year.

^c Numbers in 1968 and 1969 unknown due to unmarked animals; 4 of 33 were 1970 transplants, 4 of 21 were 1970 or 1971 transplants.

^d Sample of 20 marked and 1 recognizable bear.

^e Yearly totals with the number that were unintentional because bears charged personnel, came out of drugs during handling, injured themselves in traps, or failed to recover from drugs shown in parentheses.

Table 4. Numbers of grizzlies removed by park and state control programs and other known deaths of marked and unmarked bears in adjacent state areas, 1970-73.

	Removals due to <u>control programs</u>		Killed by vehicles	<u>Other known kills¹</u>		
	Park ²	Mont.		Wyo.	Mont.	Idaho
1970	20	0	2	8(1)	4(1)	7(1)
1971	6	14	1	6	6(3)	5
1972	9	2	1	5	0	4
1973 ³	0	1	0	4(1)	3	3
	35	17	4	23	13	19

¹ Total deaths from hunting or kills to protect livestock or property, with those marked inside Yellowstone Park prior to or since 1970 in parentheses.

² Includes 9 animals donated to zoos, 13 unintention, and 13 intentional deaths.

³ Data to September 24, 1973.

Table 5. Numbers and ratios of female grizzlies and young seen in Yellowstone Park during a 1959-66 period¹ and subsequent years².

Years	Numbers			Numbers		
	Females	Cubs	Ratios	Females	Yearlings	Ratios
1959-66 average	15	33	2.2	15	20	1.3
1972	31(11)	58(22)	1.9(2.0)	25(9)	48(18)	1.9(2.0)
1973	31(13)	59(24)	1.9(1.8)	34(15)	44(21)	1.3(1.5)

¹ Average female-cub figures from Craighead and Craighead (1967) with female-yearling figures calculated from a reported 39% mortality rate in a population segment that used garbage dumps.

² Figures in parentheses considered to be different individuals; others include some duplicate classifications of the same family group.

Table 6. Different grizzly bear population sizes based on the number of females with young, a mean 3-year reproductive cycle for adult females, adult male:female ratios, and final adjustments for equilibrium mortality and emigrations.

Classes	Nos. in classes		
	Column I	II	III
Adult females w/cubs	15	20	25
Adult females w/yearlings	15	20	25
Other adult females	15	20	25
Adult males ¹	38	50	64
Cubs ²	27	36	45
Yearlings	27	36	45
2-year-olds	27	36	45
3-year-olds	27	36	45
4-year-olds	27	36	45
Potential N	218	290	364
Mortality and emigration ³	27	36	45
Minimum N	191	254	319
Approximate \bar{N}	200	270	340

¹ Calculated as 0.85 of adult females (Craighead and Craighead 1967).

² Observed 1973 ratio of 1.8 per female used from Table 5 and carried through subsequent classes to give a potential N that is adjusted by subtracting equilibrium mortality and emigrations.

³ Equal to yearly production of cubs.